Reduce pollution from construction activities by controlling soil erosion, waterway sedimentation & airborne dust generation.

Construction Submittal
Schematic Design - Civil Engineer & Contractor
CDs & SPECS - Pre-Construction - Civil Engineer to provide ESC
Confirm compliance w/ NPDES or local

Construction - Monitor and document with digital photos, perform weekly site checks
Post-Construction - Compile all documentation, check to verify LEED online has been completed by Civil

ESC: Erosion & Sedimentation Control plan (ESC) for all construction activities to:
1. Prevent loss of soil during construction (including stockpiling topsoil for reuse)
2. Prevent sedimentation of storm sewer or receiving streams
3. Prevent polluting the air with dust and particulates.
conforming with requirements of
1 - 2003 EPA CGP Construction General Permit which conforms with
NPDES: National Pollutant Discharge Elimination System
(although CGP is for greater than 1 acre - for LEED its everything) OR
2 - local codes, whichever is more stringent)

Stabilization vs Erosion; Temporary & Permanent seeding, mulching
(moisture)
Structural Control vs Sedimentation: Earth dikes, silt fencing, sediment traps

Civil Engineer to identify prone areas & soil stabilization measures
Contractor to adopt plan accordingly.

NO Exemplary Performance
Avoid development on inappropriate sites and reduce the environmental impact from the location of a building on a site.

Design Submittal
Pre-Design - Civil Engineer
Pre-Construction - review site, insure that civil has completed LEED online BEFORE construction

Construction & Post-Construction - compliance should be verified & documented

Do NOT develop buildings, roads or parking areas on:
2. Undeveloped land with elevation lower than 5 feet above the elevation of the 100yr flood
3. Habitats for threatened or endangered species (federal or state)
4. Land within 100 feet from wetlands (OR within setback distances from wetlands)
5. Undeveloped land that is within 50 feet of any water body (Clean Water Act)
6. Land previously public parkland (unless traded with public landowner for equal value or Park Authority projects)

100 year flood: Elevation w/ 1% chance of reaching each year

NO Exemplary Performance
Channel development to urban areas with existing infrastructure, protect greenfields and preserve habitat and natural resources.

Design Submittal

Pre-Design - Leed AP
Include Vicinity Maps & Building & Site areas for both options

OPTION 1:
- Use previously developed site
- Within community with density of 60,000 sf/acre min.

1. Calculate Development Density: Building Gross Square Footage (sf)
   Project Site Area (acres) at least 60,000 sf/acre)

2. Calculate: Density Radius (LF) 3x V (Project Site Area (acres) x 43,560 sf/acre)
   Radius from center of the site. Repeat development density calculations for all properties included. These should be at least 60,000 sf/acre as well.
   Remove public parks, roads, waterways, right-of-ways etc from calculations.

OPTION 2:
- Use previously developed site
- Within ½ mile of residential neighborhood with 10 units/acre net average (at least one)
- Within ½ mile pedestrian access of 10 basic services min (only restaurants can count x2)

Radius drawn from entrance(s) of new building(s).

- Bad side: bad IEQ, limited daylighting

Exemplary Performance: meet requirements of Option 1 AND
- Project Density at least 2x Calculated Density of Radius Area OR
- Density within area of basic credit x2 is at least 120,000 sf/acre
Rehabilitate damaged sites where development is complicated by real or perceived environmental contamination, reducing pressure on undeveloped land.

Design Submittal
Pre-Design - Civil Engineer

Confirm that the site is indeed Brown, provide a narrative on how to fix it

Assessment of the site by:
- ASTM E1903-97 Phase II Environmental Site Assessment OR
- Voluntary Cleanup Program
Give preference to brownfield sites. Develop and implement a site remediation plan using strategies such as
  - in situ (use of the natural hydraulic gradient of groundwater)
    o injection wells, reactive trenches, bio-remediations
    o minimal site disturbance, BETTER
  - ex situ (use of carbon filters & incineration)
    o pump & treat (contaminated groundwater)

- Good side: existing infrastructure, less expensive, incentives for fixing them

CERCLA: Comprehensive Environmental Response, Compensation & Liability Act
RCRA: Resource Conservation and Recovery Act

NO Exemplary Performance
Reduce pollution and land development impacts from automobile use.

Design Submittal
Pre-Design - LEED AP
Pre-Construction - create a scaled map

Locate project within pedestrian route:
1. ½ mile of
   i. existing
   ii. planned or funded commuter rail, light rail or subway station or

2. ¼ mile of 2 or more public or campus lines usable by building tenants

Provision of shuttle will satisfy credit!
-Good side: Less asphalt = less stormwater runoff, less heat island effects

Exemplary Performance
(Quadrupling transit = Doubles transit ridership)
1. within ½ mile, 2+ rail/subway stations
2. within ¼ mile, 4+ campus line stops w/ 2 or more stops for 4 lines
3. 200 combination rides available daily
Reduce pollution and land development impacts from automobile use.

Design Submittal
Schematic Design - LEED AP & Architect

Pre-Construction - determine the FTE & Transient tenant occupancy & calculate 5% of the occupants for showers

Provide project drawings w/ pertinent provisions

Review requirement with Hardscape Architect for locations for bicycle storage and MEP for shower locations

1. Commercial/Institutional Buildings, provide (within 200 yds of entrance - even outside):
   a. bicycle racks for 5% min. of PEAK building users
      i. FTEs + Transient
   b. showers & changing rooms for 0.5% of FTE (Full-Time Equivalent) occupants

2. Residential Buildings, provide:
   a. covered bicycle storage for 15% min of building occupants

FTE occupants = Occupant Hours
                8

Exemplary Performance
Show Quantifiable Reduction in Automobile Use
Reduce pollution and land development impacts from automobile use.

Design Submittal
Schematic Design - LEED AP, MEP Engineer, Architect
Pre-construction: provide FTE occupancy & total parking capacity, show locations of proposed construction - Review & document construction of refueling stations
Post-Construction - complete LEED online

Provide:

1. **CARS:**
   a. low emitting & fuel-efficient vehicles for 3% of FTE and
   b. preferred parking for those cars OR

2. **PARKING:**
   a. preferred parking for ‘green’. vehicles for 5% of the total parking capacity OR

3. **STATIONS:**
   a. install refueling stations for 3% of the total vehicle parking capacity of the site.

Low-emission or fuel efficient:
- Zero Emission Vehicles (California Air Resources Board)
- Minimum Green Score of 40 (American Council for an Energy Efficient Economy)

**Exemplary Performance:** Show Quantifiable Reduction in Automobile Use
Reduce pollution and land development impacts from automobile use.

Pre-Construction - calculate parking requirements for the project and the local zoning reqs, FTEs & parking totals

Receive completed LEED online from Credit Leader

OPTION 1: Non-residential:
   a. Do not exceed local zoning requirements AND
   b. provide 5% preferred parking for carpools & vanpools

OPTION 2: Non-residential:
   a. provide parking for less than 5% of FTEs
   b. provide preferred parking for carpools & vanpools for 5% of total provided spaces

OPTION 3: Residential:
   c. do not exceed local zoning requirements AND
   d. provide infrastructure for carpool drop-offs etc

OPTION 4: ALL
   NO new parking

- Bad side: Parking = asphalt = imperviousness = stormwater runoff
  = urban heat island effects

**Exemplary Performance:** Show Quantifiable Reduction in Automobile Use
Conserve existing natural areas and restore damaged areas to provide habitat and promote biodiversity.

Construction Submittal
Schematic Design - Civil Engineer
Pre-Construction - Review Civil’s limits of site disturbance
Provide site & building areas w/ delineations/boundaries & narratives
Construction - inspect & document the site fencing to protect areas during construction
Post-Construction - complete LEED online

1. Greenfield sites: limit site disturbance to:
   a. 40 feet beyond building perimeter
   b. 10 feet beyond surface walkways, hardscapes & utilities less than 12”
   c. 15 feet beyond primary roadway curbs and main utility branch trenches
   d. 25 feet beyond constructed areas with permeable surfaces

2. Previously Developed sites:
   Restore or protect a minimum of **50% of the site area** (excluding the building footprint)
   with
      o native or adapted vegetation (require little or no maintenance)
      o NOT invasive or noxious weeds, that overrun any ecosystem they join
   Projects with Credit 2 (DD & CC) with vegetated roofs: they count!
      o **20% of site area including building footprint**

**Exemplary Performance:** Protect or Restore 75% of previously developed site
Provide a high ratio of open space to development footprint to promote biodiversity.
Design Submittal
Schematic Design - Civil Engineer

Provide project site & building footprint areas, local requirements if any
Provide delineated dedicated spaces

OPTION 1: local zoning requirements
1. Reduce the development footprint (hardscapes included) and
2. exceed local zoning open vegetative space requirements by 25% OR

OPTION 2: NO local zoning
Provide open vegetative space equal to the building footprint OR

OPTION 3: Local Zoning ZERO
Provide open vegetative space equal to 20% of the site footprint

All options
1. projects with SS2 (DD & CC)
   - green roofs can contribute
   - pedestrian oriented hardscape areas w/ minimum 25% vegetation can contribute
2. wetlands or naturally designed ponds can count if
   - the side slope gradients average 1:4 (vertical to horizontal) or less AND
   - they are vegetated

Open Space Area = Property Area - Development Footprint

Exemplary Performance: Twice the Open Vegetated Area in Each Option
Limit disruption of natural water hydrology by reducing impervious cover, increasing on-site infiltration and managing stormwater runoff.

