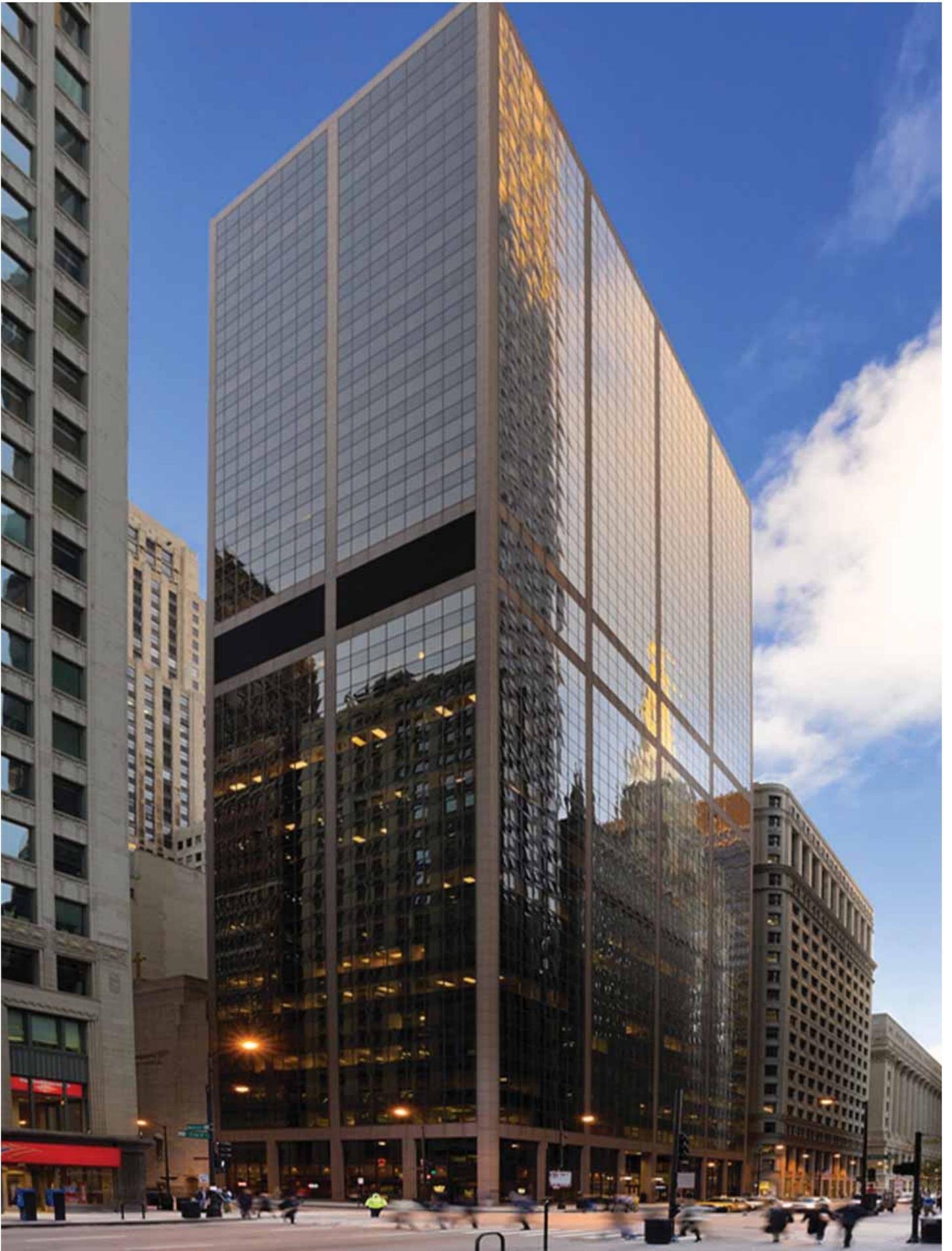


KENNEDY ASSOCIATES
Real Estate Investment Advisors
A National Leader in Responsible Property Investing

Sustainable Tenant Improvement Manual





Introduction

Kennedy Associates (“Kennedy”) is a full-service registered real estate investment advisor, providing expertise to a select number of public, corporate and Taft-Hartley retirement systems, as well as major university endowments. Throughout its history, Kennedy has brought superior value-added results to some of the country’s largest institutional investors as well as open-ended commingled funds and closed partnerships.

Kennedy has developed this Sustainable Tenant Improvement (“TI”) Manual as a means to promote sustainable best practices throughout its portfolio. The Sustainable TI Manual provides minimum design standards and construction practices that are required of all TIs, as well as additional recommended sustainable standards to consider, where feasible, when building out office space.

The manual was developed through a collaborative process to provide a framework to enhance the sustainability of all of Kennedy’s real estate investments on behalf of its clients, in support of the organization’s commitment to Responsible Property Investing (“RPI”). RPI considers the environmental and social ramifications of property investment, development, and property operations in addition to financial considerations.

This manual is intended for multiple audiences and should help asset managers, property managers, and tenants to make the right sustainable choices when evaluating TIs for first and second generation office space, including choices related to water, energy, materials, and the indoor environment. In this way, the TI process can accomplish two goals – satisfying tenant needs while at the same time upgrading building infrastructure and performance with each TI.

The manual was developed with office space in mind, but may be applicable to other types of properties such as industrial parks and retail space. However, each measure would need to be carefully evaluated for applicability to space types other than offices.

How to Use This Manual

Asset managers, property managers/engineers, leasing agents, construction managers, and members of design/construction teams should use this manual as a tool to initiate discussion, educate tenants, and facilitate the implementation of sustainable TIs. When bidding out TI projects, the manual should be provided to contractors, architects, and other responsible parties. It may be appropriate to include some of the requirements and recommendations in various project documents such as the construction contract and work letter.

Where possible, sample products that meet the given sustainability criteria are identified. Kennedy Associates does not recommend or require any specific products or manufacturers as long as the sustainability requirements are met. However, Kennedy suggests using proven companies that provide market-leading services and products. The project team (i.e., property manager, construction manager, architect etc.), in consultation with the Kennedy asset manager, should select the most appropriate sustainable option for the building, given financial, environmental, and social considerations. Property managers may wish to develop tailored lists of vendors that have already been successfully used at the building, or at other buildings within their market.

Key

The following symbols are used throughout the manual:

Level of Importance: _____

-  Building standard requirements to which Kennedy requires that all TIs adhere
-  Additional design standards and construction practices, which are recommended by Kennedy but not required

Responsibility: _____

Regardless of whose ultimate responsibility it is to implement the specifics of any particular measure in this manual, the project team will drive implementation. The property manager and engineer must coordinate with the other responsible parties identified below, sharing the information in this manual and providing other guidance and encouragement.

- T Tenant
- C Contractor
- A/ID Architect/Interior Designer
- MEP Mechanical, Electrical, & Plumbing Engineer
- CA Commissioning Agent

Cost: _____

The following symbols indicate an approximate cost range relative to the market average for a typical TI. However, the actual cost impacts will vary across markets and are often affected by the size and/or magnitude of the TI. Property and asset management teams should use this scale as a gauge for early discussions, but should assess the costs and benefits of each item considering payback, return on investment, tenant interest, and other intangibles, as project specifics are defined.

- \$ Minor or no additional cost
- \$\$ Some additional cost
- \$\$\$* Some additional cost, but will generate cost savings and have a payback
- \$\$\$\$ High additional cost
- \$\$\$\$* High additional cost, but will generate cost savings and have a payback

	
REQUIRED	
RESPONSIBILITY	MEP
COST	\$
DIFFICULTY	
LEED CI	WEp1
LEED EB: O&M	WEp1

 RECOMMENDED	
RESPONSIBILITY	MEP
COST	\$
DIFFICULTY	☞
LEED CI	WEp1
LEED EB: O&M	WEp1

Difficulty:

The following symbols indicate approximate, relative levels of effort (e.g., additional time, research, or consulting expertise required) beyond other, less sustainable practices.

- ☞ No Added Effort or Difficulty
- ☞☞ Moderate Added Effort or Difficulty
- ☞☞☞ High Added Effort or Difficulty

LEED Certification Considerations:

The requirements and considerations in this manual are intended to align with Leadership in Energy and Environmental Design (“LEED”) standards developed by the U.S. Green Building Council (“USGBC”). Use of this manual will enhance the feasibility of certification under either LEED for Commercial Interiors (“LEED CI”) for the TI, or LEED for Existing Buildings: Operations and Maintenance (“LEED EB: O&M”) for the building as a whole. Where applicable, this manual identifies the LEED CI 2009 or LEED EB: O&M 2009 credit corresponding to each requirement or consideration. (There may also be a relationship to LEED for Core & Shell credits, but this manual does not address the Core & Shell rating system.)

Kennedy Associates does not require TIs to be LEED certified and recognizes that LEED certification is not practical for all TIs or buildings. Therefore, this manual does not provide complete LEED requirements and calculations. Project teams interested in pursuing LEED certification should obtain copies of the LEED CI 2009 reference guide to obtain specific LEED CI details and to explore additional sustainable features beyond the contents of this manual. The USGBC’s LEED CI and LEED EB: O&M checklists are attached separately.

Some features within this manual may already be included in the base building design, and others may align with improvements being made to the base building in pursuit of LEED EB: O&M certification. If the building is likely to pursue LEED EB: O&M, property and asset managers may want to take advantage of the TI as an opportunity to upgrade building performance and achieve related LEED EB: O&M credits.

