GREEN GLOBES FOR NEW CONSTRUCTION 2021

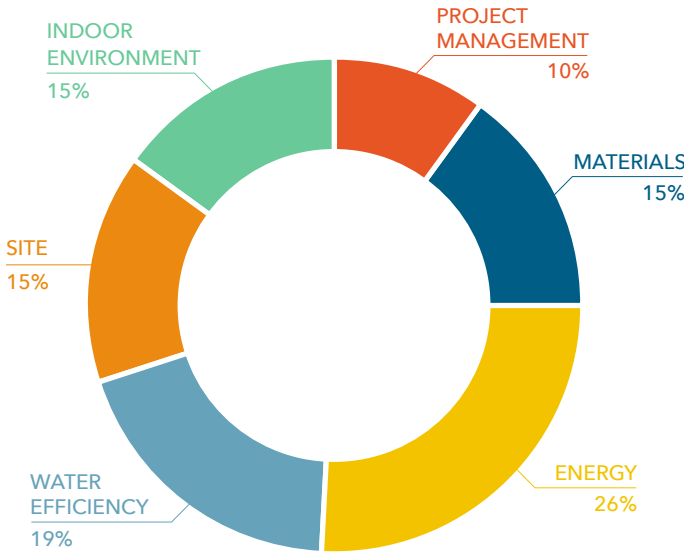
Learning Objectives

- Understand the Environmental Assessment Areas and point allocations for Green Globes for New Construction 2021
- Review the Environmental Assessment Areas, criteria, and applicable examples for Green Globes for New Construction 2021

ENVIRONMENTAL ASSESSMENT AREAS

SI	NC	EB
Project Management	Project Management	ESG Management
N/A	Site	Site
Energy	Energy	Energy
Water	Water Efficiency	Water
Materials & Resources	Materials	Materials
Emissions	N/A	N/A
Indoor Environment	Indoor Environment	Indoor Environmental Quality

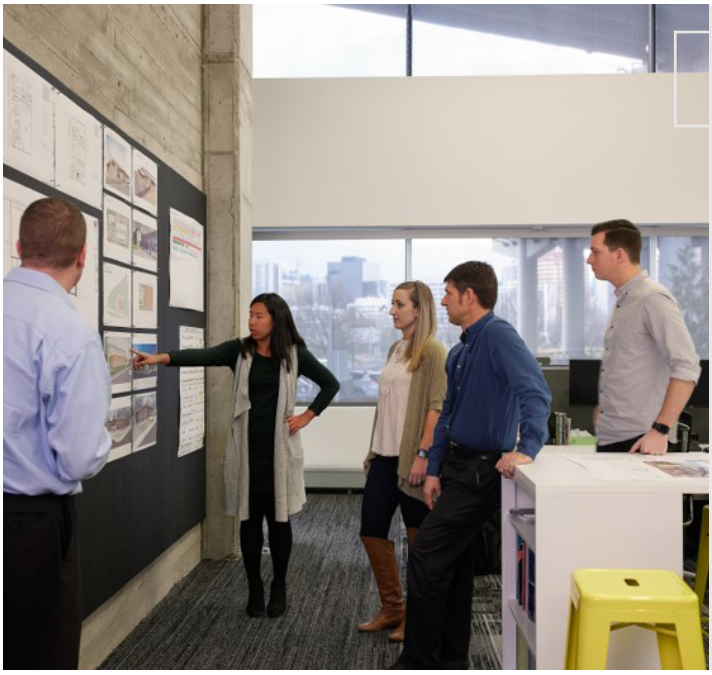
As previously mentioned, there are 1000 total points possible within Green Globes which are allocated differently under the New Construction, Sustainable Interiors and Existing Buildings programs. The diagram demonstrates the point distribution for the seven assessment areas within the NC 2021 program. Energy contains the most potential points followed by Water Efficiency.



PROJECT MANAGEMENT

The Project Management Environmental Assessment Area addresses the planning process and monitoring by project teams and building owners from pre-design through building construction and commissioning.