Design Submittal
Schematic Design - Civil Engineer
Civil should complete LEED online

Civil to calculate rates & quantities based on the surface characteristics of the site & data on storm event, frequency, intensity & duration

Provide pre & post development site runoff rates & quantities and/or proposed narrative

1. Existing imperviousness is LESS than or equal to 50%: (Undeveloped Sites)
Implement a storm water management plan that
- for the 1 & 2-year 24hr design storms
- the POST-development peak discharge rate & quantity is equal or LESS than the PRE-development peak discharge rate & quantity OR
Implement a plan that protects receiving stream channels from excessive erosion via a stream channel protection strategy

2. Existing imperviousness is MORE than 50%: (Developed Sites)
Implement a plan that
- for the 2-year 24hr design storm
- results in a 25% decrease in the volume of stormwater runoff
GOOD: maintain aquifer recharge cycle

NO Exemplary Performance
Reduce or eliminate water pollution by reducing impervious cover, increasing on-site filtration, eliminating sources of contaminants and removing pollutants from stormwater runoff.

Design Submittal
Schematic Design - Civil Engineer

Provide list of BMPs including function of each and percentage of annual rainfall it captures
Pre-Construction - Civil should complete LEED online

1. Plan that:
   a. Reduces impervious cover
   b. Promotes infiltration
   c. Captures & treats 90% of average annual rainfall runoff using Best Management Practices

2. BMPs Best Management Practices must
   a. remove 80% min, of the average annual post development TSS Total Suspended Solids AND
   b. meet criteria of program that has adopted these design criteria OR
   c. comply with performance monitoring data that conform with accepted protocol

Non-structural measures promote infiltration & limit runoff by allowing it to naturally filter into the soil and vegetation. Pollutants are broken down by microorganisms in the soil and plants
   - vegetative swales, pervious pavement

Structural measures are preferred and are mostly cheaper in urban areas
   - cisterns, manhole treatment devices & ponds

Watersheds: HUMID (40”/yr - 1” for LEED, SEMI-ARID (20-40”/yr -0.75”, ARID (20”/yr - 0.5”)
NO Exemplary Performance
Reduce heat islands (thermal gradient differences between developed and undeveloped areas) to minimize impact on microclimate and human and wildlife habitat.

Construction Submittal

Schematic Design - LEED AP, Landscape Architect, Civil Engineer

Provide site drawings w/ locations of venues, total site area & areas to be dealt with SRIs of materials used

Preconstruction - Credit Leader should begin LEED online

1. Provide any of the below for 50% of the hardscape:
   a. Shade (within 5 years of occupancy)
      i. Calculated at Summer Solstice at 10am, 12pm & 3pm
   b. Paving Materials with a Solar Reflectance Index (SRI) of at least 29
   c. Open grid pavement system (50% pervious min.)
   OR

2. Place a minimum of 50% of parking spaces under cover. (Cover must have SRI 29 min)

ASTM E1980 SRI Solar Reflectance index, to reject solar heat
ASTM E903, E1918 & E1549 Albedo /Solar Reflectance.

Emissivity is the ratio of Surface X radiation
Black Body radiation

SRI factors: Emissivity & Reflectance

Good: Hi SRI = Hi light levels = less fixtures?? (but glare)
Bad: Imperviousness & low SRI = increased cooling loads

100% on 1 or 2: Exemplary Performance
Reduce heat islands (thermal gradient differences between developed and undeveloped areas) to minimize impact on microclimate and human and wildlife habitat.

**Design Submittal**

**Schematic Design - LEED AP**

Preconstruction - review roofing materials, provide roof drawings, total specific areas & SRIs - complete LEED online

<table>
<thead>
<tr>
<th>SRIs</th>
<th>Low-slope</th>
<th>Steep-slope</th>
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<tr>
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<td>&gt;2:12</td>
</tr>
<tr>
<td></td>
<td>78</td>
<td>29</td>
</tr>
</tbody>
</table>

**Option 1:** 75% of the roof area must meet or exceed the above SRI criteria.

**Option 2:** 50% of the roof must be vegetated.

**Option 3:** Roof Area must be reflective & vegetated so that:

\[
\text{SRI Roof Area} + \text{Vegetated Roof Area} \geq \text{Total Roof Area}
\]

\[
0.75 + 0.5\]

**ASTM E408** Thermal Emittance (between 0 & 1) indicates the ability of a material to shed infrared radiation (heat).

Solar (vs Visible) Reflectance must always be used

100% on Green Roof System: Exemplary Performance
Minimize light trespass from the building and site, reduce sky-glow to increase night sky access, improve night time visibility through glare reduction, and reduce development impact on nocturnal environments.

Design Submittal
Schematic Design - LEED AP, Lighting Designer

INTERIOR LIGHTING:
1. Angle of maximum candela from each interior luminaire is located so that it hits an opaque surface and doesn’t escape to the outside OR
2. All non-emergency lighting are auto-off during non-business hours (manual override for after hours)

EXTERIOR LIGHTING: Do not exceed ASHRAE/IESNA Standards of 90.1-2004 Exterior Lighting Section
  i. 80% of LPD (w/sf) lighting power densities for exterior areas (parking, walkways etc)
  ii. 50% of LPD for building facades and landscape features

EXTERIOR LIGHT TRESPASS - IESNA RP-33 - pre-curfew 10pm
LZ1: Dark - Park & Rural Maximum initial illuminance value no greater than
  0.01 horizontal and vertical foot candles
  0% of lumens are emitted at 90 degrees or higher from nadir
LZ2: Low - Residential Areas Maximum initial illuminance value no greater than
  0.10 foot candles at the site boundary
  0.01 10 feet beyond site boundary, 2% of lumens are emitted at 90 degrees or higher from nadir
LZ3: Medium - Commercial/Industrial, High-Density Residential Max initial illuminance value no greater than
  0.20 foot candles at the site boundary
  0.01 15 feet beyond site boundary, 5% at 90 degrees or higher
LZ4: High - Major City Center, Entertainment Districts Maximum initial illuminance value no greater than
  0.60 foot candles at the site boundary
  0.01 15 feet beyond site boundary, 10% of lumens are emitted at 90 degrees or higher from nadir

Controls & timers for post curfew are good, but will not give credit

NO Exemplary Performance
Limit or eliminate the use of potable water, or other natural surface or subsurface water resources available on or near the project site, for landscape irrigation.

Design Submittal
Schematic Design - Landscape Architect

Preconstruction: TWA & TPWA Total Water Applied for both baseline & design cases
Total non-potable water supply for irrigation purposes, soil climate analysis for appropriate plant selection

Reduce potable water consumption for irrigation by 50% min (mid-summer baseline) via
- plant species selection (native = water conservation built-in! 😊)
- irrigation efficiency
  - November to April - none for plants
  - September to June - none for shrubs
- captured rainwater
- recycled wastewater
- treated water by public agency for non-potable uses

Calculations based on irrigation:
- during the month of July

1. Planning
2. Practical Turf Areas
3. Soil Analysis & Preparation
4. Appropriate Use of Plant Materials - Diversify!
5. Effective & efficient watering practices: drip, micro & subsurface
6. Use of mulch on trees, shrubs & flower beds (moisture)

NO Exemplary Performance
Limit or eliminate the use of potable water, or other natural surface or subsurface water resources available on or near the project site, for landscape irrigation.