The required measures in this manual are a significant step toward LEED CI certification, providing approximately 5 of 7 LEED CI prerequisites and 14 of 40 points required for minimum certification (with adherence to the detailed LEED CI calculation and documentation requirements). Kennedy encourages project teams to carefully consider the suggestions in this manual, and determine whether any of them may be cost-effective for a specific TI in order to move the project closer to LEED CI certification levels. As a point of reference, implementing all of the required and suggested items in this manual (plus one basic prerequisite), along with providing the required LEED calculations, would facilitate LEED CI certification at the Silver level.

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Project Checklist: LEED 2009 for Commercial Interiors

Project Checklist: LEED 2009 for Existing Buildings: Operations
& Maintenance

Checklist

!/+		Status/Notes
Water Efficiency		
!	Reduce Water Use by 20%	
Energy and Atmosphere		
!	Achieve Minimum Energy Performance	
!	Manage Refrigerants	
!	Reduce Lighting Power by 15%	
*	Reduce Lighting Power by 20-35%	
!	Install Lighting Controls	
!	Use 90% ENERGY STAR Appliances	
*	Sub-Meter Tenant Energy Use	
*	Sub-Meter Systems	
*	Practice Commissioning	
*	Purchase Green Power	
Materials and Resources		
!	Install Recycling Station(s)	
!	Divert 50% of Construction Waste	
*	Divert 75% of Construction Waste	
!	Use 10% Recycled Content	
*	Use 20% Recycled Content	
*	Reuse Interior Components	
*	Reuse Materials	
*	Reuse Furniture and Furnishings	
*	Use Regionally Manufactured Products	
*	Use Regionally Extracted Materials	
*	Use Rapidly Renewable Materials	
*	Use Certified Wood	
Indoor Environmental Quality		
!	Achieve Minimum IAQ	
!	Create an IAQ Construction Plan	
*	Create an IAQ Pre-Occupancy Plan	
!	Use Low-Emitting Adhesives/Sealants	
!	Use Low-Emitting Paints/Coatings	
!	Use Low-Emitting Flooring Systems	
!	Use Low-Emitting Composite Wood	
*	Use Low-Emitting System Furniture & Seating	
!	Design HVAC Systems for Thermal Comfort	
*	Provide Individual Comfort Control	
*	Provide Individual Lighting Control	
*	Control Indoor Pollutant Sources	
*	Provide Daylight	
*	Provide Views to the Outdoors	
Sustainable Sites		
*	Install Bicycle Storage & Changing Rooms	

Water Efficiency

Water fixtures and equipment in buildings built prior to 1990 are most likely inefficient and contribute to high water use. Reducing potable water use is an important aspect of sustainable property operations, and is especially important in markets where water is becoming more scarce and/or costly. Upgrading or replacing existing fixtures, and carefully selecting new fixtures, will produce significant water and energy savings and protect regional water resources, typically at a low installation cost. Even newer buildings may contain fixtures that can be upgraded to lower-flow models.



REQUIRED

RESPONSIBILITY	MEP
COST	\$
DIFFICULTY	Ⓜ
LEED CI	WEp1
LEED EB: O&M	WEp1 ⁱ

Reduce Water Use by 20%

Although many TIs will not include restrooms, when the opportunity arises, install low-flow/dual-flush toilets and urinals, as well as low-flow faucets and aerators. Many existing fixtures can be upgraded at a low cost with aerators or flush valves. TIs must achieve 20% water reduction below the baseline, which is calculated from federal minimum standard flow and flush rates.

Draw from the suggested list below to achieve a combination of fixture flow rates that will achieve the 20% reduction requirement while providing satisfactory performance (baselines are provided in parentheses):

- Toilets: 1.28 gallons per flush (“gpf”) or dual flush 0.8/1.6 gpf (1.6)
- Urinals: waterless or 0.5 gpf (1.0)
- Showerheads: 1.5-2.0 gallons per minute (“gpm”) (2.5)
- Restroom faucets/aerators: 0.5 gpm (0.5ⁱⁱ)
- Kitchen faucets/aerators: 0.5-2.0 gpm (2.2)

Metered faucets should use no more than 0.25 gallons per cycle.

Look for the EPA WaterSense label on products, and visit the WaterSense Web site to find products and rebates: www.epa.gov/watersense/

Product Suggestions:

- American Standard: www.americanstandard-us.com/microsite/waterefficiency/productListing.aspx
- Delta: www.deltafaucet.com
- Grohe: www.grohewatercare.com/bath.htm
- Kohler Triton Faucet; Kohler Steward Waterless Urinal: www.us.kohler.com/index.jsp
- Moen Envi Showerhead: www.moen.com
- NEOPERL: www.neoperl.com
- Niagara: www.niagaraconservation.com/Aerators.html and www.niagaraconservation.com/Showerheads.html
- Oxygenics: www.oxygenics.com/fivestar-shower.php
- Sloan: www.waterefficiency.com/products.html
- Toto: www.whytology.com/products.html
- Zurn: www.zurn.com/operations/ecovantage/pages/home.asp



ⁱ The baselines and requirements provided in this manual align with LEED CI requirements. Baselines and requirements vary for LEED EB: O&M. If the building is pursuing LEED EB: O&M certification, please refer to the LEED EB: O&M reference guide for calculations and specifications.

ⁱⁱ The 2009 version of the LEED CI rating system has reduced the baseline flow rate for a public restroom faucet to 0.5 gpm. Most projects find that 0.5 gpm is an acceptable flow rate, but reducing the rate further may have a negative effect on performance.

Energy and Atmosphere

A number of components within a TI affect energy consumption over time. In addition to design and construction best practices, tenant equipment selection can contribute to a high-performance work space. The following requirements and recommendations will help reduce energy consumption and costs, while providing a comfortable working environment for occupants.



REQUIRED

RESPONSIBILITY	MEP
COST	\$\$*
DIFFICULTY	PP
LEED CI	EAp2
LEED EB: O&M	EAp2

Achieve Minimum Energy Performance

Achieve a minimum level of energy efficiency, in support of the building’s collective efforts to achieve an ENERGY STAR rating of at least 69 (the minimum for LEED EB: O&M certification). A combination of efficient space design; lighting; heating, ventilation, and air conditioning (“HVAC”); and office equipment/appliances is necessary to achieve minimum performance.

Design the TI project to comply with ASHRAE Standard 90.1-2007 (including lighting and HVAC). This includes the mandatory provisions (Sections 5.4, 6.4, 7.4, 8.4, 9.4 and 10.4), and either the prescriptive requirements (Sections 5.5, 6.5, 7.5 and 9.5) or performance requirements (Section 11) of the ASHRAE standard. The standard covers measures related to the insulation and sealing of the building envelope; and minimum efficiency of and controls for HVAC, lighting, and water heating equipment. Visit www.ashrae.org to obtain a copy of the standard.

In addition, provide interior layouts that allow maximum daylight into the space, consider thermal comfort of the prospective occupants, and do not impede airflow.

Additional energy performance requirements for lighting and equipment, the other two components of the associated LEED prerequisite, are provided on pages 14-17.

Manage Refrigerants

The building industry is phasing out ozone-depleting chlorofluorocarbons (“CFCs”) in heating, ventilation, air conditioning, and refrigeration (“HVAC&R”) systems. Implement any of the following strategies that apply to the particular TI:

- When installing new systems and products or replacing existing systems as part of the tenant’s scope of work, the new systems must not contain CFCs. Consider also excluding hydrochlorofluorocarbons (“HCFCs”) from new installed systems. HCFCs are a less hazardous choice than CFCs but also have environmental impacts.
- When reusing existing HVAC&R systems in the tenant’s scope of work, inventory equipment and identify any that use CFC-based refrigerants, with the goal of phasing out the CFC-based refrigerant in the future.

Small HVAC&R units, standard refrigerators, small water coolers and any other cooling equipment that contains less than 0.5 pounds of refrigerant are exempt.

Depending on the volume of refrigerant used in the HVAC&R system, an additional LEED credit may be achievable under the Innovation in Design category.

REQUIRED	
RESPONSIBILITY	MEP
COST	\$
DIFFICULTY	⌘
LEED CI	EAp3
LEED EB: O&M	EAp3



REQUIRED

RESPONSIBILITY	A/ID, MEP
COST	\$
DIFFICULTY	⌘
LEED CI	EAc1.1
LEED EB: O&M	EAc1

Reduce Lighting Power by 15%

Lighting consumes an enormous amount of energy and also creates heat that must be addressed (i.e., cooled) by the HVAC system, requiring additional energy use. Design lighting systems to have a connected lighting power density 15% below that allowed by ASHRAE 90.1-2007. For office space, the ASHRAE allowance is 1.1 watts/SF, so a 15% reduction equates to a lighting power density of approximately 0.935 watts/SF.

Strategies to consider include:

- Use electronic ballasts and high-efficiency lamps. Efficient lamps may include:
 - » 25- or 28-watt T8 fluorescent tubes instead of typical 40-watt T12 fluorescents
 - » Compact fluorescent lights (“CFLs”) or cold-cathode compact fluorescents (CCFLs) instead of typical incandescent or halogen bulbs in any shape or size
 - » Light-emitting diode (“LED”) lamps instead of typical MR-16s
- Provide lower ambient light, but better task lighting, enabling the light to go where it is most needed and avoiding lighting large areas when only small areas need the most light.
- Maximize the availability of natural light by using open office floor plans that give all employees access to light and views.



Look for the ENERGY STAR label on CFLs, LEDs, and many types of lighting fixtures. Search for efficient lighting at www.energystar.gov/lighting.