1	6	PROJECT MANAGEMENT	100
1.1	6.1	Team & Owner Planning	45
1.2	6.2	Environmental Management During Construction	8
1.3	6.3	Life Cycle Cost Analysis or Building Service Life Planning	12
1.4	6.4	Moisture Control Analysis	6
1.5	6.5	Commissioning or Systems Manuals & Training	29



Eco-Charette meetings with the building owner and various disciplines are critical at the beginning of design, as they can dictate the sustainability vision for the project.

The owner has functional goals for the project based on building type, location and budget, and it is important to incorporate sustainability goals by weighing costs and benefits of various design elements.

It is also important to document goals in writing and monitor progress along the way to hold the team accountable. This information can help project teams determine the intended performance of individual measures and how they collectively maximize the building's sustainability.

Green Globes NC 21 guides resilience of the built environment, and project teams are encouraged to evaluate risks to the building including continued occupancy resulting from extreme natural events, global climate change, and human activity for the expected service life of the building, determined by a Building Risk Assessment.

Project teams and building owners can develop strategies using the guidance in this environmental assessment area to reduce impacts during construction, through the creation and use of an Emergency Management System (EMS) by the general contractor (GC) or construction manager (CM). With the use of either a Life Cycle Assessment (LCA) or building service life plan, teams can establish and guide processes for maintenance, replacement, and capital improvements.

Suggested Documentation

- Owner's Performance Requirements (OPR)
- List of written performance and green design goals
- Progress meeting agendas, attendance rosters showing function of each attendee, and meeting minutes
- Site and building resilience narratives and/or report
- Emergency Preparedness Manual
- Environmental Management Plan
- Capital asset plan and business case summary
- Building service life plan
- Moisture Control Report
- Final Commissioning Report, Systems Manual,training syllabus and evidence of completion
- Systems Manual, training syllabus and evidence of training completion

SITE

The Site Environmental Assessment Area addresses impacts to the development area, the surrounding ecology, transportation, and resilience.

2	7	SITE	150
2.1	7.1	Development Area	35
2.2	7.2	Transportation	31
2.3	7.3	Construction Impacts	34
2.4	7.4	Stormwater Management	21
2.5	7.5	Landscaping	21
2.6	7.6	Light Pollution	5
2.7	7.7	Wildland-Urban Interface Site Design	3

Project teams are encouraged to evaluate various aspects of site selection, including consideration of Urban Infill and Urban Sprawl. Project teams are incentivized to choose a site that was previously developed and has been served by existing utility and transportation infrastructure, a Brownfield or remediated Superfund site, and to avoid sensitive sites and floodplains.

Transportation to and from the building is an important aspect of site selection. Project teams should consider distance and feasibility to public transport, methods that reduce dependency on single occupancy vehicles, alternative refueling facilities or charging stations onsite or nearby, infrastructure to encourage biking, and the site's walkability.

In regards to construction site planning and management, project teams are encouraged to evaluate and minimize disturbance to the surrounding site by protecting existing trees and shrubs, mitigating heat island effect with vegetated, shaded, or high SRI roofs and permeable surfaces, and by implementing design elements to limit bird strikes, such as angled glass and external screens.

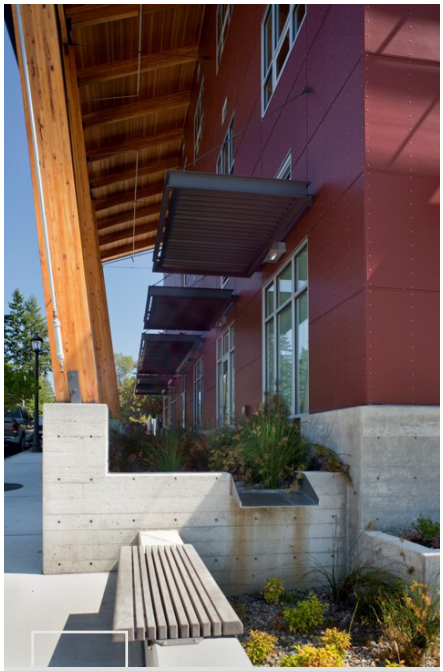
Heat island effect can contribute to over-warming a building in the warmer months, adding considerably to the cooling load which increases energy use. By reducing the heat island effect, the building remains naturally cooler, thereby reducing the amount of energy required to mechanically cool it in the warmer months. Roofs can be partially or fully vegetated to mitigate heat island effect. Plants and soil soak up rainwater in weather events to keep buildings cooler than they would with exposed asphalt. Roofs with a high Solar Reflectance Index and shading are other strategies that can be used to mitigate heat island effect.