Design Submittal
Schematic Design - Landscape Architect
Preconstruction - Landscape Architect to complete LEED online

1. Achieve WE 1.1 via captured rainwater, recycled waste water & treated water (not irrigation efficiency or plant species)

   OR

2. Install Landscaping that does not require permanent irrigation systems (remove after 1 year)

Landscape Coefficient (KL) is the volume of water lost via evapotranspiration (species dependent) and is dependent on: \[ KL = ks \times kd \times kmc \]

A. Species Factor (ks) is the variation of water needs
   Ex. 0 = does not require irrigation after establishment (KL = 0)

B. Density Factor (kd) is the total leaf area of a landscape
   Ex. 0.5 = 25% ground shading from trees (lo)
   1-1+ = trees AND understory shrubs etc (hi)

C. Microclimate factor (kmc) environmental conditions specific to landscape (temp, wind, humidity)
   Ex. 1 = evapotranspiration is not affected by surrounding buildings etc
   1+ = urban areas, heat-absorbing & reflective surfaces

Calculate reference \( ETo \) Evapotranspiration rate for region, and then for project through formula: \( ETI = ETo \times KL \)

Landscapes can be maintained at acceptable condition of 50% reference ETO

NO Exemplary Performance
Reduce generation of wastewater & potable water demand while increasing the local aquifer recharge. (Close ties w/ WE3 - less black water generation)

Design Submittal
Schematic Design - MEP Engineer
Preconstruction - MEP to complete LEED online

1. Reduce potable water for sewage usage by 50% (annual generation of black water) via
   a. water-conserving fixtures or
   b. non-potable water use (rainwater best but can be municipally treated water)
      i. FTE + transient use = PEAK

2. Treat 50% of wastewater on site to tertiary standards
   a. Packaged mechanical wastewater treatment
   b. Natural system / living machine
   c. EA more energy for treatment, possibility for commissioning & m&v attention

Provide:
- plumbing drawings w/ data on treatment facilities
- building calculated occupants
- baseline & design water usage for sewer conveyance
- total non-potable water supply or
- annual quantity of treated water
- narrative of strategies

100% on 1 or 2: Exemplary Performance
Maximize water efficiency within buildings to reduce the burden on municipal water supply and wastewater systems.

Design Submittal
Schematic Design - MEP Engineer
Preconstruction - MEP to complete LEED online

Use 20%, 30% or 40% less water annually than the baseline calculated for the building (excluding irrigation) in EPA 1992.

**Energy Policy Act of 1992 fixture performance requirements** for:

- a. water closets 1.6 gpf 1.1 gpf low
- b. urinals 1.0 gpf 0.5 gpf low
- c. lavatory faucets 2.5 gpr 1.8 gpf low
- d. showers 2.5 gpf 1.8 gpf low
- e. kitchen sinks 2.5 gpf 1.8 gpf low

Provide: building’s calculated occupants, design & baseline case water usage, non-potable water supply & narrative.
May require commissioning & m&v attention

**40% or 10% Potable Water Use Reduction in Process & other fixtures: Exemplary Performance**
Verify that the building’s energy related systems are installed, calibrated and perform according to the owner’s project requirements, basis of design, and construction documents. ($1/sf, 0.6% of project cost)

Construction Submittal

Construction Administration - Commissioning Agent (Pre-Design involvement is recommended)

Preconstruction: Review plan with CxA - Provide CxA’s name & info, compliance with 6 tasks and narrative

Construction: CxA & MEP complete LEED on-line Credit & verify compliance

1. Designate a Commissioning Authority (CxA) to lead, review & oversee the completion of the commissioning process activities. He or she should:
   a. Have experience in 2 similar buildings minimum
   b. Be independent of the project construction or design team (although can be employed from the same office). He can be employed by the Owner
   c. He reports & recommends directly to the Owner
   d. Projects smaller than 50,000 sf, he can be from the construction or design team

2. Owner should document the:
   a. OPR - Owner’s Project Requirements. (prior to approval of contractor submittals)
   Design team should develop
   a. BOD - Basis of Design (prior to approval of contractor submittals)
   CxA reviews both for clarity and completeness.

3. Develop & incorporate commissioning requirements into the Construction Documents

4. Develop & implement commissioning plan (preferably during Design Development)

5. Verify installation & performance of systems to be commissioned.
   - Installation Inspection, Systems Performance Testing & Evaluation of results vs BOD & OPR

6. Complete a summary commissioning report.

Commission at least HVAC&R, lighting & daylighting, Renewable Energy & Domestic Hot Water systems

NO Exemplary Performance
Establish the minimum level of energy efficiency for the base building and systems.

Prerequisite

Establish the minimum level of energy efficiency for the base building and systems.

Design Submittal

Design Development - MEP Engineer

Preconstruction - Review MEP design documentation that requirement has been met
MEP to verify compliance and complete LEED online Credit Workspace

Project to comply with BOTH:

1. ASHRAE/IESNA Standard 90.1-2004 (without amendments) mandatory provisions
   OR local requirements, if equal or more stringent

2. ASHRAE/IESNA Standard 90.1-2004 (without amendments) requirements
   a. Prescriptive
   b. Energy Cost Budget Method performance (allows some ‘averaging’)
   c. if the Performance Rating Method is being used for EA1, it can count (but not vice versa)

Projects pursuing EA Credit 1, computer simulation may be enough.

Standard Sections Requirements:

- Building Envelope
- HVAC
- Service Water Heating
- Power
- Lighting
- Other Equipment

NO Exemplary Performance
Reduce ozone depletion.

**Prerequisite**

**Design Submittal**

**Design Development - MEP Engineer**

**Preconstruction - Review MEP design w/o CFCs**

If CFCs are found, determine whether removal/replacement is economically feasible

MEP to verify compliance and complete LEED online Credit Workspace

Zero use of CFC-based refrigerants in new base building. Phase-out plans extending beyond the project completion date will be considered on their merits.

Alternatives:

1. Commitment of phase-out with a firm timeline of 5 years from completion of project
   a. Prior to phase-out, reduce annual CFC leakage to 5% or less using EPA Clean Air Act

2. System replacement is not economically feasible:
   a. Building is connected to a central chilled water system
   b. 3rd party proof that simple payback is greater than 10 years
   c. Reduce annual CFC leakage to 5% or less
   d. Reduce total leakage over unit’s remaining life to less than 30% of its charge

Choose refrigerants with SHORT environmental lifetimes.

**NO Exemplary Performance**
Achieve increasing levels of energy performance above the baseline in the prerequisite standard to reduce environmental and economic impacts associated with excessive energy use.

**Design Submittal**

**Schematic Design - MEP Engineer**

Preconstruction - Review MEP’s Energy Cost Budget and determine if there are other possibilities for higher scores available

MEP to complete LEED online Credit Workspace and verify compliance

Improve building performance by ASHRAE/IESNA Standard 90.1-2004 by a whole building project simulation using the Building Performance Rating Method in Appendix G of the Standard (baseline project).

**Proposed Building Performance** refers to the annual energy cost calculated for a proposed design.

<table>
<thead>
<tr>
<th>New Buildings</th>
<th>Existing Buildings</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>10.5%</td>
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</tr>
<tr>
<td>42%</td>
<td>35%</td>
<td>10</td>
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</tbody>
</table>

Ex. 45.5 New 38.5 Exemplary Performance
EA 1 Option 1 cont.1

**Performance Rating Method** is a modification of the Energy Cost Method. ECM cannot be used for EA Credit 1, only Prerequisite 2.

In general:
- reduce demand (use nature)
- harvest free energy (daylight, solar energy & wind power etc)
- increase efficiency (sizing HVAC systems etc)
- recover waste energy (waste energy recovery through exhaust air energy recovery systems, etc)

**Building Schedules:**
- PRM: may be altered
- ECM: may not be altered

**Orientation:**
- PRM: Baseline to draw average from 4 different orientations
- ECM: Baseline orientation identical to Proposed

**Vertical Fenestration:**
- PRM: Baseline 40% or less (if actual) - uniformly distributed across 4 orientations
- ECM: Baseline 50% or less - distribution similar to Proposed

**Shading Projections:**
- PRM Baseline: Everything is flush to exterior wall

**HVAC System Selection:**
- PRM: Baseline based on building type, area, no of floors & proposed fuel source (oversized 15% for cooling and 25% for heating)
- ECM: Baseline based on proposed design condenser cooling source, heating system classification & single zone vs multi-zone classification.

**Ex. 45.5** **New 38.5** **Exemplary Performance**
Baseline Fan Power: PRM: Baseline based on total supply air volume & system classification as constant or variable volume (good duct shape) ECM: Baseline fan static pressure remains the same in the budget and proposed case

Baseline System Sizing: PRM: Baseline is sized using default ratios ECM: Baseline is sized with same factors as Proposed

Building Envelope: PRM baseline - above grade walls, roof & floor = light weight

Process Energy includes office & miscellaneous equipment, computers, elevators & escalators, kitchen cooking & refrigeration, laundry washing & drying, lighting outside of allowance. Typically 25% of all building energy cost

Regulated Energy includes lighting (for interior, parking garage, surface parking, façade etc), HVAC, and service water heating.

The energy analysis should include ALL energy costs. Default process energy is 25% of total energy. Process loads should be identical for both baseline & proposed building performance rating. The Exceptional Calculation Method ASHRAE 90.1-2004 G2.5 can be used to document measures to reduce process loads.

Ex. 45..5 New 38.5 Exemplary Performance
Achieve increasing levels of energy performance above the baseline in the prerequisite standard to reduce environmental and economic impacts associated with excessive energy use.

**Design Submittal**

**Schematic Design - MEP Engineer**

Preconstruction - Review MEP’s Energy Cost Budget and determine if there are other possibilities for higher scores available.