Reduce Lighting Power by 20-35%

Consider improving lighting energy efficiency further through good lighting design. The approximate equivalent watts per square foot for each level of reduction are listed below:

- 20% Reduction: 0.88 watts/SF
- 25% Reduction: 0.825 watts/SF
- 30% Reduction: 0.77 watts/SF
- 35% Reduction: 0.715 watts/SF



RECOMMENDED

RESPONSIBILITY	A/ID, MEP
COST	\$\$\$
DIFFICULTY	⌘⌘
LEED CI	EAc1.1
LEED EB: O&M	EAc1



REQUIRED

RESPONSIBILITY	A/ID, MEP
COST	\$\$\$*
DIFFICULTY	🔧🔧
LEED CI	EAc1.2
LEED EB: O&M	EAc1

Install Lighting Controls

Lighting controls are a cost-effective energy efficiency solution. Because the need for lighting varies with occupancy and daylight levels, lighting controls save energy by turning off or dimming lights when they are not needed. They also enhance occupant comfort by not over-lighting spaces.

Daylight-responsive controls (also known as photosensors or photocells) sense the amount of daylight present and turn off or dim lights when they are not needed. Occupancy or motion sensors detect movement in a space and respond by either keeping the lights on (when movement is detected) or turning off or dimming lights (when the space is unoccupied). Combination daylight/occupancy sensors are also available.

Choose at least one of the following three strategies:

- Install daylight-responsive controls in regularly occupied spaces that are within 15 feet of windows and under skylights.
- Install daylight responsive controls for 50% of the lighting load.
- Install occupancy sensors for 75% of the lighting load.

Ensure that occupancy sensor “time to off” is set as low as possible – e.g., 3-5 minutes, rather than the pre-set 30-45 minutes.

Product Suggestions:

- Douglas Lighting Control: www.douglaslightingcontrol.com
- Hubbell Lighting: www.hubbellighting.com/greenwise/Control.php
- Leviton: www.leviton.com/OA_HTML/ibeCCtpSctDspRte.jsp?section=15550&minisite=10025
- Lutron: <http://lutron.com/products>
- Sensor Switch: www.sensorswitch.com/OnlineCatalog.aspx
- Wattstopper: www.wattstopper.com

Use 90% ENERGY STAR Appliances

ENERGY STAR products use less energy than typical models. Specify ENERGY STAR qualified equipment and appliances for 90% of the installed equipment and appliances that are eligible for the ENERGY STAR. This includes:



- **Office equipment:** computers, monitors, printers, scanners, copiers, fax machines, digital duplicators, servers, external power adapters, mailing machines, and water coolers
- **Appliances:** refrigerators, freezers, and dishwashers
- **Electronics:** TVs, DVD players, and combination units
- **Commercial food service equipment**

The project team may want to consider including this requirement in the lease, if it is not already specified.

Though the corresponding LEED CI credit requires all appliances and equipment installed at the time of occupancy to be included in the credit calculation, equipment that is being reused from another location is exempt from Kennedy’s requirement. Also excluded from this requirement are HVAC, lighting, and building envelope products, which all should be encompassed in the overall energy efficiency strategy for the TI.

Almost all leading brands carry ENERGY STAR qualified products. Product listings can be found at www.energystar.gov/products.

Wherever Kennedy controls the purchase and installation of appliances and equipment, those purchases will also meet the minimum standard of 90% being ENERGY STAR qualified.

REQUIRED	
RESPONSIBILITY	T, A/ID
COST	\$
DIFFICULTY	⌘
LEED CI	EAc1.4
LEED EB: O&M	EAc1, MRc2



RECOMMENDED

RESPONSIBILITY	MEP
COST	\$\$
DIFFICULTY	⌘
LEED CI	EAc3
LEED EB: O&M	EAc3.2

Sub-Meter Tenant Energy Use

Unless the tenant occupies 100% of the building, consider installing sub-metering equipment so that the tenant has accurate data on their energy use within the tenant space. Also consider negotiating a lease where energy costs are paid by the tenant and not included in the base rent.



RECOMMENDED

RESPONSIBILITY	MEP
COST	\$\$
DIFFICULTY	⌘
LEED CI	EAc3
LEED EB: O&M	EAc3.2

Sub-Meter Systems

For tenants that occupy a significant portion (e.g., more than 75%) of the total building, it may make sense to install continuous metering to isolate and analyze energy performance of the following systems:

- Lighting systems and controls
- Constant and variable motor loads
- Variable frequency drive (“VFD”) operation
- Chiller efficiency at variable loads (kW/ton)
- Cooling load
- Air and water economizer and heat recovery cycles
- Air distribution static pressures and ventilation air volumes
- Boiler efficiencies
- Building-related process energy systems and equipment
- Indoor water riser and outdoor irrigation systems

Engage a qualified contractor to assist with the metering system design and installation.

Practice Commissioning

At a minimum, the engineer and/or contractor should perform basic testing and balancing if any changes are made to HVAC systems during the TI, and should perform a basic tune-up of affected building systems prior to occupancy.

Also consider performing fundamental or enhanced commissioning, as appropriate. Fundamental commissioning is a prerequisite for LEED certification; enhanced commissioning can add value for large TIs that involve complex systems. The larger the size of the TI in relation to the size of the building, the more important and valuable commissioning is, especially where complex systems are being installed.

Consider engaging a designated commissioning authority and include commissioning requirements for HVAC, lighting, hot water, and renewable energy (if applicable) in contract documents. Refer to the LEED CI or LEED EB: O&M reference guide for details about the commissioning process if pursuing LEED certification. A brief overview of the activities associated with fundamental and enhanced commissioning is as follows:

Task	Fundamental Commissioning	Enhanced Commissioning
Designate Commissioning Authority (“CA” or “CxA”)	Required	Required
Document Owner’s Project Requirements (“OPR”)	Required	Required
Develop Basis of Design	Required	Required
Incorporate commissioning requirements into construction documents	Required	Required
Conduct commissioning design review prior to mid-construction documents	N/A	Required
Develop/implement a commissioning plan	Required	Required
Review contractor submittals applicable to systems being conditioned	N/A	Required
Verify installation and performance of commissioned systems	Required	Required
Develop systems manual for commissioned systems	N/A	Required
Verify that requirements for training are completed	N/A	Required
Complete summary commissioning report	Required	Required
Review building operation within 10 months after substantial completion	N/A	Required



RECOMMENDED

RESPONSIBILITY	CA
COST	
Fundamental	\$\$\$*
Enhanced	\$\$\$\$*
DIFFICULTY	
Fundamental	PP
Enhanced	PPPP
LEED CI	EAp1, EAc2
LEED EB: O&M	EAp1, EAc2



RECOMMENDED

RESPONSIBILITY	T
COST	\$
DIFFICULTY	⌘
LEED CI	EAc4
LEED EB: O&M	EAc4

Purchase Green Power

Where not procured by Kennedy, tenants are encouraged to purchase green power that has met Green-e certification requirements. Green power is produced off-site from renewable energy sources such as solar, wind, geothermal, biomass, or low impact hydropower, and delivered to the grid. Purchasing green power helps to reduce the negative impacts of fossil fuel use and support the creation of a robust infrastructure for clean, renewable energy. It also ensures that energy consumed at the building comes from renewable sources, even if not directly produced on site.

Purchasing green power can be done several ways:

- Purchase through the local utility’s green power program, if available
- Buy green power through a Green-e certified power marketer
- Purchase RECs (Renewable Energy Certificates)

Green power purchase costs vary by market and type.

A general suggested guideline is purchasing 50% of power for the first two years of tenancy from a green power source. To estimate the amount of green power to purchase, complete the following calculation:

Project area X expected energy use per SF per year X duration = Suggested purchase amount

e.g., 10,000 sf X 8 kWh/sf/yr X 2 years = 160,000 kWh

For a listing of green power sources, see: www.green-e.org/energy



Materials and Resources

Selecting materials that are harvested and manufactured sustainably or are reused or salvaged from a previous use conserves natural resources, frequently with no additional cost. Sustainable materials are often more durable, and can also contribute to an elegant, aesthetically pleasing space. In addition to choosing sustainable materials, establish procedures to recycle construction and demolition waste as well as future occupant waste, in turn, continuing the “reduce-reuse-recycle” process.



REQUIRED

RESPONSIBILITY	T
COST	\$
DIFFICULTY	Ⓜ
LEED CI	MRp1
LEED EB: O&M	MRc7

Install Recycling Station(s)

Provide designated containers and spaces for sorting and storing recyclables within the tenant space. To be the most effective, containers should be provided wherever waste receptacles are provided, and should be clearly labeled as to the recyclable materials they accept. Upon occupying the building, tenants should educate their employees on proper use of the recycling program.

Coordinate with the building's recycling program as far as the accepted recyclables, whether they can be commingled or must be separated, etc. If there is no base building recycling program in place, coordinate with Kennedy and the property manager to implement one.

At a minimum, provide recycling of paper, cardboard, glass, plastics, and metals. Also consider providing recycling containers for ongoing purchases such as toner cartridges, batteries, electronics, and food waste.

Divert 50% of Construction Waste

Instruct the contractor to divert at least 50% (by weight or volume) of construction waste from disposal in landfills. This will encourage the flow of products to be recycled, reduce the strain on overflowing landfills, and reduce the need for virgin materials to be used in the manufacture of new products.

Construction waste management and diversion should be addressed in construction specifications and contracts. Strategies include sending materials to recycling facilities, donating materials to organizations such as Habitat for Humanity or local schools, and reusing materials on site.

