Creating a High Performance Workspace

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PORTLAND'S GREEN BUILDING RESOURCE

G/Rated Tenant Improvement Guide

City of Portland
Office of Sustainable Development

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version 2.0
January 2004
City of Portland
Office of Sustainable Development

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G/Rated Tenant Improvement Guide

This guide has been created by the City of Portland and the City of Beaverton Solid Waste & Recycling Program to support and promote healthy, productive, durable, resource- and energy efficient workspaces. The City of Portland's G/Rated Green Building program offers a range of publications, fact sheets, resource guides and other resources. Please visit the G/Rated web site, www.green-rated.org, or contact us at the addresses provided below.

This is the 2nd Edition of the Guide. Thanks to the team that researched, wrote, illustrated and published the 1st Edition guide and the team of experts that advised on the revisions for this edition:

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Special thanks to Metro, and Public Technology, Inc., for funding support, and the staff at O'Brien & Company for developing the 2nd Edition.

This guide is intended to assist with leasing space and executing tenant improvements. However, because of the wide range of variations between different projects, the information is not warrantied for accuracy or relevance. Users should consult with real estate, design and construction professionals of their own choice.

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G/Rated Tenant Improvement Guide

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The G/Rated Tenant Improvement Guide: For the Project Manager

This G/Rated Tenant Improvement Guide is written for business managers who have little or no experience in tenant improvements (TI) but now find themselves in charge of one. If this is you, you probably realize that you are in a complex undertaking and under pressure to get good results on time and under budget. You may not know where or how to begin. You may not even fully understand what "good results" are.

This Guide assumes you do not know a lot about tenant improvements, and you don't have the time to become an expert. It defines good results as a "high performance" or "green" workspace that is comfortable and healthy for occupants, safer and less costly to operate, and environmentally friendly to build. In this guide, we will show you why "greening" your TI also makes good business sense because it means lower operating costs, improved worker health and productivity, and reduced liability. Then we will provide an overview of the TI process, describe the roles of key players, and explain how to "green" this process. The Action Strategies section of the Guide provides the information, specific tools, and resources to guide you on undertaking specific green practices.

This Guide assumes you do not know a lot about tenant improvements, and you don't have the time to become an expert.

This revision to the G/Rated Tenant Improvement Guide introduces the new G/Rated High Performance Commercial Interiors Certification Option. This voluntary, self-certification system will help you establish measurable goals and get recognition from your organization when you achieve them.

This Guide will not take the place of knowledgeable specialists in design, construction, real estate, or green building. It will, however, help you select them, guide their efforts, ask the right questions, and inform your decisions.

We applaud your commitment to creating a High Performance Workspace for your organization. We welcome your feedback and want to hear about your success.

For the Design & Construction Team

While this guide is addressed to your client, the manager who is leading a tenant improvement project, it will complement and support your professional role with information on the benefits of better quality workspaces and practical approaches to quality design and construction. The guide includes sections on:

- Planning (including selection of a green team)
- Interior layout and space planning
- Finishes and furnishings that are environmentally safer and more resource-efficient
- HVAC and ventilation
- Daylighting and electric lighting, and
- Waste reduction and recycling.

Information in these sections will supplement the advice and recommendations of the design and construction team. The guide can help ensure that important items are prioritized for inclusion in plans, specifications and bid documents.

A comprehensive database of local suppliers and vendors of green building materials and products is referenced. The database is on the OSD web site, www.green-rated.org. (Note that listing a product source in the database is for convenience, and is not an endorsement.)

A model specification for job-site waste management is included. Recycling can be a challenge. The specification will help make sure all team members know what's expected and do their part to meet the City of Portland's 50% recycling standard, or other jurisdiction's standards.

The guide can help educate clients about the direct benefits of better quality design, construction, materials and products. An educated client may be more open to investing time and resources in a project if convinced the investment will pay off in increased productivity, worker satisfaction, energy savings and long-term savings.

Finally, the G/Rated staff support projects located in Portland. Our services include:

- Planning sessions or 'ecocharettes' to generate green measures suitable to the project
- Assistance with developing green design strategies
- Assistance with LEED certification process, if applicable
- Research on green technologies and products as they relate to City codes
- Information about Oregon tax credits
- Referrals to local vendors and suppliers
- Presentations and speaking engagements.

We would appreciate hearing your feedback and suggestions on improving the guide.

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Greening Your Tenant Improvement Project

Green Building meets the needs of current building occupants while being mindful of the needs of future generations

What is a Green TI?

Tenant improvements are fixed improvements to a tenant's office space. A "green" Tenant Improvement (TI) project looks beyond the readily apparent aspects of the office to create a space that addresses the comfort and health of the occupants, as well as the broader environmental impacts of the construction/remodeling process.

Fortunately, we can now make informed choices and take specific actions to create a "high performance" office that will be safer and healthier for you and your staff and coworkers, beneficial to the community, and gentler on the environment. This Guide will help you do this.

First, let's take a closer look at the benefits of greening your TI to create a High Performance Workspace. Then, we will talk about the process or how to green your TI. Next, we'll talk about the new G/Rated Tenant Improvement Self Certification Option that gives you a benchmark and recognition for your efforts. Finally, we will give you detailed information about specific Green TI Strategies you can incorporate into your project.

Why? The Benefits of Greening Your TI

The bottom line is that greening your TI benefits your company's bottom line. It increases productivity by making employees more comfortable and healthy. In some cases it is more cost effective, saving money on utility bills and operating costs. It creates a positive reputation for your company in the community. And beyond all of that, it helps the larger environment that we all share, by reducing our impact on energy and natural resource consumption and cutting down on the waste and pollution we create.

We know how important it is to protect the health of occupants and conserve our natural resources. The construction and operation of buildings have enormous impacts on both. Construction consumes vast quantities of energy, water, wood, and other natural resources. Poorly designed buildings can also be hazardous to our health. Research indicates that, each year, Sick Building Syndrome costs $60 billion in lost white-collar productivity in the U.S. alone. Heating and lighting of commercial buildings uses about half of the world's fossil-fuel consumption and one-third of the US's electricity consumption.

The benefits of green building are a direct result of the characteristics of green building. For example, a green building doesn't just use a less toxic paint; it is healthier, leading to fewer sick days from headaches or respiratory conditions. A green building doesn't just choose high efficiency fluorescent fixtures; it uses energy efficiently for the occupants and uses of the building, leading to lower electric bills and greater visual comfort. The benefits of a green tenant improvement are shown below as icons. We'll use these icons in the strategy section of this guide to identify the benefits of the Action Strategies we recommend.

Quality workplaces improve worker satisfaction.

Thermal Comfort

This means the heating and ventilation system (HVAC) is designed or modified to keep inside air at comfortable ranges of temperature and humidity.

Visual Quality

This means the interior layout and lighting are designed to admit natural lighting and reduce glare, are well-matched to the tasks you do in your office, and provide access to views of other people and the outside.

A tenant's ability to control temperature in their suite is the only feature to show up in a BOMA survey on *both* the list of most important features and list of items where tenants are least satisfied.

Acoustic Quality

This means the physical layout, mechanical systems, and finish materials are designed to quiet distracting noises.

Health & Indoor Air

This means the HVAC system is designed to deliver plenty of fresh air and to exhaust odors and emissions from office equipment. It also means materials are selected to reduce emissions of common airborne pollutants, such as volatile organic compounds (VOCs), including formaldehyde.

Materials Efficiency

This means materials have recycled content, or are made from rapidly renewable and sustainably harvested natural resources, such as certified lumber. It also means construction waste is reused or recycled.

Resource Conservation

Energy. This means equipment is selected that uses less energy, which conserves fuel resources and reduces associated emissions of greenhouse gases — which in turn means a reduced demand for new hydroelectric dams and pollution-generating power plants.

Water. This means water-conserving fixtures are selected to reduce the demand on fresh water supplies and additional, new municipal potable water and waste water infrastructure.

Planning Process

While not a benefit in the same sense as those indicated by other icons, careful planning in the early stages will help create a better project overall, as well as allowing for the incorporation of green actions. You'll see this icon when we discuss planning actions.

Informal meeting spaces encourage interaction and communication.

The Business Case for Green Building

In office environments, by far the single greatest cost to employers is the salaries of the employees occupying the space. Salaries generally exceed the lease and energy costs of a facility by a factor of ten. For this reason, the health, safety and comfort of employees in a high-performance office are of paramount concern.

In the emerging trend of advanced office design, this concern has been translated into strategies such as increased fresh air ventilation rates, the specification of non-toxic and low-polluting materials and systems, and indoor air quality monitoring.

Occupant comfort is a significant aspect of workplace satisfaction. Increasingly, high-performance offices provide individualized climate control that permits users to set their own, localized temperature, ventilation rate and air movement preferences.

While difficult to quantify, recent studies demonstrate that worker satisfaction and performance is increased when office workers are provided stimulating, dynamic working environments. Access to windows and views, opportunities for interaction, and control of one's immediate environment are some of the factors that contribute to improved workplace satisfaction.

To determine the benefits of a green building, it is helpful to describe how your organization defines

success, and to look at the connections with specific green measures. Usually business success will be defined as some combination of the following outcomes:

- Profitability
- Product or service quality
- Customer satisfaction
- Ability to innovate
- Quality of work life
- Employee retention
- Perceived value of goods and services
- Operational efficiency, and
- Community responsibility.

While green building measures can add value to goods and services, work life and customer relationships; in tenant improvement projects direct costs are almost always the primary consideration. It is easier to document costs, compared to documenting benefits and value. For example, benefits like improved productivity may not be immediately apparent, while cost reductions are.

The result is that managers may want to use their workspaces to enhance organizational effectiveness and productivity, but may not want to invest in the kinds of changes needed until they have proof that they will pay off.

Research studies provide evidence that sustainable design and operations can have far-reaching impacts on an organization, including:

- Reduced operating costs
- Reduced legal and insurance costs associated with reduced risk
- Reduced regulatory inspection load
- Greater ability to negotiate with external stakeholders

Benefits of a High Performance Workspace

FINANCIAL BENEFITS

Higher productivity
Reduced absenteeism
Reduced operating costs
Reduced risk

BUSINESS PROCESSES

Efficiency
Flexibility
Competitiveness

HUMAN RESOURCES

Attraction and retention of quality employees

COMMUNITY RELATIONS

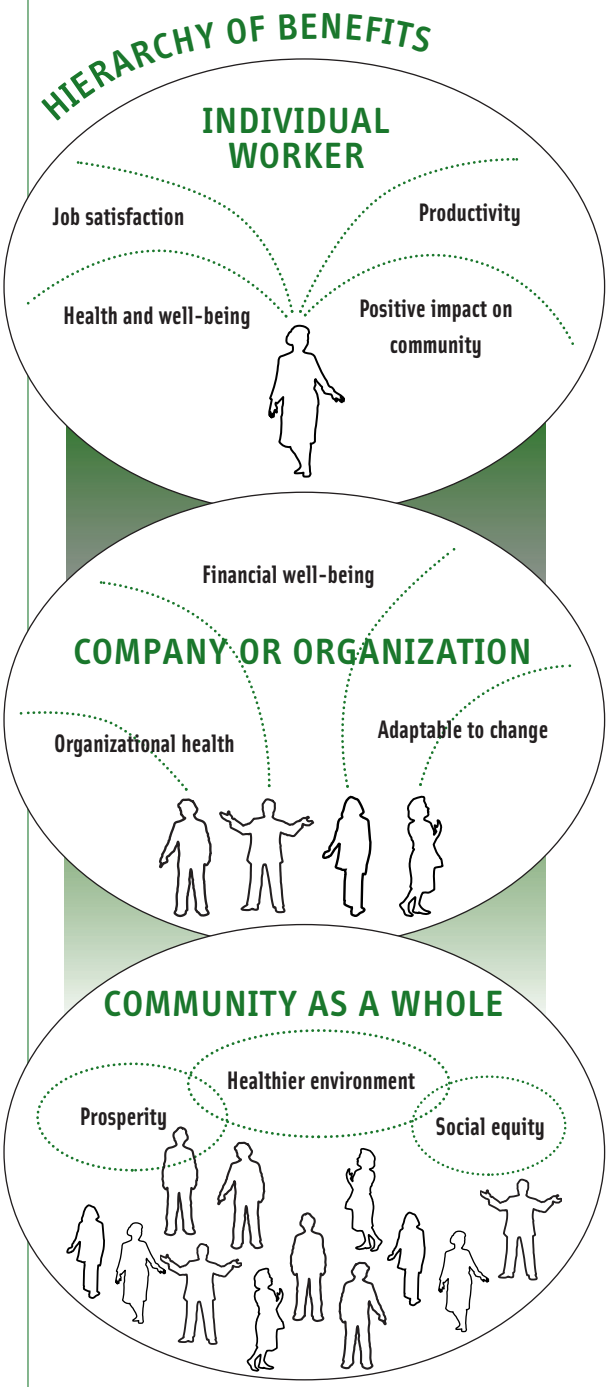
Identity
Credibility

- Enhanced community livability
- Enhanced relationships with stakeholders
- Innovation associated with the quest for resource efficiency
- Improved ability to market to pro-environmental consumers
- Better organizational image and reputation, and
- Improved ability to recruit workers.

These strategic benefits are likely to be linked to sustainable building features such as:

- Long-term energy savings
- Reduced use of water
- Use of recycled materials in building construction and in-house recycling
- Commissioning to assure the building operates as intended
- Re-commissioning following changes in building use
- Use of renewable resources, such as solar power and wind
- Pollution prevention and waste reduction
- Interior flexibility to reduce costs of reorganization
- Improved interior environmental quality
- Habitat restoration and use of native plants in landscape design
- Integration of the natural environment with the building environment
- Locating buildings close to transit and other services to reduce commutes, and
- Providing community amenities in the building or site.

—Adapted from Judith Heerwagen, Ph.D., Sustainable Design Can Be an Asset to the Bottom Line



What is "productivity"?

Judith Heerwagen, who researches the relationships between people and buildings, suggests that business success includes the following factors, all of which can be positively affected by choices made during a TI project. Some may ignore the value of these measures in favor of bottom-line costs and profitability alone, while a healthy company will maintain a balance among all of them.

- **Profitability**
- **Product quality**
- **Customer satisfaction**
- **Capacity for innovation**
- **Quality of work life (including employee work attitudes and job satisfaction)**
- **Employee retention**
- **Perceived value of goods and services**
- **Operational efficiency**
- **Social responsibility**

Productivity: the ultimate benefit of a green workspace

Productivity is a term that includes the positive financial, business process, human resources, and community relations outcomes that can result from a well designed and constructed green tenant improvement. Many of the benefits of a green TI — such as thermal comfort, acoustical comfort, visual quality, healthy indoor air quality, and general environmental responsibility — directly influence business success. In other words, they create a high performance workspace. Let's look at the outcomes that can result from such a high performance space.

Direct Financial Outcomes

- Improved output and creativity, especially among knowledge workers
- Reduced absenteeism when employees are healthy and satisfied
- Lower costs for building operation and maintenance
- Buffering from energy cost increases
- Reduced risk and potential liability (insurance and legal)

Business Process Outcomes

- Opportunity to innovate new processes or team structure
- Increased operational efficiency
- Flexibility to adapt to changing work patterns
- Increased competitiveness

Human Resources Outcomes

- Higher quality work environment and worker satisfaction
- Improved personnel morale (perception that the organization cares)

A green TI supports today's knowledge workers and can enhance productivity.

- Improved health and well-being (the organization is trustworthy)
- Reduced employee turnover in tight labor markets
- Higher quality workers attracted and retained

Community Relations Outcomes

- Healthier local environment — air, global warming, water, and health
- Improved customer perceptions and image
- Credibility with community stakeholders
- Opportunity for community outreach and education

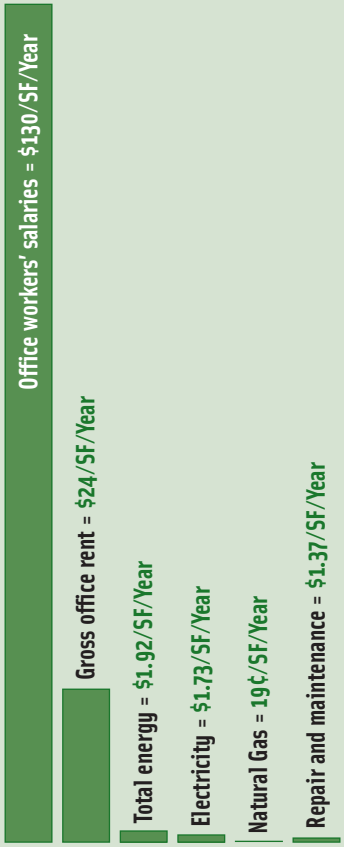
The mix of outcomes will differ for each business. What's important is that a TI project can deliver on all of the above outcomes. A business may ignore these benefits out of a perceived need to focus on the "real" bottom line drivers of time, money and short-term agendas. When a business or organization asks, "how can our workspace help us succeed?" it identifies essential needs and asks how the workspace meets these needs. Use the productivity checklist on the next page to help answer this question.

It's the People

People are the largest operating expense per square foot, adding up to more than three-fourths of total business costs.
A 1% improvement in worker productivity may be worth more than 50% in energy savings.

AVERAGE ANNUAL COMMERCIAL EXPENDITURES

(Dollars per square foot per year)



Sources: Building Owners and Managers Association, Electric Power Research Institute, Office of Sustainable Development

The Metro Construction Industry Recycling Toolkit **and** ***Recycling and Salvage Planning Guide*** **are comprehensive field guides for developers, architects and contractors that list local construction and demolition debris recyclers, and provide bid specifications and planning tools for using salvage building materials in projects. Both guides are free and can be requested through Metro's Recycling Hotline at 503-234-3000 or downloaded at** ***www.metro-region.org/Toolkit.***

METRO

Productivity Checklist

Every company has unique work styles and needs. Interior design can determine how effectively the organization can function. Considerations such as furniture systems, lighting selection and layout, and material selection all play an important role in making the work environment productive and comfortable. Many of the space performance factors are addressed through the steps to green your TI process, but there are some additional space planning considerations that support a productive work environment. These factors address how workspaces are arranged to provide people with a good balance of access, privacy, physical comfort, and flexibility.

First, consult with a professional interior designer or space planner and consider these questions:

- Can the space adapt to changes in working relationships, new teams, and new tasks? Open plans are easier to modify to adapt to churn and change.
- What specific functions are tied to the space? For example, is there a receptionist who needs to be at the entrance? Is the reception also a waiting area?
- Are conference rooms needed? Is the conference room a place where clients are brought, so image is important? Or is the conference room intended to be a working space that accommodates team meetings?
- Everyone needs some privacy to be able to do concentrated work. But which spaces really need to be completely private? A manager's office? Conference rooms?
- Does the space lend itself to an open plan, which can provide amenities to the whole group? (Sometimes closed offices are located along the perimeter, closing off light and views from the rest of the workspace and setting up a hierarchy of values.)

With your business needs in mind, develop layout strategies for managers, individual employee, and task group workspaces.

Manager Offices

Today's workforce requires organizational leaders to be easily accessible to the people they manage. To foster this, create a space plan based upon work functions and communication rather than on the hierarchy of the organization. Consider these strategies:

- Locate manager and executive offices in the middle of the workplace.

When the American Society of Interior Designers surveyed 200 US companies in 1997, they found the following top four design factors that boost productivity:

Access to other workers and resources:	**68%**
Comfort:	**42%**
Privacy:	**28%**
Flexibility:	**24%**

- Break down status barriers and allow management to interact and work more effectively with their teams by placing them in the same or similar workstations as their staff. Remember to balance privacy and accessibility.

Individual Employee Workspaces

Consider these questions:

- What is the mix of paperwork, computer work, and projects?
- What is the need for acoustical or visual privacy?
- What kind of storage? Short-term near the workstation? Long term in central location?
- Do workers like to meet informally? How many people typically meet?
- Do individuals sometimes need to work away from their desk?
- Where is the view? Can workers see outside?
- Who works with whom? Do they need to be located near one another?

Team Workspaces

By one estimate, collaboration accounts for half of the work done in a typical office. Consider these questions as you plan for team workspaces:

- Does the workspace support collaboration, or get in the way?
- How many people typically work on a project? For how long?
- How big a space do they need?
- Are there special needs? (For example, team workspaces should be equipped with the tools to display the group's solutions and ideas.)
- Will the team use equipment that has to be stored in the space?
- Do task groups need to have a workspace they can schedule for an extended time?

Support Your Team

Teamwork can account for up to half of the work done in the office. Informal areas for collaboration:

- **Team work rooms**
- **Lounges**
- **Clustered support areas**
- **Five minute meeting space**
- **White boards**
- **Data & power connections**

Courtesy PGE Green Building Services

Task Groups

Task groups require different spaces depending on the length and complexity of the task. For example, short meetings can be accommodated in informal "non-territorial" spaces available to all without advanced scheduling. Longer tasks require space and work surfaces dedicated to the team for a period of time.

The Balfour-Guthrie building features two TI green projects: Thomas Hacker Architects and the Energy Trust of Oregon. See a detailed case study at www.energytrust.org/Pages/about/library/Case_Studies/Balfour_Guthrie_Bldg.pdf

How? – Greening the TI Process

The following section describes the tenant improvement process, highlighting the major phases, key players, and actions and considerations necessary at each phase to make the process greener. In this Guide, we identify 50 specific Action Strategies, in seven different categories, that are applicable and appropriate for commercial TIs in the Portland metropolitan area. These Action Strategies are not an all-inclusive list of green strategies, and not every one will be applicable to your project. However, they provide a useful starting point for deciding how to go about improving a new office space. These Action Strategies form the basis for the G/Rated Tenant Improvement Certification Option. The Strategies provide more details about each Action, suggested strategies, and related resources.

Now, let's consider each phase of the process; we've highlighted in bold type the key steps to take to green the TI process. Figure 1, page 24, Greening the TI Process, illustrates the process and describes how green considerations are brought in.

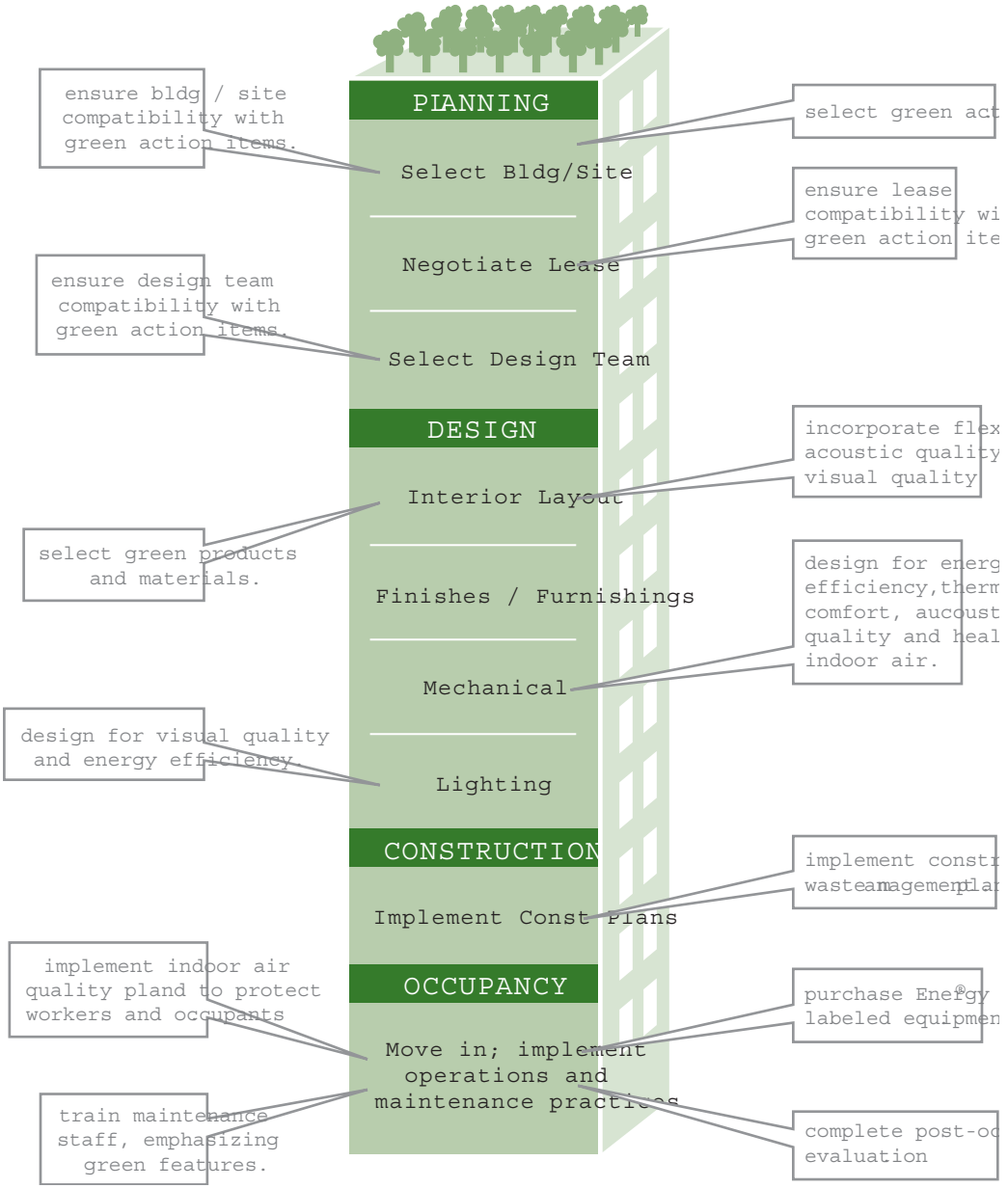
Planning

Planning begins when you first decide that you, the tenant, need a new space. This phase overlaps to a degree with the Design Phase. You want to assemble the design team and develop basic space plans in order to include your desires in the lease negotiations. Planning and shopping for a space is an iterative process, cycling back and forth between deciding what you want and need and finding a space that can best accommodate those interests.

Who? Key players and roles are:

- **Real-estate broker.** Represents a tenant to help find space and negotiate a lease.
- **Leasing agent.** Represents the building owner in lease negotiations.

Fig. 1


PIANNING
Select Bldg/Site
Negotiate Lease
Select Design Team
DESIGN
Interior Layout
Finishes / Furnishings
Mechanical
Lighting
CONSTRUCTION
Implement Const Plans
OCCUPANCY
Move in; implement operations and maintenance practices
ensure bldg / site compatibility with green action items.
ensure design team compatibility with green action items.
select green products and materials.
design for visual quality and energy efficiency.
implement indoor air quality pland to protect workers and occupants
train maintenance staff, emphasizing green features.
select green act
ensure lease compatibility wi green action ite
incorporate flex acoustic quality visual quality
design for energ efficiency,therm comfort, aucoust quality and heal indoor air.
implement constr wasteamagementplan
purchase Energy® labeled equipmen
complete post-oc evaluation

- **Real-estate attorney.** Advises tenant in lease negotiations.
- **Building owner or property management company (the landlord).** Final say on what may or may not be included in the lease agreement, including the construction plans.