**MEP to complete LEED online Credit Workspace and verify compliance**

Design must comply with the prescriptive measures of the **ASHRAE Advanced Energy Design Guide for Small Office Buildings 2004.**

- under 20,000 square feet
- office use only
- comply with the climate zone in which the building is located

The guide provides recommendations that will improve **Building Energy Performance** beyond ASHRAE 90.1-1999 by 30%

**NO Exemplary Performance**
Achieve increasing levels of energy performance above the baseline in the prerequisite standard to reduce environmental and economic impacts associated with excessive energy use.

Design Submittal
Schematic Design - MEP Engineer
Preconstruction - Review MEP’s Energy Cost Budget and determine if there are other possibilities for higher scores available
MEP to complete LEED online Credit Workspace and verify compliance

Design must comply with the Basic Criteria and Prescriptive Measures of the **Advanced Buildings Core Performance Guide** for the climate of the project. Project must be less than 100,000 sf. NOT APPLICABLE for healthcare, warehouses or laboratory projects.

Section 1: Design Process Requirements: identifying & communicating design intent, building configuration, mep design, acceptance testing, operator training & performance data review

Section 2: Core Performance Requirements: Energy Code compliance, air barrier performance, indoor air quality, below grade insulation, envelope performance, fenestration, lighting controls & power density, mechanical efficiency, dedicated mechanical systems, demand control ventilation, hot water system efficiency
3 points available for school, public assembly & retail, 2 points available for all others

Section 3: Enhanced Performance Strategies: OPTIONAL for extra points EXCEPT:
- Cool roofs, night venting & additional commissioning (under different LEED credits)
2 additional points available

Section 4: Energy Modeling NOT APPLICABLE for LEED
Achieve increasing levels of energy performance above the baseline in the prerequisite standard to reduce environmental and economic impacts associated with excessive energy use.

Design Submittal
Schematic Design - MEP Engineer
Preconstruction - Review MEP’s Energy Cost Budget and determine if there are other possibilities for higher scores available
MEP to complete LEED online Credit Workspace and verify compliance

Design must comply with the Basic Criteria and Prescriptive Measures of the Advanced Buildings Benchmark Version 1.1 for the climate zone in which the building is located EXCEPT:
- 1.7 Monitoring and Trend logging
- 1.11 Indoor Air Quality
- 1.14 Networked Computer Monitor Control

NO Exemplary Performance
Encourage and recognize increasing levels of on-site renewable energy self-supply in order to reduce environmental and economic impacts associated with fossil fuel energy use. Design Submittal

Schematic Design - MEP Engineer

Preconstruction - Review MEP design for opportunities to incorporate On-Site Renewable Energy

Provide on-site renewable source, backup source, annual energy, total costs etc

Use on-site renewable energy systems to offset cost. Calculate project performance by expressing the energy produced by the renewable systems as a percentage of the building annual energy cost. Use the building annual energy cost calculated in EA Credit 1 or use the Department of Energy CBECS Commercial Buildings Energy Consumption Survey (REC Renewable Energy Cost) database to determine the estimated electricity (full EA 1 Credit w/ PRM) % Renewable Energy

<table>
<thead>
<tr>
<th>% Renewable Energy</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.5%</td>
<td>1</td>
</tr>
<tr>
<td>7.5%</td>
<td>2</td>
</tr>
<tr>
<td>12.5%</td>
<td>3</td>
</tr>
</tbody>
</table>

Eligible Renewable Systems:

1. Electrical Systems - pvs, wind, hydro, wave, tidal & bio-fuel base:
   - Bf yes: untreated wood waste, agricultural crops & waste, animal & organic waste, landfill gas
   - Bf no: combustion of municipal solid waste, forestry biomass waste, coated or treated wood

2. Geothermal Energy Systems (thermal or electric) deep earth water/steam sources

3. Active Solar Thermal Systems that employ collection panels, and pumps or fans w/ defined storage system (ex thermo-siphon solar & storage tank batch heaters)

Non-Eligible Renewable Systems:

- Architectural Features (passive solar & daylighting strategies etc)
  - EA p2 & c1 will give them credit

Geo-Exchange Systems: geothermal or ground-source heat pumps (no deep earth heat) & Green Power

17.5% Exemplary Performance
Begin the commissioning process early during the design process and execute additional activities after systems performance verification is completed.

Construction Submittal

Schematic Design - Commissioning Agent

Preconstruction - make sure all required components have been included

Construction - Review field implementation of all required aspects of commissioning plan

Post Construction - Verify that CxA has completed LEED online credit workspace

1. designate a CxA before the start of the Construction Documents phase to:
   i. have experience in at least two buildings
   ii. CxA shall be:
      a. independent of the work of design & construction
      b. not an employee of the design firm (but can be contracted by it)
      c. not an employee of the construction company
      d. can be an employee of the Owner
   iii. Report directly to the Owner
   iv. No deviation for project size

2. * Minimum (1) commissioning review of OPR and BOD and Design Documents before mid-construction documents phase. Back-check the review comments in the subsequent design submission

3. * CxA review Contractor submittals applicable to systems being commissioned for compliance with the OPR and BOD, concurrently with A/E review and submitted to the design team and the Owner.

4. Systems manual for future staff to operate the commissioned systems (other team members can do this)

5. Verify that training requirements for personnel and occupants are completed (other team members can do this)

6. * Assure the involvement by the CxA in reviewing building operation within 10 months after substantial completion with O&M staff and occupants. Include resolution plan of outstanding commissioning-related issues.

NO Exemplary Performance
Reduce ozone depletion and support early compliance with the Montreal Protocol while minimizing direct contributions to global warming. (MP: 1980, 1995 USA stopped making CFCs)

Design Submittal

Design Development - MEP Engineer

Enter equipment type, number, size, refrigerant, refrigerant charge & narrative

MEP to complete LEED online Credit Workspace

OPTION 1
Do not use refrigerants OR use natural refrigerants: water, carbon dioxide, ammonia etc.

OPTION 2
1. Use refrigerants and HVAC&R that minimize or eliminate the emission of compounds that contribute to ozone depletion and global warming. The base building threshold for the combined contributions to ozone depletion and global warming potential:

\[ \text{LCGWP} + \text{LCODP} \times 105 < 100 \]

A. Minimize refrigerant leakage
B. Select Equipment with Efficient Refrigerant Charge
C. Select Equipment with Long Service Life (installation & decommissioning - big leaks!)
D. Use Units containing less than 0.5 lbs of refrigerant

2. Do not install fire suppression systems that contain CFCS, HCFCs of Halons

LCODP: Lifecycle Ozone Depletion Potential
LCGWP: Lifecycle Direct Global Warming Potential
\( \text{Lr} \): Refrigerant Leakage Rate - default 2% / year
\( \text{Mr} \): End-of-Life Refrigerant Loss - default 10%
\( \text{Rc} \): Refrigerant Charge (0.5 to 5.0 lbs of refrigerant per ton of cooling capacity)
Life: Equipment Life (10 years default)

NO Exemplary Performance
Provide for the ongoing accountability and optimization of building energy consumption over time.

Construction Submittal

Design Development - MEP Engineer, Building Controls Designer / Manufacturer
Pre-Construction - MEP to review current plan for Building Management System and impact of inclusion of additional points required for credit
Budget Variables: detail needed, metering types, availability of existing info
MEP, BCD, Manufacturer to complete LEED online

Develop & implement and Measurement & Verification plan from International Performance Measurement & Verification Protocol (IPMVP) Volume III: Concepts and Options for Determining Energy Savings in New Construction - not prescriptive, but leaves it up to the implementer

Option D: Calibrated Simulation (Savings Estimation Method 2)
- whole-building level w/ large number of interactive ECMs
- comparing actual building energy use to predicted/simulated (from EA 1)
- EA 1 options 2,3 & 4 addresses design only (no baseline)

Option B: ECM Energy Conservation Measure Isolation
- small / simple buildings
- isolating main energy systems

Right after Occupancy & Stabilization, it has to cover 1 year post-construction minimum - becomes Base Year for comparison

NO Exemplary Performance
**Encourage the development and use of GRID-source, renewable energy technologies on a net zero pollution basis.**

_**Occupation - Operation - LEED AP**_

Pre-Construction - MEP to determine amount of electricity to be used on the project for 1 year
LEED AP to contact Green-e providers and provide RFP for the project: 35% & 70% provisions
Post-Construction - LEED AP to obtain contract between Owner & green-e provider and complete LEED online workspace

**Green power** comes from solar, wind, geothermal, biomass or low-impact hydro sources.

Provide at least 35% of the building’s electricity from renewable sources by engaging in at least a two-year renewable energy contract. Renewable sources as are defined by the Center for Resource Solution (CRS) Green-e products certification requirements.