Demolition waste created through TI construction activities can contribute to the 50% threshold. Kennedy will endeavor to achieve at least a 50% diversion rate for demolition waste.

	
REQUIRED	
RESPONSIBILITY	C
COST	\$
DIFFICULTY	Ⓜ
LEED CI	MRc2
LEED EB: O&M	MRc9ⁱⁱⁱ

Additional Resources for Developing Construction Waste Management Plans:

- California Integrated Waste Management Board C&D Recycling Toolkit for Contractors: www.ciwmb.ca.gov/ConDemo/Toolkit/default.htm
- Construction Materials Recycling Association database of recyclers: www.cdrecycling.org/find.html and Master Specifications for C&D recycling: www.ciwmb.ca.gov/ConDemo/Specs/CMRA.htm
- Recycling C&D Wastes: A Guide for Architects and Contractors: www.mass.gov/dep/recycle/reduce/cdrguide.pdf and other resources from Massachusetts: www.mass.gov/dep/recycle/reduce/managing.htm
- Resource Venture construction waste management guidelines and fact sheets: www.resourceventure.org/green-your-business/green-building/construction-waste-management/construction-waste-management
- Seattle/King County Contractors' Guide for job-site recycling and waste prevention: www.recyclecddebris.com/rCDd/Resources/Documents/CSRContractorsGuide.pdf
- Whole Building Design Guide database of recyclers: www.wbdg.org/tools/cwm.php and CWM resource page: www.wbdg.org/resources/cwmgmt.php

ⁱⁱⁱ 50% is the minimum diversion rate to earn a LEED CI credit. For LEED EB: O&M, the threshold is different (70%, by volume, of base building elements). If the building is pursuing LEED EB: O&M certification, please refer to the LEED reference guide for credit requirements.



RECOMMENDED

RESPONSIBILITY	C
COST	\$
DIFFICULTY	☞☞
LEED CI	MRc2
LEED EB: O&M	MRc9

Divert 75% of Construction Waste

Instruct the contractor to divert a greater proportion (at least 75% by weight or volume to earn an additional LEED CI credit) of construction waste from disposal in landfills. Refer to the requirements and strategies above or in the LEED CI or LEED EB: O&M reference guides.

Use 10% Recycled Content

Using products with recycled content drives the market for these products, reduces landfill waste, promotes natural resource conservation, and uses less energy and water than the processing and production of virgin materials.

Recycled content may include post-consumer and/or pre-consumer materials. Post-consumer material is defined as waste material generated by households or facilities in their role as end-users of the product, which can no longer be used for its intended purpose (such as plastic bottles or aluminum cans). Pre-consumer material is defined as material diverted from the waste stream during the manufacturing process. An example of this is sawdust from a lumber mill that a manufacturer purchases to use in its composite wood products.

Select materials, including furniture and furnishings^v, with recycled content such that:

(post-consumer recycled content) +1/2 (pre-consumer recycled content) = at least 10% of total value of all materials used for the project

The recycled content value of a material or product is determined by weight. The recycled fraction of the assembly is then multiplied by the cost of assembly to determine the recycled content value. Mechanical, electrical and plumbing components cannot be included in this calculation.

Product Suggestions:

- 3-Form: www.3-form.com/about-path_to_zero-usgbc_leed.php
- Armstrong BioBased Tile: www.armstrong.com/commflooringna/products/biobased-tile
- Armstrong Ultima Ceiling: www.armstrong.com/commceilingsna/
- Bentley Price Broadloom: www.bentleyprincestreet.com
- Coverings Etc.: www.coveringsetc.com
- LG Floors: www.lgfloors-usa.com
- PaperStone: www.paperstoneproducts.com
- Tandus Carpet Tile: www.tandus.com

^{iv} For all items in this manual that correspond to LEED EB: O&M MRc3, the requirements are different from the associated LEED CI credit. This manual aligns to the LEED CI credit requirement in most cases. LEED EB: O&M MRc3 requires a combination of strategies such that 50% of total purchases (by cost) for facility alterations and additions are considered sustainable. Please refer to the LEED EB: O&M reference guide for specific calculations if the building is pursuing certification.

^v Furnishings consist of miscellaneous items such as casework, countertops, window treatments, entrance mats/rugs, planters, and waste receptacles; whereas furniture refers to standard items such as seating, work stations, and tables.

	
REQUIRED	
RESPONSIBILITY	A/ID, C
COST	\$
DIFFICULTY	⌘
LEED CI	MRc4
LEED EB: O&M	MRc3 ^{iv}

Directories of Green Building Products and Materials:

- BuildingGreen.com – search for products by LEED credit:
www.buildinggreen.com/menus/leedList.cfm
- California Recycled Content Products Directory: www.ciwmb.ca.gov/rcp
- EPA Environmentally Preferable Purchasing: www.epa.gov/opptintr/epp/
- Good to Be Green: www.goodtobegreen.com
- Green Building Pages – search by LEED credit:
www.greenbuildingpages.com/manufacturers/ProductSearch.php
- Green Depot: www.greendepot.com
- Green2Green: www.green2green.org
- Greener Building: www.greenerbuilding.org
- Oikos: http://oikos.com/green_products/index.php

Use 20% Recycled Content

Use materials, including furniture and furnishings, with recycled content such that the sum of post-consumer recycled content plus one-half of the pre-consumer recycled content constitutes at least 20% of the total value of all the materials in the project. Refer to the requirements and strategies above and in the LEED CI or LEED EB: O&M reference guides.



RECOMMENDED

RESPONSIBILITY	A/ID, C
COST	\$
DIFFICULTY	☞☞
LEED CI	MRc4
LEED EB: O&M	MRc3

Reuse Interior Components

Reusing as much as possible of the existing building components can mitigate some of the environmental impacts of TIs by conserving resources, extending the life of the existing building, reducing waste, and minimizing the negative environmental impacts of transporting new materials.

To achieve the corresponding LEED credit, maintain 40% (one point) or 60% (two points) by area of the existing non-structural floors, walls, and ceilings of the tenant space.



RECOMMENDED

RESPONSIBILITY	A/ID, C, T
COST	\$
DIFFICULTY	☞☞
LEED CI	MRc1.2
LEED EB: O&M	None



RECOMMENDED

RESPONSIBILITY	A/ID, C
COST	\$
DIFFICULTY	☆☆
LEED CI	MRc3.1
LEED EB: O&M	MRc3

Reuse Materials

Reuse salvaged or refurbished materials from this or other projects in order to reduce the demand for virgin materials and reduce waste. Consider salvaged materials such as beams and posts, flooring, paneling, doors and frames, cabinetry, brick, and decorative items.

To earn the corresponding LEED CI credits, use 5% (one point) or 10% (two points) reused materials. Percentages are based on cost. Materials reused from the site also count toward the LEED CI credit for diverting construction waste (MRc2).

Materials Exchange Networks:

- Building Materials Reuse Association Directory: www.bmra.org
- California Materials Exchange: www.ciwmb.ca.gov/CalMAX/
- Green Building Resource Guide Salvaged Building Materials Exchange: www.greenguide.com/exchange/index.html
- Reuse Development Organization: www.redo.org/SearchRedo.aspx
- Used Building Materials Exchange: www.build.recycle.net

Many providers of useful salvaged materials will be local or regional, rather than national, organizations, so look for providers in your area.



RECOMMENDED

RESPONSIBILITY	A/ID, T
COST	\$
DIFFICULTY	☆☆
LEED CI	MRc3.2
LEED EB: O&M	None

Reuse Furniture and Furnishings

Use salvaged, reused, or refurbished furniture and furnishings from this and other projects. Consider items such as case pieces, seating, filing systems, decorative lighting, and accessories.

To earn the corresponding LEED CI credit, reused items must constitute 30% of the total furniture and furnishings budget.

Product Suggestions:

- Davies Office Refurbishing: www.daviesoffice.com
- OMWorkspace: www.omworkspace.com

Many providers of salvaged furniture and furnishings are local or regional, rather than national, companies, so be certain to explore the many providers that may be available in your area.

Use Regionally Manufactured Products

Using products manufactured locally or regionally decreases the project's environmental footprint by reducing the transportation required to deliver products to the building, while supporting the local/regional economy. To earn the corresponding LEED CI credit, a minimum of 20% of the combined value of construction and Division 12 (Furniture) materials and products must be manufactured regionally (within 500 miles).



RECOMMENDED

RESPONSIBILITY	A/ID, C
COST	\$
DIFFICULTY	☞☞
LEED CI	MRc5
LEED EB: O&M	None

Use Regionally Extracted Materials

Using products manufactured and extracted locally can further decrease the project's environmental impacts. To earn the corresponding LEED credit, a minimum of 10% of the combined value of construction and Division 12 (furniture) materials and products must be extracted, harvested or recovered, as well as manufactured, within 500 miles of the project. Salvaging the project's own materials may also contribute to the corresponding LEED CI credit (MRc5).



RECOMMENDED

RESPONSIBILITY	A/ID, C
COST	\$
DIFFICULTY	☞☞
LEED CI	MRc5
LEED EB: O&M	MRc3



RECOMMENDED

RESPONSIBILITY	A/ID, C
COST	\$\$
DIFFICULTY	☞☞
LEED CI	MRc6
LEED EB: O&M	MRc3

Use Rapidly Renewable Materials

Use building products made from rapidly renewable materials (those harvested on a 10-year or shorter cycle). These may be available for little to no cost premium and can include:

- Wool carpet in place of carpet made from synthetic materials
- Bamboo or cork flooring in place of hardwood
- Linoleum flooring in place of vinyl
- Cotton batt insulation in place of fiberglass
- Wheatboard, strawboard, or sunflower seed board in place of typical composite wood

A reasonable goal, which qualifies for the corresponding LEED CI credit (MRc6), is for the value of rapidly renewable materials to equal at least 5% of the total materials cost. This includes construction materials, furniture and furnishings, and other products.