What? Key steps to green your TI:

- **Review this Guide and mark the Action Strategies you want to implement in your TI project on the "G/Rated Tenant Improvement Checklist" (p. 139).**
- Select a new building or decide to remodel your existing facility, **and confirm that it is amenable to your green goals, which might include green site and building features.**
- Choose a design team, **one that understands your green goals and can help you realize them.**
- Negotiate your new lease **and include design and construction plans to achieve your green goals, as well as perhaps additional green objectives.**

Design

At this stage, you work with the designers, architects, and engineers to develop a plan for remodeling the space you've chosen. The Design Phase is where you decide on the design details and materials required to meet your needs. The design phase ends with the issue of bid documents and selection of a contractor.

Who? Key players and roles are:

- **Architects and engineers.** Design workspace and electrical, mechanical and structural systems.
- **Interior designers.** Design and specify the layout and furniture, materials and finishes.

What? Key steps to green your TI:

Develop and refine the plans and specifications for your:

Non-toxic cleaning products help maintain air quality.

- interior layout — **include considerations for flexibility, privacy, and good light**
- finishes and furnishings — **choose low emission and environmentally preferable products**
- mechanical systems — **address energy efficiency, thermal comfort, noise, and indoor air quality**
- lighting systems — **use good design to provide visual comfort and energy savings**

Construction

The construction phase begins once you have a contract with the contractor you have selected. It ends when the project is complete and ready for occupancy.

Who? Key players and roles are:

- **General contractor and sub-contractors.** Construct and install components, systems and finishes

What? Key steps to green your TI:

- Direct contractors to implement the remodeling construction plans, removing old materials and installing and upgrading new materials and structures.

- **Implement a Construction Waste Management Plan and try to beat a 50% standard. (Check with your jurisdiction for standards. In the City of Portland, 50% recycling is a minimum required by ordinance.)**
- **Implement a Construction Indoor Air Quality Plan to protect the health and comfort of both the workers and future occupants.**

Occupancy

Occupancy begins with initial move-in and includes ongoing operations.

Who? Key players and roles are:

- **Facilities manager.** Manages ongoing maintenance and operational support.
- **Tenants.** Use the facilities and make some operational decisions.
- **Maintenance staff.** Perform ongoing maintenance and cleaning tasks.

What? Key steps to green your TI:

- Order new office equipment (**specify Energy Star®-labeled products**).
- Establish cleaning and maintenance schedule (**provide training to maintenance staff where appropriate**).
- **Complete a post-occupancy evaluation phone call between 3 months and 1 year after occupancy; discuss with G/Rated lessons learned to help us share your experience with others.**

The actions printed in boldface type are examples of the kinds of steps you can take to lessen the environmental and health impacts of your TI project and achieve productivity and cost saving benefits for your company.

Oregon NATURAL STEP NETWORK

The Natural Step

A growing international organization, The Natural Step offers businesses a way to incorporate environmental stewardship into their business practices. The Oregon Natural Step Network provides introductory workshops, speakers and conferences where businesses can learn about The Natural Step and what other leading companies are doing to reduce environmental impacts.

Businesses ranging in size from Nike to Neil Kelly Remodelers are active members. Many local architecture, engineering and property management firms are members.

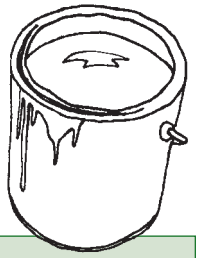
www.ortns.org

Value-added, no-cost TI measures that are easy to do:

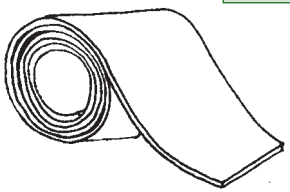
Select carpet and cushion that do not off-gas harmful chemicals. (Tell your designer to select products with the Carpet and Rug Institute Indoor Air Quality Label.)

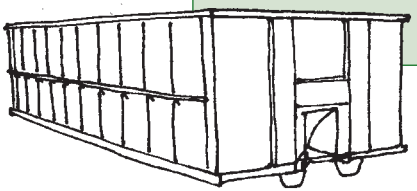
Specify lighting fixtures and controls that provide the best light for computer work and for desktop reading. (Free assistance available).

Have your general contractor salvage or recycle tearouts like carpet, cushion, drywall, lumber, cardboard, paper, metals, and glass (Ask for documentation).



Specify safer low-toxicity paints, primers, and finishes. (Make sure the painting subcontractor has read the specifications before accepting the bid.)





What Does A Green TI Cost?

Usually this question means: will a green TI cost more than the TI allowance that a building owner has offered during lease negotiations?

You and your project team can choose a set of green measures that make sense to you in terms of costs and benefits. This guide is intended to provide you with ideas that are practical and cost-efficient today.

Many green measures will add no cost to your project. Some measures involve a modest first cost increase, but save money over the long run by lowering utility bills. Some green measures may cost more, but yield benefits that are hard to quantify, such as improved occupant productivity. In all cases, the key to eliminating or minimizing added costs is to set your goals early and have them as part of your project from the very beginning.

Some green measures may cost more. An example is using certified wood from sustainably managed forests. The cost premium could be in the range of 10-15% over similar conventional wood. Any extra cost can be minimized with some advance planning. The designer can select and specify wood species, grades, applications and sizes that are readily available as certified — this information is available through the Certified Wood and Paper Association, a Portland non-profit that advises on uses of certified wood, at no cost to designers and developers (www.cwpa.info/about_us.asp).

Daylighting and high-efficiency electric lighting. Mesh shades provide sun control on windows.

Invest In Design

Hiring an architect or space planner to create an initial plan, showing the general layout of offices, meeting rooms, corridors, major fixtures and common areas for a building, can be very helpful in determining the suitability of the space under consideration. This initial plan can provide a basis for negotiating items such as defining usable and rentable space and tenant improvement allowances.

To accurately assess the impact of green measures on your project budget, it is important to consider operational costs as well as first costs, and to avoid evaluating any one strategy in isolation. One measure may cost more initially, but pay for itself very quickly in reduced operating costs. Even if you don't pay directly for your own utilities, energy efficient and water efficient features will help protect you from related lease fee increases. Some measures may save money on first cost. Look at using these savings to help pay for measures that may cost more initially.

In other words, look to get the "greenest" you can with your budget. For ideas on cost-effective green TI packages, review the two sample "G/Rated Tenant Improvement" certifications starting on page 143.

There are two ways to go with this guide.

SIMPLY USE IT AS A REFERENCE: review the Action Strategies and use them to inform your decision making as you proceed with your TI project.

GO FOR G/RATED CERTIFICATION: make a more serious commitment to implementing green improvements and take the few extra steps to get recognition for it. The next section describes the Certification Option and the Action Strategies and Tools to help you follow it.

What Now? Achieving a High Performance Work Space

Congratulations on your commitment to creating a high performance workspace for your organization. Let's dig into the details. As you face the many decisions to come, follow the recommendations and strategies in this guide to inform your selection of technologies, design strategies, and materials. You will minimize risks and costs by

- following a proven process for greening construction projects
- incorporating green strategies and materials early in the planning process
- protecting the safety and health of construction workers and office occupants

Although this Guide will help you plan and execute your green TI, it is best used in consultation with knowledgeable professionals, such as a commercial leasing agents, space planners or interior designers, mechanical engineers, lighting designers, and contractors specializing in commercial TIs. If you are negotiating a tenant improvement allowance, this information will help ensure that your TI includes everything needed for your organization to be satisfied with the finished space.

Be aware that no matter how successful a "green champion" you become for creating change within your organization, it is rarely easy or absolute. Yet each step along the path is important. By educating yourself, your management, your peers, and your design team, you make a difference that has lasting impact. Throughout this document, we use the terms "green" and "high performance" synonymously; you may find that one or the other works better with your company's culture.

Action Strategies

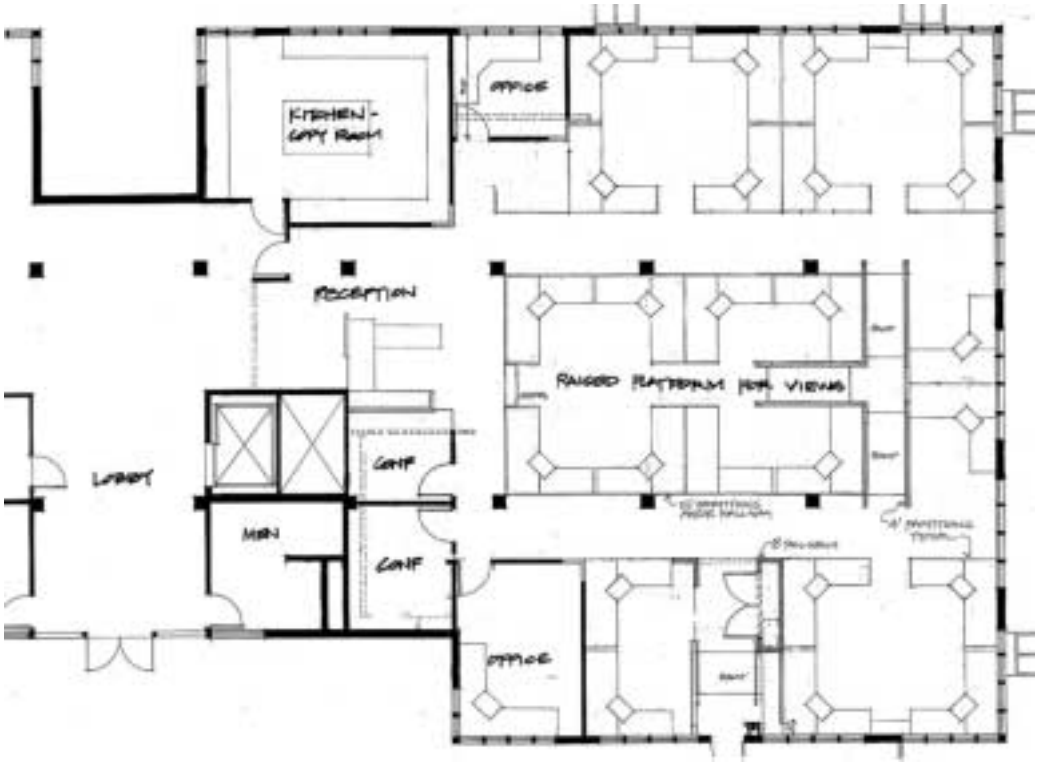
33▶ Planning
45▶ Interior Layout
55▶ Finishes & Furnishings
81▶ Mechanical & Electrical
103▶ Lighting
113▶ Construction
125▶ Occupancy

Planning

Open plans allow flexible work station arrangement.

PLANNING

		✔
Ⓡ	**P-1: Tenant Improvement Guide Review** At the start of the project, review the Tenant Improvement Guide and become familiar with the characteristics of a High Performance Commercial Interior.	☐
Ⓡ	**P-2: Action Strategies Selection** Identify the Action Strategies on this checklist that you want to target for your project.	☐
Ⓡ	**P-3: Green Construction Documents** Make sure the high performance Strategies you've identified for the project are reflected in the project's plans and construction documents.	☐
○	**P-4: Green Location** Use the "Shopping for Your Space" checklist to select the space or location for your project.	☐
○	**P-5: Green Lease** Make sure the high performance Strategies you've identified for the project and any other green goals are reflected in your lease.	☐
○	**P-6: Green Design Team** Select a green design team for your project.	☐



Open plan supports teamwork while small meeting rooms and offices offer privacy.

Planning Strategies

The earlier you can start thinking about opportunities to create a high-productivity workspace, the better. By identifying strategies that make sense for your organization, you will be more equipped to negotiate a lease, a workspace design and a budget that support your goals. Basically, there are some fundamental steps to consider at the start:

- Review this guide.
- Identify initial strategies that make sense for your company or organization.
- Find a building and/or space that can be adapted to fit your company or organization. Use the "Shopping for Your Space" checklist to help organize priorities.
- Negotiate a lease that includes and supports your strategies.
- Choose a design and construction team who will support your strategies.
- Make sure that your strategies are included in construction documents, especially plans and specifications. Your organization, the designers, the construction contractor and the building owner (or manager) will follow these construction documents to determine what to build, and you will use them as a basis for project management. In case of any question, the documents will rule. In other words, verbal agreements may not be binding.

P-1 Tenant Improvement Guide Review

At the start of the project, review this Tenant Improvement Guide and become familiar with the characteristics of a High Performance Commercial Interior.

Benefits PLANNING PROCESS	This guide will give you an overview of the scope of possible steps you can take during your tenant improvement project to address environmental performance issues. It is important to understand the benefits of green building actions and how they in turn can benefit your organization. The characteristics introduced in the guide — thermal comfort, visual quality, acoustic quality, indoor air quality, resource conservation, and materials efficiency — are represented by the icons on the left, which capture basic high performance or green characteristics. By addressing these characteristics throughout the process, you will create a workspace that increases productivity, enhances your organization's reputation, and improves financial well being.
What?	Review this Guide when starting to plan your Tenant Improvement project. It will help you understand how various actions can help you achieve performance goals and describe the steps to implement them. The Certification Program, Strategies, Checklists, and other tools and resources will help you easily integrate high performance goals.
Design Guidelines and Standards	**Required for G/Rated Certification**
When?	For best results, before you negotiate lease terms and tenant improvement allowance. You can discuss the measures you would like to include with the building owner or manager. If they are building out the improvements it is important to agree on your expectations early in the process. You may be able to negotiate more favorable lease terms. For example, if you are installing energy efficient lighting and controls, the lease should allow you to get the benefit of monthly savings.
Who is Responsible?	YOU — the project leader within the company — and any internal or external team members you work with.

P-2 Action Strategies Selection

Identify the Action Strategies on this checklist that you want to target for your project.

Benefits PLANNING PROCESS	It is important to identify actions you'd like to take early in the process, so they can be discussed with prospective property managers, designers, architects, engineers, and other team members.
What?	Review the associated Strategies for the actions you intend to take. Use the Checklist to note these Action Strategies. Use the Checklist and Strategies to help communicate your intentions to other team members and ensure you can address them during the planning (space shopping, lease development, design planning) and implementation (construction and occupancy) phases.
Design Guidelines and Standards	**Complete the Checklist (on p. 139) for G/Rated Certification**
When?	Planning
Who is Responsible?	Project leader and team

P-3 Green Construction Documents

Make sure the high performance Strategies you've identified for the project are reflected in the project's plans and construction documents.

Benefits PLANNING PROCESS	Project plans and construction documents describe the floor plan, mechanical and lighting plans, and the specifications for finishes. They also include environmental instructions for the contractor, such as indoor air quality management during construction, and construction waste management. Without carefully specifying your intentions in these documents, you may not be able to carry out the action goals you've set for the project. You may be required to sign off to confirm that the construction documents fully represent your design criteria, so it is important to take the time to review these documents carefully. Do not hesitate to request clarification if anything is unclear. In many cases, errors or omissions are discovered during the construction phase, when it may be too late or too costly to make corrections.
What?	Beginning in the planning phase, but predominately during the design phase, detailed construction specifications are prepared by the architect, engineers and interior designers that give specific instructions to the contractors. These instructions need to clarify and specify green products and designs, as well as green practices, such as construction waste recycling.
Design Guidelines and Standards	**Required for G/Rated certification**
When?	Design. During this phase, the design team will produce detailed drawings and specifications to communicate your tenant improvement plan to the general contractor.
Who is Responsible?	Project leader and design team

P-4 Green Location

Use the "Shopping for Your Space" Checklist to select the space or location for your project.

Benefits PLANNING PROCESS	The location and configuration of a building can have a big impact on the quality of the final workspace. This tool was developed to help you clarify unique options that your company needs to look for in a new space. Include it in discussions with your broker, leasing agent, and designer when you begin searching. Following this recommended process for identifying and comparing candidate sites will help you make sure you achieve your green goals.
What?	Use the Checklist to help you to identify criteria to evaluate prospective buildings and grounds for your new workspace, and identify opportunities to create green tenant improvements.
How? Strategies for Getting It Done	Use the Action Strategy Checklist and the Space Checklist to identify and compare spaces that are amenable to your desired tenant improvements and offer additional green features.
When?	Planning
Who is Responsible?	Project leader and internal team Communicate this responsibility to leasing broker, agent and design team.
Resources/ Products	Green Rated Buildings: leasing space in a green rated building will help meet some of your goals for your company's space. This is because buildings certified under these programs are built to higher energy efficiency and environmental standards than conventional buildings. A green rating is also a good indicator that the building management will understand and support meeting the rest of your goals. Two building rating systems widely recognized in Portland are LEED™ and Earth Advantage. **LEED™ rating system:** the LEED (Leadership in Energy and Environmental Design) Green Building Rating System™ is a voluntary, consensus-based national standard for developing high performance, sustainable buildings. LEED standards are currently available for ► New construction and major renovation projects (LEED-NC) ► Existing building operations (LEED-EB, Pilot version) ► Commercial interiors projects (LEED-CI, Pilot version, final to be released in 2004). For more information on LEED, visit www.leedbuilding.org. **PGE's Earth Advantage Program:** for a quick overview of Portland General Electric's Earth Advantage Program standards, visit www.earthadvantage.com/commercial/ea_glance.asp. Earth Advantage includes many of the same measures as G/Rated, and offers strong technical support and third-party certification.

P-5 Green Lease

Make sure the high performance Strategies you've identified for the project and any other green goals are reflected in your lease.

Benefits PLANNING PROCESS	To understand how to create a green lease, you must first gain an understanding of standard lease language. Work through this process with professional brokers, leasing agents, real estate attorneys, and facilities personnel whom you trust. The property manager's design firm, or a firm you have selected, will create a detailed space plan. Your lease is often negotiated based on this space plan, so it is critical to include all of the expected attributes. Be aware that any design features not included in the lease agreement may be considered upgrades. The lease terms will be a major factor in finding a suitable space, particularly for addressing your green goals. The lease will include space plans that identify the improvements you are seeking, as well as additional stipulations.
What?	Once you have defined green criteria for your TI, you can "green" your lease by adding language to stipulate product requirements and construction practices. This step is key to achieving a successful green TI. Always seek advice from a real estate attorney when considering modifications to a lease agreement.
How? Strategies for Getting It Done	With your attorney's assistance, consider the sample language below. Some point to specific Action Strategies, while others stipulate additional health and comfort factors you may want to include. ► A final flush-out period of 48 to 72 hours shall be provided before occupancy. Lessor shall ventilate with 100 percent outside air at the recommended air change rate during installation of materials and finishes, unless outside air would cause unacceptable inside temperature levels, humidity levels, and/or air quality. (See Action Strategy C-2, p. 118) Note: This item may be difficult for some building owners to accommodate; building systems may not allow them to flush one space without flushing the entire floor or building, which might disrupt other tenants. ► To the greatest extent possible, Lessor shall sequence the installation of finish materials so that materials that will be high emitters of VOCs are installed and allowed to cure before installing interior finish materials, especially soft materials that are woven, fibrous or porous in nature that may absorb contaminants and release them over time. (See Action Strategy C-2) ► New carpet, cushion and adhesives must comply with Carpet and Rug Institute Indoor Air Quality labeling standards. (See Action Strategy F-5, p. 69)

How (con'd)	▶ The Lessee may eliminate from consideration products with significant quantities of toxic, flammable, corrosive or carcinogenic material and products with potential for harmful chemical emissions. Materials used often or in large quantities will receive the greatest amount of review. (See Action Strategies F-5 through F-8., p. 69ff) ▶ The Lessor (Contractor) shall provide to the Lessee Material Safety Data Sheets (MSDS) upon request for the following products prior to their installation or use: adhesives, caulking, sealants, insulating materials, fireproofing or firestopping materials, paints, carpets, floor and wall patching or leveling materials, lubricants, clear finish for wood surfaces, and janitorial cleaning products. ▶ The Lessor and its agents must comply with all recommended measures in the MSDS to protect the health and safety of personnel. ▶ Where demolition or construction work occurs adjacent to occupied space, Lessor shall erect appropriate barriers (noise, dust, odor, etc.) and take necessary steps to minimize interference with the occupants. This includes maintaining acceptable temperature, humidity and ventilation in the occupied areas during window removal, window replacement, or similar types of work. ▶ The Lessor and its agents must notify Lessee at least 24 hours in advance of any pest control activities planned for within the building. In addition, you might want to include terms that address the following: ▶ Acceptable temperature and humidity ranges. ▶ Provisions for protection from future damage due to moisture or mold caused by building failures (such as leaks). ▶ Responsibilities for potential future exposure to hazardous materials such as asbestos, radon, and lead.
When?	Planning, after selecting a space and completing preliminary space planning and Action Strategy selection.
Who is Responsible?	Project leader, company owner or designated legal representative, real estate attorney, and building owner or property manager
Resources/ Products	See Appendix A (p. 148) for leasing resources and references.

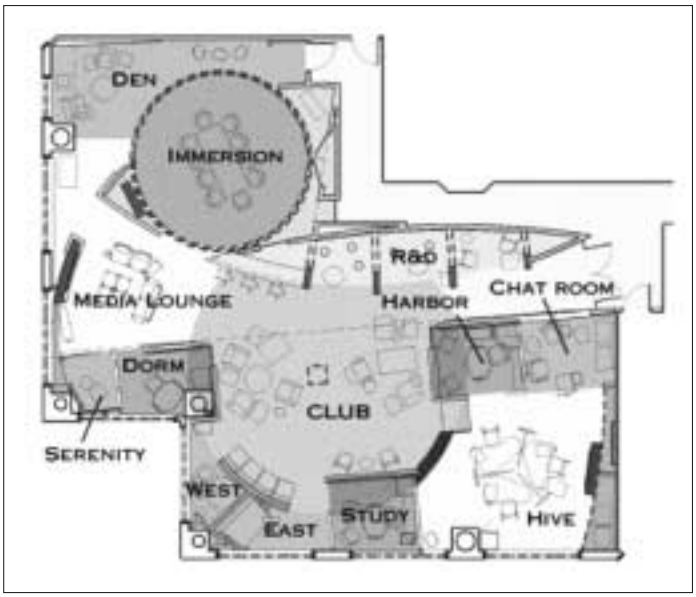
P-6 Green Design Team

Select a green design team for your project.

Benefits PLANNING PROCESS	An inexperienced designer or space planner may not have the resources and knowledge to adequately address both your general design interests and your green features. The wrong designer may take more time and effort to bring on board and not be effective at providing solutions that meet your Action Strategy goals. Your design team should work with you to ▶ evaluate the way you work ▶ define your useable area* requirements ▶ verify the precise area of available, usable space ▶ evaluate the usable space ▶ with business needs in mind, develop layout strategies for managers, individual employees, and task group workspaces.
What?	Hire a design team that knows their stuff and knows green. Spend the money for experience or develop the project as a training forum for the greatest number of people (e.g., enlist as many participants as possible).
How? Strategies for Getting It Done	With your attorney's assistance, consider the sample questions below. Some point to specific Action Strategies, while others stipulate additional health and comfort factors you may want to include. ▶ Make sure that the project design team understands your business and has experience with your workspace needs. ▶ Whether selecting your own design firm or working with one selected by the property manager, be sure to request a team that is knowledgeable about green office design. ▶ Check references from previous TI projects. Have they experienced benefits from green design? Sample questions for pre-qualification: ▷ What is your experience with green building and LEED? ▷ What is your experience with green commercial interiors? ▷ What is your experience with efficient lighting design and other technical fields that will be relevant to our scope of renovations?

* "Usable Area" is the area that your organization actually occupies, such as your offices and other workspaces. "Rentable Area" includes your pro-rated share of other space, like corridors and lobbies. See BOMA's Standard Method for Measuring Floor Area in Office Buildings, 1-800-426-6292 or www.boma.org.

How? (con'd)	**Design Process** ▶ Clearly communicate your green criteria to the design team. If possible, request a goal-setting session with the design team and general contractor to facilitate open communication and develop support for your goals. ▶ During this phase the design team will refine the space plan and select materials, furnishings, and equipment. ▶ Establish regular meeting times with the design team to review progress and budget, and to confirm that the design meets your requirements. Be aware that any design features not included in the lease agreement may be considered upgrades. ▶ Space planning should be coordinated with HVAC and lighting designs and indoor environmental quality (IEQ) considerations. For example, by coordinating space planning with lighting planning, you achieve higher quality lighting, save on energy and operating costs, and avoid added first costs.
When?	Planning
Who is Responsible?	Project leader, property manager
Cost and Schedule	Hiring a design team may increase costs over a do-it-yourself approach. Opting for a team outside of the one the property management company recommends may also increase costs.



Fit space layout to the way the organization works.

Employees in high-performing companies rate their physical working conditions higher than their counterparts in all other companies.

Source: Competing for Talent, The Hay Group, Inc., 1998

Interior Layout

Flexible meeting spaces can be rearranged and adapted quickly.

INTERIOR LAYOUT

		✔
®	**IL-1: Occupant Recycling** Provide space and convenient container placement for an occupant recycling program.	☐
○	**IL-2: Limit Permanent Walls** Limit permanent walls to building core.	☐
○	**IL-3: Multiple Power Locations** Provide multiple locations with power for office equipment..	☐
○	**IL-4: Noise Control** Provide noise control for walls, ceilings, and floors.	☐
○	**IL-5: Walk-Off System** Provide a permanent walk-off mat or grille at all entrances of the building.	☐

The open plan gives everyone access to daylight and views of the outdoors.

Interior Layout Strategies

The way that workspace is organized will influence the ways that work gets done. This section focuses on providing flexibility with adjustable partitions, access to power and data, and noise control.

One long-term study of commercial buildings concludes that what people want is a building that "doesn't get in the way." That is, it provides a neutral support system for what they do, without them having to think about it. However, all too often people are disappointed with their buildings or workspaces because they don't perform as expected, or are expensive to operate, or inhibit the organization's goals, or may even be "sick."

Some key factors in successful workplaces that are emerging from research include:

- A design that lifts the spirits. If people like a building, they will be more tolerant of its shortcomings.
- Access to views to the outdoors and of nature.
- The ability for each person to control his or her own workspace conditions such as daylighting, electric lighting, temperature, and air flow. For example, the ability to open a window for fresh air seems to improve satisfaction and reduce illness.
- A balance between an open plan that allows for informal communications and teamwork, and private personal space for concentrated attention without interruptions.
- Lighting brightness ratios on ceilings, walls, work surfaces and floors that provide a sense of good overall illumination.
- Responsive building management that acknowledges requests from occupants, completes the requested action, and sends a follow-up message.
- Building management systems that are well understood by a committed facilities manager who has clear objectives, constantly monitors performance, responds rapidly to problems or complaints, and gives feedback to tenants.

IL-1 Occupant Recycling

Provide space and convenient container placement for an occupant recycling program.