To determine annual electricity consumption:

1. Use results of EA Credit 1 (DEC - Design Energy Cost)
2. Use DOE (Department of Energy) **Commercial Buildings Energy Consumption Survey (CBECS)** database to determine the estimate electricity use

A. **Open Electrical Markets:** select green-e certified power provider
B. **Closed Electrical Markets:** Green-e accredited program for 35% of provided energy (premium)
C. **Green-e not locally available:** REC - Tradable Renewable Certificates for 35% predicted consumption per year (= 70%) , compensating e-generators

**Exemplary Performance:** DOUBLE the amount of electricity OR length of contract
Prerequisite

Facilitate the reduction of waste generated by building occupants that is hauled to and disposed of in landfills.

Design Submittal

Schematic - Architect

Confirm area has been provided, material types being recycled and optional narrative

Provide an area that serves the entire building and is dedicated to the:
- separation
- collection
- storage

of, at minimum the materials:
- paper
- corrugated cardboard
- glass
- plastics
- metals

Minimum recycling area is suggested only, based on the square footage of the building.

1 ton paper = 17 processed trees = 3 cubic yards in landfill!
Aluminum Recycling = 5% of Energy for Virgin Aluminum production

Easy access to area, signage to prevent contamination, 20-25 gallon containers optimal, co-mingled versus source-separated according to hauler, security for hi-value materials, ramp up & front-loader bin space

NO Exemplary Performance
1.1 BUILDING REUSE

Extend the life cycle of existing building stock, conserve resources, retain cultural resources, reduce waste and reduce environmental impacts of new buildings as they relate to materials manufacturing and transport.

Construction Submittal
Pre-Design - Architect / Contractor

Preconstruction: Review demolition plan to determine amount of reused area
Confirm addition reqs, tabulation of existing & reused areas, optional narrative
Construction: Document the areas that were maintained during construction

Maintain at least **75% (based on surface area)** of
1. existing building structure including
   a. structural floor, walls (count both sides for shear walls)
   b. roof decking) and
2. envelope
   a. exterior skin
   b. framing

Exclude: window assemblies, non-structural roofing materials, hazardous materials, MEP or furniture.

COST SAVINGS: 1. masonry, 2. site work, 3. concrete, 4. carpentry
- If the project includes an addition to an included building, the square footage of the addition cannot be more than 2 times the square footage of the existing building.
- If percentage is not enough for Credit, can still comply with MR 2.

NO Exemplary Performance
1.2 BUILDING REUSE

Extend the life cycle of existing building stock, conserve resources, retain cultural resources, reduce waste and reduce environmental impacts of new buildings as they relate to materials manufacturing and transport.

Construction Submittal
Pre-Design - Architect / Contractor

Preconstruction: Review demolition plan to determine the amount of reused area
Confirm addition reqs, tabulation of existing & reused areas, optional narrative

Construction: Document areas that were maintained during construction

Maintain at least **95% (based on surface area)** of existing building structure including
- structural floor, walls (count both sides for shear walls)
- roof decking) and

envelope
- exterior skin
- framing

Exclude: window assemblies, non-structural roofing materials, hazardous materials, MEP or furniture.
- If the project includes an addition to an included building, the square footage of the addition cannot be more than 2 times the square footage of the existing building.
- If percentage is not enough for Credit, can still comply with MR 2.

NO Exemplary Performance
1.3 BUILDING REUSE

1 point

Extend the life cycle of existing building stock, conserve resources, retain cultural resources, reduce waste and reduce environmental impacts of new buildings as they relate to materials manufacturing and transport.

Construction Submittal
Pre-Design - Architect / Contractor

Preconstruction: Review demolition plan to determine the amount of reused area
Confirm addition reqs, tabulation of TOTAL & reused areas, optional narrative
Construction: Document areas that were maintained during construction

Use existing interior non-structural elements such as:
- interior walls
  - both sides of finished floor to ceiling
- doors (one side)
- floor coverings (one side)
- ceiling systems (one side)
- casework
  - visible surface area of assembly

in at least **50% by area** of the total completed building (new and existing)

Elements must perform the same function - otherwise, they count for MR 3
If there is compliance, the same elements cannot count for MR 3.
But if the addition is more than 200% of footprint, materials can count for MR 2.

NO Exemplary Performance
2. CONSTRUCTION WASTE MANAGEMENT

Divert construction, demolition and land clearing debris from disposal in landfill. Redirect recyclable recovered resources back to the manufacturing process. Redirect reusable materials to appropriate sites.

Construction Submittal

Construction Documents - Contractor

Preconstruction: implement waste management plan and determine the likely waste stream of the project

Provide in template: waste type, location of receiver, quantity of waste, narrative

Construction: Weekly monitor recycling & hauling and keep documentation updated

Post-Construction complete LEED online

Recycle and/or salvage at least:

- 50% - 1 point
- 75% - 2 points

of TOTAL non-hazardous construction and demolition debris.

At minimum, the plan should:

- identify the materials to be diverted from disposal and
- whether the materials will be resorted on-site or co-mingled

Calculations can be done by weight or volume but should be consistent throughout.

Exclude excavated soil & land-clearing debris. If materials aren’t enough for MR 1, they can count here.

HABITAT FOR HUMANITY can count!

Generally beneficial to recycle: metals, concrete, asphalt, & cardboard

95% Exemplary Performance
3. MATERIALS REUSE

Reuse building materials and products in order to reduce demand for virgin materials and to reduce waste, thereby reducing impacts associated with the extraction and processing of virgin resources.

**Construction Submittal**

**Construction Documents - Architect / Contractor**

Preconstruction: require all bidders to provide documentation of the nature and source of their recycled materials so there are no surprises

Provide total cost, tabulation of reused materials (description, source and cost), narrative of strategy

Use salvaged, refurbished or reused materials such that the sum of these materials constitutes at least **5% or 10% of the total materials cost** on the project. Reused materials do NOT have to be from within the building.

MEP components & elevators and equipment do not count. Only materials permanently installed in the project. Furniture may be included as long as it is included consistently in MR Credits 3-7.

**ON-SITE**

**Fixed** components can no longer serve their original function, are reinstalled and reconditioned
- ex. Fire door used as a counter top
- other fixed items ex walls don’t count here, but in MR 1.

**Finish** materials serve their original function after refurbishment
- ex. Refurbished door hardware

If a material counts for MR 3, it cannot count towards MR 1, 2, 4, 6 or 7. It can count for MR 5.

**Replacement** cost is always the highest of the reused or the equivalent new.

**OFF-SITE** has to be previously used

Buildings account for 40% of raw stone, gravel & sand consumption & 25% of virgin wood

**15% Exemplary Performance**
4. RECYCLED CONTENT

Increase demand for building products that incorporate recycled content materials, thereby reducing impacts resulting from extraction and processing of virgin materials.

Mandatory / 30% Exemplary Performance

Construction Submittal
EARLY Schematic - Architect / Contractor

Preconstruction: Evaluate contributions of highest cost items to determine feasibility
- Provide total materials cost, tabulation of all recycled materials: description, source, manufacturer, pre & post percentage, optional narrative

Construction: Verify that all contributions discussed at bidding and precon are being used

Use materials with recycled content such that:

Post-Consumer Recycled Content + Pre-Consumer Recycled Content

= 10% / 20% Total Material Cost

Steel has a default post-consumer content of 25% (can go up to 90%)
SCMs Supplemental Cementitious Materials used in concrete can count as part of cementitious materials versus part of entire concrete mix.
- ex. Fly ash (pre-consumer)

Recycled content value of a material assembly shall be determined by weight.
Recycled content definitions in International Organisation of Standards ISO 14021 - Environmental labels & declarations - self-declared environmental claims (Type II environmental labeling).
 MEP & equipment do not count.
5. REGIONAL MATERIALS

Increase demand for building materials that are extracted and manufactured within the region, thereby supporting the use of indigenous resources and reducing the environmental impacts resulting from transportation.

Construction Submittal

EARLY Schematic - Architect / Contractor

Preconstruction: Evaluate contributions of highest cost items to determine feasibility
Provide total cost, regional material costs, distances between site & manuf. / site & extraction

Construction: Verify that all contributions discussed at bidding and precon are being used

Post-Construction: complete LEED online

Use materials or products that have been:

- Extracted (must have their source as a raw material)
- Harvested
- Recovered
- Manufactured (must be assembled as a finished product)

within 500 miles from the project site for 10% or 20% of the total cost.

Reused materials from MR 3 can count also for MR 5 if point of salvage is less than 500 miles.

If only a fraction of a product is eg. Extracted locally, then only that percentage by weight shall contribute to the regional value,

40% Exemplary Performance
6. RENEWABLE MATERIALS

Reduce the use and depletion of finite raw materials and long-cycle renewable materials by replacing them with rapidly renewable materials.

**Construction Submittal Schematic - Architect / Contractor**

Preconstruction: Evaluate contributions of highest cost items to determine feasibility
Construction: Verify that all contributions discussed at bidding and precon are being used
Provide total materials cost, renewable material cost, manuf., percentage by weight
Post-Construction: complete LEED online

**Rapidly renewable material** is an agricultural product - fiber or animal - that takes **10 years or less** to grow or raise, and to harvest in an ongoing and sustainable fashion.
- Ex. Wheat for composite panels, bio-based plastics from starch etc.
- Bamboo, cork, wool, cotton insulation
- Agrifiber, linoleum
- Wheatboard, strawboard, sunflower seed board panels

Use rapidly renewable materials for **2.5% of the total material cost**.