Product Suggestions:

- Armstrong linoleum products: www.armstrong.com/resflram/na/linoleum/en/us/
- Columbia Bamboo Plywood: www.columbiaforestproducts.com
- Eco-Friendly Flooring: www.ecofriendlyflooring.com
- Ecofinishes: www.ecofinishes.com
- EnvironBiocomposites engineered panel products: www.environbiocomposites.com
- Expanko Cork Flooring: www.expanko.com
- Forbo Flooring Systems linoleum products: www.forbo-flooring.com
- Globus Cork: www.corkfloor.com
- GreenSage bamboo products: www.greensage.com
- Kirei bamboo and wheatboard products: www.kireiusa.com
- Plyboo bamboo products: www.plyboo.com
- Sustainable Flooring bamboo and cork products: www.sustainableflooring.com

Also refer to the Directories of Green Building Products listed for “Use 10% Recycled Content” on page 26.

Use Certified Wood

In order to encourage sustainable management of forests, the Forest Stewardship Council (“FSC”) developed a certification system that provides internationally recognized standards and accreditation services to companies, organizations, and communities involved in forestry. The FSC certification ensures that wood products do not come from protected natural forests or habitats and were not treated with highly hazardous pesticides. Refer to www.fsc.org for more information.

Consider choosing FSC-certified wood when installing new wood-based products and materials. To earn the corresponding LEED CI credit, the project must use a minimum of 50% certified wood products out of all new wood-based products including construction materials and furniture/furnishings.

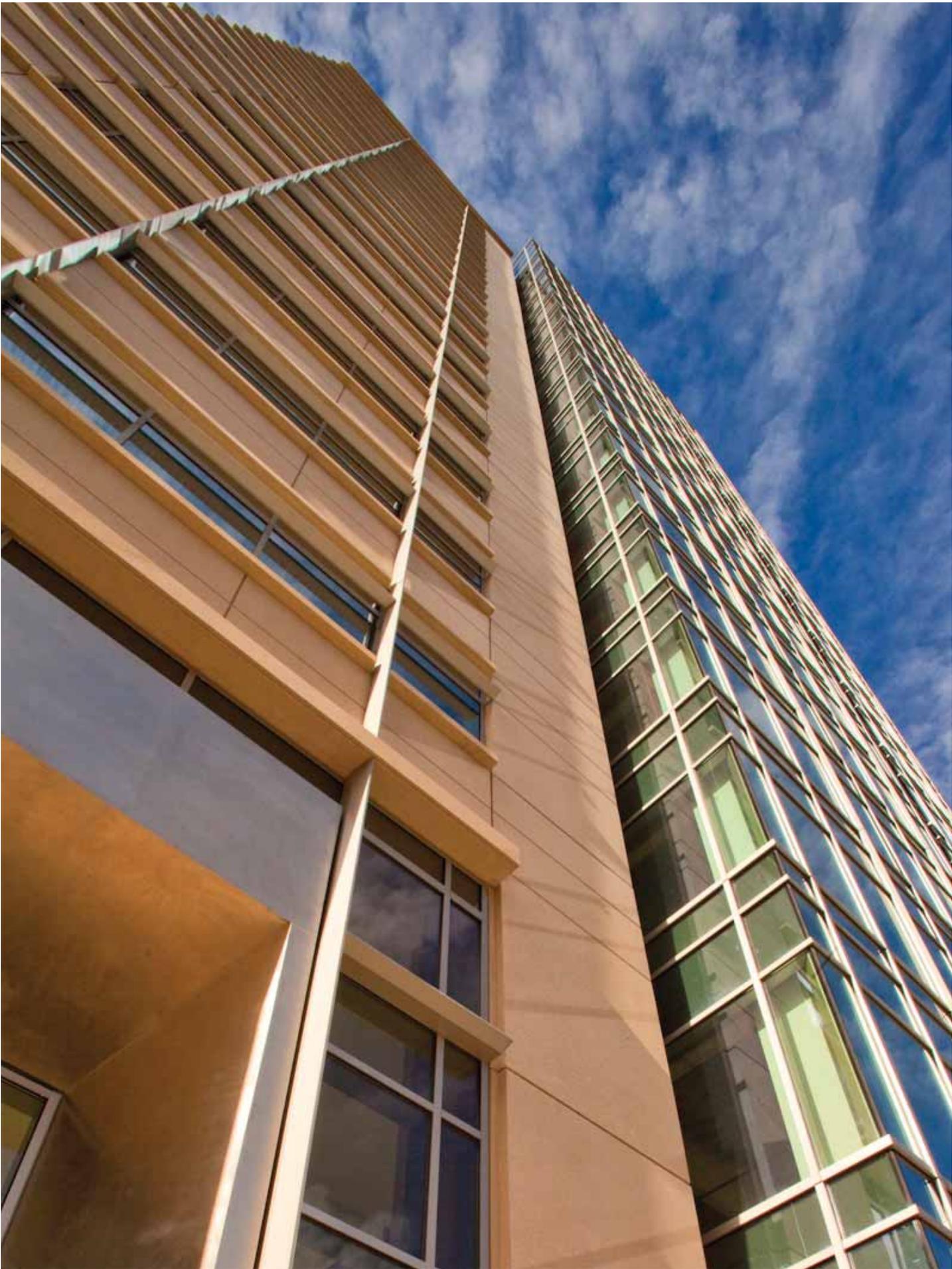
Product Suggestions:

- DuroDesign FSC flooring: www.duro-design.com
- Eco-Friendly Flooring: www.ecofriendlyflooring.com/woods.html
- Knoll FSC Modular Office Furniture: www.knoll.com
- Neil Kelly FSC Cabinets: www.neilkellycabinets.com
- Sustainable Flooring:
www.sustainableflooring.com/index.php?index=certified



RECOMMENDED

RESPONSIBILITY	A/ID, C
COST	\$\$
DIFFICULTY	PP
LEED CI	MRc7
LEED EB: O&M	MRc3



Indoor Environmental Quality

Indoor environmental quality (“IEQ”) is important for occupant health, well being, and comfort. Building systems, space design, finish materials, workplace procedures, cleaning and maintenance practices, and TI construction practices can have a negative effect on IEQ. However, it is relatively simple and cost-effective to mitigate potential negative effects by instituting a plan for Indoor Air Quality management during construction; using environmentally sensitive paints, adhesives, treated woods, and cleaning products; and providing effective air distribution and ventilation systems. Be sure to balance IEQ and energy efficiency, as the two can be synergistic but also have the potential to work against each other when it comes to air distribution and ventilation.



REQUIRED

RESPONSIBILITY	MEP
COST	\$
DIFFICULTY	⌘
LEED CI	IEQp1
LEED EB: O&M	IEQp1

Achieve Minimum IAQ

A major component of overall indoor environmental quality, Indoor Air Quality (“IAQ”) is especially important to occupant health. Design the ventilation systems to meet the minimum requirements of Section 4 through 7 of ASHRAE Standard 62.1-2007, Ventilation for Acceptable Indoor Air Quality. Modify or maintain the existing building outside-air ventilation distribution system to supply at least the outdoor air ventilation rate required by ASHRAE. If that is not possible, document the applicable space and system constraints, and achieve the maximum possible cubic feet per minute (“cfm”) with a minimum of 10 cfm per person.



REQUIRED

RESPONSIBILITY	C
COST	\$
DIFFICULTY	⌘
LEED CI	IEQ3.1
LEED EB: O&M	IEQ1.5

Create an IAQ Construction Plan

Construction generates dust and off-gassing of harmful chemicals, but much of this can be avoided with a plan for IAQ management during construction. Ensure that the contractor develops and implements an IAQ construction plan that meets the following requirements:

- 2007 Sheet Metal and Air Conditioning Contractors National Association (“SMACNA”) IAQ Guidelines for Occupied Buildings under Construction (www.smacna.org/).
- Protect on-site and installed absorptive materials from moisture damage.
- Use MERV 8 filters at each return air grille if air handlers are to be used during construction. Replace all filtration media prior to tenant occupancy.

Create an IAQ Pre-Occupancy Plan

Many construction materials off-gas after installation. Post-construction cleaning of tenant spaces can also be harmful, especially if solvents are used. One way to mitigate these IAQ risks is to develop an IAQ Pre-Occupancy Plan and implement it after installation of all finishes, furniture and fixtures; after completion of building cleaning; and before occupancy. The plan should include one of the following two measures:

- Install new filtration media and flush out the building by supplying 14,000 cubic feet (“cf”) of air per square foot of space, while maintaining a temperature of at least 60 degrees F and relative humidity no higher than 60%.
- Through air testing (conducted in accordance with testing protocols of the EPA Compendium of Methods for the Determination of Air Pollutants in Indoor Air), air contaminants should not exceed the specified amounts in the table below.