Benefits MATERIALS EFFICIENCY	The waste generated during construction can be very significant, but the waste generated during occupancy can easily catch up. Moreover, in cities with an active residential recycling programs, workers are used to having a place to recycle materials and will think less of a company that doesn't provide facilities for this. Some office materials are toxic or hazardous as well, and should be diverted from the waste stream.
What?	Depending on the size of the office, provide individual recycling containers at desks along with wastebaskets, and central collection areas for common recyclable materials, such as paper, cardboard, aluminum, glass, plastic (beverage containers), toner cartridges, batteries, and fluorescent bulbs.
Design Guidelines and Standards	**Required for G/Rated Certification**
How? Strategies for Getting It Done	► Clearly label containers and provide signage in high waste areas to alert people to their availability and as to what materials are accepted. ► Set goals for waste reduction and provide feedback on progress. ► Target collection programs for any waste streams unique to your operation.
When?	Design and Occupancy, depending on scale of operations.
Who is Responsible?	Project leader and interior designer
Resources/ Products	Portland's commercial recycling collection system varies from most other jurisdictions in the region. It is important to know what system is in place in your jurisdiction. Portland's commercial recycling collection system is an open and competitive garbage and recycling collection system that allows commercial customers to choose among 64 permitted haulers in the city and negotiate rates for service. Portland garbage haulers are required to offer recycling collection for the most common recyclables. There are also independent recyclers that specialize in various recyclables. The City of Portland is the only city in the Metro region that has mandatory recycling requirements for the commercial and construction and demolition waste streams. ► A Commercial Technical Assistance Program is available to help you. **City of Portland, Office of Sustainable Development** Solid Waste and Recycling, 503-823-7037 wasteinfo@ci.portland.or.us

Resources/ Products (con'd)

Beaverton's commercial recycling collection system is franchised. This means that haulers are assigned an area of operation within City limits. Generally, recycling is included as part of the garbage service rate. To find out who your hauler is in Beaverton contact the recycling team at the address below.

A Commercial Technical Assistance Program is available to help you.

- **City of Beaverton**
  Solid Waste and Recycling Program, 503-526-2665
  recyclingmail@ci.beaverton.or.us

IL-2 Limit Permanent Walls

Limit permanent walls to building core.

Benefits MATERIALS EFFICIENCY	Recognize that work patterns will continue to evolve in any organization, and that having an adaptable workspace is one of the keys to success. Build in organizational flexibility by selecting furniture systems that easily and efficiently adapt to changes in your workspace layout. A successful space plan will accommodate future change with minimal cost, waste, and disruption to the work process. A space plan that can be rearranged and reused for a variety of designs is less likely to end up as a "waste" product. It can often be accomplished with fewer materials than new, permanent construction for the same purpose, and helps reduce resource use.
What?	Limit permanent walls in your office space to bathrooms, around elevators, and around other functional spaces in the core of the building. Use temporary space dividers for separating offices and workspaces.
How? Strategies for Getting It Done	► Use equipment and furnishings that can be relocated and reconfigured easily. ► Select furnishings that are mobile and flexible, such as reconfigurable conference tables, mobile storage pedestals, and movable white boards. ► For enclosed offices, consider de-mountable partitions instead of framed gypsum board walls to allow for quick and inexpensive reconfiguration without waste. ► Consider raised access floor systems where appropriate, allowing easy modifications to the distribution of power, data and communications cabling.
When?	Design
Who is Responsible?	Interior designers, space planners
Cost and Schedule	Reduced life cycle costs associated with future remodels and reorganizations.

IL-3 Multiple Power Locations

Provide multiple locations with power for office equipment.

Benefits MATERIALS EFFICIENCY	As with the flexible layout options offered by limiting permanent walls (IL-2), providing ample and well distributed power and communication outlets allows you to reconfigure the workspace over time to best suit changing needs.
What?	Provide power and communication outlets regularly throughout the space, not just with the existing workspace layout.
How? Strategies for Getting It Done	▶ Provide power, data, and communications outlets in all rooms, and at regular intervals along all walls. ▶ Install a raised access floor system, allowing easy modifications to the distribution of power, data, and communications cabling.
When?	Design
Who is Responsible?	Electrical engineer
Cost and Schedule	Reduced life cycle costs associated with re-wiring to accommodate future changes

IL-4 Noise Control

Provide noise control for walls, ceilings, and floors.

Benefits ACOUSTIC QUALITY	The acoustic qualities of a space should enable the occupants to effectively perform their tasks without distractions. This includes speech privacy and intelligibility, freedom from distraction, and the ability to concentrate on tasks and on the safe operation of equipment.
What?	Provide noise control using the permanent surfaces in the space, floors, permanent walls, and ceilings.
How? Strategies for Getting It Done	▶ Use acoustical batts and other sound-absorption materials and techniques in walls and above ceilings of private offices and conference rooms. ▶ Locate sound-absorbing materials (soft or porous surfaces) such as acoustical ceiling tiles, wall panels, suspended baffles and acoustical clouds to "soften" open work areas. ▶ Avoid large areas of hard, smooth continuous surfaces and concave shapes on ceilings and walls, which tend to reflect and concentrate sounds. ▶ Eliminate potential sound transmission pathways between offices created by ductwork and recessed lighting; place switches and outlets back-to-back on opposite sides of a wall. ▶ Locate noisy equipment away from quiet areas or put into separate rooms. ▶ Specify white noise or sound masking to help deaden sound transmission. ▶ Also, see Action Strategy M-5, p. 91.
When?	Design
Who is Responsible?	Project lead, interior designer You may want to consult with an acoustical engineer.
Cost and Schedule	Some equipment, like acoustical batts and other sound absorbing materials, will have additional costs associated.

IL-5 Walk-Off System

Provide a permanent walk-off mat or grille at all building entrances.

Benefits HEALTH & INDOOR AIR	Tracked-in soil includes many contaminants. These are deposited in the workspace as people walk around. A simple way to stop soil and contaminants is to install a walk-off mat or grille at the entries. These mats can be cleaned periodically.
What?	If your space has outside entries, provide a walk-off mat or grille at each entrance. If your space is located inside the building, work with the property manager to ensure outside entries have walk-off mats or grilles. ▶ Types of mats/grilles include: ▶ Rubber mats. Some are made with recycled tires. ▶ Built in systems. For example, metal grille with opening for periodic cleaning. ▶ Plan for regular maintenance and cleaning of these surfaces to prevent a build-up of dirt that would ultimately be tracked onto the remaining surfaces.
Design Guidelines and Standards	These mats should be large enough for a person to take two steps before stepping onto other flooring surfaces.
When?	Design
Who is Responsible?	Project lead, interior designer

Finishes & Furnishings

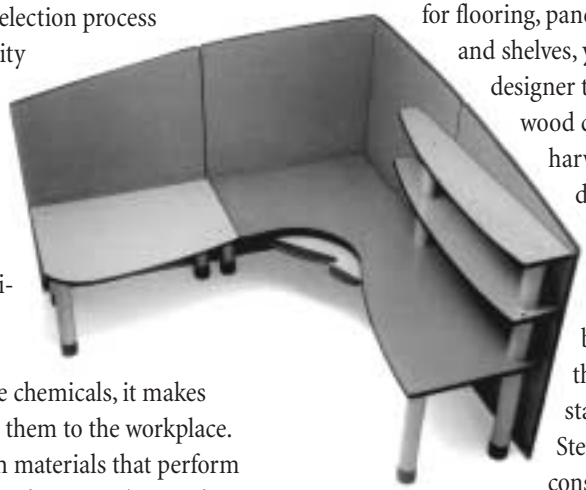
Bamboo flooring is durable, attractive and rapidly renewable.

FINISHES & FURNISHINGS

		✔
®	**F-1: Material Matrix** Use the Material Matrix to plan and track use of materials with green characteristics.	☐
○	**F-2: Durable Materials** Select durable materials.	☐
○	**F-3: Recycled-Content Materials** Use recycled-content materials.	☐
○	**F-4: Salvaged/Refurbished Materials** Use salvaged and refurbished materials.	☐
○	**F-5: Low-Emitting Carpet** Use low-emitting carpet and carpet pad.	☐
○	**F-6: Low-Emitting Interior Paints and Coatings** Use low-emitting interior paints and coatings.	☐
○	**F-7: Low-Emitting Interior Adhesives and Sealants** Use low-emitting interior adhesives and sealants.	☐
○	**F-8: Formaldehyde-Free Interior Composite Wood** Use no urea-formaldehyde-containing composite interior wood materials or products.	☐
○	**F-9: Local Materials** Use materials that are manufactured or harvested locally.	☐
○	**F-10: Rapidly Renewable Materials** Use products made from rapidly renewable materials.	☐
○	**F-11: Certified Wood** Use certified wood products.	☐

Finishes & Furnishings Strategies

Finishes like carpets and paints are usually selected to fit an overall design and provide reasonable performance and value. The selection process also provides an opportunity to eliminate and reduce common indoor pollutants that may be emitted by these finishes.



Finish materials may emit or 'offgas' hazardous chemicals. While there is debate over the potential risks of injury or illness from these chemicals, it makes sense to avoid introducing them to the workplace. Fortunately there are finish materials that perform well, cost about the same, and emit no (or much less) hazardous chemicals. The sections on carpets, paints and coatings, and adhesives and sealants describe some standards and some certifications to guide your choices.

Getting safer finishes is not usually a question of paying more, rather a result of direct communications with designers, contractors and building managers. They may be accustomed to using certain products and materials. To make a change, you will need to be specific with them about your requirements. For example, tell them that you want paints that meet GreenSeal certification standards.

Formaldehyde is a common pollutant emitted by composite wood products like particleboard underlayment, cabinet casings, and shelving. The formaldehyde section offers safer alternatives.

In choosing materials, your organization can make a big difference to the environment. For example, when you work with your designer to select woods for flooring, paneling, trim, cabinets and shelves, you can ask the designer to specify that the wood come from sustainably harvested forests. The designer can specify 'certified' wood, meaning that the forest has been certified by an independent third party using the standards of the Forest Stewardship Council. As a consumer, you have the power to assure that wood in your workplace will look good and do good by protecting forests.

In general, you can help the environment by choosing:

- Locally made products that don't have to be transported over long distances,
- Products with recycled content like Metro recycled paint or Armstrong ceiling tiles,
- Rapidly renewable products like bamboo flooring or wheatboard cabinets,
- Salvage materials like wood flooring, and
- Certified wood products.

Metro produces recycled paint.

Workstations built from recycled doors.

Green Products and Materials

Building material choices are important in green design because of the extensive extraction, processing, and transportation costs associated with manufacturing. The process of making building materials has a huge effect on our environment, creating air and water pollution, destroying our natural habitats, and depleting our natural resources. We can help reduce this devastation by our choices of materials for TI projects.

In addition, careful selection of interior materials and products can have a big impact on the appearance, ease of maintenance, and environmental impact of a tenant improvement project. Of course, each material must also be considered for its performance, quality, durability, and maintenance requirements.

Today, we also recognize that environmental considerations should also encompass the entire life cycle of a product — how and where a raw material is extracted, the energy, water, pollution, and transportation impacts of its manufacture, and how the material is disposed of at the end of its life. (For more information, see "Life Cycle Analysis" in the Glossary: Green Building Terms.)

The ReBuilding Center carries a variety of salvage building materials.

Tips for Selecting Green Materials

Although life cycle analysis provides a scientific, quantitative methodology for selecting environmentally preferable materials, such data are often unavailable. Here are some tips for selecting green materials based on qualitative life cycle considerations.

► Give preference to products that are locally and regionally manufactured, using raw materials from the area. The transportation of materials, particularly by truck, causes considerable environmental impact.

► Purchase salvaged and refurbished materials in place of new ones. Salvaged doors, wood paneling and trim, furniture systems and other materials may be available at lower cost and/or higher quality. In Portland, the Rebuilding Center carries many salvaged building materials. Salvage wood is often of higher quality than new wood.

► Purchase products manufactured from recycled materials. Some carpet, ceiling tiles, paint are available from recycled sources. "Wheatboard" made from waste straw is a replacement for particleboard and fiberboard.

► Specify materials that are easy to maintain using safe, low-toxicity cleaners. Avoid materials that require frequent cleaning, and maintenance with unsafe chemicals.

► Specify high quality, durable materials that are appropriate to the expected wear they will receive in use. Consider where floor and wall surfaces will be impacted by high foot traffic, movable carts and equipment and other sources of wear. For example, high density wall board resists dents and reduces future repairs.

► Specify products that are manufactured from rapidly renewable resources (raw material sources that regenerate in less than ten years). These products include cork, bamboo, natural linoleum flooring and composites made from agricultural fiber (strawboard and wheatboard).

► Specify sustainable wood products from "well-managed" forests. Look for products certified under the guidelines of the Forest Stewardship Council (FSC).

► Where information is available, consider the environmental performance of the material manufacturer. Do they have an environmental management system in place for reviewing performance? Do they have ISO 14001 Certification? Are they using a sustainable decision making framework such as The Natural Step (see www.naturalstep.org)?

► Check out locally available green materials at the Northwest Green Materials database, www.green-rated.org.

Environmentally Preferable Alternatives to Conventional Tenant Improvement Materials

This is a listing of common finish materials used in tenant improvement projects, followed by potential alternatives to these materials and a summary of the environmental benefits of choosing the alternatives. This listing is by no means exhaustive, but is intended to assist in the identification and evaluation of alternatives.

Common Material	Alternate Material	Environmental Benefits
Sheet Vinyl Flooring	▶ Linoleum Flooring ▶ Cork Flooring	▶ Low VOC, rapidly renewable ▶ Low VOC, rapidly renewable
Vinyl Composition Flooring	▶ Stratica by Amtico ▶ MetaFlor by Lees, Burlington Indiana ▶ Rubber Flooring ▶ Stained Concrete	▶ Low VOC ▶ High recycled content, meets CRI green label, less material use ▶ High recycled content ▶ Minimal material use
Rubber Base	▶ Carpet Base	▶ Can be recycled at end of life ▶ Meets CRI Green Label
Vinyl Wallcovering	▶ Paint ▶ Sisal Wallcoverings ▶ Cork Wallcoverings ▶ Natural Fiber Wallcoverings	▶ Use paint that has no or low VOC's ▶ Rapidly renewable material ▶ Rapidly renewable material ▶ Rapidly renewable material
Nylon Broadloom carpet	▶ Nylon Carpet with recycled content face fibers and/or recycled content backing. ▶ Wool Carpet ▶ Nylon Carpet Tile ▶ Stained Concrete ▶ Bamboo Flooring	▶ Encourages recycling of materials, meets CRI Green Label ▶ Rapidly renewable/high performance ▶ Backing has high recycled content, meets CRI Green Label ▶ Minimal material use, high durability ▶ Rapidly renewable
Plastic Laminate	▶ Linoleum ▶ Sealed Concrete ▶ Syndecrete Concrete	▶ Rapidly renewable ▶ Include fly ash for recycled content ▶ High recycled content
Plywood Medium Density Fiberboard Oriented Strand Board	▶ Cellulose fiberboard ▶ Straw Board	▶ Uses recycled newsprint, no formaldehyde ▶ Agricultural waste, no formaldehyde
Finish Wood Materials	▶ FSC Certified wood materials	▶ Supports sustainable forest management

F-1 Materials Matrix

Use the Material Matrix to plan and track use of materials with green characteristics.

Benefits HEALTH & INDOOR AIR MATERIALS EFFICIENCY	Various common construction and finishing materials have a range of impacts on health and indoor air quality and materials efficiency. Specific guidelines for choosing green building materials that can conserve material resources and help create a healthier office space are outlined in Action Strategies F-2 through F-11 in this section. The materials matrix is a simple tool to visually track your material choices and help you identify and clarify your choices to best achieve your goals
What?	List all of the building materials to be used in your project and mark the environmental characteristics of each material. Review the matrix to determine if the project's materials meet your green requirements.
Design Guidelines and Standards	Refer to individual Strategies for finish material standards when completing the matrix. **Required for G/Rated Certification**
How? Strategies for Getting It Done	Refer to the individual Strategies on finish materials for more information how to select green materials.
When?	Design
Who is Responsible?	Project leader, interior designer
Cost and Schedule	Refer to individual Strategies for various materials.
Resources/ Products	There are numerous resources for identifying environmentally preferable products. The G/Rated web site will get you to the best ones. Here's how: go to the G/Rated Home page at www.green-rated.org. Click on "Technical Resources," then "Tools," then "Product Databases." Recommended Resources include: ▶ **GreenSpec**: The Environmental Building News Product Directory and Guidelines Specifications. From the publishers of Environmental Building News, this is a comprehensive guide to over 1200 green building products and materials. Full listings of 119 of the more than 1500 products listed in GreenSpec are available online at www.greenspec.com/prod_info.html. The entire listing is available by subscription.

F-1 Materials Matrix (con'd)

Resources/ Products (con'd)

- **EPA's Environmentally Preferable Purchasing (EPP) Database**, at www.epa.gov/opptintr/epp/database.htm, is a searchable database providing environmental information on over 600 products and services.
- **Oikos**, www.oikos.com/library/index.html
  This web site is a Green Building Library with links to a number of publications on greener building materials, construction practices, and other web sites.
- **Environmental Building Supplies**, www.ecohaus.com, 819 SE Taylor St., Portland, OR 97214, 503-222-3881
  Local supplier of a full line of residential construction materials, including recycled and natural fiber carpet, certified and salvaged flooring, certified lumber, panel material, low- and no-VOC paints and finishes, recycled content tile, Marmoleum, and other materials.
- **The Environmental Home Center**, in Seattle, is also a good regional source of green building materials. Visit them at www.environmentalhomecenter.com.

Materials Matrix

CSI	Material List	Who	ENVIRONMENTAL ATTRIBUTES										Comments
			Durable (F-2)	Recycled Content (F-3)	Salvage/Refurbished (F-4)	Low-Emitting Carpet (F-5)	Low-Emitting Interior Paints and Coatings (F-6)	Low-Emitting Interior Adhesives and Sealants (F-7)	Formaldehyde-Free Interior Composite Wood (F-8)	Local Materials (F-9)	Rapidly Renewable (F-10)	Certified Wood (F-11)	
05000: METALS													
05100	Metal framing												
06000: WOOD & PLASTICS													
06070	Plywood and OSB												
06100	Lumber - rough carpentry												
06160	Fiberboard sheets, MDF												
06170	Engineered lumber												
06200	Finish lumber and millwork												
06400	Architectural woodwork												
06500	Structural plastics												
06600	Plastic Fabrications												
08000: DOORS & WINDOWS													
08100	Metal doors and frames												
08200	Wood and plastic doors												
08550	Wood windows												
08560	Vinyl windows												

CSI	Material List	Who	ENVIRONMENTAL ATTRIBUTES										Comments
			Durable (F-2)	Recycled Content (F-3)	Salvage/Refurbished (F-4)	Low-Emitting Carpet (F-5)	Low-Emitting Interior Paints and Coatings (F-6)	Low-Emitting Interior Adhesives and Sealants (F-7)	Formaldehyde-Free Interior Composite Wood (F-8)	Local Materials (F-9)	Rapidly Renewable (F-10)	Certified Wood (F-11)	
09000: FINISHES													
09250	Gypsum												
09300	Ceramic tile												
09510	Acoustical ceiling panels												
09640	Wood flooring												
09650	Resilient flooring												
09680	Carpet												
09910	Interior paints and stains												
10000: SPECIALITIES													
10110	Fixed tackboards												
10155	Toilet compartments												
10150	Portable partitions, screws and panels												
10670	Storage shelving												
10705	Exterior sun control devices												
12000: FURNISHINGS													
12484	Floor mats												
12492	Window shades												
12510	Office furniture												
12000	Manufactured casework												

F-2 Durable Materials

Select durable materials.

Benefits MATERIALS EFFICIENCY	Durable materials, such as wood, tile, and linoleum, are generally easy to maintain, reducing costs and the use of cleaning chemicals, and rarely need replacement, thereby decreasing waste. Materials, such as carpet, that require more frequent replacement, may be recyclable or could even be refurbished for reuse. Durable office furnishings not only reduce the environmental impact of producing new products, but often provide higher quality products for the same or less money.
What?	Materials should have a minimum 15-year life or be readily recyclable, reusable, or refurbishable. First, select materials that are appropriate for your project with a minimum 15-year warranty. For all other materials, chose products that can be refurbished, are readily recyclable in the Portland area, or come from manufacturers who offer a special recycling program.
Design Guidelines and Standards	Use warranties as a guideline for length of product performance, but specifically evaluate each material for it's durability in a particular use and location
How? Strategies for Getting It Done	▶ Identify areas requiring durable materials. These include congested channels and traffic lanes, such as doorways, elevators, stairs, pivot areas, and areas in front of vending machines and copiers. These areas are prone to increased wear and concentrations of soil. The congested channel at a doorway typically extends three feet on either side, and 10 feet in front of elevators. Traffic lanes are where the greatest amount of foot traffic occurs, including aisles between desks, corridors, and areas near drinking fountains, food or cafeteria lines, and break areas. ▶ Durable finish materials include linoleum, ceramic tile and terrazzo, finished concrete for flooring, wood flooring, bamboo flooring, fiber-reinforced cement products, recycled-content plastic toilet partitions. ▶ Use floor materials such as carpet tiles, which can be replaced when worn without requiring replacement of the flooring in the entire space. ▶ List all materials in the materials matrix and mark each one as either durable or recyclable/refurbishable.
When?	Design
Who is Responsible?	Interior designer
Cost and Schedule	Some durable materials may have a higher first cost compared to less durable products. However, the life cycle cost is usually less, due to less frequent replacement.

F-3 Recycled-Content Materials

Use recycled-content materials.

Benefits Characteristics MATERIALS EFFICIENCY	Recycled content materials reduce the impact of mining and extraction of virgin resources. In many instances using recovered materials reduces energy, water and waste impacts of manufacturing processes. Buying recycled products creates a market for recycled materials and helps keep them out of landfills.
What?	Identify in the materials matrix, and use, at least six materials with recycled content in the project. Choose the highest percentage of recycled content available that meets the project's requirements and choose post-consumer content over post-industrial recycled content. For products listed below, use at least the minimum content identified.
Design Guidelines and Standards	Use at least 6 recycled-content materials with a minimum 10% post-consumer* content. each material for it's durability in a particular use and location
How? Strategies for Getting It Done	► Ask for recycled-content materials. For example, Metro sells good quality recycled paint that can be tinted to match your color preferences. ► Carpet, tile, ceiling acoustical panels, drywall, and insulation with recycled content are readily available.
When?	Design
Who is Responsible?	Interior designer
Cost and Schedule	Many common recycled content materials are available at no additional cost. They include concrete with flyash, gypsum, insulation, and acoustical ceiling tiles. Some recycled content finish materials, such as recycled content ceramic tile, may cost more.
Resources/ Products	See Action Strategy F-1 and: ► The **EPA Comprehensive Procurement Guidelines**, at www.epa.gov/epaoswer/non-hw/procure/index.htm. This is a good place to check for common materials available with recycled content and recommended ranges. ► **Recycled-Content Products Database**: California's Integrated Waste Management Board provides this searchable recycled-content products database. www.ciwmb.ca.gov/RCP/default.asp *Post-consumer refers to waste materials that have been used by the end consumer. Pre-consumer refers to products that are waste or byproducts of manufacturing. For example, junk mail is post-consumer, paper trim from a card making process is pre-consumer.

F-4 Salvaged/Refurbished Materials

Use salvaged or refurbished materials.

Benefits MATERIALS EFFICIENCY	Salvaged and refurbished materials are products that don't require significant reprocessing to be used again (compared to recycled content, where the materials have been broken down and reused as a raw material). Wood and office furnishings — such as desks, panels, chairs, and file cabinets — are two common areas to use salvaged/refurbished materials. Very often you can get higher quality products this way — products that have finished emitting VOCs — and save money as well.
What?	Identify in the materials matrix and use at least three (3) refurbished or salvaged materials in the project.
How? Strategies for Getting It Done	▶ Check the availability of products you need with used building material and used office furniture stores in the area. ▶ Make sure you check manufacturer products specs and warranty information, and get concurrence of architect and structural engineer when required.
When?	Design
Who is Responsible?	Interior designer, architect, structural engineer
Cost and Schedule	Often less cost
Resources/ Products	▶ **The ReBuilding Center** 3625 North Mississippi Ave., Portland, OR 97227 p: 503-331-1877, f: 503-331-1873 or 503-684-8928 e-mail: info@rebuildingcenter.org A project of Our United Villages, the Rebuilding Center sells quality salvaged building materials, including lumber, at 50-90% less than new materials. Non-profits may apply for free materials in advance by submitting a written request, reviewed at the weekly staff meeting. The ReBuilding Center has plumbing fixtures, cabinets, framing lumber, Metro recycled paint, and doors. In order to use salvaged lumber for structural purposes, it must be re-graded. ▶ **Hippo Hardware & Trading Company** 1040 East Burnside St., Portland, OR 97214, p: 503-231-1444 Specializes in new, used, renovated, and vintage hardware, plumbing, house parts, and lighting.

F-4 Salvaged/Refurbished Materials (con'd)

Resources/ Products (con'd)

- **Rejuvenation**, www.rejuvenation.com
  1100 SE Grand Ave., Portland, OR 97214, p: 503-238-1900
  Specializing in 1880-1940 original and reproduction home renovation products.

- **Habitat for Humanity Restore**
  1814 N. Columbia Blvd., Portland, OR 97217, p: 503-283-6247

Lumber grading services – vendors:

- **West Coast Lumber Inspection Bureau**
  Box 23145, Portland, OR 97281, p: 503-639-0651

- **Western Wood Products Association**
  Yeon Building, 522 SW Fifth Ave., Portland, OR 97204-2122
  p: 503-224-3930, f: 503-224-3934, e-mail: info@wwpa.org

F-5 Low-Emitting Carpet

Use low-emitting carpet and carpet pad.

Benefits HEALTH & INDOOR AIR	The materials in carpet may release gases and compounds into the air for a period of time after the carpet is installed. The emissions, such as volatile organic compounds (VOCs) and formaldehyde, may cause respiratory irritation or other health impacts. The carpet industry has responded to concerns about emissions and now offers many low emitting products.
What?	Use carpet that is certified by one of the programs below to have limited emissions of VOCs and formaldehyde.
Design Guidelines and Standards	**Carpet and Rug Institute (CRI):**

CRI Emission Factor Limit	[mg/m2/hr]
Carpet Total VOCs	**0.50**
4-Phenylcyclohexene	0.50
Formaldehyde	0.05
Styrene	0.40
Adhesives Total VOCs	**10.0**
Formaldehyde	0.05
2-Ethyl-1-Hexonol	3.00
Cushion Total VOCs	**1.00**
4-Phenylcyclohexene	0.30
Formaldehyde	0.50
Styrene	0.50

Green Guard Flooring Standards

Total VOCs	**0.50 mg/m3**
Formaldehyde	0.05 ppm
Total aldehydes	0.1 ppm
4-phenylcyclohexene	0.0065 mg/m3
Styrene	0.070 mg/m3

When?	Design
Who is Responsible?	Interior designer
Cost and Schedule	No impact

F-5 Low-Emitting Carpet (con'd)

Resources/ products

- The web site of the **Carpet and Rug Institute**, www.carpet-rug.com, contains an online database of products meeting the CRI IAQ Green Label standards.
- **"Environmentally Responsible Carpet Choices"** at www.metrokc.gov/procure/green/carpet.htm
- **Green Seal report on Carpet**, www.greenseal.org/cgrs/Carpet_CGR.pdf.
- **Green Guard**, www.greenguard.org/manufacturers/standards.asp#flooring

F-6 Low-Emitting Interior Paints and Coatings

Use low-emitting interior paints and coatings.