A fraction of an assembly that is considered renewable will be determined by weight, and then the material cost will be determined according to that percentage.

**Percentage of Rapidly Renewable Materials = Total Cost of R.R. Materials**

**Total Cost of Materials**

5% Exemplary Performance
7. CERTIFIED WOOD

Encourage environmentally responsible forest management.

Construction Submittal
Schematic - Architect / Contractor

Preconstruction: Calculate cost of all wood based materials, evaluate each for FSC certified content

Construction: Verify that all contributions discussed at bidding and precon are being used, COC numbers

Post-Construction: complete LEED online

Use a minimum of 50% of TOTAL cost of wood-based materials & products certified in accordance with

FSC Forest Stewardship Council Principles & Criteria. These include:

i. structural & general dimensioning framing
ii. flooring & sub-flooring
iii. wood doors & finishes

Temporary wood (for staging etc) can be included as long as all of it is.

1. COC Certification is awarded to companies that process, manufacture and/or sell products made of certified wood after audits verify proper accounting of material flows and proper use of FSC name.

   A. with FSC COC label on product (for individual sale), then the individual who purchases it
      a. does not need further COC unless he alters it (ex. Casework)
         (against FSC rules)
   B. without FSC COC label & lumber (not individually packaged)
      a. ex. Contractor as end user, needs copies of his vendor’s COC numbers

2. Forest Management Certification is awarded to responsible forest managers.

Pre-purchasing is wise but FOIC do not store at job site! Buying lower grade wood would be good.

FSC Pure & Mixed = 100% FSC
95% Exemplary Performance
Establish minimum indoor air quality performance to:
   i. prevent the development of indoor air quality problems in buildings and
   ii. contribute to the comfort and well-being of the occupants

Design Submittal
Schematic - MEP Engineer

Preconstruction: Verify whether or not the MEP has performed the analysis required (BOD)
Describe project’s ventilation design, confirm that project complies, natural: provide drawings

Meet the minimum requirements of
ASHRAE 62.1-2004 Sections 4-7 Ventilation for Acceptable Indoor Air Quality (standard practice)
   - NOT Thermal comfort Standards
   - Standard practice

Mechanically/Active ventilated buildings, use the Ventilation Rate Procedure (better than IAQ Procedure) OR applicable code, whichever more stringent
Ventilation Rate Procedure: by occupancy category, determine the outdoor air needed to ventilate
   - people-related source contaminants (occupancy density & activity)
   - area-related source contaminants (off-gassing etc)

Naturally/Passive ventilated buildings, also comply with ASHRAE 62.1-2004 paragraph 5.1:
   - location & size of openings
   - all spaces within 25 ft of operable openings
   - operable area at least 4% of net occupiable floor area
   - Mixed Mode spaces comply with Chapter 6.
Prerequisite

Minimize exposure of building occupants, indoor surfaces & ventilation air distribution systems to Environmental Tobacco Smoke Control.

Design Submittal

Pre-Design - LEED AP

Options 1, 2 & 3: Provide confirmation of the appropriate category

Smoking Rooms: cds for location, area separation & dedicated ventilation systems

Preconstruction: Investigate whether or note smoking is allowed in the building

ETS (aka Second Hand Smoke) consists of airborne particles emitted from the burning end of cigarettes, pipes and cigars and exhaled by smokers. These particles contain about 4,000 different compounds, up to 40 of which are known to cause cancer.

Option 1

- **Prohibit smoking** in the building
- Locate any **exterior** designated smoking areas at least **25 feet** away from:
  - Entries
  - Outdoor air intakes
  - Operable Windows

NO Exemplary Performance
Prerequisite

Minimize exposure of building occupants, indoor surfaces & ventilation air distribution systems to Environmental Tobacco Smoke Control.

Design Submittal

Pre-Design - LEED AP

Preconstruction: Investigate whether or not smoking is allowed in the building

Option 2
- Prohibit smoking in the building except in designated smoking areas:
  - Directly exhausted to outdoors
  - No recirculation of ETS air back to non-smoking areas
  - Enclose them with impermeable deck-to-deck partitions
  - (closed doors) exhaust to create average negative pressure of
    - at least 5 Pa average
    - minimum 1 Pa vs adjacent spaces
  - Performance monitoring:
    - Lasts 15 minutes (min 1 test every 10 seconds)
    - differential pressure w/ respect to adjacent spaces
    - worst transport air conditions
    - smoking rooms’ doors closed
    - ANSI-ASTM E-779 Testing for Air Leakage

Locate any exterior designated smoking areas at least 25 feet away from entries, outdoor air intakes, windows

NO Exemplary Performance
Prerequisite

Minimize exposure of building occupants, indoor surfaces & ventilation air distribution systems to Environmental Tobacco Smoke Control.

Design Submittal
Pre-Design - LEED AP

Option 3 - Residential Only
- Prohibit smoking in all common areas
- Locate any exterior designated smoking areas at least 25 feet away from:
  o Entries
  o Outdoor air intakes
  o Operable windows opening to common areas
- Minimize uncontrolled ETS pathways:
  o between residential units by sealing penetrations in walls, ceilings & floors
  o sealing vertical chases adjacent to units
  o if hallways vs units are not pressurized:
    ▪ weatherstrip doors
  o if hallways vs units are pressurized (see Option 2 for negative pressure specs):
    ▪ no need to weatherstrip doors
- Acceptable sealing of residential units in accordance with
  ▪ Residential Manual for Compliance with California’s 2001 Energy Efficiency Standards progressive sampling methodology, Chapter 4 (Compliance Through Quality Construction)
    ▪ Units must show less than 1.25 square inches leakage /100 square feet enclosure area (sum of all wall, ceiling & floor areas)

NO Exemplary Performance
Provide capacity for ventilation system monitoring to help sustain occupant comfort and well-being

Design Submittal - Schematic - MEP Engineer

Preconstruction: provide type of ventilation system, type of monitors, design narrative & drawings

Construction: Gather location & type of sensor documentation, PART OF COMMISSIONING

Install permanent monitoring systems that provide feedback on ventilation system performance to ensure that ventilation systems maintain design minimum ventilation requirements. Configure all monitoring equipment to generate an alarm when the conditions vary by 10% or more from set point via either:

OUTDOOR AIRFLOW MONITORING - Mechanically Ventilated less densely occupied
- airflow devices (pitot tubes, venture meters & rotating vane anemometers, or mass balance calculation
  - NOT air balance methods, fan-tracking & building pressurization strategies
- typically located in the outdoor air intakes or each HVAC system
- accuracy of plus or minus 15% of design minimum air rate; if not:
  - a building automation system alarm to the building operator or
  - via a visual or audible alert to the building occupants
  - BAS Building Automation System may trigger corrective action
- CAVs, different rates for weekdays etc, VAVs rate needs to stay constant even at reduced supplies

CO2 MONITORING - ASHRAE 62.1-2004 - link to HVAC system not necessary (1100 ppms max?)
- Ex. DCV Demand Controlled Ventilation: CO2 monitor determines outdoor air rate (energy conservation for variable occupancy spaces)
- Densely occupied Mechanically ventilated Buildings: 25 people / 1000 sf. (monitor each space)
- Naturally Ventilated Buildings vertical breathing zone 3-6 feet
  - Just 1 sensor needed if design uses passive stacks or equal & simultaneous airflow through all spaces w/o occupant intervention

NO Exemplary Performance
Provide additional outdoor air ventilation to improve indoor air quality for improved occupant comfort, well-being, and productivity

Design Submittal

Schematic - MEP Engineer / Contractor
Include Credit info in EA1 as it may be compromised

MECHANICALLY Ventilated + Mixed-Mode Spaces
- Increase breathing zone outdoor air ventilation rates to all occupied spaces by at least 30% above the minimum rates at ASHRAE 62.1-2004 (2001 was 50% - 25 cfm/person)
- use HEAT RECOVERY to minimize EA consumption because of high ventilation rates

NATURALLY Ventilated Spaces (milder environments typically, not only though)
- meet recommendations of Carbon Trust Good Practice Guide 237
- CIBSE Chartered Institution of Building Services Engineers Applications Manual:
  o follow flow diagram process in it to determine if natural is effective strategy

1. Compliance path of CIBSE (use diagrams and calculations to show that the project meets their recommendations)
   a. Establish required flow rates through each space
   b. Explain ventilation strategy, airflow paths, different rates, peak temps
   c. Operable window size calcs according to CIBSE
   d. Driving pressure calcs for wind & stack-induced pressure differentials

2. Use macroscopic, multi-zone analytic model to predict that room-by-room airflows will effectively naturally ventilate per minimums in ASHRAE 62.1-2004 at least 90% of spaces
   a. Room-by-room outdoor airflow rates
   b. Narrative w/ same info as for CIBSE compliance

NO Exemplary Performance
Reduce indoor air quality problems resulting from the construction / renovation process in order to help sustain the comfort and well-being of construction workers and building occupants.