Photo courtesy of Mackenzie

Construction activities can improve the natural integrity of the site by removing invasive plant species, replacing existing hardscapes with vegetation, restoring prairie or wetlands, or increasing onsite water retention through stormwater management by way of rain gardens, swales, retention ponds, or berms.

These photos are from a project that processes 100% of the stormwater volume by using several onsite bio swales that also function as landscape features. In Green Globes NC 21, full credit is awarded for sites retaining at least the 95th percentile storm volume as per a site water balance assessment.

Stormwater Management also evaluates types of vegetation and irrigation practices of landscaping.



A dip in the wall allows water to flow out of the first planter when full and into the next planter. This process also filters out the total suspended solids (TSS) and phosphorous before it reaches the ground.

A downspout into a planter, which provides a free, non-potable irrigation system and educational benefit to the public as a demonstration garden on water conservation.

Photos courtesy of Mackenzie

Most of the existing landscaping was preserved in the project seen on the right, including saving mature trees behind the building. All new landscape in front of the building is drought tolerant and/or native to the region. Non-invasive plants keep the surrounding landscape healthy and drought-tolerant plants require little to no irrigation.

Photo courtesy of Mackenzie

Exterior light pollution is the result of lighting that reaches over the property line and may deter occupants in surrounding buildings from opening their windows or blinds.

Green Globes NC 21 offers two pathways for assessing exterior light pollution: (of equal weight), a performance path and prescriptive path.

Project teams should conduct a light analysis to ensure low cut off angles that reduce exterior light pollution.

The exterior lighting in this example met the requirements of IDA-IES Model Lighting Ordinance for zero light trespass at the property boundary. The two primary design approaches used were directing light down and installing fixtures low to the ground to reduce horizontal light pollution.

Photo courtesy of Mackenzie

Site resilience is evaluated with the Wildland-Urban Interface Site Design to prevent fire hazard, with reference to ICC 2015 International Wildland-Urban Interface Code.

Suggested Documentation

- Documentation by EPA, municipal, or other governmental authority of Superfund and Brownfield site
- Community resilience, climate action, or similar mitigation plan
- Landscaping plans
- Pre-construction site documentation
- Government maps of wildland-urban interface areas
- Site civil plans and existing site civil plans
- Floodplain map
- Pre-construction site documentation
- Zoning maps
- Construction Documents
- Narrative stating total expected full-time building occupants
- Erosion and sediment control plan
- Construction Documents
- Tree preservation plan or landscaping or civil engineering plans that document the protection of existing trees during construction
- Landscaping and irrigation plans
- Shade site plan
- Ten-year hardscape shading plan
- Roof plans
- Photo-documentation
- Storm water discharge plan
- Soil boring reports
- Site plans, including all areas of hardscape
- Local or regional plant list
- Cut-sheets and calculations
- Exterior lighting plans
- Path taken for compliance to the MLO
- Percolation test results
- Area rainfall charts
- Storm water discharge plan
- Exterior lighting plans
- Electrical engineer's site lighting plan with illumination map
- Zoning ordinance requirements

ENERGY

The Energy Environmental Assessment Area is weighted most heavily in Green Globes NC 21.

3	8	ENERGY	260
3.1	8.1	Energy Performance	180
3.2	8.2	Non-Modeled Energy Efficiency Impacts	15
3.3	8.3	Metering, Monitoring, and Measurement	25
3.4	8.4	Renewable Sources of Energy	40

There are three pathways for assessing energy performance in Green Globes NC 21:

Path A: Performance – ANSI/ASHRAE/IES Standard 90.1-2010 Appendix G (180 points)

When pursuing Path A, the design team assembles a "model" of energy use under conventional design methods that meets the minimums established by Standard 90.1. This becomes the "baseline" by which all design case energy performance strategies will be measured. The objective is to design and implement energy design strategies that result in using less energy than the baseline.