Benefits HEALTH & INDOOR AIR	The materials used in paint manufacture may release gases and compounds into the air for a period of time after the painting is complete. The emissions, such as volatile organic compounds (VOCs) from solvents, may cause respiratory irritation or other health impacts. The paint industry has responded to concerns about these emissions and now offers many low- or zero-VOC products. Some paint manufactures are also reducing or changing other paint ingredients of concern, such as fungicides.
What?	Use only paints that meet the emission standards set below.
Design Guidelines and Standards	Green Seal Standard GS-11: 1. Non-flat sheen: 150 g/l VOC maximum 2. Flat sheen: 50 g/l VOC maximum
When?	Design
Who is Responsible?	Designer (specifications) and contractor (execution)
Cost and Schedule	Many low-emitting paints and coatings are available for the same cost or slightly more than conventional products.
Resources/ products	▶ **Green Seal**, www.greenseal.org. Lists products currently certified by Green Seal at: www.greenseal.org/certproducts.htm#paints ▶ **King County, Washington** web page, Environmentally Responsible Paint Options, www.metrokc.gov/procure/green/paint2.htm ▶ **Environmental Building Supplies**, www.ecohaus.com 819 SE Taylor St., Portland, OR 97214, p: 503.222.3881 Local supplier of a full line of construction materials, including recycled and natural fiber carpet, certified and salvaged flooring, certified lumber, panel material, low- and no-VOC paints and finishes, recycled content tile, Marmoleum, and other materials. ▶ **Miller Paint** p: 503-233-4491 Several locations in the area. Manufactures a low-biocide, low-fungicide paint. ▶ **Rodda Paint** p: 503-233-6016 Several locations in the area. Manufactures "Horizon," a low-odor Green Seal certified paint with more solids, less binders, and better coverage.

F-6 Low-Emitting Interior Paints and Coatings (con'd)

Resources/ products (con'd)

- **Sherwin-Williams**
  p: 503-760-8233
  Several locations in the area. Manufactures "Health-spec," a low-odor, solvent-free paint.
- **Timber-Tek UV Wood Finishes**
  2232 E Burnside, Portland, OR 97214, p: 503-232-1705
  A line of natural stains, sealants and urethanes manufactured in Portland.

F-7 Low-Emitting Interior Adhesives & Sealants

Use low-emitting interior adhesives and sealants.

Benefits

HEALTH & INDOOR AIR

Interior adhesives and sealants can be a significant source of VOCs, both during construction and occupancy. The chemicals that liquefy glues and similar substances for application evaporate into the air while the material dries, or "cures."

Low-VOC products protect indoor air quality and help reduce smog in the outdoor environment.

What?

Use only adhesives and sealants that meet the standards below.

Design Guidelines and Standards

South Coast Air Quality Management District, Rule #1168 (www.aqmd.gov) for adhesives as follows:

Application	Current VOC Limit*
Indoor Carpet Adhesives	50
Carpet Pad Adhesives	50
Outdoor Carpet Adhesives	150
Wood Flooring Adhesive	100
Rubber Floor Adhesives	60
Subfloor Adhesives	50
Ceramic Tile Adhesives	65
VCT and Asphalt Tile Adhesives	50
Dry Wall and Panel Adhesives	50
Cove Base Adhesives	50
Multipurpose Construction Adhesives	70
Structural Glazing Adhesives	100
Single Ply Roof Membrane Adhesives	250

* Less Water and exempt compounds in grams per liter

How? Strategies for Getting It Done

- ▶ Specify adhesives that meet the VOC limits of the South Coast Air Quality Management District, Rule #1168 for carpet, seam sealer, tile, flooring, cove base, countertop, framing, and panel adhesives.
- ▶ Use low toxic painter's caulk as sealant; Use low-VOC water-proofing sealants.

When?

Design

Who is Responsible?

Designer (specifications) and contractor (execution)

F-7 Low-Emitting Interior Adhesives & Sealants (con'd)

Cost and Schedule	Many low-emitting adhesives and sealants are available for the same cost or slightly more than conventional products.
Resources/ products	**Local Vendors:** ▶ **John Latta Associates** 1001 SE Division St., Portland, OR 97202 p: 800-444-8877 or 503-238-1253 Stocks solvent-free waterproofing and other sealant materials. **Products:** ▶ **Speed Grip** is a 100% VOC-free, chemically reactive formula, construction adhesive for use on a variety of porous and nonporous surfaces, including plastic, wood, concrete, brick, plasterboard, carpet, and metal. This adhesive is intended for applications such as panel installation, sheathing, windows, and other building components. Speed Grip cleans up in water. Geocel Corporation, Elkhart, IN, 800-348-7615, www.geocelusa.com. ▶ **Titebond** is a solvent-free, nonflammable construction adhesive that contains 6.6 g/l VOCs. Its performance is equivalent to conventional adhesives. Titebond complies with the requirements of the APA, AFG-01 test for subfloors. The cost is about 10% higher than conventional solvent-based adhesives. Franklin International, 800-877-4583, www.titebond.com. Available through Environmental Home Center, 206-682-7332. ▶ **DAP Weldwood**, DAP Inc, 800-543-3840. (for laminate to casework) ▶ **Earthbond 7000**, Roberts Co, 626-369-7311. (for laminate to casework) ▶ **Premium Wood Glue**, OSI Sealants, 800-999-8920, OSI Sealants, Inc., Mentor, OH, 800-624-7767, www.osisealants.com.

F-8 Formaldehyde-Free Interior Composite Wood

Use no urea-formaldehyde-containing composite interior wood materials or products.

Benefits HEALTH & INDOOR AIR	Urea-formaldehyde resin is commonly added to composite wood products and continues to emit into the air after the products are installed in the office space. A colorless, pungent-smelling gas, formaldehyde can cause watery eyes, burning sensations in the eyes and throat, nausea, and difficulty in breathing in some humans exposed at elevated levels. High concentrations may trigger attacks in people with asthma. Avoiding formaldehyde-containing products reduces risk of adverse impacts on occupant health and productivity.
What?	Use no indoor composite wood products that contain urea-formaldehyde.
Design Guidelines and Standards	Greenguard certified or "no-urea-formaldehyde" statement from manufacturer.
How? Strategies for Getting It Done	▶ Specify composite wood products (e.g., particleboard) with no added urea-formaldehyde resins. ▶ Specify wheatboard, plywood or formaldehyde-free fiberboard for cabinets, storage systems and shelving.
When?	Design
Who is Responsible?	Designer (specifications) and contractor (execution)
Cost and Schedule	Alternatives can cost slightly less, the same, or up to 25% more depending upon the product and application. Wheatboard costs less than conventional particleboard. Possible savings due to avoidance of IAQ issues after move-in.
Resources/ products	▶ **WheatBoard** by Primeboard Inc., distributed by United Board Group. Kevin Smith, Sales/Marketing Manager, 701-642-9700 ▶ **FIBEROCK Brand Gypsum Fiber Underlayment**, manufactured by U.S. Gypsum Co., 800-874-4968, www.usg.com. ▶ **Formaldehyde-free MDF** from Medite Corporation, Medford, OR, 800-676-3339. Available through local suppliers.

F-8 Formaldehyde-Free Interior Composite Wood (con'd)

Resources/ products (con'd)

- **AllGreen(R) MDF** is the first fiberboard made from 100% waste wood. Proprietary technology produces panels exceeding ANSI standards for industrial MDF, with superior dimensional stability and zero incremental formaldehyde emissions. AllGreen MDF is available in four versions "FR" Class 1 fire-rated, a highly moisture-resistant "MR" version, a powdercoating grade, and standard board. Primed moldings are also available. CanFibre Group Ltd., Toronto, ON, 416-681-9990.
- **Woodstalk from Dow Bioproducts**
  www.dow.com/bioprod/prodapp/index.htm
- **Hardwoods, Inc.**
  Vancouver, WA, p: 360-695-6600
- **Neil Kelly Naturals Collection** is a line of manufactured cabinets that uses certified woods and veneers as well as environmentally friendly finishes and case materials. Neil Kelly Signature Cabinets, 804 North Alberta, Portland, OR 97217, p: 503-288-6345, www.neilkelly.com.
- **Greenline** builds cabinets, casework, and countertops using wheatboard structural cores, FSC-certified veneers, high pressure plastic laminates, and various ISO 14001-certified materials. Casework is formaldehyde- and solvent-free. Forefront Designs, 1075 Shelley St., Springfield, OR 97477, p: 541-747-4884 or 888-245-0075, www.forefrontdesigns.com.
- **Green Guard**
  www.greenguard.org

F-9 Local Materials

Use materials that are manufactured or harvested locally.

Benefits MATERIALS EFFICIENCY	The purchase of local materials helps support the regional economy by supporting regional business and industries. Not only do direct expenditures support those businesses, but that money is more likely to be recirculated in the local economy. Using local materials conserves energy by avoiding fuel consumption for transporting materials long distances. This in turns protects our atmosphere from the air pollution and CO2 emissions that would be produced by burning this fuel.
What?	Use at least six materials that are manufactured, assembled, or harvested within 500 miles of Portland.
Design Guidelines and Standards	"Local" means within 500 miles of the Portland metropolitan area.
When?	Design Development.
Who is Responsible?	Architect (specifications) General contractor. During construction, ensure that the specified local materials are installed and quantify the total percentage of local materials installed.
Cost and Schedule	Reduced first costs for materials because regional building materials are more cost effective for projects due to reduced transportation costs.
Resources/ products	There are numerous resources for identifying environmentally preferable products. The **G/Rated web site** will get you to the best ones. Here's how: go to the G/Rated Home page at www.green-rated.org. Click on "Technical Resources," then "Tools," then "Product Databases."

F-10 Rapidly Renewable Materials

Use products made from rapidly renewable materials.

Benefits MATERIALS EFFICIENCY	Rapidly renewable materials are products that regenerate quicker than the demand for the products. In practical terms, this means that the materials substantially replenish themselves (planted and harvested) in less than 10 years. Many rapidly renewable materials, such as agricultural waste products converted into pressed agri-board products, bamboo, cork flooring, linoleum and others perform equally as well as their non-renewable counterparts. There are many applications for rapidly renewable materials; however the most common applications include flooring and cabinetry. Using rapidly renewable materials rather than non-renewables, which include fossil fuel-based plastics or slowly regenerating resources such as old-growth lumber, may reduce the environmental impact of your building by lowering its impact on the climate, and by avoiding contributions to deforestation.
What?	Use at least three products made from rapidly renewable materials.
Design Guidelines and Standards	10 year or less regeneration rate for the materials
When?	Design
Who is Responsible?	Designer
Cost and Schedule	The cost premium, if any, depends upon the specific material. For example, bamboo flooring costs significantly more than conventional wood flooring.
Resources/ products	► **American Bamboo Society**, www.americanbamboo.org Also check with: ► **Environmental Building Supplies** 819 SE Taylor St., Portland, OR 97214, 503-222-3881 Local supplier of a full line of residential construction materials, including recycled and natural fiber carpet, certified and salvaged flooring, certified lumber, panel material, low- and no-VOC paints and finishes, recycled content tile, Marmoleum, and other materials. ► **The Environmental Home Center**, in Seattle, is also a good regional source of green building materials. Visit them at www.environmentalhomecenter.com.

F-11 Certified Wood

Specify wood products from well-managed forests certified to meet Forest Stewardship Council (FSC) standards.

Benefits MATERIALS EFFICIENCY	Forest certification is a means of protecting forests by promoting responsible forestry practices. Forest certification provides an independent third-party assurance that a forestry operation meets standards set by a certification program. Companies apply voluntarily, and government has no direct role in the process. Although there are several forest certification systems, this Action Strategy requires the use of lumber from forests certified by the Forest Stewardship Council (FSC). The use of certified woods provide assurance that forest resources are managed and harvested in a sustainable way, protecting the integrity of the forest, riparian areas, and wildlife.
What?	Specify at least one major wood use as certified by the Forest Stewardship Council (FSC), flooring, framing, trim, etc.
Design Guidelines and Standards	Forest Stewardship Council Certification Guidelines
How? Strategies for Getting It Done	Carefully evaluate specified species and grades, especially for non-visible areas, such as closets or behind counters. Often a lower grade or different species can suffice, increasing the range of available products and often lowering cost as well.
When?	Design
Who is Responsible?	Designer
Cost and Schedule	Cost premium, if any, depends upon lumber type. Some types can cost up to 30% more than conventional wood. However, many wood products are now readily available that cost no more than conventional lumber. In addition, it is often possible to substitute a lower grade wood for some applications, reducing cost. It is important to research material availability and order early to avoid potential schedule impacts due to material availability.
Resources/ products	► "Specifying and Using Certified Wood," a web page of the **Certified Forest Products Council** web site. A Project Toolkit containing sample specifications and other information is available at www.certifiedwood.org/education-modules/specifying-using-certified-wood.htm

F-11 Certified Wood (con'd)

Resources/ products (con'd)

- **Metafore** (formerly Certified Forest Products Council, CFPC) is a an independent non profit organization, with a broad membership comprised of interested individuals and businesses, institutions and organizations that buy, sell, specify, manufacture or use third-party independently certified forest products. Visit them at www.metafore.org. Search for a source of certified wood products at their online searchable database: www.certifiedwood.org/search-modules/SearchProducts.aspx
- **Forest Stewardship Council**: www.fscoax.org

Mechanical & Electrical

Your TI can maximize comfort and efficiency of heating, cooling and ventilation system.

MECHANICAL & ELECTRICAL

		✔
Ⓡ	**M-1: HVAC Filtration** Ensure HVAC system is equipped with medium efficiency or better filtration.	☐
Ⓡ	**M-2: Thermal Comfort** Design the HVAC system to provide thermal comfort for all occupants in all zones.	☐
Ⓡ	**M-3: Ventilation** Design the HVAC system to provide adequate ventilation to all occupied spaces.	☐
Ⓡ	**M-4: Testing and Balancing** After the tenant improvement project is complete, test & balance the air distribution system.	☐
○	**M-5: Mechanical Equipment Design (Acoustic)** Use best practices for the design and installation of mechanical equipment and the design and installation of ductwork to minimize equipment noise.	☐
○	**M-6: Selected Independent Exhaust System** Provide independent exhaust for rooms containing a concentration of copiers, printers and fax machines.	☐
○	**M-7: Ductwork Design and Installation** Design & install efficient air distribution ductwork.	☐
○	**M-8: HVAC Zone Control** Provide separately controlled HVAC zones throughout the workspace, anticipating the differing heating and cooling needs in each area during different times of the day.	☐
○	**M-9: VAV Design (Layout)** For variable air volume (VAV) systems, include appropriate number of properly adjusted VAV boxes.	☐
○	**M-10: Automatic Temperature Controls** Provide automatic controls to adjust thermostat setting when the spaces are not occupied	☐
○	**M-11: Pressurized Zones** Design HVAC system to provide barometric (air pressure) levels in order to control odors and moisture migration between spaces and to adjacent tenants' spaces.	☐

M-12: Water Conservation
Install water-using devices to exceed current code requirement.

M-13: Individual Sub-metering

Introduction to Heating, Ventilating and Air Conditioning (HVAC) Systems

All occupied buildings require a supply of outdoor air. Depending on outdoor conditions, the air may need to be heated or cooled before it is distributed into the occupied space. As outdoor air is drawn into the building, indoor air is exhausted, thus removing air contaminants. The term "HVAC system" is used to refer to the equipment that can provide heating, cooling, filtered outdoor air, and humidity control to maintain comfort conditions in a building.

There are two major types of HVAC systems based upon the use of airflow to control temperature — the Constant Volume (CV) system, and the Variable Air Volume (VAV) system.

- Constant volume systems, as their name suggests, generally deliver a constant airflow to each space. Changes in space temperatures are made by heating or cooling the air or switching the air handling unit on and off, not by modulating the volume of air supplied. These systems often operate with a fixed minimum percentage of outdoor air or with an air economizer. (Economizers are controls of the outdoor air designed to save energy by using cool outside air as a means of cooling the indoor space.) These systems are generally less versatile and efficient than VAV systems.
- Variable air volume systems maintain thermal comfort by varying the amount of heated or cooled air delivered to each space, rather than by changing the air temperature. Overcooling or overheating can occur within a given zone if the system is not adjusted to respond to the load. Underventilation frequently occurs if the system is not arranged to introduce at least a minimum quantity (as opposed to percentage) of outdoor air as the VAV system throttles back from full airflow, or if the system supply air temperature is set too low for the loads present in the zone.

Air conditioning and ventilation systems can significantly affect a building's profitability. These systems consume about one-fourth of an office building's electricity, and they often have a strong influence on worker productivity. (Many workers report that their workplaces are too hot or too cold.)

A properly designed and functioning HVAC system is critical to energy efficiency and the health and comfort of occupants. Newer codes and standards seek to balance the conflicting requirements of energy efficiency (which means reducing energy use to heat and cool outside air) and indoor air quality (which means introducing more outside air).

When you move into an existing building, you need to carefully consider the design, condition, and flexibility of the existing HVAC system and make sure it will perform to your requirements. Your ability to affect the HVAC system is constrained by its age and condition and you will need the owner's cooperation to make any changes. However, there are some things you can do to help ensure future comfort and satisfaction. The Action Strategies in this section of the checklist provide some of these strategies.

M-1 HVAC Filtration

Ensure HVAC system is equipped with medium efficiency or better filtration

Benefits HEALTH & INDOOR AIR	Low-efficiency filters are generally used in HVAC systems to trap lint, dust, and other large particles and keep them from damaging the equipment. However, outside air can also contain traffic-related pollution, pollen, and mold spores. And re-circulated indoor air can contain fumes and airborne debris from human and office activity. These contaminants do not jeopardize equipment, but they do degrade indoor air quality for occupants. And if dirt accumulates in ductwork, and if the relative humidity increases so that condensation occurs, nutrients and moisture may also support the growth of mold. Protecting the quality of the indoor ventilation air therefore requires use of medium or better efficiency filters. These higher efficiency filters remove bacteria, pollens, and mold spores as well as larger particulates such as dust and lint.
What?	Specify medium efficiency or better filtration. Some manufacturers offer higher efficiency "partial bypass" carbon filters and carbon-impregnated filters to reduce volatile organics in the ventilation air of office environments. This might be important if the building is next to a pollution source like a major road. However, high efficiency filters are more expensive and maintenance-intensive.
Design Guidelines and Standards	Filters are rated by different standards and test methods such as dust spot and arrestance, which measure different aspects of performance. The current accepted standard is: ANSI/ASHRAE 52.2-1999 Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size. This standard defines the "minimum efficiency reporting" value (MERV) to describe filter performance. At a minimum, specify MERV 8. (The prior test standard used a "Dust Spot" rating, and some filters may still be on the market with the older rating.) **Required for G/Rated Certification**
How? Strategies for Getting It Done	▶ Select filters based on equipment requirements, the filters' ability to protect the HVAC system components, and the filters' ability to protect general indoor air quality. In many buildings, the best choice is a medium efficiency, pleated filter. These filters have a higher removal efficiency than low-efficiency filters, yet they will last without clogging for longer than high efficiency filters. Medium efficiency filters (ASHRAE Dust Spot rating of 30% to 60% or MERV 8) can provide much better filtration than low-efficiency filters. High efficiency filters (MERV 13) should be used subject to equipment compatibility. A 'HEPA' filter is very high efficiency. ▶ Require that filters be changed during construction and before occupancy. (See C-3)

How? (con'd)	▶ In HVAC systems with acoustical fiber duct liner (frequently used in air handler fan housings and supply ducts to reduce sound and insulate), check duct linings for microbiological growth and replace contaminated linings. Note: All air filters, whatever their design or efficiency rating, require regular maintenance (cleaning for some and replacement for most). As the particles accumulate on the filter, air flow through the filter is increasingly hindered, causing the air pressure on the upstream side of the filter to increase over time. This difference in pressure between the upstream and downstream side of the filter is its "pressure drop." Filter manufacturers can provide information on the pressure drop through their products under different conditions. Low-efficiency filters, if loaded to excess, will become deformed and even "blow out" of their filter rack. When filters blow out, bypassing of unfiltered air can lead to clogged coils and dirty ducts. Filtration efficiency can be seriously reduced if the filter cells are not properly sealed to prevent air from bypassing.
When?	Design
Who is Responsible?	Mechanical engineer
Cost and Schedule	A quality medium efficiency filter will cost more than a low-efficiency filter. For most systems, the number of filters is small, and the increase is not significant. First cost increase is more than offset by improved worker productivity and lost time to resolve reduced indoor air quality complaints

M-2 Thermal Comfort

Design the HVAC system to provide thermal comfort for all occupants in all zones.

Benefits THERMAL COMFORT	Thermal comfort is one of the highest ranked factors in employee comfort and consequent productivity. Thermal comfort in work space is determined by four variables: ► air temperature ► air speed ► relative humidity ► radiant surface temperature Designing for thermal comfort not only protects occupant comfort, but also helps to keep the system operating efficiently. If the system is not comfortable to the occupants, it is likely that the system is not operating at peak energy efficiency either.
What?	Design or modify the heating and ventilation system (HVAC) to keep inside air at comfortable ranges of temperature and humidity.
Design Guidelines and Standards	ASHRAE Thermal Comfort Requirements. ASHRAE Standard 55-1992, Thermal Environmental Conditions for Human Occupancy, identifies many factors that influence thermal comfort and the perception of thermal conditions. Among them are air temperature, radiant temperature, humidity, air movement, vertical and horizontal temperature differences, temperature drift, personal activity and clothing. As a practical matter, maintaining a building within the following ranges of temperature and relative humidity will satisfy thermal comfort requirements for most of the occupants most of the time. **Required for G/Rated Certification**
How? Strategies for Getting It Done	► Design the HVAC system to provide thermal comfort to occupants during all normal hours of occupancy. ► Requirements for temperature, relative humidity, and air movement during all seasons should be established and monitored to ensure that thermal comfort requirements are met. ► Develop a protocol to manage complaints and preferences. Note: generally, the climate in the Northwest makes humidity easy to control. In most cases, neither humidification in winter nor dehumidification in summer is required for occupant comfort. Special conditions may require automatic humidity monitoring and control, if activities in the space generate much moisture or require a specific or constant humidity.
When?	Design

Table 2.2 Acceptable Temperature and Humidity Ranges

Measurement Type	Winter	Summer
Dry Bulb at 30% RH	68.5°F - 76.0°F	74.0°F - 80.0°F
Dry Bulb at 50% RH	68.5°F - 74.5°F	73.0°F - 79.0°F
Wet bulb maximum	64°F	68°F
Relative humidity *	30% - 60%	30% - 60%

* Upper bound of 50% RH will also control dust mites.

Who is Responsible?	Mechanical engineer
Cost and Schedule	Potential modest design cost increase due to added design analysis.

M-3 Ventilation

Design the HVAC system to provide adequate ventilation to all occupied spaces.

Benefits HEALTH & INDOOR AIR	Indoor air quality requires the HVAC system to deliver adequate amounts of clean, fresh air to occupants. This fresh air replaces the used, stale air that has become polluted with airborne contaminants from occupant and equipment activities. These airborne pollutants include carbon dioxide or CO2 (from breathing), equipment emissions (ozone and particulates from copiers and printers), moisture, dirt, dust, mold and various other airborne chemicals (from perfume and other hygiene products, furniture, maintenance products, and numerous other sources).
What?	For existing buildings, the HVAC system should be operated to meet, at a minimum, operating parameters for providing thermal comfort and outdoor air ventilation flow as specified in the original design documents. However, if system is capable, it is a good idea to go beyond design requirements where feasible, and program the operating controls to satisfy the outdoor air ventilation requirements of the current standard, ASHRAE 62-2001. Should the outdoor air flow rates of ASHRAE Standard 62-2001 exceed the system's design flow rates, a careful load analysis at these elevated flow rates should be undertaken to ensure that the system has sufficient capacity for the added load at peak load conditions. Failure to perform such an analysis could result in deterioration of indoor air quality and/or coil freezing during extreme weather conditions.
Design Guidelines and Standards	ASHRAE Standard 62-2001, Ventilation for Acceptable Indoor Air Quality, is the generally accepted standard for commercial buildings in the United States. The Standard provides ventilation requirements (in cubic feet per minute (CFM) of fresh air per person and per square foot) for office other commercial spaces. **Required for G/Rated Certification**
How? Strategies for Getting It Done	► Make sure the heating contractor provides properly sized and spaced grilles to avoid drafts. ► Carefully locate supply grilles to ensure that all occupied spaces will receive adequate ventilation. Consider the impact of beams, soffits, partitions, shelving and furniture adjacent to grilles. ► Consider company policy or "good manners" to minimize use of fragrant personal products. ► Consider materials for the fit-out that will minimize contributions to odors and the emission of volatile organic compounds (VOCs).
When?	Design

Who is Responsible?	Architect or engineer
Cost and Schedule	Potential modest design cost increase due to added design analysis

M-4 Testing & Balancing

After the tenant improvement project is complete, test & balance the air distribution system.

Benefits THERMAL COMFORT HEALTH & INDOOR AIR RESOURCE CONSERVATION	A properly functioning HVAC system operates at peak design energy efficiency while providing plenty of clean fresh air to occupants at the right temperature and humidity. System testing, adjusting, and balancing (TAB) is the process of checking and adjusting the building's HVAC system to verify that it system does in fact operate as intended. Proper testing is time-consuming, requires diligence and expertise, and includes: ▶ Duct airflow ▶ Pressure measurements on filters, coils, and components ▶ Temperature measurements ▶ Electrical measurements
What?	After the tenant improvement project is complete, test and balance the air distribution system to ensure proper airflow to all workspaces.
Design Guidelines and Standards	**Required for G/Rated Certification**
How? Strategies for Getting It Done	Testing and balancing (TAB) is accomplished at completion of work by your mechanical contractor or by a firm specializing in this work.
When?	TAB is accomplished during construction. However, proper air and water testing, adjusting, and balancing require careful planning during the design phase.
Who is Responsible?	Contractor
Cost and Schedule	TAB may be an added cost. Schedule impact should be minimal if it is well-coordinated.

M-5 Mechanical Equipment Design (Acoustic)

Use best practices for the design and installation of mechanical equipment and the design and installation of ductwork to minimize equipment noise.

Benefits ACOUSTIC QUALITY	A well-designed HVAC system will be free of distracting noises due to equipment vibration, fans, compressors, and air movement. Acoustic quality includes speech privacy and intelligibility, freedom from distraction, the ability to concentrate on tasks, and on the safe operation of equipment.
What?	Use best practices for the design and installation of mechanical equipment and the design and installation of ductwork to minimize equipment noise.
Design Guidelines and Standards	Chapter 43, "Sound and Vibration Control," of the 1995 ASHRAE Applications Handbook
How?	▶ Evaluate the level of acoustic control needed; consider privacy issues and "cross-talk" (the sound that is carried between rooms through the mechanical system) ▶ Ductwork should be sealed, well-insulated, sized correctly, and laid out to avoid added air resistance from tight bends or excessive us of flexible ducts. ▶ Where appropriate, ducts should be lined with absorptive material to reduce sound transmission. ▶ Incorporate where appropriate special duct-mounted devices such as attenuators or active electronic noise controls. ▶ Consider the benefits of some background noise. ▶ Consult with an acoustical engineer.
When?	Design
Who is Responsible?	Mechanical engineer

M-6 Selected Independent Exhaust Systems

Provide independent exhaust for rooms containing a concentration of copiers, printers and fax machines.