Contaminant	Maximum Concentration
Formaldehyde	27 parts per million
Particulates (PM10)	50 micrograms per cu. meter
Total Volatile Organic Compounds (TVOC)	500 micrograms per cu. meter
4-Phenylcyclohexene (4-PHC)	6.5 micrograms per cu. meter
Carbon Monoxide	9 ppm and no greater than 2 ppm above outdoor levels



RECOMMENDED

RESPONSIBILITY	MEP, C
COST	\$\$
DIFFICULTY	☞☞
LEED CI	IEQc3.2
LEED EB: O&M	IEQc1.5



REQUIRED

RESPONSIBILITY	C
COST	\$
DIFFICULTY	⌘
LEED CI	IEQ4.1
LEED EB: O&M	MRc3

Use Low-Emitting Adhesives/Sealants

Over time, materials including adhesives, treated wood, foam, and plastic can release air contaminants, including Volatile Organic Compounds (“VOCs”). This off-gassing can cause respiratory issues and other illnesses.

To promote good IAQ, use building materials and products that conform to the standards in the table below. The VOC contents of a product can be readily obtained from its Material Safety Data Sheet (“MSDS”), provided by the manufacturer.

Architectural Applications	VOC Limit [g/L less water]	Specialty Applications	VOC Limit [g/L less water]
Indoor Carpet Adhesives	50	PVC Welding	510
Carpet Pad Adhesives	50	CPVC Welding	490
Wood Flooring Adhesives	100	ABS Welding	325
Rubber Floor Adhesives	60	Plastic Cement Welding	250
Subfloor Adhesives	50	Adhesive Primer for Plastic	550
Ceramic Tile Adhesives	65	Contact Adhesive	80
VCT & Asphalt Adhesives	50	Special Purpose Contact Adhesive	250
Drywall & Panel Adhesives	50	Structural Wood Member Adhesive	140
Cove Base Adhesives	50	Sheet Applied Rubber Lining Operations	850
Multipurpose Construction Adhesives	70	Top & Trim Adhesive	250
Structural Glazing Adhesives	100		
Substrate Specific Applications	VOC Limit [g/L less water]	Sealants	VOC Limit [g/L less water]
Metal to Metal	30	Architectural	250
Plastic Foams	50	Nonmembrane Roof	300
Porous Material (except wood)	50	Roadway	250
Wood	30	Single-Ply Roof Membrane	450
Fiberglass	80	Other	420

Sealant Primers	VOC Limit [g/L less water]
Architectural Non Porous	250
Architectural Porous	775
Other	750
Aerosol Adhesives	VOC weight (g/L minus water)
General purpose mist spray	65% VOCs by weight
General purpose web spray	55% VOCs by weight
Special purpose aerosol adhesives (all types)	70% VOCs by weight

The source for the VOC limits for non-aerosol adhesives is the South Coast Air Quality Management District (SCAQMD) Rule 1168. For aerosol adhesives, the source is the Green Seal Standard for Commercial Adhesives, GS-36.



REQUIRED

RESPONSIBILITY	C
COST	\$
DIFFICULTY	☞
LEED CI	IEQ4.2
LEED EB: O&M	MRc3

Use Low-Emitting Paints/Coatings

Many paint and stain manufacturers have developed high-quality, cost-competitive products that are either water-based or contain a reduced quantity of VOCs, further enhancing IAQ. Use paints and coatings that meet following standards:

Paints	VOC Limit [g/L]
Flat	50
Non-flat	150
Anti-corrosive/anti-rust	250
Clear Wood Finishes	VOC Limit [g/L]
Varnish	350
Lacquer	550
Sealers	VOC Limit [g/L]
Waterproofing sealers	250
Sanding sealers	275
All other sealers	200
Shellacs	VOC Limit [g/L]
Clear	730
Pigmented	550
Stains	VOC Limit [g/L]
All stains	250
Shellacs	VOC Limit [g/L]
Clear	730

Source: Green Seal Standard GS-11, Paints; Green Seal Standard GS-03, Anti-Corrosive Paints (www.greenseal.org)

Source: South Coast Air Quality Management District (SCAQMD) Rule 1113, Architectural Coatings

Product Suggestions:

- AFM SafeCoat: www.afmsafecoat.com
- Benjamin Moore: www.benjaminmoore.com/ecoadvantage
- Find a certified paint through Green Seal: www.greenseal.org/findaproduct/paints_coatings.cfm
- Sherwin Williams: www.sherwin-williams.com/pro/sherwin_williams_paint/product_specifications/leed/index.jsp

Use Low-Emitting Flooring Systems

Many carpeting and flooring manufacturers now offer high-quality, cost-competitive products with lower off-gassing potential. Pre-finished wood flooring that has been given time to off-gas is also recommended. Flooring products should conform to the following standards:

Option A:

- All carpet must meet the requirements of the Carpet and Rug Institute (“CRI”) Green Label Plus program (www.carpet-rug.org/commercial-customers/green-building-and-the-environment/green-label-plus/index.cfm), and carpet cushion must meet the requirements of the CRI Green Label program (www.carpet-rug.org/commercial-customers/green-building-and-the-environment/green-label-plus/cushion.cfm).
- All carpet adhesive must have less than 50 g/L VOC content. Other flooring adhesives and finishes must meet the requirements of Low-Emitting Adhesives/Sealants and Paints/Coatings detailed above.
- All hard flooring must be certified as compliant with FloorScore standards (www.rfci.com/int_FS-ProdCert.htm). This includes vinyl, linoleum, laminate, wood, ceramic, rubber, and wall base.

Option B:

All flooring products must meet the testing and product requirements of the California Department of Public Health Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers (www.cal-iaq.org/VOC/), including 2004 Addenda.

Look for synergies among different sustainable elements when purchasing flooring. In addition to low VOC content, sustainable carpeting and wood flooring may be made with recycled content or rapidly renewable materials. Further, look for manufacturers that offer recycling or take-back programs for used flooring products, and consider purchasing carpeting with easily replaceable tiles so that specific worn areas can be replaced as needed. Metropolis Magazine has produced a helpful carpet matrix with examples of brands that meet various environmental criteria:

www.metropolismag.com/PDF_files/2997/SB2_10_07.pdf.

Other product suggestions include:

- InterfaceFLOR: www.interfaceflor.com
- LG Floors: www.lgfloors-usa.com
- Mannington Commercial: www.manningtoncommercial.com

 REQUIRED	
RESPONSIBILITY	A/ID, C
COST	\$
DIFFICULTY	☞
LEED CI	IEQ4.3
LEED EB: O&M	MRc3



REQUIRED

RESPONSIBILITY	A/ID, C
COST	\$\$
DIFFICULTY	☞☞
LEED CI	IEQ4.4
LEED EB: O&M	MRc3

Use Low-Emitting Composite Wood

Traditionally, composite wood and agricultural fiberboards (e.g., low-, medium-, and high-density fiberboards) are manufactured with binders and resins containing formaldehyde, a known carcinogen. Select composite wood and fiberboard with no added urea-formaldehyde resins wherever these materials are used in the TI, including casework, millwork, and finish panel construction.

Product Suggestions:

- Crystal Cabinets: www.crystalcabinets.com/GreenProducts.htm
- Harring Doors: www.harringdoors.com/leed.html
- Kellogg Cabinets: www.kelloggcabinets.com
- The Millenium Collection: www.millenniumdoors.com/environmental.html
- Neil Kelly Cabinets: www.neilkellycabinets.com
- Pentco: www.pentco.com/page131.htm
- TRS Cabinet Company: www.trscabinets.com/www/prd/home.html
- TruStile Doors: www.trustile.com/techinfo/green.asp?cid=184

When purchasing materials such as composite wood, looking for synergies among different sustainable elements can enable a project to cost-effectively achieve higher levels of sustainability. Many of the products suggested above also include pre-consumer recycled content, may be made with low-VOC adhesives and sealants, and may contain FSC-certified wood, aiding in efforts to achieve other LEED CI credits.

Use Low-Emitting System Furniture & Seating

The materials used in furniture systems (e.g., fiberboard, synthetic fabrics, adhesives, and finishes) can emit VOCs and other harmful substances. To mitigate these potential effects, consider having all systems furniture and seating that has been manufactured, refurbished, or refinished within one year prior to occupancy meet one of the possible standards below. Salvaged/reused furniture greater than one year old is excluded from the associated LEED CI credit requirements, as is occasional furniture.

- **OPTION A:** Greenguard Indoor Air Quality Certified (www.greenguard.org/Default.aspx?tabid=109), which indicates that a product meets performance-based standards for low chemical and particle emissions
- **OPTION B:** Indoor air contaminant concentrations less than or equal to the limits in the table below.

Chemical Contaminant	Emission Limits Systems Furniture	Emission Limits Seating
TVOC	0.5 mg/m ³	0.25 mg/m ³
Formaldehyde	50 parts per billion	25 parts per billion
Total Aldehydes	100 parts per billion	50 parts per billion
4 – Phenylcyclohexene (4-PCH)	0.0065 mg/m ³	0.00325 mg/m ³



RECOMMENDED

RESPONSIBILITY	A/ID, T
COST	\$\$
DIFFICULTY	☞☞
LEED CI	IEQc4.5
LEED EB: O&M	None



REQUIRED

RESPONSIBILITY	MEP
COST	\$\$
DIFFICULTY	☞☞
LEED CI	IEQ7.1
LEED EB: O&M	None

Design HVAC Systems for Thermal Comfort

Comfortable building occupants are healthier and more productive. A well-designed HVAC system is able to meet comfort criteria (air temperature, radiant temperature, air speed, and relative humidity) under normal operating conditions. Evaluate these criteria together and coordinate system design with the requirements of “Achieve Minimum IAQ Performance” in order to meet ASHRAE Standard 55-2004, and demonstrate design compliance in accordance with the Section 6.1.1 documentation. Visit www.ashrae.org to obtain a copy of the standard.