Path B: Performance – Building Carbon Dioxide Equivalent Emissions (180 points)

Path B measures the reduction of carbon dioxide equivalent (CO2e) emissions over the established baseline.

Path C: Prescriptive for lighting, controls, HVAC equipment, hot water heaters and other systems (111 points)

Path C offers an alternative path with less points, providing prescriptive measures for energy efficiency for those projects that cannot meet the minimum achievement levels in performance paths A and B.

Photo courtesy of Mackenzie

In this example, a double interactive wall (or wall-mounted green house) was installed on the south side of the building to preheat cooler outdoor air prior to being processed by the building's heating system. The double interactive wall is capable of pre-heating air in the heating season by as much as 15 degrees. The warmed air then rises and is used in the HVAC system. This results in an annual energy savings of 10% below the threshold established by ANSI/ASHRAE/IES Standard 90.1-2010.

The double interactive wall combined with other energy efficient features helped this building achieve annual energy use up to 50% below the threshold established by ANSI/ASHRAE/IES Standard 90.1-2010.

The Energy Environmental Assessment Area also addresses Non-Modeled Energy, which can be determined through an energy modeling report. Project teams should include documentation describing any variances between models for plug and process loads.

Projects may earn credit for the percentage of a building's total site energy that is metered through building-level energy meters.

Sub-metering is encouraged in each tenant space to inform occupants of the rate of energy use and to incentivize them to reduce energy consumption.

Generally, if occupants are made aware of how much energy they are using (and paying for), they are more likely to conserve energy.

Projects receive credit for evaluating the use of renewables onsite with a feasibility study, and points may be achieved for the use of both onsite and offsite renewables.

Photo courtesy of Mackenzie

Suggested Documentation

- Energy Modeling Report
- Energy simulation program's inputs and results
- ENERGY STAR Target Finder results
- Lighting design permit documents (e.g. COMcheck reports)
- PER, BER, and CO2e emission reduction calculations
- Manufacturer's specifications, cut sheets, and performance documentation
- Mechanical design drawing, details, and specifications
- Fenestration ratios for north/south and east/west orientations
- Construction Documents
- List of SGHC values including calculations for overall performance
- List of thermal resistance or thermal transmittance factors, thermal conductance factors, and F-factors
- Construction Documents
- Fenestration ratios for north/south and east/west orientations
- Site plans
- List of lamps specified on the project
- LPD calculations and results (COMcheck is one acceptable calculation method)
- Lighting plans with controls information or separate lighting controls plan
- Floor plans illustrating daylight areas
- Roof plan illustrating skylight area
- Specifications for time switch/photo sensor
- Electrical exterior/site lighting plans
- BAS specifications
- Equipment specifications, control schedules, and diagrams
- Description and control specifications for load shedding systems

- Appliance and equipment inventory
- Purchase policy
- Description and control specifications for receptacle control systems
- Cut sheets for meters and meter reading equipment
- Resource Management Plan in the Operations and Maintenance Manual for both building level and sub-metering application
- Description of the monthly monitoring and verification reports that will be sent to building management and the process for constant feedback evaluation for improvement
- IPMVP Measurement & Verification Plan
- Study and financial evaluation for implementation
- Onsite renewable energy feasibility studies
- Onsite renewable energy construction documents
- Descriptive documentation of the utility provider's renewable energy sources used to provide consumable energy at the project
- Executed agreements on "green" power or REC contracts

WATER EFFICIENCY

The Water Efficiency Environmental Assessment Area focuses on reducing water consumption. Water conservation is addressed through the installation of fixtures including US EPA's WaterSense certified labeled plumbing fixtures and appliances and ENERGY STAR labeled appliances with low water factors.