Benefits HEALTH & INDOOR AIR RESOURCE CONSERVATION	Office equipment generates modest amounts of emissions (for example, toner particles and ozone) and excess heat. When they are grouped together, their aggregate emissions and heat buildup can affect the air quality and temperature of the whole indoor environment. Providing separate exhaust for rooms containing office machines products the quality of the indoor air and saves energy by avoiding heat buildup.
What?	Provide independent exhaust for rooms containing a concentration of copiers, printers and fax machines.
How? Strategies for Getting It Done	► Isolate rooms with printers and copiers; provide direct exhaust for these spaces. ► Locate these rooms as close to exterior walls or mechanical chases as possible to minimize duct work and the need for large fans. ► For energy efficiency, install a heat recovery ventilator to capture the heating or cooling energy in the exhaust. (A heat exchanger is designed to recover energy from air being exhausted from the space and transfer it to the fresh air supply.)
When?	Design
Who is Responsible?	Mechanical engineer, architect, interior designer, space planner
Cost and Schedule	Potential modest cost increase due to additional exhaust fan

M-7 Ductwork Design and Installation

Design & install efficient air distribution ductwork.

Benefits HEALTH & INDOOR AIR RESOURCE CONSERVATION THERMAL COMFORT	The layout and configuration of ductwork and the location of supply grilles can have a big impact on the indoor air quality, the thermal and acoustical comfort of people in the workspace, and the efficiency of the system. Poor ductwork design can lead to inadequate air flow (poor indoor air quality), excessive noise, and excessive fan power (wasted energy). On the other hand, a properly functioning HVAC system with a well designed distribution system operates at peak design energy efficiency while providing plenty of clean, fresh air to occupants at the right temperature and humidity.
What?	Design and install efficient air distribution ductwork that minimizes excess noise, friction losses, air leakage, and conduction losses.
Design Guidelines and Standards	Oregon Non-Residential Energy Code: Mechanical Systems. ASHRAE Handbook of Fundamentals. SMACNA IAQ Guidelines for Occupied Buildings Under Construction.
How?	▶ Consider upsizing the duct system. For example, reducing the design friction rate from the typical 0.1 inch Water Column (WC) per 100 ft to 0.05 inch WC per 100 ft cuts the portion of the total pressure drop attributable to the ductwork by 50% and can result in fan energy savings of 15% to 20%. This Strategy also helps minimize excess noise, without the use of duct liners or silencers, which increase pressure drop. ▶ Design for conditions that minimize friction losses from fan and pump discharge. ▶ Lay out the ductwork to minimize the total duct length, the number of turns, and number of fittings. ▶ Use radius or section elbows for all turns greater than 45 degrees. ▶ Use smooth wye branch fittings instead of right angle fittings for branch takeoffs and avoid turns immediately before a supply or return register ▶ Avoid duct connection details at the unit that degrade fan performance (“system effect”). ▶ Provide at least two feet of straight duct before the first turn to minimize noise and loss of fan capacity. ▶ Install turning vanes in supply ducts at the first turn after entering the building.

M-7 Ductwork Design and Installation (con'd)

How? (con'd)	► Avoid excessive use of flexible ducts, which have more than 60% higher pressure drop than galvanized metal duct of the same diameter. ► Allow no more than five feet of flexible ductwork per duct run. Flexible duct should be fully extended and well-supported. The bend radius should be greater than one times the duct diameter to avoid kinking. ► Seal and insulate (R-8) duct work outside the conditioned space to prevent energy-wasting air leakage and conduction losses. Check existing ductwork for air leakage and insulation.
When?	Design
Who is Responsible?	Mechanical engineer
Cost and Schedule	Upsizing the ducting will increase costs. For example, reducing the design friction rate from the typical 0.1 inch Water Column (WC) per 100 ft to 0.05 inch WC per 100 ft increases the duct size and costs by 15%. However, this cuts the portion of the total pressure drop attributable to the ductwork by 50% and can result in fan energy savings of 15% to 20%.
Resources/ products	► **"Design Brief: Integrated Design for Small Commercial HVAC"**, http://216.98.139.76/resource/162. From Energy Design Resources, a project funded by California utility customers and administered by Pacific Gas and Electric Company, San Diego Gas & Electric, Southern California Edison, and Southern California Gas, under the auspices of the California Public Utilities Commission. www.energydesignresources.com. ► **Air Movement and Control Association International**. www.amca.org. AMCA publishes a series of manuals related to air system design and operation, which can be ordered from their web site. ► **American Society of Heating, Refrigeration, and Air Conditioning Engineers, Inc.** (ASHRAE). www.ashrae.org. ASHRAE publishes numerous standards, guides, and technical papers related to HVAC issues. ► **Sheet Metal and Air Conditioning Contractors National Association (SMACNA)** www.smacna.org. Standards and guidelines for HVAC distribution systems.

M-8 HVAC Zone Control

Provide separately controlled HVAC zones throughout the workspace, anticipating the differing heating and cooling needs in each area during different times of the day.

Benefits

RESOURCE CONSERVATION

THERMAL COMFORT

In order to maintain thermal comfort for all occupants, the HVAC system must be able to respond to differing heating and cooling needs in different parts of the building. These areas of differing heating and cooling needs are referred to as "zones."

In addition to enhanced thermal comfort, a system with multiple zones also creates opportunities to save energy because it allows independent adjustments to smaller areas for heating and cooling.

What?

Clearly identify the heating and cooling needs when considering your interior layout. For example, a typical office floor has five primary heating/cooling zones: an internal zone and four perimeter zones, one along each side of the building.

Because the internal zone is separated from the windows and packed with heat producing lights, electronic equipment, and people, it typically requires cooling all day long throughout the year.

The four perimeter zones are affected by heat gain and heat loss through the windows, and internal heat gains. The zone on the south side, exposed to solar heat gain through the windows for most of the day, will require primarily cooling, even in winter months. The north zone, by contrast, will be losing heat through the windows and may require heating throughout the winter. The zone on the east side may require more cooling in the morning as the sun warms that side of the building, but may need heating in the afternoon during winter months. The west zone will be just the opposite.

In addition to these primary zones, some areas in the workspace should be considered separate zones. Large conference rooms and workrooms with concentrations of equipment (high-volume copiers and computer servers, for example) will have special cooling and ventilation needs. Enclosed private offices will likely have different heating and cooling needs than open office areas.

One of the limitations of older HVAC systems may be an inability to add or modify zones. If you are planning an office layout that is much different from the previous layout, this will be an important question.

M-8 HVAC Zone Control (con'd)

How? Strategies for Getting It Done	► Organize the interior layout to create zones with similar needs for heating and/or cooling, based on function, level of activity, exposure to the sun or wind, schedules of use, and location in the building. ► Provide adequate supply and returns and controls for each zone. ► Coordinate sensors by zone and function so they do not contradict or compete with one another. ► Provide separate thermostats for each zone, so a zone's temperature can be set independently of the other zones.
When?	Design
Who is Responsible?	Mechanical engineer, architect, interior designer, space planner
Cost and Schedule	There may be additional modest design and/or construction cost associated with additional analysis and controls.

M-9 VAV Design (Layout)

For variable air volume (VAV) systems, include appropriate number of properly adjusted VAV boxes.

Benefits RESOURCE CONSERVATION THERMAL COMFORT	Commercial office space in large buildings is usually equipped with a Variable Air Volume (VAV) HVAC system, which allows efficient and flexible control of space temperature. VAV systems have two basic parts: a central duct that supplies the same chilled air to all the zones, and VAV boxes in each zone that heat up the chilled air to match the needs of each zone. Each VAV box is connected to a thermostat that modulates the temperature and volume of air supplied to that zone, depending on heating or cooling needs. The VAV boxes have an electric or hot water reheat coil to warm the conditioned air before it is supplied to the space. When connected to CO2 sensors, VAV systems can also be used to regulate the ventilation rate based on demand, so as more people occupy a given space, more fresh air is supplied. A VAV system should be good news for your TI project, because it means you can relocate partitions and workspaces and adjust the zones to match.
What?	For variable air volume (VAV) systems, provide at least one VAV box for each enclosed workspace, adjusted to provide to 1 cfm/sq. ft. of room area served, or to meet the minimum ventilation requirements of the space, whichever is greater. It is important to ensure that VAV box minimum settings (e.g., 30% of peak flow), when combined with the outdoor air fraction, provide enough supply air so that sufficient outdoor air enters the space at partial loads. Malfunctioning VAV boxes can result in thermal discomfort and fail to prevent buildup of indoor air contaminants.
Design Guidelines and Standards	Oregon Non-Residential Energy Code: Mechanical Systems Note: The code dictates air requirements on a per-square-foot basis and the number of times the air must be exchanged based on the main function of the space.
When?	Design
Who is Responsible?	Mechanical engineer

M-10 Automatic Temperature Controls

Provide automatic controls to adjust thermostat setting when the spaces are not occupied.

Benefits RESOURCE CONSERVATION	Automatic controls that return the space to a predetermined temperature when it is not occupied save energy by avoiding unnecessary heating and cooling for human comfort.
What?	Provide automatic controls to re-set thermostat by 2 degrees each side of the usually desired setting when the spaces are not occupied for more than 2 hours (setback or lower the temperature setting for heating mode setup or raise the temperature setting for cooling mode). This allowable temperature range is called the thermal "dead band."
Design Guidelines and Standards	Oregon Non-Residential Energy Code: Mechanical Systems
How? Strategies for Getting It Done	▶ Install more sophisticated thermostats or controls to allow for fine tuning temperature settings and scheduling. ▶ Install carbon dioxide sensors to control ventilation. ▶ Install occupancy sensors. ▶ Program for a half-hour time frame, rather than 2 hours. ▶ Expand thermal "dead band" to more than five degrees: allow the space to get cooler or warmer before the heating and cooling systems start to work. "Lock-in" the range of temperatures.
When?	Design
Who is Responsible?	Mechanical engineer
Cost and Schedule	Modest increase due to additional controls

M-11 Pressurized Zones

Design HVAC system to provide barometric (air pressure) levels in order to control odors and moisture migration between spaces and to adjacent tenants' spaces.

Benefits HEALTH & INDOOR AIR THERMAL COMFORT	Pressurization of spaces limits odors and moisture to specific locations. This Strategy saves energy and improves air quality and comfort by minimizing the volume of air and the number of times air has to be refreshed or exchanged. For example, using a separate exhaust in a kitchen or bathroom creates a negative pressure in those spaces.
What?	Provide supply inlets and exhaust outlets in appropriate locations and sufficient quantity to create a balanced combination of positive and negative pressures.
Design Guidelines and Standards	Oregon Non-Residential Energy Code: Mechanical Systems
How? Strategies for Getting It Done	▶ Identify spaces and activities that generate odors, fumes, or moisture (for example, copy rooms, housekeeping closets, restrooms, hallways, kitchens, and smoking lounges). Identify the spaces that need protection. ▶ Cluster spaces with similar pressure needs to simplify the mechanical system layout. ▶ Establish optimal barometric pressures(how much pressure is needed) to control odors, fumes, and moisture migration . ▶ Appropriately size exhaust fans so that they do not draw air from a MORE polluted space to replace the air in a room. ▶ Locate intakes and exhausts, both within the space and to and from the outside air, to avoid cross contamination. ▶ Check that the supply air to the building is not situated near pollution sources, such as parking lots, bus lines, dumpsters, or loading docks. ▶ Balance the HVAC system. Commission the systems. (See Action Strategy M-4.)
When?	Design
Who is Responsible?	Mechanical engineer, architect, interior designer, space planner
Cost and Schedule	Minimal to modest cost increase for design input and potential changes to HVAC equipment

M-12 Water Conservation

Install water-using devices to exceed current code requirement.

Benefits RESOURCE CONSERVATION	Water fixtures, fittings (faucets), and equipment in buildings constructed prior to 1992 are likely high water use fixtures. Upgrade or replacement of these outdated fixtures will mean significant water and energy savings and will and help protect our region's precious fresh water resources.
What?	Replace or upgrade existing fixtures, fittings and equipment, such as toilets, urinals, faucets, and showerheads to exceed current code requirements.
Design Guidelines and Standards	The federal 1992 Energy Policy Act established uniform national standards for plumbing fixtures to promote conservation. Fixture ratings are as follows: **Water closets** (gallons per flush) 1.6 **Urinals** (gallons per flush) 1.0 **Showerheads** (gallons per minute) 2.5 **Faucets** (gallons per minute) 2.5 **Replacement aerators** (gallons per minute) 2.5 **Metering faucets** (Gallons per cycle) 0.25 Note: Currently, the Oregon State Plumbing Board is reviewing the code concerning the use of waterless urinals. At the time of publication they were not allowed in the state of Oregon.
How? Strategies for Getting It Done	► Include fixtures, fittings, and equipment modifications in plans and specs. ► Replace or install low-flow devices such as aerators or automatic controls on faucets and showerheads. ► Consider recirculation loops or on-demand water heating devices to minimize running extra water while waiting for it to heat up.
When?	Design
Who is Responsible?	Mechanical engineer
Cost and Schedule	Upgrading fixtures will increase cost. The added cost can be offset by reduced utility bills from reduced water and energy consumption.
Resources/ products	► **How to Buy a Water-Saving Faucet**, available online at www.eren.doe.gov/femp/procurement/pdfs/faucet.pdf and ► **How to Buy a Water-Saving Showerhead**, available online at www.eren.doe.gov/femp/procurement/pdfs/toilet.pdf.

Resources/ products (con'd)

- **How to Buy a Water-Saving Replacement Toilet**, US Department of Energy, FEMP, available online at www.eren.doe.gov/femp/procurement/pdfs/toilet.pdf.
- Publications of the **US Department of Energy Federal Emergency Management Program**, these two-page fact sheets are primarily for federal agencies. However, they provide good general information for other commercial applications as well.

M-13 Individual Sub-Metering

Implement individual sub-metering of your space for electrical use.

Benefits RESOURCE CONSERVATION	Studies have found that electrical sub-metering usually saves electricity because tenants are more aware of their individual space's consumption and the impact of conservation efforts. Individual sub-metering creates a separate metered account for your office space's electrical use and provides an alternative to splitting the cost between all the building users. The Strategy helps ensure achieving the benefit of energy conservation practices you implement.
What?	Implement individual sub-metering of your space for electrical use.
How? Strategies for Getting It Done	► Coordinate with the building owner and your local utility.
When?	Design
Who is Responsible?	Architect, engineer, property manager

Lighting

Views provide a connection to outdoors that can enhance productivity.

LIGHTING

		✔
Ⓡ	**L-1: Efficient Lighting Design** Design lighting to maximize energy efficiency and visual comfort.	☐
○	**L-2: Window Upgrade** Upgrade fenestration (windows) or add film to control heat gain and light transmittance.	☐
○	**L-3: Natural Lighting Design** Develop a lighting design that makes effective use of natural light and reduces electric light and cooling cost.	☐
○	**L-4: Individual Lighting Controls** Provide individuals with the ability to adjust lighting to their needs.	☐

Introduction to Lighting

Quality workspace lighting is the optimal mix of daylighting and artificial (electric) lighting; and it allows for both individual and automatic controls. Visual discomfort from poor quality lighting ranks as a primary complaint of office workers. In addition, electric lighting accounts for approximately 37% of the energy used in a typical workplace (because lighting generates waste heat it is a major load on your cooling system). For these reasons, providing quality lighting is one of the most important strategies for creating a comfortable, productive, and energy efficient work environment. Fortunately, there are many options available to provide high quality, efficient workspace lighting.

Luminaire: A complete lighting unit consisting of a lamp and ballasting (where applicable) together with parts designed to distribute the light, to position and protect the lamps, and to connect the lamps to a power supply.

For example, many high quality lighting fixtures (luminaires) are now available. A luminaire that delivers higher quality lighting may cost more to purchase than a standard luminaire, but a well-designed lighting scheme based on the higher quality luminaire may reduce the number of required luminaires by one-third to one-half. As a result, the higher unit purchase price may be offset by the savings on reducing total units purchased and the installation cost.

Keep in mind the three main types of lighting in a typical office space: ambient, task, and accent:

- 1. Ambient lighting refers to the general illumination typically provided by direct overhead luminaires. Lighting solutions that attempt to provide all necessary lighting from one such source usually result in workspaces that are overlit, visually uncomfortable, and inefficient.
- 2. Task lighting refers to lighting provided by smaller, individual work station fixtures such as desk lamps and under-shelf lights. Energy efficient compact fluorescent desk lamps are available that provide higher quality lighting than incandescent alternatives. A lighting design that makes use of task lighting can provide a lower level of ambient lighting in the workspace. This reduces the overall wattage of lighting (lighting power density), glare, and reflections, while improving the quality of lighting for various visual tasks (reading, computer work, etc.).
- 3. Accent lighting refers to lighting that provides a variety of visual experiences within the field of view. Lighting can complement and highlight colors and surfaces (ceilings and walls) within a space. Lighting can also offer visual clues for way-finding, helping people navigate through a space.

For best results, consult a lighting designer or electrical engineer experienced in lighting design. To experience these lighting options firsthand, visit Portland General Electric's lighting demonstration facility in Tualatin. Call 503-603-1706 to set up an appointment. Lighting design assistance from a professional is also available at no charge from the Lighting Design Lab in Seattle. Call 206-325-9711 for details.

Eliminate toxics in light bulbs

Small amounts of mercury can damage the brain and nervous system so it is a pollutant of concern. Your organization can help reduce mercury pollution by:

- **Specifying low-mercury lamps and tubes**
- **Recycling used bulbs with a lamp recycler.**

L-1 Efficient Lighting Design

Design lighting to maximize energy efficiency and visual comfort.

Benefits RESOURCE CONSERVATION VISUAL QUALITY	A poor lighting design and inefficient fixtures waste energy and increase the load on your cooling system. In addition, glare and reflections from poor workspace lighting can lead to eye strain, fatigue, reduced productivity, and increased errors in visual tasks. A thoughtful lighting design will provide adequate light levels and reduce or eliminate glare and reflections. In addition, advances in ballast, lamp, luminaire, and control technology make it possible to obtain higher quality lighting with significant reductions in electricity usage. Savings of 25% to 50% are possible when you replace older lighting.
What?	Develop a lighting design based on your space layout that makes optimal use of natural and artificial lighting for ambient, task, and accent lighting needs. Select high quality, energy efficient fixtures. Consider aesthetics and visual comfort of occupants.
Design Guidelines and Standards	Design to reduce the "lighting power density" by at least 10% below the 1.2 watts per square foot prescribed by the Oregon Energy Code. High quality lighting solutions are available that use 0.7 W/s.f. Follow basic guidelines to create visual comfort and attractive, effective lighting. See chart below. **Required for G/Rated Certification**
How? Strategies for Getting It Done	► Create an integrated task/ambient lighting solution with a reduced level of overall space illumination, supplemented by task lighting appropriate to the needs of the people who will be working in the space. For example, task lights can be used to illuminate papers on the desktop and offer personal control. ► For computer workstations, provide 30 foot-candles of ambient light (less is insufficient, more is too much). Select luminaires recommended for computer screen workspaces, such as linear indirect/direct fluorescent-pendant luminaires. ► Incorporate high-efficiency luminaires, lamps, electronic ballasts, and lighting controls. ► Use occupancy sensors and sweep controls to automatically turn off lights in unoccupied spaces and in the entire workspace (including security lighting) at the end of the day. (See Action Strategy O-3.) ► Eliminate glare. A brightly-lit surface like a window or luminaire beside or above a computer monitor can be a source of glare for the user. Likewise, bright, contrasting surfaces above and behind a workstation can cause veiling reflections on computer screens and glossy paper, making reading difficult.

Lighting Efficiency Ranges in Watts per Square Foot

Design Type	Lighting Power Density	Watts/Ft²
Mediocre	Standard ceiling-mounted fluorescent fixtures using standard lamps and ballasts. Same lighting level throughout the office space.	**2.0+**
Good	High-efficiency ceiling-mounted fluorescent fixtures using T-8 lamps and electronic ballasts. Same lighting level throughout the office space.	**1.2 - 1.4**
Excellent	High-efficiency, ceiling-mounted, fluorescent fixtures (T-5 HO downlight and uplight type) with fixtures used to provide wall illumination within about a 1:3 ratio of ambient. Individual task lights used at each work station	**0.6 - 0.9**
State of the art	As above plus daylight integration (bringing daylight into the working areas and automatically dimming lights according to daylight).	**0.3 - 0.5**

How? (con'd)	▶ Use accent lighting, such as wall sconces, to increase lighting quality by adding color and variety. Install direct/indirect-ceiling fixtures that throw light on the ceiling as well as the workspace. For example, luminaires with T-5 lamps can be installed on standard 8-ft-6-inch suspended ceilings without compromising headroom. ▶ Use variations in lighting to highlight surfaces and define or delineate spaces having different uses, such as circulation zones, work areas, and meeting spaces. ▶ Increase the effectiveness of lighting by using light-colored finishes on ceilings and walls. ▶ Select a pleasant color temperature of lamps e.g. 4100 degrees Kelvin or above with a Color Rendering Index (CRI) of 80 or more. ▶ Use T-5 fluorescent tubes rather than T-8s to get maximum efficiency with fewer fixtures. ▶ Select parabolic fixtures rather than prismatic fixtures to reduce glare.
When?	Design
Who is Responsible?	Architect, interior designer, lighting designer, electrical engineer
Cost and Schedule	Can entail additional costs associated with design and use of efficient fixtures. First costs may be offset by utility rebates, if available. Total cost will be offset by reduced electrical bills.
Resources/ products	PGE and Pacific Power offer lighting rebates; the State of Oregon offers Business Energy Tax Credits that may offset the cost of more efficient lighting technologies. ▶ **PGE**: www.portlandgeneral.com/business/energy_efficiency/programs/lighting.asp ▶ **Pacific Power**: www.pacificpower.net/pages/Navigation2881.html ▶ **Oregon Office of Energy**: www.energy.state.or.us/bus/tax/taxcdt.htm

L-2 Window Upgrade

Upgrade fenestration (windows) to control heat gain and light transmittance.

Benefits RESOURCE CONSERVATION VISUAL QUALITY	Window upgrades should be considered in buildings where there is substantial heat gain from windows. This solar heat can occur with windows that face south or west, but can happen even with windows facing east. In addition to conserving energy used to cool the office, upgraded fenestration can reduce glare and improve access to daylight, which will lead to a more comfortable visual environment for all tasks.
What?	Window upgrades include replacing the windows (frames or glass or both), adding special film to the inside surface of the existing glass, or installing interior or exterior shading devices. All upgrades reduce excessive solar heat gain and direct sunlight. Consider this Strategy before upgrading mechanical systems, because upgrading windows can allow the HVAC existing system to perform better and cost less to operate. Or if a new system is required, upgrading windows can allow use of a smaller and less expensive system. Also, factor these upgrades into the design of electric lighting systems, so you appropriately account for new daylight levels. The ability to actually upgrade the windows is most likely in scenarios where a tenant occupies a whole building. But using a film coating to alter the heat and light transmitting qualities of the existing windows, and/or adding shading devices, may be an option for any tenant.
Design Guidelines and Standards	► Oregon Energy Code ► Model Energy Code (Chapter 5 of the 2000/2001 IECC, Section 502.1.5) requires the area-weighted average SHGC of all glazed fenestration products (including the effect of any permanent exterior solar shading devices) in the building to not exceed 0.4. Solar Heat Gain Coefficient (SHGC) measures how well a product blocks heat caused by sunlight. The SHGC is the fraction of incident solar radiation admitted through a window, directly transmitted and absorbed, then subsequently released inward. SHGC is expressed as a number between 0 and 1. The lower a window's SHGC, the less solar heat it transmits. Visible Light Transmittance (Tvis) is a measure of the amount of visible light that passes through the glass. For optimal daylighting glass, select a Tvis with a high percentage (clear glass is Tvis 78). For extreme glare-sensitive conditions, a low percentage would be better used.

How? Strategies for Getting It Done	Determine if there is unwanted heat and light gain from the windows, and the feasibility of new windows. Identify the orientation of the glass to determine if different strategies would be more appropriate, depending on which way the glass faces into the sun. Perhaps there is an opportunity to change out only the windows in worst condition, in a way that is unnoticeable when compared to the other windows. First, select strategies to keep heat and light off the exterior of the window and out of the building; use exterior shading devices (trees, awnings, etc.) and high performance windows, and control leaks (infiltration) around windows with sealants and insulation. Second, select strategies to reflect light and heat back to the exterior: films, shading curtains, and blinds. Make the most of daylighting techniques by using clear glass near the ceiling where it counts the most, while using more "shaded" glass at the lower or viewing areas of glass.
When?	Design
Who is Responsible?	Architect, mechanical engineer, interior designer
Cost and Schedule	Window replacement adds cost, but can be less expensive than a major HVAC upgrade. Adding shading devices or film to existing windows is less costly than replacing windows.
Resources/ products	▶ **Green Seal Standard GS-14**, "Window Films," establishes environmental requirements for residential retrofittable window films. ▶ **National Fenestration Rating Council (NFRC) Standard No. 200-93**: Procedure for Determining Fenestration Product Solar Heat Gain Coefficients at Normal Incidence

L-3 Natural Lighting Design

Develop a lighting design that makes effective use of natural light and reduces electric lighting and cooling costs.

Benefits RESOURCE CONSERVATION VISUAL QUALITY	Daylighting refers to the use of available sunlight for interior illumination. Many studies have shown the positive benefits to occupants and businesses of admitting abundant daylight into the workplace. These benefits include increased productivity, improved health, and reduced absenteeism. When coupled with electric lighting controls, daylighting can also reduce energy consumption for artificial lighting. While it may not be possible to add daylighting to an existing tenant space, there are things you can do to make sure you are making full use of the daylight that is available.
What?	Design lighting for optimal productivity, health, and efficiency by making good use of daylight resources. For best results, consult a lighting designer or electrical engineer experienced in lighting.
Design Guidelines and Standards	Oregon Energy Code See Resources below.
How? Strategies for Getting It Done	**Get the most from available natural light.** ► Design open office areas to provide universal occupant access to available daylight and views. ► Arrange furniture and partitions to allow daylight to reach deeper into the space. ► Avoid placing private offices along the outside walls. ► Increase the effectiveness of daylighting and electric lighting by using light-colored, reflective surfaces and finishes on ceilings and walls. This also helps reduce glare. ► In workspaces located directly below the building roof, consider adding diffusing skylights or light monitors to bring in more daylight. **Optimize energy efficiency.** ► Factor available daylighting into lighting design to reduce the requirements for artificial lighting. ► Place luminaires located adjacent to windows and skylights on independent control circuits. Provide "stepped switching" or dimming controls connected to photosensors to reduce electric light levels when sufficient daylighting is available. ► Layout lighting fixtures so they run parallel to the windows to aid in switching off banks of light closest to the windows when they are not needed.