RECOMMENDED

RESPONSIBILITY	MEP
COST	\$\$\$
DIFFICULTY	☞☞☞
LEED CI	IEQc6.2
LEED EB: O&M	None

Provide Individual Comfort Control

Building occupants have a wide range of preferred thermal comfort zones. By allowing individuals to adjust their thermal conditions (including temperature and ventilation), tenants can provide improved comfort and satisfaction for their employees.

If pursuing this LEED CI credit, provide temperature and ventilation controls to 50% of occupants, and provide control systems for all shared and multi-occupant spaces (such as conference rooms). Individual controls may include thermostats, diffusers, radiant panels, or operable windows.

This suggestion should be balanced with the energy efficiency goals of the building, since allowing individuals to control temperatures and ventilation has the potential to impact HVAC operations and the associated energy usage. Integrating occupancy sensors into the thermal comfort controls – so that the systems can automatically be set back when the space is unoccupied – can help avoid a potential energy consumption increase.

Provide Individual Lighting Control

Building occupants have different lighting needs at different times. Providing the appropriate level of lighting for different tasks reduces energy use, compared to centrally-controlled overhead lighting, which lights the entire tenant space for the task requiring the highest lighting level. Individual lighting controls also increase occupant satisfaction and comfort with light levels.

Consider providing individual lighting controls for at least 90% of occupants to enable adjustments to suit individual task needs and preferences. This can be achieved cost-effectively through task lighting at individual workstations and offices, allowing the amount of overhead lighting provided to be reduced.

In addition, consider providing separate lighting system controls for all shared multi-occupant spaces (e.g., conference rooms) to enable adjustments. To achieve the greatest level of energy efficiency in combination with controllability, evaluate this suggestion in conjunction with the requirement “Install Lighting Controls” on page 16.



RECOMMENDED

RESPONSIBILITY	A/ID, MEP
COST	\$\$
DIFFICULTY	☞☞
LEED CI	IEQc6.1
LEED EB: O&M	IEQc2.2

Control Indoor Pollutant Sources

It is important to minimize the pollutants that enter the building from the outside, as well as those that are created within it. Consider implementing the following control measures:

- If the tenant space has entrances leading to the exterior, install walk-off grilles or grates to prevent dirt and particulates from entering the building.
- Provide contaminant drains plumbed for appropriate disposal of hazardous liquid waste in spaces where chemical concentrate mixing occurs for maintenance or laboratory purposes.
- Where hazardous gases or chemicals may be present or used (including janitorial, copying, and printing rooms), provide segregated areas with self-closing doors and deck-to-deck partitions. Also provide separate outside exhausting at a rate of at least 0.5 cfm/SF, with no air recirculation, maintaining a negative pressure compared with the surrounding spaces. (This consideration may add costs to the project.)
- Consider providing regularly occupied areas of the tenant space with new MERV 13 or better air filtration media prior to occupancy.



RECOMMENDED

RESPONSIBILITY	C
COST	\$\$
DIFFICULTY	☞☞
LEED CI	IEQc5
LEED EB: O&M	IEQc3.5 ^{iv}

^{iv} The suggestions in this manual align with the LEED CI credit. The LEED EB: O&M credit requires the first two bullet points to be implemented. Please refer to the LEED reference guides for details.



RECOMMENDED

RESPONSIBILITY	A/ID
COST	\$\$\$
DIFFICULTY	RRR
LEED CI	IEQc8.1
LEED EB: O&M	IEQc2.4

Provide Daylight

Several studies have shown a strong connection between access to daylight and employee health and productivity. Open office planning and design is one method for providing ample daylighting to all occupants. Consider locating open work spaces and offices around the perimeter of the tenant space, providing the majority of employees with access to windows, and locating non-regularly-occupied areas (such as conference rooms, employee kitchens, and break rooms) in the interior. Other strategies to consider include lower partition heights, interior glazing, and high ceiling reflectance values. Provide sunlight redirection, interior shading devices, and/or glare control devices to ensure daylight effectiveness.

If pursuing certification via either LEED CI or LEED EB: O&M, please see the reference guide for required daylight thresholds and methods for demonstrating compliance.

Provide Views to the Outdoors

Design the space to maximize occupants' views to the outdoors, providing a direct line of sight to vision glazing from regularly occupied areas wherever possible. Utilize many of the same strategies as the item "Provide Daylight" above, including lower partition heights and interior glazing.

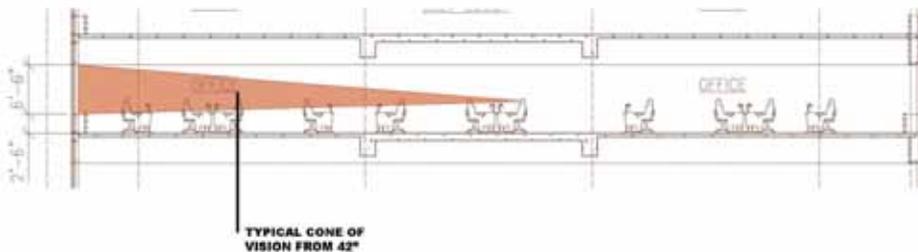
If pursuing certification via either LEED CI or LEED EB: O&M, please refer to the reference guide for methods for demonstrating compliance with the view requirements.

Typical Plan and Section Diagram of View Access Analysis



RECOMMENDED

RESPONSIBILITY	A/ID
COST	\$
DIFFICULTY	☺☺☺
LEED CI	IEQc8.2
LEED EB: O&M	IEQc2.4





Sustainable Sites

The location and configuration of a building have a significant impact on commuting, energy efficiency, occupant well-being, and conservation of natural resources. Buildings sited sustainably give occupants the opportunity to carpool, utilize public transportation, and use less energy and water.

Although TIs rarely involve site work and infrastructure scope, consider reducing negative impacts to the local site and surroundings. Under both the LEED CI and EB: O&M rating systems, site-related credits (including simply being located in a LEED certified base building) can supplement the Sustainable TI Manual requirements and recommendations to aid in achieving certification.



RECOMMENDED

RESPONSIBILITY	A/ID, C
COST	\$\$
DIFFICULTY	☞☞
LEED CI	SSc3.2
LEED EB: O&M	None

Install Bicycle Storage & Changing Rooms

To encourage the use of alternatives to single occupant automobiles, consider incorporating secure bike storage and showers/changing rooms into the TI. Many racks and hanger systems are available for efficient bicycle storage. In shower rooms, consider supplying lockers as well.

A suggested guideline is to provide secure bicycle storage for 5% of employees, and to provide showers for 0.5% of employees.

Product Suggestions:

- Dero Space Saver Bike Rack: www.dero.com/commercial_racks.html
- DuMor Bike Racks: www.dumor.com/bike-racks.shtml

Closing Comments

Additional Considerations

Kennedy encourages project teams and tenants to explore further opportunities for incorporating sustainability into TIs, above and beyond the minimum requirements in this manual. In support of the principles of Responsible Property Investing, Kennedy welcomes creativity in identifying and implementing strategies such as:

- Implementing enough of the suggested items in this manual to qualify for LEED CI certification
- Collaborating with property and asset managers to implement measures that will further the building's progress toward LEED EB: O&M certification
- Pursuing exceptional performance beyond the minimum thresholds identified (e.g., achieving water reductions of greater than 20%, which could qualify the project for additional LEED CI credits)
- Developing sustainability programs for ongoing operational activities, including green cleaning, Integrated Pest Management, occupant education/communication, and enhanced operations and maintenance of equipment

By implementing its own LEED CI Gold certified TI in 2008, Kennedy learned that it is possible to achieve a highly efficient, green TI with very little added cost. The following measures, among others, were included in Kennedy's TI:

- Energy efficient lighting, occupancy sensors and task lighting, resulting in 35% less energy consumed
- Low- and no-flow restroom fixtures, which has reduced water consumption by over 40%
- FSC certified wood
- Purchase of Green-e certified green power
- Use of low-VOC paints, carpets, and sealants
- Bicycle storage, showers, and changing rooms
- Improved access to daylighting and views

Future Updates

The requirements and considerations in this manual are subject to market conditions. Further, sustainable building technologies and practices are constantly evolving; this manual will be updated periodically as the market advances. Kennedy welcomes feedback from project teams. Please email christiang@kennedyusa.com with comments.

Acknowledgments



BetterBricks is the commercial building initiative of the Northwest Energy Efficiency Alliance, which is supported by local electric utilities. Through the BetterBricks initiative, NEEA advocates for changes to energy-related business practices in Northwest buildings. In this era of heightened appreciation for the impact climate change is having on our environment and our economy, energy efficiency is a crucial component in addressing these issues. On betterbricks.com, you'll find the information, tools, training and resources to help your building make a difference to your bottom line and the environment.



Deborah Cloutier and Alison Drucker of JDM Associates collaborated with Kennedy Associates and BetterBricks on the development of the Sustainable Tenant Improvement Manual. JDM Associates is an energy management and environmental consulting firm specializing in real estate. JDM focuses on linking sustainability with financial performance, using cost-effective strategies that are good for the environment and the bottom line. More information about JDM Associates is available at www.jdmgmt.com.