4	9	WATER EFFICIENCY	190
4.1	9.1	Indoor Domestic Plumbing	54
4.2	9.2	Cooling Towers	22
4.3	9.3	Boilers and Hot Water Systems	9
4.4	9.4	Water Intensive Applications	19
4.5	9.5	Water Treatment	4
4.6	9.6	Alternate Water Sources	25
4.7	9.7	Metering	20
4.8	9.8	Leak Detection	10
4.9	9.9	Irrigation	27

Four paths are provided for assessing Indoor Domestic Plumbing:

Path A: ANSI/ASHRAE/ICC/USGBC/ IES Standard 189.1-2017, Section 6.3.2.1 (up to 52/52 points)

Path B: 2018 International Green Construction Code (IgCC) (up to 52/52 points)

Path C: 2020 IAPMO WEStand Section 402 (up to 52/52 points)

Path D: Major Renovations (up to 45/52 points)

This property harvests rainfall in retention ponds, which is stored and processed to provide 100% year-round irrigation and water for flushing toilets throughout the facility.

An underground tank holds water and an advanced filtration system allows the water to be reused.

In drier July and August months, the water tank is recharged with fire sprinkler water so that potable water is never used for landscaping.

Photos courtesy of Mackenzie

Other water efficient strategies include prescriptive measures for cooling towers, boilers and hot water systems, and water intensive applications.

In this area, project teams are awarded for incorporating innovative approaches for reusing water, water treatment, and using alternate sources of water, such as rainwater and gray water.

Project teams are encouraged to implement adaptive system monitoring for water leaks to mitigate loss due to leaks, and to incorporate a landscape design that does not require irrigation. Partial credit is awarded to projects that demonstrate best practices when minimal irrigation is required. the percentage of landscaping that does not require irrigation and best practices for irrigation when required.

Suggested Documentation

- ENERGY STAR labeling
- Manufacturer's published fixture flush and flow rates
- Manufacturer's published water use rates
- WaterSense labeling
- Plumbing plans
- Construction Documents
- Manufacturer's specifications, cut sheets, and performance documentation for pre rinse spray valves, ice machines, food steamers, dishwashers, and combination ovens
- Manufacturer's specifications, cut sheets and performance documentation for steam sterilizers, laboratory or medical equipment using non-potable water for once through cooling, water recycling units, and wet scrubbers
- Description of alternate water sources to be used
- Manufacturer's specifications, cut sheets, and performance documentation for all special water features and for all meters
- Manufacturer's specifications, cut sheets, and performance documentation for filtration systems, pressure drop gauges, reverse osmosis systems, water softeners, and recharge controls
- Designer's drawings, specifications, and performance documentation including estimated yield and calculations to demonstrate the percentage of water from non-potable sources and alternate water sources
- Building plans showing sub-meters
- Plan for billing of tenants
- Sub-meter specifications
- Landscape architect/designer approved irrigation plan

MATERIALS

Green Globes encourages life cycle thinking from project conception.

5	10	MATERIALS	150
5.1	10.1	Whole Building Life Cycle Assessment	20
5.2	10.2	Product Life Cycle	39
5.3	10.3	Product Risk Assessment	10
5.4	10.4	Sustainable Materials Attributes	15
5.5	10.5	Reuse of Existing Structures and Materials	30
5.6	10.6	Waste	26
5.7	10.7	Resources Conservation	10

A whole building life cycle assessment evaluates environmental impact by addressing at least two different building designs using ASTM E2921-16a and using at least three impact indicators.

This area also awards credit for Product Life Cycle through third-party verifications / certifications that measure cradle-to-gate product life cycle and the number of products that include verifications which evaluate the products through end of life (cradle-to-grave product) life cycle.

Product Risk Assessment evaluates the number of formulated products that have a completed Occupant Exposure Screening Report prepared in accordance with ASTM E3182-20. Points in this section are earned for discrete products with different functional uses and not variations of the same product unless the manufacturers show substantial difference between the chemical constituents or components.

Credit is earned under Sustainable Material Attributes based on the Sustainable Materials Index (SMI), which provides the percentage of the total value of building materials that have sustainable materials attributes.The sustainable materials attributes considered in calculating the SMI are pre-consumer recycled content, postconsumer recycled content, biobased content, third-party sustainable forestry certification content and materials or that meet the requirements of the Eco-Certified Composite sustainability standard. The SMI is the sum of the value of these attributes divided by the Total Materials Value (TMV) expressed as a percentage.