How? (con'd)	**Control glare and direct sunlight.** ▶ Provide window coverings to control glare and direct sunlight for workstations closest to windows. A tight weave black or dark gray mesh roller shade can allow some light and views while eliminating glare. Optimize the interior shading strategy and glare control with "blinds" that have a light colored surface facing the outdoors and a darker color surface facing the interior. Window blinds also offer extra shading when the sun is low in the sky or total darkness is needed. ▶ If the space is provided with high windows (top of windows nine feet or more above the floor), install window shades that cover only the lower portion (below seven feet) to allow glare control adjacent to the window without cutting off daylight to the interior. ▶ Use light shelves to reduce glare from daylighting. ▶ Set up work stations so that computer screens are at right angles to windows to control glare. ▶ If replacing glazing, select low-transmittance glass to prevent glare from interfering with computer-based tasks. ▶ Install exterior shading to prevent direct sunlight from entering the building.
When?	Design
Who is Responsible?	Lighting designer, interior designer, architect
Cost and Schedule	Daylighting design can add nominal cost. Costs are more than offset by improved productivity and reduced absenteeism.
Resources/ products	▶ Visit **Portland General Electric's lighting demonstration facility** in Tualatin. Call 503-603-1706 to set up an appointment. Professional lighting design assistance is also available at no charge from the Lighting Design Lab in Seattle (206-325-9711). Visit BetterBricks at www.BetterBricks.com for resources and access to daylighting labs in Seattle, Portland, and Eugene. ▶ **The Daylighting Collaborative**, www.daylighting.org. The Daylighting Collaborative is a program started by utilities and the State of Wisconsin to incorporate daylighting into mainstream design and construction. (Lots of information on daylighting benefits, strategies, and resources.) Free to download: "Cool Daylighting Design Approach Workbook, Volume 1, Office Buildings," www.daylighting.org/pubs/v1offices.pdf . ▶ **"Daylighting: Energy and Productivity Benefits,"** Environmental Building News, September, 1999, Vol. 8, No. 9. www.buildinggreen.com ▶ **"Daylighting-Part 2: Bringing Daylight Deeper into Buildings,"** Environmental Building News, October 1999, Vol. 8. No. 10.

L-4 Individual Lighting Controls

Provide individuals ability to adjust lighting to their needs.

Benefits RESOURCE CONSERVATION VISUAL QUALITY	New control technologies make it easier to provide individuals with control of the lighting level in their personal workspace. A laboratory study found that workers who have controllable lighting are more satisfied with the lighting, feel more comfortable in the room, and rate their tasks as less difficult. Moreover, the individually controlled lighting resulted in energy savings of 35% to 42%.
What?	Provide each employee with individual lighting and window controls within their workspace. These should be integrated with the design and use of efficient lighting and daylighting techniques.
Design Guidelines and Standards	Oregon Energy Code
How?	Give occupants individual control of lighting in their personal workspace through the use "stepped" switching, dimming controls, window shades, task lighting, and occupancy sensors with manual "on" and automatic "off" controls.
When?	Design
Who is Responsible?	Architect, electrical engineer, lighting designer
Cost and Schedule	Nominal increased cost for additional controls

Construction

Using certified wood products helps protect forests.

CONSTRUCTION

		✔
Ⓡ	**C-1: Construction Waste Management** Implement a Construction Waste Management Plan.	☐
Ⓡ	**C-2: Construction IAQ** Implement a Construction IAQ Management Plan.	☐
Ⓡ	**C-3: Green Monitoring** Monitor the project to ensure green products and practices are installed or incorporated as specified.	☐
○	**C-4: Recycling Rate Greater Than 50%** Achieve recycling rate greater than the 50% by weight.	☐
○	**C-5: Recycling Documentation** Ask for recycling and garbage receipts to document recycling rate.	☐
○	**C-6: Waste Minimization** Use construction methods that minimize waste generated in future renovations.	☐

TIs create high levels of waste – you can change this!

Construction Strategies

The cities of Portland and Beaverton have been working with Metro to reduce solid waste. Overall, our communities have been very successful: about 54% of our waste is diverted from the landfill, and this rate is among the highest in the nation. Now the focus is on reducing waste from building construction and demolition. Although much progress has been made, today about 27% of all waste sent to the landfill is from building projects. Research shows that tenant improvement projects are a major source of this waste, and that one of the most important reasons contractors give for NOT recycling is that their clients don't ask for it.

So, you can help reduce waste, simply by requesting that your contractor recycle. The guide includes sources of advice and assistance to help get started. With a little advanced planning, some of the materials torn out of the old space can be salvaged and recycled, and the contractor can recycle wastes from new construction, like cardboard packaging, plastic wrap, and scrap wood and drywall. The contractor can collect receipts from recycling and waste disposal facilities to calculate the overall recycling rate for your job.

The City of Portland requires that at least 50% of construction waste be recycled. Experience shows this goal is practical. Some construction companies regularly achieve recycling rates in excess of 90%.

According to a March 2002 study conducted by the Office of Sustainable Development on TI construction recycling practices, property managers and owners have a great deal of influence on whether or not recycling and reuse occurs on the job site.

C-1 Construction Waste Management

Implement a Construction Waste Management Plan.

Benefits

MATERIALS EFFICIENCY

Your TI project will generate a variety of construction wastes. Those wastes are resources that could be remanufactured into new, useful materials. Local governments in the region have been leaders in promoting recycling and waste management for many years. The region has established infrastructure to support recycling of construction materials from TI projects, including

- carpet and cushion
- ceiling acoustical tiles
- corrugated cardboard
- clean dimensional lumber
- plywood, OSB, & particle board
- paint
- interior glazing
- interior doors
- plumbing fixtures
- light fixtures
- metals

Recycling, salvaging and/or reusing construction waste can save money on disposal costs, in addition to being a more efficient use of materials.

In the City of Portland, an ordinance exists that requires construction projects valued at $50,000 or more to develop a waste management plan to recycle 50% of construction waste. This is a good guideline for all TI projects in the Metro area. Your help is needed, however, to make sure that it is implemented on your TI project.

What?

Require your contractor to develop a construction waste management plan that includes recycling.

Design Guidelines and Standards

City of Portland ordinance and "Pre-Construction Recycling Plan Form."
www.sustainableportland.org/SW_SAMPLE_plan_form.pdf

Required for G/Rated Certification

Contact your local jurisdiction to get the latest design standards for the area in which you are working.

How? Strategies for Getting It Done

- Tell the leasing agent, building manager, and general contractor that you want to recycle.
- Set a specific target. In the City of Portland, 50% is the minimum required by ordinance.
- Better yet, do a walk-through with the contractor to identify salvageable and recyclable items. Common materials like carpet, light fixtures, sinks, partitions, ductwork and ceiling tiles are often changed out before they wear out.
- Work with the building/property manager to identify a good location to collect recyclable debris on-site. Alternatively, the contractor can use a facility that will accept, sort, and recycle commingled waste to avoid the space requirements of multiple containers.

How? (con'd)	▶ Ask your contractor to identify tear-out materials that can be salvaged or recycled. Tell the general contractor to communicate the recycling goal to subcontractors and suppliers. Require sub-contractors who haul their own waste to recycle. For example, a carpet installer may be able to salvage or reuse old carpet removed from the space. (Local companies that accept carpet for reuse are listed in the METRO Toolkit.) Acoustical ceiling tiles can be recycled through Armstrong's program. Suppliers can be asked to take back wood palettes, cardboard packaging, shrinkwrap plastic and styrofoam. ▶ Ask your contractor to arrange for recycling with the hauler. Find out where the hauler takes materials for recycling and arrange to get copies of the load tickets to confirm delivery (also, tickets will record weights; useful if you want to know how much you recycled). ▶ Require that hazardous materials be properly disposed of. For example, if fluorescent lights are being removed, the bulbs should be taken to a recycling facility to remove the mercury. Other hazardous materials include lighting ballasts, mercury switches and thermostats, transformers, and materials containing asbestos or covered in lead-based paint. ▶ In the City of Portland, for projects valued $50,000 or more, ensure the contractor completes and signs the City of Portland's "Pre-Construction Recycling Plan Form," returns it to the City of Portland, and posts it at the job site.
When?	Organize before construction starts. Include recycling in specs and bid documents so general contractor and specialty trades will see what is expected.
Who is Responsible?	Contractor
Cost and Schedule	Typical waste disposal fees in the Metro region are about $67.50 per ton; most construction waste can be dropped off at a recycling facility for fees ranging from free to $35.00 per ton.
Resources/ products	**Recycling Assistance.** For more information and assistance with recycling, use the following resources to assist you with the process. ▶ **METRO's Construction Industry Recycling Toolkit** www.metro-region.org (http://www.metro-region.org/library_docs/recycling/toolkit.pdf) ▶ **METRO's Recycling Hotline**: (503) 234-3000 ▶ Contact the **City of Portland's Office of Sustainable Development** for additional information on solid waste and recycling at www.sustainableportland.org. ▶ Contact the **City of Beaverton's Solid Waste and Recycling Team** for additional information on solid waste and recycling at (503) 526-2665 or www.ci.beaverton.or.us/departments/recycling. ▶ Reusable materials can be taken to nonprofits like **The Rebuilding Center** or **Restore** for processing and resale. You can even get a small tax deduction.

C-2 Construction IAQ Management

Implement a Construction Indoor Air Quality (IAQ) Management Plan.

Benefits HEALTH & INDOOR AIR	Construction practices can have a big impact on the indoor air quality, both during and after construction. While working with your interior designer and general contractor, insist on specifying and using only safe products and materials. These products are covered under the strategies for various finishes and furnishings. See Action Strategies F-5 through F-8. These actions can help protect the health of your contractors as well as your staff. Steps can also be taken to protect the indoor air quality during the construction process. These measures help prevent contamination of indoor air with particulates and moisture generated by the construction process itself.
What?	Specify in the construction documents that the contractor implement an indoor air quality management plan to ensure that your other efforts to protect the health of the staff aren't undermined by the construction process itself.
Design Guidelines and Standards	Sheet Metal and Air Conditioning National Contractors Association (SMACNA) IAQ Guideline for Occupied Buildings Under Construction, 1995 **Required for G/Rated Certification**
How? Strategies for Getting It Done	The general contractor's plan should address five key elements to prevent, reduce, and protect against indoor pollution: ▶ protection of the HVAC system ▶ source control of emitting products (if used) ▶ interrupting pathways of pollution ▶ general housekeeping ▶ scheduling of work. Suggested strategies include: ▶ Seal off the return grilles, so that dust and pollutants won't be picked up during construction. ▶ In spaces where there is no ducted return (rather, an open ceiling plenum) ask if the HVAC can be turned off during construction when there will be dust and odors. ▶ Install temporary air filters during construction that are replaced when the dusty phases are complete. ▶ Have the ducts vacuumed out after construction is complete, to remove dust and debris. ▶ Lay down temporary walk-off mats to catch dust, mud, and debris from workers' shoes as they enter the workspace or building.

How? (con'd)	▶ Instruct the general contractor not to apply any high-emitting products (paints, adhesives, etc.) in the workspace after "sink" materials (absorptive fabrics, carpets, and ceiling tiles) have been installed. These materials can absorb and re-emit VOCs over time. ▶ Specify materials and construction practices that reduce pollutant levels and request documentation of VOC level, such as a Material Safety Data Sheets (MSDS), for all potentially polluting products the contractor proposes to use. ▶ Do not use gasoline or other fossil fueled equipment inside the space. ▶ Use construction methods to reduce dust production such as wet sanding or vacuum sanding of drywall. ▶ Fully isolate dust producing activities from the rest of the space. ▶ Prohibit smoking. ▶ Clean the construction area daily. ▶ Provide monitoring of IAQ protection measures.
When?	Construction
Who is Responsible?	Contractors
Cost and Schedule	If the contractor has worked in buildings with sensitive populations like hospitals, or remodeled occupied spaces, they are likely to be familiar with these practices, and have appropriate equipment. There may be some cost for supplies like additional filters.
Resources/ products	▶ **Sheet Metal and Air Conditioning National Contractors Association (SMACNA) IAQ Guidelines for Occupied Buildings Under Construction**, 1995, www.smacna.org/bookstore. ▶ **"Construction IAQ Management: Job-site Strategies for Ensuring a Healthy Building,"** Environmental Building News, Vol. 11 No 5, May 2002. Provides a checklist based on the SMACNA guide above.

C-3 Monitor Implementation

Monitor the project to ensure green products and practices are installed or incorporated as specified.

Benefits MATERIALS EFFICIENCY	Some of these practices may be quite new to the contractors involved in your construction project. When people don't understand something or are unsure of how to undertake it, they may be tempted to skip steps and not implement all of the activities that you have specified. By visiting the site and implementing steps to monitor the follow-through on your goals, you can help ensure that you achieve all your objectives. Visiting the site also makes you available to help address problems or questions that arise in a timely manner.
What?	Confirm through the design team representative that the contractor is following through on green strategies that were included in the construction documents and specifications.
Design Guidelines and Standards	**Required for G/Rated Certification**
How? Strategies for Getting It Done	► Ask for documentation of construction site recycling (see Action Strategy C-4) and copies of Material Safety Data Sheets (MSDS) and other data on building materials and finishes used on the job. ► Accompany the design team representative during several site visits to review construction progress.
When?	Construction
Who is Responsible?	Project lead

C-4 Recycling Rate Greater than 50%

Achieve recycling rate greater than the 50%.

Benefits MATERIALS EFFICIENCY	As explained in Action Strategy C-1, recycling construction waste conserves material resources and can reduce disposal costs. The City of Portland requires projects valued at $50,000 or more to recycle 50% of their debris. Many projects in the Metro area can achieve 75% or greater recycling rates with good planning and implementation, resulting in greater environmental and monetary benefits.
What?	Require your contractor to develop a construction waste management plan that will result in a greater than 50% recycling rate.
Design Guidelines and Standards	City of Portland ordinance and "Pre-Construction Recycling Plan Form" with a higher recycling rate required. Also refer to Action Strategy C-5: Recycling Documentation.
How? Strategies for Getting It Done	▶ Tell the leasing agent, building manager, and general contractor that you want to recycle greater than 50% on the project and include this requirement in your lease agreement. Refer to Action Strategy C-1 for additional Strategies to implement an effective recycling program.
When?	Construction
Who is Responsible?	Contractors
Cost and Schedule	Typical waste disposal fees in the Metro region are about $67.50 per ton; most construction waste can be dropped off at a recycling facility for fees ranging from free to $35.00 per ton.
Resources/ products	Recycling Assistance. For more information, sample specifications and assistance with recycling, use the following resources. ▶ **METRO's Construction Industry Recycling Planning Toolkit** www.metro-region.org/library_docs/recycling/toolkit.pdf ▶ **METRO's Recycling Hotline**: 503-234-3000 ▶ **METRO's on-line recycling resource**: www.metro-region.org/article.cfm?articleid=727 ▶ Contact the **City of Portland's Office of Sustainable Development** for construction recycling requirements and downloadable "pre-construction recycling planform" at www.sustainableportland.org. ▶ Contact the **City of Beaverton's Solid Waste and Recycling Team** for additional information on solid waste and recycling at 503-526-2665 or www.ci.beaverton.or.us/departments/recycling ▶ Reusable materials can be taken to nonprofits like **The Rebuilding Center** or **Restore** for processing and resale. You can even get a small tax deduction.

C-5 Recycling Documentation

Ask for recycling and garbage receipts to document recycling rate.

Benefits MATERIALS EFFICIENCY	Recycling construction waste conserves material resources and can result in savings on disposal costs, but most construction recycling is done in an informal, untracked manner. Recycling rates, as with many good business practices, tend to improve when they are well planned, monitored, and tracked. The documentation recommended in this Action Strategy is meant assure recycling goals are met and help identify additional opportunities for conserving material resources.
What?	Ask for a recycling report at the end of the job. The general contractor can keep a record of materials that he recycles, using weight tickets from haulers and recyclers, and requiring subcontractors to report on the quantities they recycle and dispose of as garbage.
Design Guidelines and Standards	METRO's Construction Industry Recycling Planning Toolkit includes a sample waste management reporting form.
How? Strategies for Getting It Done	► Request this documentation in the construction specifications; don't wait until the end of the job. That way, contractors will all know that you expect to see these receipts and will help make them more accountable for their recycling efforts.
When?	Construction
Who is Responsible?	Contractors
Resources/ products	**METRO's Construction Industry Recycling Toolkit** www.metro-region.org/library_docs/recycling/toolkit.pdf

C-6 Waste Minimization

Use construction methods that minimize waste generated in future renovations.

Benefits MATERIALS EFFICIENCY	Construction and installation methods can have far reaching impacts, beyond the immediate project. Choices made now about products and installation methods can help address future waste issues, as well as the waste generated during the current project. Thinking ahead will allow you to make changes down the line without ending up needing to dispose of a lot of new waste materials.
What?	Work with your designer and contractor to use construction practices (adhesives, fasteners, etc.) that will make it easy to remove and sort salvageable and recyclable materials during the next renovation. Also, think about using modular partitions and office systems addressed in the Interior Layout section.
How?	▶ Fasten items like cabinets with screws and nails instead of glue. ▶ Install broadloom carpet without adhesive, or use a carpet tile system that can be replaced. ▶ Review all applications of adhesives with the contractor and discuss options for mechanical fasteners instead.
When?	Construction
Who is Responsible?	Project lead and contractor
Cost and Schedule	Costs will vary based on the changes requested in the contractors' construction practices. Typically available practices like tack strips for carpet should not increase cost.

Occupancy

Safe, non-toxic interior finishes should be followed up with safe cleaning and maintenance products.

OCCUPANCY

		✔
®	**O-1: Post Occupancy Evaluation** Commit to participating in a post-occupancy evaluation phone call with G/Rated staff.	☐
○	**O-2: Energy Star® Equipment** Purchase Energy Star®-labeled equipment (copiers, faxes, computers and monitors, etc.).	☐
○	**O-3: Occupancy Sensors** Install individual occupancy sensors in workstations to turn off task lights, monitors, and personal electronics when the occupant leaves for an extended period.	☐
○	**O-4: Green Maintenance** Provide green guidelines for maintenance staff.	☐
○	**O-5: Occupant Training** Develop a plan for education and training of staff at initial occupancy and on a continuing basis.	☐
○	**O-6: Purchase Green Power** Purchase electricity generated from renewable resources.	☐

0-1 Post-Occupancy Evaluation

Commit to participating in a post-occupancy evaluation phone call with G/Rated staff.

Benefits MATERIALS EFFICIENCY	Learning from experience can be invaluable, but often we don't take the time to reflect on it and document it. This requirement will ensure that you learn from your experience, and will help G/Rated staff adapt the program where necessary and share valuable lessons with others looking to make green improvements.
What?	Please contact G/Rated program staff to discuss your experience using this guide and implementing green TI measures. 503-823-5494 or 5431, mobrien@ci.portland.or.us or gacker@ci.portland.or.us
Design Guidelines and Standards	**Required for G/Rated Certification**
When?	Occupancy
Who is Responsible?	Project lead
Cost and Schedule	None

0-2 ENERGY STAR® Equipment

Purchase ENERGY STAR®-labeled equipment (copiers, faxes, computers and monitors).

Benefits RESOURCE CONSERVATION	The ENERGY STAR® label is a voluntary program that provides an easy way to identify high quality, high performance equipment that meets strict guidelines for energy efficiency. The EPA and Department of Energy set specifications for a wide range of products. Manufacturers that meet those specifications can use the label, which helps consumers choose energy efficient products.
What?	When purchasing new office equipment, ask for models that have earned the ENERGY STAR® label to ensure that you are getting high quality and high efficiency.
Design Guidelines and Standards	The ENERGY STAR® label means you don't need to know a lot of different standards for different pieces of equipment. If you want to know what the specifications are for a particular product, or find product models that have earned it, visit the Energy Star web site at www.energystar.gov.
When?	Occupancy
Who is Responsible?	Project lead or procurement staff
Cost and Schedule	Energy efficient equipment doesn't necessarily cost more, but sometimes does. If there is a premium cost, you will almost always earn it back in energy cost savings.
Resources/ products	► **www.energystar.gov** has lots of resources to help you identify products, calculate their savings, and save energy.

0-3 Occupancy Sensors

Install individual occupancy sensors in workstations to turn off task lights, monitors, and personal electronics when the occupant leaves for an extended period.

Benefits MATERIALS EFFICIENCY	Individual occupancy sensors come with or connect to the power strip or surge protector in an employee's workspace and can turn off equipment when the employee leaves it for a period of time. Sensors can greatly reduce power use, particularly in a larger office with lots of workstations. Sensors use passive infrared technology to determine slight variations in motion.
What?	Purchase sensors for each workstation and install correctly.
When?	Occupancy
Who is Responsible?	Project lead
Cost and Schedule	Units cost from $30-$80.

0-4 Green Maintenance

Provide green guidelines for maintenance staff.

Benefits HEALTH & INDOOR AIR	Proper maintenance and cleaning to prolong the life of materials and maintain good indoor air quality is as important as selecting and installing resource efficient building materials. Floor coverings especially receive the highest amount of wear and high maintenance. An integrated plan for preventive, daily, periodic, and intensive maintenance is key to preserving the appearance and longevity of the flooring. The responsible selection and proper use of cleaning products is critical to maintaining indoor air quality. It is important to develop criteria for the selection and use of environmentally preferable cleaning products.
What?	Create a set of guidelines to communicate green maintenance procedures and practices. Review these items with the maintenance staff so that they are familiar with the special needs of your space and your desires to reduce toxins in the cleaning and maintenance system.
How?	Some ideas for things to include in your guidelines: ▶ Provide a schedule for inspecting/cleaning/changing out HVAC filters on a regular basis, at least every six months. ▶ Provide a schedule for regular maintenance and cleaning. Ensure high traffic areas receive daily maintenance including vacuuming and spot cleaning. ▶ Require that custodial service uses only non-toxic, biodegradable cleaning products. Specify use of products that contain no phosphates, perfumes or animal by-products. Require use of nature-based products with anti-bacterial properties if necessary. Prohibit products with man-made anti-bacterial cleaning agents. ▶ Prohibit the use of any pesticides in your workspace that bioaccumulate or are classified as “known” or “likely” carcinogens. ▶ Provide instructions for maintenance staff on proper use, application and disposal of all products.
When?	Occupancy
Who is Responsible?	Project lead

O-5 Occupant Education and Training

Develop a plan for education and training of staff at initial occupancy and on a continuing basis.

Benefits	To make sure that you get the most out of some features of your green TI, you will want to train staff. Human factors can sometimes undermine the best technical efforts. On the other hand, a well informed and committed staff can help broaden the impact of your environmental efforts through their daily work practices.
What?	Educate employees on the efficient use of resources, such as turning equipment off when not in use, understanding the automated HVAC system controls, and using manual controls and overrides. Let staff know whom to contact if a problem arises. Address ongoing education and new employee education. Some other ideas for environmental training with staff are listed below.
How?	► Consult a trained ergonomist to help employees optimally adjust their furniture, computers, and other equipment. ► Create signage highlighting new features, reminding employees about how systems work, and letting visitors know the steps you've taken in green your TI. ► Solicit staff for additional ideas to save resources and operating expenses. ► Provide employees with ongoing opportunities to learn about sustainable practices. ► Incorporate ways to reduce printing, copying, and distributing paper. Purchase paper that has a high recycled content and is manufactured without chlorine bleaching. ► Promote and support employee commute options. Consider programs to allow employees to purchase transit passes at a reduced cost (i.e., pre-tax purchase, company-paid subsidy). Develop an incentive plan for employees who ride their bikes to work, and provide safe bicycle storage and a shower/changing facility. Assist employees with convenient transportation options to travel to an unexpected medical visit or get a ride home to care for a sick family member. ► Purchase fuel-efficient, low-emission company vehicles such as the new gas/electric hybrids, or consider joining a vehicle-sharing organization like FlexCar in place of purchasing, storing, and maintaining a vehicle. ► Where possible, promote flextime schedules or telecommuting to reduce the impact on rush hour traffic.
When?	Occupancy

O-5 Occupant Education and Training (con'd)

Who is Responsible?	Project lead or other designated staff member
Resources/ products	► The **North West Earth Institute** offers excellent workplace discussion courses at no charge. For more information, contact NWEI at 503-227-2807 or visit www.nwei.org. ► Consider participating in organizations such as **The Oregon Natural Step Network** or Businesses for Social Responsibility to learn how other companies are implementing workplace environmental practices. ► Share your success by applying for the **Businesses for an Environmentally Sustainable Tomorrow (BEST) Awards**. (www.sustainableportland.org)

0-6 Purchase Green Power

Purchase electricity generated from renewable resources.

Benefits	Generating electricity is a significant source of air pollution and a major cause of smog, acid rain and habitat destruction. About 40% of the electricity consumed in the Northwest comes from burning fossil fuels, such as coal and gas. These and other conventional sources of electricity harm human health, degrade ecosystems and add to global warming. Electricity generated from sunlight, wind, geothermal heat or burning of waste biomass reduces air pollution and preserves our quality of life. The cost and reliability of renewable energy are stable, especially compared to fluctuations in the supply and cost of electricity from conventional sources.
What?	Electric power is derived from renewable energy sources such as solar, wind, geothermal, biomass, or low-impact hydro sources. PGE and Pacific Power both offer a variety of Green Power options that allow you to voluntarily purchase power from more sustainable sources. The Bonneville Environmental Foundation sells 'green tags' that guarantee power you buy from a utility has been offset by the same amount of renewable power generation.
How?	**Fixed Renewable** Here, you can choose to buy a fixed amount of your electricity from new wind generation each month through Portland General Electric's Clean Wind program ($3.50/block) or Pacific Power's Blue Sky program ($2.95/block). Buying just one "block" of green power a month for one year is equivalent to planting one-third of an acre of trees. **Renewable Usage** This option lets you, through your utility, purchase all of your electricity from Green Mountain Energy's 100% green sources (85% geothermal and 15% wind). At less than a penny more per kilowatt hour, this option will cost an average household about $7-$8 more per month than their regular electric bill. **Habitat** You can get 100% of your electricity from sources that are not harmful to fish while you help rebuild native fish habitat. Electricity is from Green Mountain Energy Company's geothermal and new wind sources, brought to you by your utility. For the Sake of the Salmon, a nonprofit conservation group, will manage habitat restoration funds.
When?	Occupancy
Who is Responsible?	Project leader
Resources/ products	► **www.rnp.org/GreenPower/options.html** ► **www.b-e-f.org/GreenTags/index.cfm** ► You can join the Clean Energy Challenge to show your commitment and get recognition for meeting minimum targets. **www.rnp.org/GreenPower/cec_info.html**

G/Rated Tenant Improvement Certification Option

The G/Rated Certification Process At-A-Glance

How to self-certify your project:

1. Early in the project, use the Checklist and Strategies to identify the Action Strategies you want to target for your project. This should include the 14 Required Action Strategies and 14 additional Action Strategies from the remaining 36 Optional Strategies.