Construction Submittal

Construction Administration - MEP Engineer, Contractor

Preconstruction/bidding: verify with all subcontractors for achievement of compliance
  Provide copy of IAQ plan, confirm air handler use, media & replacement
  Construction: weekly walkthroughs & digital photo documentation

Develop and implement an IAQ Management Plan for the construction & pre-occupancy phases of the building as follows.

1. Meet the criteria of: **SMACNA Sheet Metal and Air Conditioning Nat’l Contractors Association**: 
   - during construction meet or exceed the recommended control measures
     - HVAC protection - ideally do not use, seal & protect from odors and dust
     - Source Control - low toxicity levels
     - Pathway Interruption - 100% outside air ventilation ideal, depressurize work areas
     - Housekeeping
     - Scheduling - sequence carefully
2. Protect stored on-site or installed absorptive materials from moisture damage
   - carpet, ceiling tile & gypsum board
3. if permanently installed air handlers are used during construction (avoid if possible)
   - filtration media with a **MERV 8** Minimum Efficiency Reporting Value shall be used at each return air grille (ASHRAE 52.2-1999)
   - all media shall be immediately replaced prior to occupancy OR prior to flush-out
   - coordinate with **EQ Credits 3.2 & 5**

NO Exemplary Performance
Reduce indoor air quality problems resulting from the construction / renovation process in order to help sustain the comfort and well-being of construction workers and building occupants.

Construction Submittal

Construction Administration - MEP Engineer, Contractor

Preconstruction/bidding: inform & verify with all subcontractors for achievement of compliance

Construction: weekly walkthroughs & digital photo documentation

Option 1 - Flush Out - Commissioning can occur carefully

- after construction, all finishes installed, prior to occupancy
- after punchlist items and after cleaning
- replace hvac media unless only outside air is filtered
  o Supply total air volume of **14,000 cu.ft. outdoor air / sf of floor area**
  o Maintain internal temperature of **minimum 60 degrees F**
  o Maintain relative humidity of **60% maximum**
    
    OR

- if occupancy before completion of the flush out is desired:
  o occupancy once **3,500 cu.ft. outdoor air / sf of floor area minimum** is provided
  o once occupied:
    ▪ ventilate at **0.30 cfm/sf minimum OR rate from EQ prerequisite 1**, whichever is greater
    ▪ each flush out day:
      • begin ventilation 3 hours minimum before occupancy & during it
      • maintain flush out until **14,000 cu.ft. / sf** of outside air has been delivered
        - switch HVAC system to its normal operational mode
Reduce indoor air quality problems resulting from the construction / renovation process in order to help sustain the comfort and well-being of construction workers and building occupants.

Construction Submittal
Construction Administration - MEP Engineer, Contractor
Preconstruction/bidding: inform & verify with all subcontractors for achievement of compliance
Construction: weekly walkthroughs & digital photo documentation
Post-Construction: complete LEED online

Option 2 - Air Testing - SPECS
- replace all filtration media from Construction
- all interior finishes have to be installed (furniture recommended, but not required)
- baseline IAQ testing prior to occupancy consistent with United States Environmental Protection Agency Compendium of Methods for the Determination of Air Pollutants in Indoor Air
- demonstrate that the contaminant maximum concentrations are not exceeded
  - when sample fails, flush out and repeat from same place
  - samples taken
    o during normal occupied hours (although prior to occupancy)
    o minimum outside flow rates for ventilation systems
- minimum 1 sample /25,000 sf or of contiguous floor area per separate system
- samples collected between 3 and 6 feet - vertical breathing zone
- over minimum 4 hour period
- include least ventilated areas & greatest presumed source strength

Common contaminants: formaldehyde (50ppbs), particulate matter PM10 (50 micro/m30), TVOCs (500 micrograms/m3), 4-PCH (6.5 micro/m3) & Carbon Monoxide (9 ppm, 2 ppm over outdoor concentrations)

NO Exemplary Performance
Reduce the quantity of indoor air contaminants that are odorous, irritating and/or harmful to the comfort and well being of installers and occupants.

Construction Submittal
Design Development - Architect / Contractor
Preconstruction: review specifications; obtain lists from subs during bidding
Provide listing of each indoor adhesive, sealant & sealant primer
Product & Manufacturer’s name, VOC data & corresponding allowable VOC & narrative
Construction: verify subs’ use of materials they previously listed, document weekly
Post-Construction: complete LEED online

VOC Volatile Organic Compounds are carbon compounds that participate in atmospheric photochemical reactions except:
- carbon monoxide
- carbon dioxide
- carbonic acid
- metallic carbides and carbonates
- ammonium carbonate
They vaporize / become a gas at normal room temperatures.

All adhesives & sealants used inside (inside of the weatherproofing system and applied on-site) comply with SCAQMD South Coast Air Quality Management District.
Aerosol adhesives: Green Seal Standard GS 36

NO Exemplary Performance
Reduce the quantity of indoor air contaminants that are odorous, irritating and/or harmful to the comfort and well being of installers and occupants.

Construction Submittal
Design Development - Architect / Contractor

- **INTERIOR PAINTS, COATINGS & PRIMERS** limits in Green Seal Standard GS-11
  - Flats: 50 g/l (minus water)
  - Non-flats: 150 g/l

- **ANTI-CORROSIVE & ANTI-RUST PAINTS** limits in Green Seal Standard GC-03

- **CLEAR WOOD FINISHES & COATINGS** limits in SCAQMD Rule 113
  - Clear wood finishes:
    - Varnish 350 g/l
    - Lacquer 550 g/l
  - Floor coatings: 100 g/l
  - Sealers:
    - Waterproofing: 250 g/l
    - Sanding 275 g/l
    - All others 200 g/l
  - Shellac:
    - Clear 730 g/l
    - Pigmented 550 g/l
    - Stains 250 g/l

NO Exemplary Performance
Reduce the quantity of indoor air contaminants that are odorous, irritating and/or harmful to the comfort and well being of installers and occupants.

Construction Submittal

EMISSION-BASED Design Development - Architect / Contractor

Design Phase: Include info in specifications, Division 1 & technical division, maybe make requirements a condition of product approval?

Construction Phase: Stress importance during pre-bid meetings & after contract award, include requirements in subcontract and purchase order language

VOC Budget: (EQ Credits 4.1 & 4.2) the overall low-VOC performance has been attained for paints and adhesives separately, not in combination. Multiply the volume of the product used by
- the threshold VOC level for the baseline case and
- the actual product VOC level for the design case

All installed carpet & carpet cushion to meet Carpet & Rug Institute’s Green Label Plus Program.

Emission rates must be verified by conducting annual testing - test results submitted must be no more than 2 years old at time of submission.

All installed carpet adhesives meet EQ Credit 4.1 VOC limits of 50g/L

NO Exemplary Performance
Reduce the quantity of indoor air contaminants that are odorous, irritating and/or harmful to the comfort and well being of installers and occupants.

Construction Submittal

Design Development - Architect / Contractor
Preconstruction: review specifications, obtain lists from subs during bidding
Construction: verify subs’ use of materials they previously listed, document weekly
Post-Construction: complete LEED online

Agrifiber Board is a composite panel product from recovered agricultural waste fiber mixed with resins
- wheat board, strawboard

Composite Wood consists of wood or plant particles mixed with resin.
- Particleboard, MDF medium density fiberboard, Plywood, OSB, Panel substrate, Door cores

- Composite wood & agrifiber products AND
- Laminating adhesives used to fabricate them (field & shop applied) should NOT contain urea-formaldehyde resins (no more than 0.1 ppm)

NO Exemplary Performance
Minimize exposure of building occupants to potentially hazardous particulates and chemical pollutants.

Design Submittal

Design Development - LEED AP, MEP Engineer, Contractor

Provide confirmation of all 3 requirements, Post-Construction: complete LEED online

ASHRAE 52.2-1999 (MERV: 1. ability to remove particles from air stream, and 2. its resistance to airflow)

- permanent entryway (regular entry points) systems
  - six feet long minimum in the primary direction of travel
    - permanently installed grates, grilles or slotted systems allowing for cleaning underneath
    - roll-out mats maintained on a weekly basis by a contracted service organization

- hazardous gas or chemicals areas: (garage, laundry, copy areas)
  - self-closing doors
  - deck to deck partitions or a hard lid ceiling
  - (dedicated - no return) exhaust system to create negative pressure vs adjacencies (doors closed)
    - rate of at least 0.50 cfm/sf with no air recirculation
    - pressure differential with surrounding spaces:
      - at least 5 Pa average
      - minimum 1 Pa with doors closed

- mechanically ventilated spaces: MERV 13 (Minimum Efficiency Reporting Value) or better
  - PSE Particle Size Removal Efficiency (based on 3 particle sizes)
  - both return and outside air to be delivered as supply

Additional HVAC may affect:
- Commissioning
- Measurement & Verification
- HVAC system design (capable of accommodating MERV 13)

NO Exemplary Performance
Provide a high level of lighting system control by individual occupants or by specific groups in multi-occupant spaces (i.e., classrooms or conference areas) to promote the productivity, comfort and well-being of occupants.