Sustainable Materials Index (%) =

$$\left(\frac{\begin{array}{l}\$ \text{ value of pre-consumer recycled content} + \\ \$ \text{ value of post-consumer recycled content} + \\ \$ \text{ value of biobased content} + \\ \$ \text{ value of third-party sustainable forestry certification content} + \\ \$ \text{ value of Eco-Certified Composite}\end{array}}{\text{TMV}} \right) \times 100$$

In this example, all wood materials used are third-party sustainable forestry certified.

The building's columns and beams are laminated timber made from certified wood products, as well as the decorative guardrail of the building's main staircase.

Photo courtesy of Mackenzie

Project teams are encouraged to reuse existing materials and structure whenever possible, and use of structural systems and non-structural interior systems and finishes from an existing building that are retained on site and incorporated in the new design. The percentage of the project that incorporates reused, refurbished and/or off-site salvaged materials in place of new materials also allows project teams to achieve credit in this area.

This building was constructed on the site of a warehouse that had been destroyed by a fire.

Many portions of the pre-redevelopment project were salvaged and incorporated in the new building design. The partial façade of the previous building was used as a screen for the site parking area (on the opposite side). The graffiti was also preserved to add character in this Portland, OR neighborhood.

Photo courtesy of Mackenzie

Reducing construction waste and diverting waste from landfills through reuse or recycling is evaluated through Post Occupancy Solid Waste Recycling rate verification with a third-party organization. The Supply Chain Waste Minimization section awards credit for sourcing products that come from facilities that divert over 80% of their waste.

The diversion rate is expressed as a percentage and calculated as follows:

$$\left\{1-\left(\frac{\text{Mass Landfilled + Mass Incinerated w/o Energy Recovery}}{\text{Mass Discarded Material}}\right)\right\}\times 100$$

Another important component of the Materials Environmental Assessment Area is Resource Conservation. In Green Globes NC 21, credit is earned for the percentage (above 5%) of the project that incorporates building elements produced by either Modular Construction, Prefabrication or both. Project teams are also encouraged to apply design for and document deconstruction (DFD) principles and provide the owner with a Deconstruction plan that addresses both partial and total deconstruction.

Suggested Documentation:

- Manufacturer's product data sheets or a statement from manufacturer(s) certifying claims or third-party certification from an organization that has the program in its SO 17065 scope of accreditation
- Calculation for area of existing major structural systems reused
- Construction Documents
- Calculations for surface area of existing non-structural elements reused
- Calculation for percentage of off-site material reused onsite
- Calculation for percentage of furniture reused
- Preconstruction waste management plan
- Waste management report
- Verification to ZWIA or UL 2799
- Manufacturer's specifications, cut sheets and performance documentation
- Design specifications
- Deconstruction Plan

INDOOR ENVIRONMENT

During the ANSI consensus process, subject matter experts weighed the benefits of the occupant comfort and wellness needs to create a standard with a human-centric approach. The Indoor Environment Assessment Area provides guidance for designing and constructing a safe, healthy, and productive space for tenants of any commercial building type.

6	11	INDOOR ENVIRONMENT	150
6.1	11.1	Air Ventilation and Quality	35
6.2	11.2	Source Control and Measurement of Indoor Pollutants	34
6.3	11.3	Lighting Design and Systems	32
6.4	11.4	Thermal Comfort	23
6.5	11.5	Acoustic Privacy and Comfort	26

Air Ventilation and Quality is heavily weighted, and credit is awarded if the quantity of ventilation is compliant with one of four standards or local codes or standards if they are more stringent. Air Change Effectiveness, Air Handling Equipment filtration and CO2 Sensing and Ventilation Control Equipment are also evaluated in this section.

In this example, operable windows allow occupants to bring in fresh outside air directly.

The impacts on building air circulation and thermal comfort for this project were calibrated between the operable windows and the building's HVAC system for optimal performance.

Smart controls were installed to sense when windows are open and adjust the HVAC as needed to maintain air balance and efficient operation.

Source Control and Measurement of Indoor Pollutants includes evaluating materials that contain reduced Volatile Organic Compounds (VOCs). Green Globes NC 21 offers two paths for achieving credit for Pre-Occupancy Indoor Air Quality Testing. Carbon Monoxide monitoring, water systems conforming with ASHRAE 188-2018 for legionellosis mitigation implementing an Integrated Pest Management Strategy, and eliminating Other Indoor Pollutants, such as tobacco and radon.