2. After you have identified the strategies you wish to pursue, fill out a draft Checklist located on p. 139.

3. Implement the strategies in your Checklist, using the Strategies as reference as well as the assistance available from G/Rated.

4. Questions? contact:
Michael O'Brien
City of Portland Office of Sustainable Development
Jean Vollum Natural Capital Center
721 NW 9th Ave, Suite 350
Portland, OR 97209
503-823-5494
mobrien@ci.portland.or.us

Introduction

This guide was developed to be a resource to anybody working on Tenant Improvements. However, we encourage you to take the extra steps necessary to complete and certify your project as G/Rated.

G/Rated certification gives you a target to shoot for, and a way to acknowledge your results to share with your organization. Certification will help you let staff and clients or customers know about the steps you took to care for employees' comfort and the environment in your TI project.

We've kept the process simple, so that you don't get bogged down in additional administrative requirements. Each step is elaborated below.

Identify Action Strategies

A copy of the G/Rated Tenant Improvement Checklist follows this section; another copy is provided in the Appendix C. Each of the 50 Action Strategies is described in a Strategy that:

- describes the action steps,
- provides general background information,
- lists benefits,
- lists any associated standards and guidelines
- discusses when, how, and with whom to accomplish the action,
- provides further resources and references that provide more details.

For G/Rated certification, fourteen (14) strategies are required to qualify and another fourteen (14) must be chosen from among the optional actions. Review the actions with the team at the beginning of your project, so that everyone has a clear idea of goals and responsibilities. Once you've done this

you have already completed the first required strategy. Congratulations!

Required Strategies

The 14 required strategies include many of the process steps, as well as key steps applicable to any project. Actions that may not be relevant or feasible in all TI projects are listed as optional or recommended actions. Required Strategies are marked with an "R" and highlighted in the Checklist.

Optional Strategies

The 36 strategies that are optional provide a menu of actions that can help improve performance or productivity, but that may not be appropriate to all situations. For example, if there is relatively new carpet in your space, then "F-5: Use low-emitting carpet and carpet pad" is not relevant to your project (and might in fact create unnecessary waste!). Instead, you might more easily be able to apply "L-3: Develop a lighting design that makes effective use of natural light and reduces electric light and cooling cost." Chose at least 14 of the Optional Strategies for your project and check them off on the list.

Complete Your Checklist

Fill out a copy of the Checklist so you and others on the project team will have a list of measures to refer to. Many of these strategies will be in the project plans and specs, but those are inconvenient to refer to monitor progress.

The certification form is included in Appendix C.

Implement Action Strategies

Using the information on "How to Green Your TI Process" on pages 7-9, the Strategies and the Resources in Appendix A, proceed with your TI project; incorporate the Action Strategies you chose. If a barrier arises, the G/Rated office may be able to help. Otherwise you may need to find another optional strategy to add.

G/Rated Program Assistance

G/Rated offers technical assistance to support you. If you're starting early, the G/Rated office can help review strategies, discuss your project focus, and help you prioritize Action Strategies that might be appropriate to your specific Tenant Improvement Project. We can also help if you're looking for quick answers to specific questions. If you live in Portland please feel free to call at 503-823-7725, or email: mobrien@ci.portland.or.us. If you live in the City of Beaverton, feel free to call 503-526-2665, or email: recyclingmail@ci.beaverton.or.us.

Complete Final Checklist for Certification

This certification works on the honor system. All you have to do to achieve G/Rated certification is to complete the checklist of Action Strategies you complete. The certification form is included on p. 138.

Standards – How do you know you've completed a strategy?

Many of the strategies are quite straightforward. Others have a specific design standard or specification associated with them — these are all noted in the Strategy corresponding to that Action Strategy.

City of Portland Office of Sustainable Development

CERTIFICATE OF COMPLETION

A G/Rated Tenant Improvement

This renovation project has been
sustainably designed and constructed to meet G/Rated guidelines.

_____

(COMPANY OR ORGANIZATION)

_____ _____

(PROJECT MANAGER) (DATE)

rated
PORTLAND'S
GREEN BUILDING
RESOURCE

Dan Saltzman, *Commissioner*

Susan Anderson, *Director*

G/Rated Tenant Improvement Certification Checklist

PLANNING [Shaded strategies required, non-shaded optional]

		✔
Ⓡ	**P-1: Tenant Improvement Guide Review** At the start of the project, review the Tenant Improvement Guide and become familiar with the characteristics of a High Performance Commercial Interior.	☐
Ⓡ	**P-2: Action Strategies Selection** Identify the Action Strategies on this checklist that you want to target for your project.	☐
Ⓡ	**P-3: Green Construction Documents** Make sure the high performance Strategies you've identified for the project are reflected in the project's plans and construction documents.	☐
○	**P-4: Green Location** Use the "Shopping for Your Space" checklist to select the space or location for your project.	☐
○	**P-5: Green Lease** Make sure the high performance Strategies you've identified for the project and any other green goals are reflected in your lease.	☐
○	**P-6: Green Design Team** Select a green design team for your project.	☐

DESIGN

Interior Layout

Ⓡ	**IL-1: Occupant Recycling** Provide space and convenient container placement for an occupant recycling program.	☐
○	**IL-2: Limit Permanent Walls** Limit permanent walls to building core.	☐
○	**IL-3: Multiple Power Locations** Provide multiple locations with power for office equipment.	☐
○	**IL-4: Noise Control** Provide noise control for walls, ceilings, and floors.	☐
○	**IL-5: Walk-Off System** Provide a permanent walk-off mat or grille at all entrances of the building.	☐

Finishes & Furnishings

Ⓡ	**F-1: Material Matrix** Use the Material Matrix to plan and track use of materials with green characteristics.	☐
○	**F-2: Durable Materials** Select durable materials.	☐
○	**F-3: Recycled-Content Materials** Use recycled-content materials.	☐
○	**F-4: Salvaged/Refurbished Materials** Use salvaged and refurbished materials.	☐
○	**F-5: Low-Emitting Carpet** Use low-emitting carpet and carpet pad.	☐
○	**F-6: Low-Emitting Interior Paints and Coatings** Use low-emitting interior paints and coatings.	☐
○	**F-7: Low-Emitting Interior Adhesives and Sealants** Use low-emitting interior adhesives and sealants.	☐
○	**F-8: Formaldehyde-Free Interior Composite Wood** Use no urea-formaldehyde-containing composite interior wood materials or products.	☐
○	**F-9: Local Materials** Use materials that are manufactured or harvested locally.	☐
○	**F-10: Rapidly Renewable Materials** Use products made from rapidly renewable materials.	☐
○	**F-11: Certified Wood** Use certified wood products.	☐

Mechanical & Electrical

Ⓡ	**M-1: HVAC Filtration** Ensure HVAC system is equipped with medium efficiency or better filtration.	☐
Ⓡ	**M-2: Thermal Comfort** Design the HVAC system to provide thermal comfort for all occupants in all zones.	☐
Ⓡ	**M-3: Ventilation** Design the HVAC system to provide adequate ventilation to all occupied spaces.	☐

Ⓡ	**M-4: Testing and Balancing** After the tenant improvement project is complete, test & balance the air distribution system.	☐
○	**M-5: Mechanical Equipment Design (Acoustic)** Use best practices for the design and installation of mechanical equipment and the design and installation of ductwork to minimize equipment noise.	☐
○	**M-6: Selected Independent Exhaust System** Provide independent exhaust for rooms with a concentration of copiers, printers and fax machines.	☐
○	**M-7: Ductwork Design and Installation** Design & install efficient air distribution ductwork.	☐
○	**M-8: HVAC Zone Control** Provide separately controlled HVAC zones throughout the workspace, anticipating the differing heating and cooling needs in each area during different times of the day.	☐
○	**M-9: VAV Design (Layout)** For variable air volume (VAV) systems, include appropriate number of properly adjusted VAV boxes.	☐
○	**M-10: Automatic Temperature Controls** Provide automatic controls to adjust thermostat setting when the spaces are not occupied.	☐
○	**M-11: Pressurized Zones** Design HVAC system to provide barometric (air pressure) levels in order to control odors and moisture migration between spaces and to adjacent tenants' spaces.	☐
○	**M-12: Water Conservation** Install water-using devices to exceed current code requirement.	☐
○	**M-13: Individual Sub-metering** Implement individual sub-metering of your space for electrical use.	☐

Lighting

Ⓡ	**L-1: Efficient Lighting Design** Design lighting to maximize energy efficiency and visual comfort.	☐
○	**L-2: Window Upgrade** Upgrade fenestration (windows) or add film to control heat gain and light transmittance.	☐
○	**L-3: Natural Lighting Design** Develop a lighting design that makes effective use of natural light and reduces electric light and cooling cost.	☐

○	**L-4: Individual Lighting Controls** Provide individuals ability to adjust lighting to their needs	☐

Construction

Ⓡ	**C-1: Construction Waste Management** Implement a Construction Waste Management Plan.	☐
Ⓡ	**C-2: Construction IAQ** Implement a Construction IAQ Management Plan.	☐
Ⓡ	**C-3 Green Monitoring** Monitor the project to ensure green products and practices are installed or incorporated as specified.	☐
○	**C-4: Recycling Rate Greater Than 50%** Achieve recycling rate greater than the 50% rate required by the City of Portland.	☐
○	**C-5: Recycling Documentation** Ask for recycling and garbage receipts to document recycling rate.	☐
○	**C-6: Waste Minimization** Use construction methods that minimize waste to be generated in future renovations.	☐

Occupancy

Ⓡ	**O-1: Post-Occupancy Evaluation** Commit to participating in a post-occupancy evaluation phone call with G/Rated staff.	☐
○	**O-2: Energy Star® Equipment** Purchase Energy Star®-labeled equipment (copiers, faxes, computers and monitors, etc.).	☐
○	**O-3: Occupancy Sensors** Install individual occupancy sensors in workstations to turn off task lights, monitors, and personal electronics when the occupant leaves for an extended period.	☐
○	**O-4: Green Maintenance** Provide green guidelines for maintenance staff.	☐
○	**O-5: Occupant Training** Develop a plan for education and training of staff at initial occupancy and on a continuing basis.	☐

Examples

This Guide and the Certification Option are designed to assist all types and sizes of tenant improvements. Even if you are just remodeling your existing space — half a floor of a downtown office building, for example — you can cost-effectively reap the high performance benefits of a green TI and receive recognition for your achievement. The following examples show some ways to organize your checklist and to achieve certification. You should identify the best combination of Action Strategies for your company and your space.

Required Action Strategies for all projects are summarized here:

Required Action Strategies

Ⓡ	**P-1: Tenant Improvement Guide Review** At the start of the project, review the Tenant Improvement Guide and become familiar with the characteristics of a High Performance Commercial Interior.	☐
Ⓡ	**P-2: Action Strategies Selection** Identify the Action Strategies on this checklist that you want to target for your project.	☐
Ⓡ	**P-3: Green Construction Documents** Make sure the high performance Action Strategies you've identified for the project are reflected in the project's plans and construction documents.	☐
Ⓡ	**IL-1: Occupant Recycling** Provide space and convenient container placement for an occupant recycling program.	☐
Ⓡ	**F-1: Material Matrix** Use the Material Matrix to plan and track use of materials with green characteristics.	☐
Ⓡ	**M-1: HVAC Filtration** Ensure HVAC system is equipped with medium efficiency or better filtration.	☐
Ⓡ	**M-2: Thermal Comfort** Design the HVAC system to provide thermal comfort for all occupants in all zones.	☐
Ⓡ	**M-3: Ventilation** Design the HVAC system to provide adequate ventilation to all occupied spaces.	☐
Ⓡ	**M-4: Testing and Balancing** After the tenant improvement project is complete, test & balance the air distribution system.	☐
Ⓡ	**L-1: Efficient Lighting Design** Design lighting to maximize energy efficiency and visual comfort.	☐
Ⓡ	**C-1: Construction Waste Management** Implement a Construction Waste Management Plan.	☐
Ⓡ	**C-2: Construction IAQ** Implement a Construction IAQ Management Plan.	☐
Ⓡ	**C-3 Green Monitoring** Monitor the project to ensure green products and practices are installed or incorporated as specified.	☐
Ⓡ	**O-1: Post-Occupancy Evaluation** Commit to participating in a post-occupancy evaluation phone call with G/Rated staff.	☐

Example 1: Small Remodel

- Remodeling existing space
- Less than one floor of a downtown office
- Limited changes to systems
- Tight budget

Completion of the following Action Strategies, in conjunction with the required strategies listed above, will achieve certification.

ACTION STRATEGY	DESCRIPTION	COST	PTS
Planning-4: Green Location	Although you are not moving, use the "Shopping for Your Space" checklist to help you evaluate and improve green features of your current location	Staff time to review and discuss checklist	1
Planning-6: Green Design Team	On a small remodel, you may choose not to hire many design professionals. For those professionals you do choose to hire, ensure they have knowledge of green TI process and materials. This will assure an easier and more cost-effective result than working with resistant or non-knowledgeable professionals.	None. Portland has a active community of green design professionals.	1
Interior Layout-2: Limit Permanent Walls	Take advantage of this opportunity to remove exterior offices and permanent walls and, instead of paying to replace them, purchase modular office systems to create flexible, open workspaces. Use de-mountable wall systems for conference rooms and private spaces along the inner core of the building.	Modular walls and office systems will require some additional upfront investment, but can help avoid many future remodeling projects and costs.	1
Interior Layout-4: Noise Control	Provide effective noise control for your open office environment on the walls, ceilings, and floors surrounding the space.	Minor cost increase for acoustical insulating materials.	1
Interior Layout-5: Walk-Off System	Reduce contaminants entering the building by including this simple but effective strategy in your remodel.	Minor cost for mats or grills. Should not increase overall square foot cost.	1
Finishes & Furnishings-3: Recycled-content Materials	Include six (6) recycled-content projects in your project, such as carpet, wallboard, ceiling tiles, steel studs, and maybe a recycled-content countertop material and glass tile in the entry.	Little to none. Recycled materials are readily available.	2
Finishes & Furnishings-4: Salvaged/Refurbished Materials	Because you are remodeling, there will be many opportunities to salvage existing materials and reuse them. Identify three or more likely candidates such as, cabinetry, newer light fixtures, ceiling tiles, and doors.	Saves costs on materials; may have some handling costs to preserve and reinstall the salvaged materials	1

page 1

ACTION STRATEGY	DESCRIPTION	COST	PTS
Finishes & Furnishings-5&6: Low-emitting Carpet, Paints, And Coatings	Low-emitting carpets and paints are the easiest low-emitting materials to specify because they are readily available from a wide variety of vendors.	No-cost. Must specify and request from sub-contractors or vendors.	1
Lighting-3: Natural Lighting Design	Take advantage of any new daylighting opportunities created by changing the office layout (such as removing exterior offices). Be aware of daylight patterns when positioning workstations and computer monitors: provide window shades and photo sensors on electrical lighting located near windows. Set sensors to automatically dim lights to balance with daylight levels.	Nominal cost for photo-sensitive fixtures; will pay back in lower operating costs.	1
Construction-4&5: Recycling rate greater than 50% and recycling documentation.	Although more challenging than recycling on new construction, studies have shown that a greater than 50% recycling rate is achieved by many contractors on TI jobs. Be sure to specify your requirement, and require documentation to prove it. If you need help, contact G/Rated.	Little to no-cost. A contractor familiar with recycling will have an effective system in place.	2
Occupancy-4&5: Green Maintenance and Occupant Training	These two Action Strategies leverage the benefits of the green features you implemented by making sure they are used and maintained properly, and by raising awareness among employees and visitors of the benefits of a high performance work space.	Staff time planning and coordinating; a few hours of design team for con-tent of the maintenance guidelines	2
TOTAL			14

Example 2: New, Larger Space

- New space
- At least one floor of a downtown office
- Changing some systems
- Budget includes system upgrades and new finishes

Complete the required Action Strategies, some of the Action Strategies recommend in Example 1, and the following Action Strategies to garner greater benefits by enhancing comfort, health, and efficiency.

ACTION STRATEGY	DESCRIPTION	COST	PTS
Planning-5: Green Lease	Because you will be negotiating a new lease, you will have the opportunity to codify many of your green requirements and assure they are implemented.	Staff time negotiating lease	1
Finishes & Furnishings-7&8: Low-emitting Adhesives, and Sealants, and Formaldehyde-free Composite Wood.	Add these two low-emitting materials Action Strategies to eliminate the majority of indoor contaminants from building material emissions. Adhesives, sealants, and formaldehyde-free wood composites may be slightly less available or have a small premium, but are available and used on many projects in the Portland area.	Possible premium for materials	2
A selection of strategies from Mechanical & Electrical 5-13	Because you are investing in upgrading the mechanical systems on your floor, work with the mechanical engineer or contractor to design a system that delivers high quality air and thermal comfort efficiently and quietly. Although many of these Action Strategies are similar to code requirements, they are not always implemented well, so it benefits you to focus on the designing a system for your desired outcomes.	Similar to any mechanical upgrade to code, with possible costs for more detailed design and calculations	1-8
Mechanical & Electrical-12: Water Conservation	Often, major renovations involve layout changes that require reconfiguring bathrooms and kitchen facilities. This presents an opportunity to replace fixtures with water saving devices and models.	Some cost increase, though less if fixtures would be replaced anyway	1
Occupancy-2: Energy Star® Equipment	For any appliance replacement, choosing Energy Star® appliances is an easy way save water and energy.	Energy Star® appliances are cost-competitive and save money in operating costs	1
Occupancy-4: Occupancy Sensors	Installing occupancy sensors on workstations and office equipment allows a high level of control of energy use without burdening employees.	Varies by type of equipment	1
Total additional points			7-14

Appendices

Permanent overnight
Compatible with all bu
Exceeds VOC complian
Environmentally safer
No shrinkage
Nonflammable/Noncomb
Non toxic
WARNING LABEL

APPENDIX A: Resources & References

The following resources offer assistance in creating a high performance workspace. Some provide information, while others are potential sources of funding that may offset the costs of improvements.

Resources

G/Rated ▷ A program of the City of Portland Office of Sustainable Development, G/Rated offers technical assistance for high performance commercial tenant improvements. Call 503-823-7725 or visit www.green-rated.org.

BetterBricks ▷ A program of the nonprofit partnership Northwest Energy Efficiency Alliance. BetterBricks provides technical assistance and resources on improving productivity through better workplace design. Visit www.betterbricks.com.

Oregon Office of Energy (ODOE) ▷ ODOE provides technical and financial assistance for various energy-efficiency investments through the Small Scale Energy Loan Program (SELP) and a Business Energy Tax Credit (BETC). Call 800-221-8035 or visit www.energy.state.or.us.

Energy Trust of Oregon, Inc. ▷ ETO provides a wide range of energy-saving services and financial incentives for Oregon's business community. Most facilities can receive services, including office buildings, retail stores, and agriculture, hospital and municipal facilities. Call 1-877-510-6800 or visit www.energytrust.org.

Portland General Electric (PGE) ▷ PGE Green Building Services offers expert assistance in green design and project management. Call 503-603-1661 or visit www.greenbuildingservices.com.

Building Owners and Managers Association (BOMA) International ▷ BOMA offers training and information on green leasing. Visit www.boma.org.

Corporate Realty, Design & Management Institute ▷ Produces the "Tenant's Toolbox," a resource guide for commercial tenants. Call 800-452-4480 for a copy.

References

Creating Workspaces Where People Can Think, Phyl Smith and Lynn Kearny, Jossey-Bass Publishers, 1994. Includes hands-on, re-useable worksheets, checklists, surveys and cost-estimating forms for reducing or eliminating performance-related problems due to inadequate workspace.

The Impact of Interior Design on the Bottom Line, American Society of Interior Designers, http://www.asid.org/about_asid/products_services/pubs/asid_productive_solutions.pdf.

Brewery Blocks Tenant Manual: A Guide to Greening Your Space, Gerding Edlen Development, 2002.

BuildingGreen, Inc., Brattleboro, VT, 802-257-7300, www.buildinggreen.com. BuildingGreen is the source for authoritative information on environmentally responsible building design and construction. They publish:

> *Environmental Building News* (EBN). This monthly newsletter features comprehensive, practical information on a wide range of topics related to sustainable building.

GreenSpec — The Environmental Building News Product Directory and Guidelines. GreenSpec is organized in standard CSI divisions.

Hard copy and online access to both *Environmental Building News (EBN)* and *Green Spec* is available by subscription. See the web site for more information.

Guidelines for Creating High Performance Green Buildings and Model Green Office Leasing Specifications. Commonwealth of Pennsylvania http://www.gggc.state.pa.us/publictn/leaspecs.html.

"Toward a General Theory of the Human Factors of Sustainability." A paper delivered at the AIA-USGBC Conference, "Mainstreaming Green," Chattanooga, TN, October 1999. Judith H. Heerwagen, Ph.D. http://www.cal-iaq.org/CLASS/Heerwagen_ 1999.pdf.

"Green Building, Organizational Success, and Occupant Productivity." Published in a special edition of Building Research and Information, Vol. 28 (5), 2000:353-367, London, UK. Judith H. Heerwagen, Ph.D.

High-Performance Commercial Buildings: A Technology Roadmap. A publication of the US Department of Energy Building Technologies Program, developed by representatives of the commercial building industry. http://www.eere.energy.gov/buildings/documents/#technology %20roadmaps.

Green Building Materials: A Guide to Product Selection and Specification. Ross Spiegeland & Dru Meadows, John Wiley & Sons, Inc., 1999.

LEED for Commercial Interiors Pilot Draft, U.S. Green Building Council www.usgbc.org/docs/LEEDdocs/LEEDCIvPilot.pdf

"Drivers for Change: An Organizational Perspective on Sustainable Construction," Jorge A. Vanegas, Ph.D. and Annie R. Pearce, Ph.D., 2000. Georgia Institute of Technology. Published in *Proceedings, Construction Congress VI,* February 20-22, 2000, Orlando, FL. http://maven.gtri.gatech.edu/sfi/resources/pdf/RCP/RCP001.PDF.

What Office Tenants Want. BOMA/ULI Office Tenant Survey Report, 1999. A publication of the Building Owners and Managers Association (BOMA). Order from http://www.boma.org/pubs/bomauli.htm.

APPENDIX B: Glossary

Real Estate/Lease Terms

Amenity ▶ A natural or man-made feature that enhances a property's attractiveness and increases the satisfaction of the user.

Building Codes ▶ Regulations established by a local government stating fully the fire/life safety and structural requirements for a building.

Building Standard ▶ The specific construction and finish element, defined in terms of quality and quantity, that an owner provides for tenants throughout a building.

Client ▶ The one by whom a broker is employed and by whom the broker will be compensated.

Commissioning ▶ According to the Building Commissioning Association (http://www.bcxa.org), "The basic purpose of building commissioning is to provide documented confirmation that building systems function in compliance with criteria set forth in the Project Documents to satisfy the owner's operational needs. Commissioning of existing systems may require the development of new functional criteria in order to address the owner's current systems performance requirements."

In other words, it is a process to ensure that the HVAC and other critical systems in the building function the way they are intended to function (for example, for efficiency, air movement, and ventilation rates). Commissioning has become increasingly important as buildings systems have become more complex and integrated.

Competitive Space ▶ Office space in the open market that is comparable to the subject building, which will vie for the same tenant population.

Concession ▶ Granting a reduction or allowances on rent in order to lease new space or to retain an existing tenant.

Constant Volume (CV) System ▶ Constant volume HVAC systems deliver a constant airflow to each space. This is one of the two major types of HVAC systems based upon the use of airflow to control temperature. The other type is the Variable Air Volume (VAV) system.

Core ▶ Includes the square footage used for public corridors, elevators, washrooms, stairwells, and electrical and janitorial closets.

Demising Clause ▶ A clause found in a lease whereby the landlord (lessor) leases and the tenant (lessee) takes the property.

Efficiency Ratio ▶ The ratio of a building's net rentable area, which is the space used and occupied exclusively by the tenant, to its gross area, which includes the building's core.

Finish Allowance ▶ A landlord's allowance for constructing tenant improvements; i.e. what the owner allows to "finish off" tenant space.

Graduated Lease ▶ A lease that provides for a graduated change at stated intervals in the amount of rent to be paid. Used largely in long-term leases.

Green Power ▶ Power is derived from renewable energy sources such as solar, wind, geothermal, biomass, or low-impact hydro sources. PGE and Pacific Power both offer a variety of Green Power options that allow you to voluntarily purchase power from more sustainable sources.

Gross Square Footage (GSF) ▶ A unit of measuring space, particularly useful in measuring and studying

a building's energy consumption.

Heating, Ventilating, and Air Conditioning (HVAC) System ▶ The unit(s) regulating the even distribution of heat, conditioned air, and fresh air throughout a building.

Lease ▶ A written document in which the owner of a property transfers the right to use and occupy that property to another for a specified period of time, and in exchange for a specified rent.

Leasing Agent ▶ The individual directly responsible for renting space in assigned properties.

Lessee ▶ A person to whom property is rented under a lease.

Lessor ▶ One who rents property to another under a lease.

Low Rise ▶ A building up to five stories high.

Mid Rise ▶ A building six to ten stories high.

Net Lease ▶ A type of lease under which the tenant assumes the obligation to pay for utilities, real estate taxes, and other special assessments associated with the leased premises.

Double Net lease ▶ A type of lease under which the tenant assumes the obligation to pay utilities, real estate taxes, and other special assessments associated with the leased premises, plus ordinary repairs and maintenance.

Triple Net Lease ▶ A type of lease under which the tenant assumes the obligation to pay utilities, real estate taxes, and other special assessments associated with the leased premises, plus ordinary repairs, maintenance, and some capital improvements.

Net Operating Income (NOI) ▶ The balance remaining after deducting a property's operating expenses from its effective gross income.

Net Rentable Square Foot ▶ The unit of measure in which office space on a multi-tenant floor occupied and used exclusively by tenants is determined.

Non-Competitive Space ▶ Office space occupied by owners or long-term tenants and therefore not available to satisfy demand.

Occupancy Levels ▶ The ratio of rented space to the total amount of rentable space.

Operating Expense Escalation Clause ▶ A lease provision under which increases in operating expenses are to be passed on to tenants on a pro rata basis.

Operating Expenses ▶ The expenditures for salaries, taxes, insurance, utilities, maintenance, and other similar items paid in connection with operating a building, and which are property [what does this mean?]charged against income.

Operating Expense Stop ▶ A per-square-foot dollar amount at which the owner stops covering operating expenses and passes them on to the tenant.

Pass Throughs ▶ Refers to specified costs that the landlord will pass on to the tenant for payment on top of rent.

Pre-Leasing ▶ The leasing of space in a project under construction in order to ensure a high occupancy level upon completion.

Pro Forma ▶ A financial projection for a proposed project based on certain specified assumptions and reflecting construction costs, financing, leasing rates, turnover, and operating costs.

Relet Space ▶ Office space that has been previously occupied by another tenant and is currently vacant and available for occupancy.

Renovation ▶ A general term covering the modernization, rehabilitation, or remodeling of existing real estate.