NBBJ is a global architecture, planning and design firm that helps companies and organizations create innovative places. The firm is a leader in using design as a tool to achieve its client's business goals and accomplish change across multiple dimensions—behavioral, relational, organizational, and performance. NBBJ's client roster includes Fortune 500 companies, leading public and civic organizations worldwide and US News & World Report top hospitals. Together, NBBJ's employees and clients have designed communities, buildings, products, environments and digital experiences across the globe that enhance people's lives, improve businesses' bottom lines and contribute to a more sustainable and livable world. NBBJ sees energy efficiency and high-performance sustainable solutions as inherent to good design and they are a signatory of the progressive goals of the 2030 Challenge.

Appendix



LEED 2009 for Commercial Interiors

Project Checklist

Project Name

Date

		Sustainable Sites			Possible Points: 21
Y	N	?			
					1 to 5
					6
					6
					2
					2

		Water Efficiency			Possible Points: 11
					6 to 11

		Energy and Atmosphere			Possible Points: 37
					1 to 5
					6
					6
					2
					2

		Materials and Resources			Possible Points: 14
					1 to 5
					1 to 3
					5 to 10
					1 to 4
					5
					2 to 5
					5

		Indoor Environmental Quality			Possible Points: 17
					1
					1
					1
					1
					1
					1
					1
					1
					1
					1
					1
					1 to 2
					1

		Innovation and Design Process			Possible Points: 6
					1
					1
					1
					1
					1
					1

		Regional Priority Credits			Possible Points: 4
					1
					1
					1
					1

		Total			Possible Points: 110
					110



LEED 2009 for Existing Buildings: Operations & Maintenance

Project Checklist

Project Name

Date

0 0 0 Sustainable Sites Possible Points: 26

Y	N	?			
			Credit 1	LEED Certified Design and Construction	4
			Credit 2	Building Exterior and Hardscape Management Plan	1
			Credit 3	Integrated Pest Management, Erosion Control, and Landscape Management Plan	1
			Credit 4	Alternative Commuting Transportation	3 to 15
				Reduce by 10%	3
				Reduce by 13.75%	4
				Reduce by 17.5%	5
				Reduce by 21.25%	6
				Reduce by 25%	7
				Reduce by 31.25%	8
				Reduce by 37.5%	9
				Reduce by 43.75%	10
				Reduce by 50%	11
				Reduce by 56.25%	12
				Reduce by 62.5%	13
				Reduce by 68.75%	14
				Reduce by 75%	15
			Credit 5	Site Development—Protect or Restore Open Habitat	1
			Credit 6	Stormwater Quantity Control	1
			Credit 7.1	Heat Island Reduction—Non-Roof	1
			Credit 7.2	Heat Island Reduction—Roof	1
			Credit 8	Light Pollution Reduction	1

0 0 0 Water Efficiency Possible Points: 14

Y	N	?			
Y			Prereq 1	Minimum Indoor Plumbing Fixture and Fitting Efficiency	
			Credit 1	Water Performance Measurement	1 to 2
				Whole building metering	1
				Submetering	2
			Credit 2	Additional Indoor Plumbing Fixture and Fitting Efficiency	1 to 5
				Reduce by 10%	1
				Reduce by 15%	2
				Reduce by 20%	3
				Reduce by 25%	4
				Reduce by 30%	5
			Credit 3	Water Efficient Landscaping	1 to 5
				Reduce by 50%	1
				Reduce by 62.5%	2
				Reduce by 75%	3
				Reduce by 87.5%	4
				Reduce by 100%	5
			Credit 4	Cooling Tower Water Management	1 to 2
				Chemical Management	1
				Non-Potable Water Source Use	2

0 0 0

Energy and Atmosphere

Possible Points: 35

Y N ?

Y	Prereq 1	Energy Efficiency Best Management Practices	
Y	Prereq 2	Minimum Energy Efficiency Performance	
Y	Prereq 3	Fundamental Refrigerant Management	
	Credit 1	Optimize Energy Efficiency Performance	1 to 18
		ENERGY STAR Rating of 71 or 21st Percentile Above National Median	1
		ENERGY STAR Rating of 73 or 23rd Percentile Above National Median	2
		ENERGY STAR Rating of 74 or 24th Percentile Above National Median	3
		ENERGY STAR Rating of 75 or 25th Percentile Above National Median	4
		ENERGY STAR Rating of 76 or 26th Percentile Above National Median	5
		ENERGY STAR Rating of 77 or 27th Percentile Above National Median	6
		ENERGY STAR Rating of 78 or 28th Percentile Above National Median	7
		ENERGY STAR Rating of 79 or 29th Percentile Above National Median	8
		ENERGY STAR Rating of 80 or 30th Percentile Above National Median	9
		ENERGY STAR Rating of 81 or 31st Percentile Above National Median	10
		ENERGY STAR Rating of 82 or 32nd Percentile Above National Median	11
		ENERGY STAR Rating of 83 or 33rd Percentile Above National Median	12
		ENERGY STAR Rating of 85 or 35th Percentile Above National Median	13
		ENERGY STAR Rating of 87 or 37th Percentile Above National Median	14
		ENERGY STAR Rating of 89 or 39th Percentile Above National Median	15
		ENERGY STAR Rating of 91 or 41st Percentile Above National Median	16
		ENERGY STAR Rating of 93 or 43rd Percentile Above National Median	17
		ENERGY STAR Rating of 95+ or 45th+ Percentile Above National Median	18
	Credit 2.1	Existing Building Commissioning—Investigation and Analysis	2
	Credit 2.2	Existing Building Commissioning—Implementation	2
	Credit 2.3	Existing Building Commissioning—Ongoing Commissioning	2
	Credit 3.1	Performance Measurement—Building Automation System	1
	Credit 3.2	Performance Measurement—System-Level Metering	1 to 2
		40% Metered	1
		80% Metered	2
	Credit 4	On-site and Off-site Renewable Energy	1 to 6
		3% On-site or 25% Off-site Renewable Energy	1
		4.5% On-site or 37.5% Off-site Renewable Energy	2
		6% On-site or 50% Off-site Renewable Energy	3
		7.5% On-site or 62.5% Off-site Renewable Energy	4
		9% On-site or 75% Off-site Renewable Energy	5
		12% On-site or 100% Off-site Renewable Energy	6
	Credit 5	Enhanced Refrigerant Management	1
	Credit 6	Emissions Reduction Reporting	1

0	0	0
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Materials and Resources

Possible Points: 10

Y N ?

Y			Prereq 1	Sustainable Purchasing Policy	
Y			Prereq 2	Solid Waste Management Policy	
			Credit 1	Sustainable Purchasing—Ongoing Consumables	1
			Credit 2.1	Sustainable Purchasing—Durable Goods	1 to 2
				40% of Electric	1
				40% of Furniture	1
			Credit 3	Sustainable Purchasing—Facility Alterations and Additions	1
			Credit 4	Sustainable Purchasing—Reduced Mercury in Lamps	1
			Credit 5	Sustainable Purchasing—Food	1
			Credit 6	Solid Waste Management—Waste Stream Audit	1
			Credit 7	Solid Waste Management—Ongoing Consumables	1
			Credit 8	Solid Waste Management—Durable Goods	1
			Credit 9	Solid Waste Management—Facility Alterations and Additions	1

0	0	0
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Indoor Environmental Quality

Possible Points: 15

Y N ?

Y			Prereq 1	Minimum IAQ Performance	
Y			Prereq 2	Environmental Tobacco Smoke (ETS) Control	
Y			Prereq 3	Green Cleaning Policy	
			Credit 1.1	Indoor Air Quality Best Management Practices—Indoor Air Quality Management Program	1
			Credit 1.2	Indoor Air Quality Best Management Practices—Outdoor Air Delivery Monitoring	1
			Credit 1.3	Indoor Air Quality Best Management Practices—Increased Ventilation	1
			Credit 1.4	Indoor Air Quality Best Management Practices—Reduce Particulates in Air Distribution	1
			Credit 1.5	Indoor Air Quality Best Management Practices—Facility Alterations and Additions	1
			Credit 2.1	Occupant Comfort—Occupant Survey	1
			Credit 2.2	Controllability of Systems—Lighting	1
			Credit 2.3	Occupant Comfort—Thermal Comfort Monitoring	1
			Credit 2.4	Daylight and Views	1
			Credit 3.1	Green Cleaning—High Performance Cleaning Program	1
			Credit 3.2	Green Cleaning—Custodial Effectiveness Assessment	1
			Credit 3.3	Green Cleaning—Purchase of Sustainable Cleaning Products and Materials	1
			Credit 3.4	Green Cleaning—Sustainable Cleaning Equipment	1
			Credit 3.5	Green Cleaning—Indoor Chemical and Pollutant Source Control	1
			Credit 3.6	Green Cleaning—Indoor Integrated Pest Management	1

0	0	0
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Innovation in Operations

Possible Points: 6

Y N ?

			Credit 1.1	Innovation in Operations: Specific Title	1
			Credit 1.2	Innovation in Operations: Specific Title	1
			Credit 1.3	Innovation in Operations: Specific Title	1
			Credit 1.4	Innovation in Operations: Specific Title	1
			Credit 2	LEED Accredited Professional	1
			Credit 3	Documenting Sustainable Building Cost Impacts	1

0	0	0	Regional Priority Credits	Possible Points: 4
Y	N	?		
			Credit 1.1 Regional Priority: Specific Credit	1
			Credit 1.2 Regional Priority: Specific Credit	1
			Credit 1.3 Regional Priority: Specific Credit	1
			Credit 1.4 Regional Priority: Specific Credit	1
0	0	0	Total	Possible Points: 110
<p style="text-align: center;"> Certified 40 to 49 points Silver 50 to 59 points Gold 60 to 79 points Platinum 80 to 110 </p>				