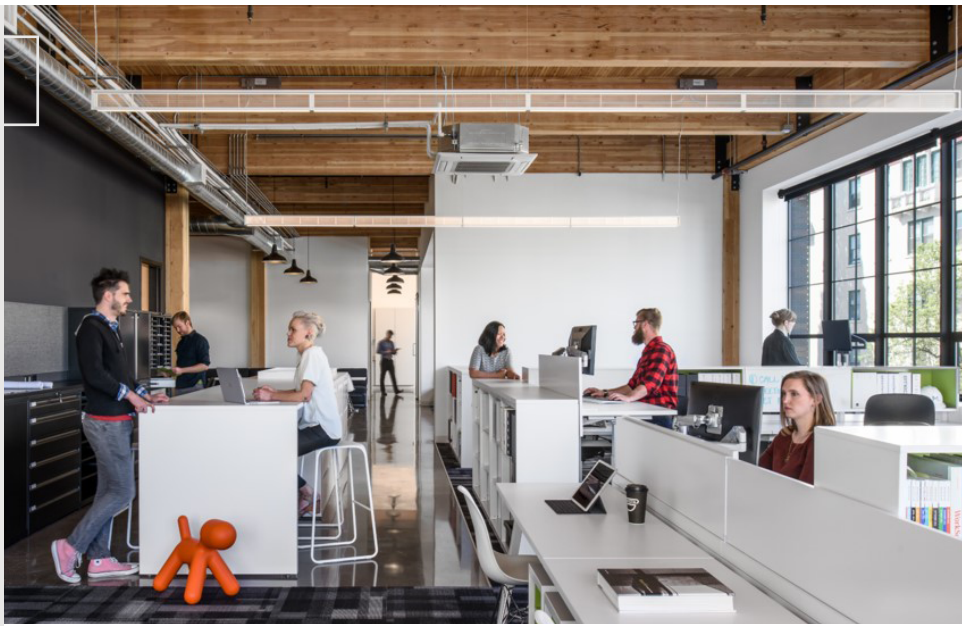
Photo courtesy of Mackenzie

Lighting Design and Systems measures daylighting levels and exterior views for occupants. The Lighting Sustainability section awards credit if the output of lights has lost no more than 30% of their initial output at 35,000 hours and if a lighting maintenance plan has been implemented.

Here, high ceilings and high windows allow daylight to penetrate deep into the space.

Lighting controls that automatically sense daylight levels brighten when the sky grows dark and dim when the sky brightens.

These controls reduce the need for artificial lighting and thereby reduce energy consumption. Natural daylight can also improve occupant health and productivity.



Thermal comfort zones are specific to building types or may be marked “Not Applicable” , and Thermal comfort design evaluates if HVAC systems are designed in conformance with ANSI/ASHRAE Standard 55-2017.

Acoustical Privacy and Comfort provides guidance for assessment, measurement and remediation, and addresses noise limits, masking sound level, and Acoustic Insulation and Vibration Isolation.

Suggested Documentation

- Balancing reports for the ventilation systems
- Engineering drawings and specifications for ductwork
- Filter submittals
- List of regularly occupied zones and associated air distribution system
- Engineering drawings and specifications for ductwork
- Balancing reports for the ventilation systems
- Local ventilation codes or standards
- Specifications for ventilation systems, CO2 sensing and ventilation control equipment
- Air-handling equipment submittals
- Occupant density calculation
- Ventilation air quality design data
- Ventilation schedule and tables
- HVAC drawings and specifications
- Design drawings
- Percentages and calculations for occupied areas with daylight illumination levels
- Percentages and calculations for primary occupied spaces with IESNA recommended task lighting levels
- Specifications for solar shading devices and luminaries
- Lighting plans
- Manufacturer’s specifications, cut sheets and performance documentation
- Basis of Design document AND/OR specifications
- Zone plan
- Documentation demonstrating compliance with ANSI/ASHRAE Standard 55- 2017, including relevant worksheets and report