Rent Escalation Clause ▶ A provision in a lease that guarantees automatic rent adjustments for increased operating expenses.

Space Planning ▶ The process of creating office interiors that combine functional efficiency with a pleasing appearance, based on the financial limitations of the potential tenant.

Sublet ▶ Renting part or all of the space currently leased by another tenant. The new tenant pays rent to the initial tenant instead of paying directly to the landlord.

Tenant ▶ One who pays rent to occupy, or gain possession of real estate.

Tenant Improvements ▶ Fixed improvements made to a tenant's office space.

Usable Area ▶ On a multi-tenant floor, usable area is the gross area minus core space. On a single tenant floor, the usable area is the gross square footage excluding lobby, duct shafts, stairwells, and elevators.

Vacancy Rate ▶ The ratio of vacant space to total rentable area.

Workletter ▶ That part of the lease pertaining in detail to all work that is to be done for the tenant by the landlord; also called a construction rider.

Zoning ▶ A public regulation determining the character and intensity of land use.

Green Building Terms

Air Pollutant ▶ As defined by the EPA, any substance in air that could, in high enough concentration, harm humans, other animals, vegetation, or material. Pollutants may include almost any natural or artificial composition of airborne matter.

Air Quality Standards ▶ As defined by the EPA, the level of pollutants prescribed by regulations that is not being exceeded during a given time in a defined area.

Ambient lighting ▶ Lighting that produces general illumination throughout an area.

Asbestos ▶ A mineral fiber that can pollute air or water and cause cancer or asbestosis when inhaled. EPA has banned or severely restricted its use in manufacturing and construction.

Asbestos Abatement ▶ Procedures to control fiber release from asbestos containing materials in a building or to remove them entirely. These include removal, encapsulation, repair, enclosure, encasement, and maintenance.

ASHRAE Standard 55 ▶ Thermal Environmental Conditions for Human Occupancy. This standard identifies the many factors that influence thermal comfort and the perception of thermal conditions. Among these factors are temperature, radiation, humidity, air movement, vertical and horizontal temperature differences, temperature drift, personal activity, and clothing. The standard specifies the range of design values for temperature, humidity, and air movement to provide satisfactory thermal comfort for at least 80% of building occupants.

ASHRAE Standard 62 ▶ Ventilation for Acceptable Indoor Air Quality. The generally accepted standard for commercial buildings in the United States, it provides ventilation requirements (in CFM per person and per square foot) for office spaces and other commercial spaces.

Biological Contaminants ▶ Contaminants that include bacteria, viruses, molds, pollen, animal and human dander, insect and arachnid excreta.

Biodegradable ▶ Able to break down or decompose rapidly under natural conditions and processes.

Bioaccumulants ▶ Substances that, because they are very slowly metabolized or excreted, tend to increase in concentration in living organisms as those organisms take in contaminated air, water, or food.

Building Related Illness ▶ A situation where building occupants experience discomfort and minor health effects as a result of exposure to contaminated air in the building. Symptoms typically subside when the occupant leaves the building.

Carcinogen ▶ Any substance that can cause or aggravate cancer.

Certified Wood ▶ Wood products that come from certified "well managed" forests, as defined by the Forest Stewardship Council (FSC). Well managed forests meet the long-term forest product needs of humans while maintaining the health and biodiversity of forest ecosystems.

Chlorofluorocarbons (CFCs) ▶ Class of chemicals that formerly were used as refrigerants in buildings. When released to the atmosphere, they react photochemically, depleting ozone on the stratospheric ozone layer.

CFM ▶ Cubic feet per minute. A measurement of the ventilation rate of a ventilation system expressed as the volume of air supplied by the system every minute.

Chronic Effect ▶ An adverse effect on human or animal health, whereby symptoms recur frequently or develop slowly over along period of time.

Clearcut ▶ As defined by the EPA, an area where all the trees have been cut at one time; clear cutting can increase rain or snowmelt runoff, erosion, sedimentation of streams and lakes, and flooding, and destroys vital habitat.

Closed-loop Recycling ▶ Recycling in which a product is recycled into a similar product; a recycling system in which a particular mass of material is remanufactured into the same product (e.g., glass bottles into glass bottles).

Chain-of-Custody ▶ A form of tracking certified wood products from the forest, through the mill, manufacturer and distributor to their final place of use. It is important to ensure that the purchased certified wood product actually originated from a certified well managed forest.

Commingling ▶ The process of mixing various recyclable materials, such as construction debris, together at the point of collection, and sending the mixed loads to a sorting facility, where the materials are separated for recycling. Commingling requires less space at a construction site because multiple sorting bins are not needed.

Construction waste ▶ Waste generated as a result of the construction of residential dwellings, commercial buildings, and infrastructure such as bridges and roads. Construction waste is typically "cleaner" than demolition waste since it has not been previously used and therefore generally has not been painted, treated, or combined with other materials.

Contaminant ▶ As defined by the EPA, any physical, chemical, biological, or radiological substance or matter that has an adverse effect on air, water, or soil.

Cradle-to-Cradle ▶ A term used in life cycle analysis to describe a material or product that can be renewed as a new product at the end of its useful life. This concept can be contrasted with a Cradle-to-Grave life cycle, where a product will simply be disposed of at the end of its useful life.

Carpet and Rug Institute (CRI) ▶ The national trade association representing more than 90% of carpet and rug manufacturers and suppliers of raw materials and services to the industry.

CRI Green Label ▶ A carpet label signifying that the manufacturer has voluntarily participated in the CRI Green Label Indoor Air Quality Test Program and is committed to developing ways to minimize VOC emissions from its product. A representative sample of the product type is tested quarterly by an independent laboratory to meet established VOC emission limits.

Daylighting ▶ Using natural daylight to provide ambient indoor illumination.

Dimming Controls ▶ Devices used to control the intensity of light emitted by a lamp, by limiting the power supplied to it.

Down Cycling ▶ The recycling of a material into a different product, typically less refined (i.e. old carpet which becomes parking wheel stops).

Ecological Footprint ▶ The land area required to produce the resources consumed by, and absorb the wastes and emissions produced by, a particular population or process. A method of measuring the environmental impact of an individual, a business, a city, or any other entity.

Environmental Tobacco Smoke ▶ Air pollution from burning cigarettes, pipes, cigars, and smoke exhaled by smokers.

EPA ▶ The United States Environmental Protection Agency.

Forest Stewardship Council (FSC) ▶ An independent organization that sets criteria for sustainable forest management, certifies production streams that comply with their criteria, and permits the posting of their "FSC-Certified" logo on the product label. www.fscus.org

Flush-out ▶ A process used to remove VOCs from a newly constructed or renovated building by operating the HVAC system at 100 percent outside air for a specified period of time, typically before occupancy.

Formaldehyde ▶ A colorless, gaseous compound used as a preservative, disinfectant, and curing agent. It is used widely in production of construction products such as adhesives, plastics, composite wood, preservatives, and fabric treatments. These products often "off-gas" formaldehyde, which is highly irritating if inhaled and is now listed as a probable human carcinogen.

Glare ▶ The sensation produced by a high contrast in the apparent brightness or "luminance" of surfaces within a persons field of view. Glare can result from bright sunlight or poorly designed electric lighting and can cause annoyance, discomfort, and/or loss in visual performance.

Green Building ▶ Refers to the use of building materials, systems, and methods that promote environmental quality, economic vitality, and social benefit through environmentally responsible design, construction, and operation of buildings. Green building design incorporates energy and water conservation, construction waste management, the use of environmentally preferable materials, site protection, and indoor environmental quality.

Halon ▶ Substances used in fire suppression systems and fire extinguishers in buildings. Halon depletes stratospheric ozone at a rate of up to 16 times that of CFC-11 (a common refrigerant). The Montreal Protocol prohibited the production of halon in developed countries after December 31, 1993.

Hydrochloro-fluorocarbons (HCFCs) ▶ Classes of chemicals used as refrigerants in buildings. When released to the atmosphere, they react photochemically, depleting ozone on the stratospheric ozone layer. However, HCFCs are not as reactive as CFCs and therefore have a lower "ozone depleting potential" (ODP).

High Performance Workspace ▶ A workspace that is business-efficient, environmentally friendly to construct, healthy for occupants, and safer and less costly to operate.

Impervious surfaces ▶ A hard surface area that either prevents or slows the soaking of water into the soil. Common impervious surfaces include, but are not limited to, roof tops, walkways, patios, driveways, parking lots or storage areas, concrete or asphalt paving, gravel roads with compacted subgrade, packed earthen materials, and oiled, macadam or other surfaces which similarly impede the natural infiltration of stormwater.

Indoor Air Pollution ▶ As defined by the EPA, chemical, physical, or biological contaminants in indoor air.

Indoor Air Quality (IAQ) ▶ The quality of air that affects the health and well-being of building occupants.

Landfill ▶ A system of trash and garbage disposal in which the waste is buried between layers of earth to build up low-lying land.

Life Cycle Cost (LCC) ▶ An accounting method that extends beyond capital cost to include the present value of operation, maintenance and replacement costs. Typically used to assess energy conservation measures.

Life Cycle Assessment (LCA) ▶ The assessment a product's environmental and economic impact, from the extraction of the raw materials through its useful life to its ultimate disposal or recycling. Usually measured in terms of consumption of resources and energy and generation of waste.

Low Emissivity (low-E) Glazing ▶ Insulated glazing assembly manufactured with a special coating that reduces heat loss and/or heat gain through windows by inhibiting the transmission of radiant heat while allowing visible light to pass.

Material Safety Data Sheets (MSDS) ▶ A compilation of information required under the OSHA Communication Standard on the identity of hazardous chemicals, health and physical hazards, exposure limits, and precautions.

Stormwater ▶ The surface water runoff resulting from all natural forms of precipitation. In general, development increases the rate, quantity, or both, of stormwater on the site, which can cause environmental degradation such as scouring, silting, and pollution of nearby waterways.

Post-Consumer Recycled Content ▶ The percentage by weight of waste material from consumer use incorporated into a product. Post-consumer recyclable materials include discarded carpet, ceiling tile, beverage containers, and scrap paper.

Post-Industrial Recycled Content ▶ The percentage by weight of waste material from industrial use incorporated into a product. Post-industrial recyclable materials are different from industrial scrap, which are by-products of industrial processes that can be easily reused as feedstock.

Potable Water ▶ Water that meets drinking water quality standards and is approved for human consumption by state or local authorities.

Rapidly Renewable Materials ▶ Rapidly renewable materials include bamboo flooring, wool carpet, strawboard, cotton batt insulation, linoleum flooring, poplar OSB, sunflower seed board, and wheatgrass cabinetry.

Reclamation ▶ Beneficial use of waste materials otherwise destined for disposal.

Reclamation Agency ▶ Designated agent providing used carpet recycling under a carpet reclamation program.

Resource conservation ▶ Practices that serve to reduce the consumption of our natural resources, including energy, water, and materials.

Recycled Content ▶ The percentage by weight of waste material incorporated into a product.

Recyclable ▶ A waste material that can be used as a raw material for the manufacture of another product.

Renewable Energy ▶ Energy that comes from an undepletable or naturally replenishable source, such as wind, solar, or biomass.

Renewable Resource ▶ A natural resource that can be replenished at a rate equal to or greater than its rate of depletion, such as many agricultural and forest products.

Sick Building Syndrome ▶ A situation where a substantial proportion of building occupants experience acute discomfort and negative health effects as a result of exposure to contaminated air in the building.

Source Reduction ▶ The design, manufacture, acquisition, and reuse of materials so as to minimize the quantity or toxicity of waste generated.

Sustainability ▶ Action that meets the needs of the present without compromising the ability of future generations to meet their needs.

Sustainable Design ▶ Design practice that integrates sustainability.

Task Lighting ▶ The lighting directed to a specific surface or area to provide illumination for visual tasks.

Variable Air Volume (VAV) ▶ Variable air volume HVAC systems maintain thermal comfort by varying the amount of heated or cooled air delivered to each space, rather than by changing the air temperature. This is one of the two major types of HVAC systems based upon the use of airflow to control temperature. The other type is the Constant Volume (CV) system.

Volatile Organic Compound (VOC) ▶ Any organic compound that reacts photochemically in the atmosphere. Volatile organic compounds are chemical compounds based on carbon and hydrogen structures that can be vaporized at room temperatures, typically with an odor.

APPENDIX C: Construction Waste Management Model Specification

PART 1: GENERAL

1.1 JOB SITE WASTE REDUCTION

Goals: Owner has set a waste minimization goal for the project, within the limits of the construction schedule, contract sum, and available materials, equipment, products, and services. These goals are consistent with the 1997 "Statement on Voluntary Measures to Reduce, Recover, and Reuse Building Construction Site Waste" released by the American Institute of Architects and the Associated General Contractors of America, Federal Executive Order 13101, and EPA Comprehensive Procurement Guidelines (CPG).

- Minimize the amount of CDL (construction, demolition, and landclearing) waste generated. The project goal is to recycle, salvage, or reuse at least 75% of the wastes generated.
- Divert waste created through CDL processes from disposal, through reuse (salvage) and recycling.
- Use recycled or salvaged building materials.

1.2 REGULATORY REQUIREMENTS

Some jurisdictions have requirements for recycling at the job site. It is vital to check with the proper authorities of the jurisdiction you are operating in. The City of Portland requires all building projects in Portland with a permit value of $50,000 or more (including construction and demolition phases) to separate and recycle certain materials from the job site (City Code 17.102.180 and the related Administrative Rules). There are monetary penalties for noncompliance, up to $500 per violation. Under Portland regulations, the general contractor is responsible for ensuring recycling at the job site and for completing the Pre-Construction Recycling Plan Form. Where no general contractor is named on the permit, the property owner is considered the responsible party. For more information contact, the City of Portland Recycling Hotline at (503) 823-7202 or visit www.sustainableportland.org.

1.3 DEFINITIONS

Waste ▶ For the purpose of this section, the term applies to all excess materials, including materials that can be recycled, unless otherwise indicated.

Construction, Demolition, and Landclearing Waste (CDL) ▶ Includes all non-hazardous solid wastes resulting from construction, remodeling, alterations, repair, demolition, and landclearing.

Proper Disposal ▶ As defined by the jurisdiction receiving the waste.

Hazardous Waste ▶ As defined by the jurisdiction receiving the waste.

Recycling ▶ The process of sorting, cleaning, treating, and reconstituting materials for the purpose of using the materials in the manufacture of new products. Can be conducted on-site (as in the grinding of concrete and reuse on-site).

Recycling Facility ▶ An operation that can legally accept materials for the purpose of processing the materials into an altered form for the manufacture of a new product. Recycling facilities have their own specifications for accepting materials.

Reuse ▶ Making use of a material without altering its form.

Salvage ▶ Recovery of materials for on-site reuse or donation to a third party.

Source-Separated Materials ▶ Materials that are sorted at the site for the purpose of reuse or recycling.

Commingled Materials ▶ Mixed recyclable CDL materials that have not been source-separated. Some facilities will separate commingled materials off-site for recycling.

1.4 WASTE MANAGEMENT PLAN (WMP)

Plan Submittals ▶ Prior to demolition or construction startup, and prior to any waste removal by the contractor from the project, the contractor shall develop and submit to the owner for review a Waste Management Plan. The Waste Management Plan shall include:

- Types and estimated quantities (where reasonably available) of salvageable materials that are expected to be generated during demolition.
- The method to be used to salvage or reuse demolition materials on-site or off-site. Methods shall include one or more of the following options: contracting with a deconstruction specialist to salvage all or most materials generated, selective salvage as part of demolition contractor's work, and/or reuse of materials on-site or in new construction.
- Types and estimated quantities (where reasonably available) of recyclable materials expected to be generated during demolition and construction in significant amounts, including but not limited to wood, concrete, metals, cardboard, and drywall.
- The method to be used to recycle these materials. Methods shall include one or more of the following options: requiring subcontractors to take materials back for recycling at a permitted facility, contracting with a full service recycling service to recycle all or most materials at a permitted facility, or processing and reusing materials on-site or off-site.

Meetings and Communication ▶ Contractor shall conduct Project Waste Management Plan meetings. Meetings shall include subcontractors affected by the Waste Management Plan. At a minimum, waste management goals and issues shall be discussed at pre-bid, pre-construction, job site meetings and project close out meetings.

Materials Handling Procedures ▶ Prevent contamination of materials to be salvaged and recycled and handle materials in a manner consistent with requirements for acceptance by designated facilities. Where space permits, source separation is recommended. Where materials must be commingled, they must be taken to a processing facility for separation off site.

Transportation ▶ The contractor may engage a hauling subcontractor, self-haul or make subcontractors responsible for their own waste. Provide documentation of compliance with these requirements.

Waste Management Plan Implementation

- **Manager:** The contractor shall designate an on-site party (or parties) responsible for instructing workers and overseeing and documenting results of the Waste Management Plan. Waste prevention and recycling activities shall be discussed at the beginning of each safety meeting.
- **Distribution:** As each new subcontractor comes on-site, the recycling coordinator will present him/her with a copy of the Waste Management Plan and provide a tour of the recycling areas.
- **Instruction:** The subcontractor will be expected to make sure all their crews comply with the Waste Management Plan. Instruction

of appropriate separation, handling, and recycling to be used by all parties at the appropriate stage of the project will be provided. On demolition projects, the contractor shall provide on-site instructions for salvage and requirements for reusing salvaged materials within the project, either in new construction or in a renovation.

- **Separation facilities:** The contractor shall lay out and label a specific area for the separation of materials for recycling and salvage. Recycling and waste bins are to be kept neat, clean and clearly marked to avoid contamination of materials. If space is not available, the contractor must work with the owner and hauler to develop a commingling plan to separate materials at a processing facility. Lists of acceptable/unacceptable materials will be posted throughout the site.

1.5 DOCUMENTATION

Final Waste Management Plan ► Once the owner has determined that the recycling options addressed in the Waste Management Plan are acceptable, the contractor shall submit a final Waste Management Plan prior to demolition or construction startup. To each application for progress payment submitted to the owner or its representative, the contractor shall attach a record of the amount of material disposed (in tons) and the amount of each material recycled by type (in tons or cubic yards, whichever is available). For commingled materials, the contractor shall include weight tickets from the recycling hauler or drop-off facility and verification of the recycling rate for mixed loads at the facility. The contractor shall be responsible for providing such information, whether directly involved in recycling the materials or not (i.e., whether the contractor performs recycling tasks or hires or requires others, such as subcontractors, to do so).

1.6 SUBSTITUTIONS

Should the contractor desire to use procedures, materials, equipment, or products that are not specified but meet the intent of these specifications to reduce materials waste, the contractor shall propose these substitutions in accordance with Substitutions and "Or Approved Equal" in General Requirements.

1.7 REVENUES

Revenues or other savings obtained from recycled, reused, or salvaged materials shall accrue to contractor unless otherwise noted in the Contract Documents.

PART 2: PRODUCTS

2.1 MATERIALS

Recycled-content, salvaged, rapidly renewable, or otherwise resource-efficient products are specified in appropriate sections.

PART 3: EXECUTION

3.1 DEMOLITION

Salvage (sell or reuse) or recycle the items listed below (on- or off-site). For information about disposal and recycling options in the Portland metropolitan area call the Metro Recycling Hotline at 503-234-3000.

- acoustical ceiling tiles
- asphalt
- asphalt shingles
- brick
- cardboard packaging

- carpet and carpet pad
- cabinets and casework
- Concrete and concrete block
- dimensional lumber and heavy timbers
- drywall
- electric equipment and light fixtures
- flooring, hard and softwood
- heritage architectural elements, such as mantle pieces, columns, etc.
- insulation
- landclearing debris (vegetation, stumpage, dirt)
- metals
- paint (through Metro transfer stations)
- plastic film (sheeting, shrink wrap, packaging)
- plumbing fixtures and brass
- structural steel
- windows, doors, and frames
- wood paneling, molding, trim, and wainscoting
- wood siding (salvage)
- job-shack wastes, including office paper, pop cans and bottles, and office cardboard

3.2 NEW CONSTRUCTION

Recycle the items listed below (on- or off-site). For information about disposal and recycling options in the Portland metropolitan region, call the Metro Recycling Hotline at 503-234-3000.

- acoustical ceiling tiles
- asphalt
- asphalt shingles
- cardboard packaging
- carpet and carpet pad
- concrete, concrete block, brick
- drywall
- fluorescent lights and ballasts
- landclearing debris (vegetation, stumpage, dirt)
- scrap metal
- paint (through hazardous waste outlets)
- wood flooring
- plastic film (sheeting, shrink wrap, packaging)
- window glass
- wood products
- job-shack wastes, including office paper, pop cans and bottles, and office cardboard

Include in supply agreements a waste reduction provision specifying a preference for reduced, returnable, and/or recyclable packaging.

Use detailed material estimates to reduce risk of unplanned and potentially wasteful cuts.

Store materials properly to avoid moisture damage or other damage to materials and outdating.

Materials that become wet or damp due to improper storage shall be replaced at contractor's expense.

Use safety meetings, signage, and subcontractor agreements to communicate the goals of the Waste Management Plan.

As part of regular clean up, schedule visual inspections of dumpsters and recycling bins to identify potential contamination of materials.

APPENDIX D: "Shopping for Your Space" Checklist

MAX, Portland Streetcar and bus lines offer commuting options.

This "Shopping for Your Space" process and checklist, along with your list of target Action Strategies, will help you identify characteristics of the space and property management that are most conducive to your High Performance Tenant Improvement goals.

The Process

1. First, evaluate your current space. Ask your colleagues the following questions and use their responses to help guide your search and space planning. Add unique criteria to the Space Evaluation Checklist that follows.

- What do people enjoy about the space (such as daylight, views, and historic character)?
- What are the best features of the current workspace that we want in the new space?
- What are the worst features that should be avoided in the new space?
- How does the current space plan affect communication among team members?
- How can we change the space layout to improve communication?
- How do work spaces fit individual worker needs?
- Is the workspace flexible enough to accommodate changes in work?
- Is the space too warm, cold, or humid?
- How is the lighting?
- Is there distracting noise?
- Is there access to views?
- How do people feel about current air quality?

Site Considerations Beyond TI: A Fish-Friendly Site

The design and maintenance of parking areas and landscaping have a big impact on the health of local waterways. The health of indigenous fish and other aquatic life is a good indicator of this bigger issue. Look for site features that help retain rainwater on site so that it soaks into the ground and is filtered naturally before returning to local rivers. Also ask about landscaping maintenance. Practices that limit or eliminate the use of conventional fertilizers, pesticides, and herbicides, and instead use non-toxic alternatives, are also healthier for local waterways and wildlife.

Commuting by bicycle is popular in Portland.

2. Define your existing and future organizational requirements.

- Know when your current lease expires. Many facility planners allow themselves a year or more to renegotiate a current lease or negotiate a new one.
- Develop an outline of space, equipment and functional needs. Account for short-term and long-term space needs and location requirements of your organization.
- Select a broker who will support your preferences and efforts. You may need to interview several brokers to determine their knowledge of green workspace issues.
- Consider tradeoffs you are willing to make with respect to features such as building type and amenities, location, and local transportation.
- Estimate how long it will take to plan and implement your tenant improvement project and workspace move. Critical items that can affect schedule include lease negotiations, developing working drawings, building permit processing,

This office layout provides excellent balance of daylight and electric light for office tasks.

order and delivery times for some products and furnishings, and construction.

3. Determine requirements for the new building and space. Use the information from steps 1 and 2 above, along with your list of target Action Strategies (Action Strategy P-2) to define the requirements for your new space. Use the following Space Evaluation Checklist to identify these requirements in writing.

4. Identify and compare candidate properties. Now that you have clearly defined the requirements for your new space, your agent can use the Space Evaluation Checklist as a guide in identifying potential sites. Use it to compare tradeoffs between candidates. When you are finished, the completed Checklist will highlight which site(s) meet(s) the greatest number of your most important criteria and will aid your final selection.

Space Evaluation Checklist

Characteristics	Site 1	Site 2	Site 3	Site 4
Your Company's Key Criteria				

Building Considerations

Building management is amenable to our High Performance Tenant Improvement goals				
The building or space conforms and adapts to our functional, organizational and managerial needs. It can accommodate expansion.				
The geographical location is suitable.				
Lease costs and other terms are acceptable.				
The building meets current codes including seismic and ADA requirements or owner will upgrade at owner's expense.				
The property has the aesthetic appeal to support the image and marketing strategies of our organization.				
The building has been certified under the US Green Building Council's LEED™ or Portland General Electric's Earth Advantage Program.				
Other:				
Other:				

Site Considerations

The building location provides convenient and inexpensive commute options, including easy access to mass transit and safe bicycle and pedestrian routes.				
There are showers and changing facilities for employees who bicycle.				
The parking lot allows preferred parking spaces for carpools.				
The site design supports clean watersheds by limiting impervious paving and by managing stormwater on the site. (See sidebar above, Site Considerations Beyond TI: A Fish-Friendly Site.)				
The landscape is maintained with little, if any, potable irrigation water and without the use of chemical fertilizers, herbicides or pesticides.				
Other:				
Other:				

Resource Efficiency

The tap water is clean and odor-free or it is filtered.				
The building is equipped with water-efficient water fixtures: low-flow toilets, low-flow faucet aerators and shower heads, and automatic faucet shutoffs.				
Records of past energy usage are available.				
The building gets some or all energy from renewable resources.				
The building is enrolled in a local utility green power program.				
The heating, cooling and ventilation system is within the typical service life of 15 to 20 years and has been maintained regularly.				
The building systems have been commissioned recently. (See "Commissioning" in the Glossary: Real Estate/Lease Terms.)				
Other:				
Other:				

Health Considerations

The building shows no evidence of mold or moisture damage, such as plumbing leaks, roof leaks, flooding or condensation. If either mold or moisture damage has occurred, ask to see all the documentation about remediation and follow-up testing, and have it reviewed by a knowledgeable indoor air quality professional before leasing.				
The lease has provisions for tenant protection from future moisture damage or mold caused by building failures, such as leaks.				
The building has been tested/checked for the presence of hazardous materials, including radon gas, asbestos, and/or lead (in paint and water).				
If testing showed presence of hazardous materials, the management can show that they mitigated according to EPA guidelines, and provide evidence that levels are currently within EPA guidelines.				
If the building has a parking garage below the occupied spaces, the garage is vented so that exhaust fumes do not enter the workspaces. Similarly, if the building has a loading dock or loading zone, exhaust from idling vehicles will not enter the workspaces.				
There are no other occupants or activities in the building that may generate odors, noise, or potentially hazardous fumes.				
Workspaces will be protected from odors and fumes if re-roofing is planned.				
Other:				

$5.00

RESIDENTIAL PROJECTS

COMMERCIAL BUILDING

COMMERCIAL INTERIORS

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Portland is rich in expertise related to sustainable development, including design, programs, research and real-world experience. Talk to G/Rated staff about getting started on your green building project. They provide initial technical assistance with both residential and commercial buildings. G/Rated can guide you toward best practices, LEED certification, green products and technologies, incentives and permitting assistance. G/Rated is a gateway to current information, innovation and successful Portland green building projects.

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