**Design Submittal**

*Design Development - Lighting Designer, MEP Engineer*

Provide information on strategy & number/type of controls

Post-Construction: complete LEED online

1. Provide **individual lighting controls for 90% min** of the building occupants for adjustments to suit individual task needs and preferences. Don’t have to be permanently wired.

2. Provide lighting system **controllability for all shared multi-occupant spaces** to enable lighting adjustment that meets group needs and preferences.

**Adjustable Task Lighting** at minimum, enables occupant to turn fixture on and off

- Include Task Lighting in **EA P2 & EA 1**
- Integrate daylighting (**EQ 8.1 & 8.2**)

**Shared Multi-Occupant Spaces** should have control over lighting scheme either fixtures or daylighting to suit their needs.

Determine if commissioning will be required.

NO Exemplary Performance
Provide a high level of thermal comfort system control by individual occupants or by specific groups in multi-occupant spaces to promote the productivity, comfort and well-being of building occupants.

Design Submittal
Design Development - MEP Engineer

Pre-construction: review ventilation controls, complete LEED online
Provide list of total individual & multi-occupant spaces and list of thermal controls & narrative

Post-construction: verify that everything is taken care of

1. Provide
   a. individual comfort controls OR
   b. operable windows for occupants
      i. 20 feet inside
      ii. 10 feet either side of the window
      iii. **ASHRAE 62.1-2004** (Operable Area = 4% of net occupiable floor area)
         Natural Ventilation should be met
   For **50% min of building occupants**

2. Provide
   a. Comfort system controls for all multi-occupant/transient spaces
      i. Defined as control in **at least one** of these environmental factors defined in **ASHRAE 55-2004** (acceptable to 80% or more occupants within a space)
         1. AIR TEMPERATURE
         2. RADIANT TEMPERATURE (THERMAL RADIATION)
         3. AIR SPEED
         4. HUMIDITY

Commissioning and Measurement & Verification attention may be required.
Daylighting and view strategies are also affected.

NO Exemplary Performance
Provide a comfortable thermal environment that supports the productivity and well-being of building occupants.

Design Submittal
Design Development - MEP Engineer

Design HVAC systems, Building envelope to meet **ASHRAE 55-2004 Thermal Comfort Conditions for Human Occupancy.**

Based on **PMV Predicted Mean Vote model:** relates comfort based on the thermal sensation scale (-3 to +3) incorporating heat balance principles. (max air speed 40 fpm)

**Natural ventilation:** by thermal, wind, diffusion effects through doors, windows or other intentional openings in the building. For this, ASHRAE 55-2004 allows for broader temperatures (monthly averages) that are independent of humidity, air speed and clothing considerations.

**Thermal Comfort** condition of mind: satisfaction with the thermal environment
**Personal thermal comfort factors:** metabolic rate, clothing levels etc

**Comfort criteria** are specific original design conditions that at minimum include
- temperature
- humidity
- air speed
- outdoor temp & humidity design conditions, clothing & activity

Coordinate with EAp1, EA 1 & EA 2.

NO Exemplary Performance
Provide for the assessment of building thermal comfort over time.

Design Submittal

Design Development - Building Management

Provide narrative describing survey planned, and plan for corrective actions if needed

Pre-construction: MEP design in accordance with ASHRAE 55-2004

Agree to implement a building occupant survey
- 6-18 months after occupancy
- anonymous responses
- overall satisfaction

Agree to develop a corrective action plan if
- 20% dissatisfaction (PMV below 0)
- plan to include ASHRAE 55-2004 compliance

Thermal discomfort is often caused by local variations in the thermal environment.
Corrective actions typically include control adjustments, operating modes, schedules, diffuser airflow adjustments & solar control.

NO Exemplary Performance
Provide for the building occupants a connection between indoor spaces and the outdoors through the introduction of daylight & view into the regularly occupied areas of the building.

Design Submittal

Schematic - Architect, Lighting Designer & LEED AP

Preconstruction: review design
Construction: review any changes

Complete template calculation: spreadsheet: occupied space area, glazing area & type, Tvis

Methods of daylighting: orientation, shallow floor plates, increased building perimeter, shading devices.

OPTION 1 - CALCULATION

Achieve **minimum glazing factor of 2%** in a **minimum 75%** of all regularly occupied areas.

**Glazing Factor** is the ratio of exterior illumination to interior illumination expressed as a percentage.

Variables:
- floor & window areas
- window geometry
- window height
- visible transmittance

Exclude light shelves, partitions, significant exterior obstructions or exterior reflective surfaces.

**Vision glazing:** 2’-6” - 7’-6”

**Daylight glazing:** 7’-6” + most effective as distributing light deep into interiors.

**Visible Light Transmittance** is the ratio of total transmitted light to total incident light.

\[
GF = \frac{\text{Window Area (sf)}}{\text{Floor Area (sf)}} \times \text{Window Geometry} \times \frac{\text{Actual Tvis}}{\text{Min. Tvis}} \times \text{Window Height Factor}
\]

Exemplary Performance: 95%
Provide for the building occupants a connection between indoor spaces and the outdoors through the introduction of daylight & view into the regularly occupied areas of the building.

Design Submittal

Schematic - Architect, Lighting Designer & LEED AP

Complete template calculation spreadsheet: total occupied space, total space w/ 25 foot candle min

OPTION 2 - SIMULATION

Computer simulation demonstration that **25 foot-candles** daylight minimum in

- clear sky conditions, noon,
- on the equinox (March 21, September 21) for specific geographic location
- 30 inches above the floor - DESK HEIGHT

in **75% minimum** of all regularly occupied areas

1. Create daylight simulation model
   a. include glazing factors & surface reflectance settings for interior finishes
   b. include horizontal calculation grid at 30” above floor (typical work plan height - desk)
   c. 2 foot intervals

2. Create spreadsheet with
   a. Regularly occupied areas w/ respective minimum illumination level
   b. Spaces with above 25 foot candles counts towards credit!
   c. Sum all the square footages that count & divide by total regularly occupied square footage

Provide documentation of Glare Control: 1. Fixed Exterior, light shelves, louvers, blinds, fins, shades

Photo-responsive controls may require Commissioning & m&v attention

**Exemplary Performance: 95%**
Provide for the building occupants a connection between indoor spaces and the outdoors through the introduction of daylight & view into the regularly occupied areas of the building.

Design Submittal
Schematic - Architect, Lighting Designer & LEED AP

Template Calculation Spreadsheet: total area & total area with minimum 25 fc & copies of drawings w/ simulation results & narrative

OPTION 3 - MEASUREMENT
Records of indoor light measurements that have 25 foot-candles daylight minimum in
- 75% minimum of all regularly occupied areas
- 10 foot grid recorded on building floor plans
- Per room/space, square footage with above 25 foot candles count - does not have to be 100%
- Below 25 foot candle areas/spaces count toward total occupiable area

ALL CASES:
- From each space, only square footage that meets minimum illumination reqs can count
- Provide daylight redirection and/or glare control
  o Fixed exterior shading devices
  o Light Shelves, interior & exterior
  o Interior Blinds or Pull-Down Shade
  o Fritted Glazing
  o Drapes
  o Electronic Black-Out Glazing

Photo- responsive controls would required Commissioning & Measurement & Verification

Exemplary Performance: 95%
Provide for the building occupants a connection between indoor spaces and the outdoors through the introduction of daylight & view into the regularly occupied areas of the building.

Design Submittal
Schematic – Architect & LEED AP
Preconstruction: review design

Complete spreadsheet w/ areas info, provide plans & sections & narrative for special occupancies
Construction: review any changes

Achieve **DIRECT LINE OF SIGHT** to the outdoor environment via Vision glazing (between 2’-6” and 7’-6”)
In **90%** of all regularly occupied areas. Determine/total the regularly occupied areas that have:

1. **Line of Sight to Perimeter Glazing** in plan, the area is within sight lines from perimeter vision glazing
   a. based on square footage
   b. vision glazing & full height partitions  **AND**
2. **Horizontal Views** in section, a direct sight line can be drawn from the area to perimeter vision glazing (seated eye 42”)
Lines can be drawn through interior glazing for both.

**Private offices only:**
   entire square footage can be counted if 75% of more has direct sight line to perimeter vision (if less, only compliant area counts)

**Multi-occupant offices**
   actual square footage with direct sightline to perimeter vision glazing

Well designed daylight = 50% - 80% light energy reduction! 😊

**Exemplary Performance Vague**