

SITE SUSTAINABILITY

501.1 (5.1) Scope. This section addresses requirements for *building projects* that pertain to site selection, site development, mitigation of *heat island effect*, light pollution reduction, and mitigation of transportation impacts.

501.2 (5.2). (Reserved.)

501.3 (5.3) Mandatory Provisions.

501.3.1 (5.3.1) Site Selection. The *building project* shall comply with Sections 501.3.1.1 (5.3.1.1) and 501.3.1.2 (5.3.1.2).

501.3.1.1 (5.3.1.1) Allowable Sites. The *building project* shall take place in or on one of the following:

- a. An existing *building envelope*.
- b. A *brownfield*.
- c. A *greyfield*.
- d. A *greenfield* that is not *agricultural land*, *forest land*, or *designated park land* and that meets one or more of the following:
 1. The boundary of the area of the proposed *building project* is within $\frac{1}{4}$ mile (400 m) of *residential* land that is developed, or that has one or more *residential* buildings under construction, and the average *dwelling unit* density of the residential land is not less than 10 *dwelling units* per acre (4 units per ha).
 2. The proposed building complies with ASTM E2843.
 3. The proposed building complies with ASTM E2844.
- e. A *greenfield* that is *agricultural land*, and the purpose of the proposed building is related to the agricultural use of the land.
- f. A *greenfield* that is *forest land*, and the purpose of the proposed building is related to the forestry use of the land.
- g. A *greenfield* that is *designated park land*, and the purpose of the proposed building is related to the use of the land as a park.

501.3.1.2 (5.3.1.2) Prohibited Development Activity. There shall be no site disturbance or development of the following:

- a. [JO] Category IV *building projects* as defined by the *International Building Code*, on land located within a 0.2% annual chance flood hazard area.
- b. Previously undeveloped land having an elevation lower than 5 ft (1.5 m) above the elevation corresponding to a 1% annual chance flood.

Exception: Development of *low-impact trails* shall be allowed anywhere within a flood zone.

- c. Land within 150 ft (50 m) of any *fish and wildlife habitat conservation area*.

Exceptions:

1. Development of *low-impact trails* shall be allowed, provided that such trails are located at least 15 ft (4.5 m) from the area.
 2. Site disturbance or development shall be allowed for habitat enhancement measures.
- d. Land within 100 ft (35 m) of any *wetland*.

Exceptions:

1. Development of *low-impact trails* shall be allowed, provided that such trails are located at least 15 ft (4.5 m) from the *wetland*.
2. Site disturbance or development shall be allowed for habitat enhancement measures or for restoration of the functions of the *wetland*.

501.3.2 (5.3.2) Predesign Site Inventory and Assessment. A predesign inventory and assessment of the natural resources of the site shall be submitted with the site design and *construction documents*. The inventory and assessment shall include all of the following:

- a. Location of any prohibited development areas identified in Section 501.3.1.2 (5.3.1.2) that are located on or adjacent to the site.
- b. Identification of *invasive plant* species.
- c. Identification of *native plant* species.
- d. Identification of site features designated for preservation.

501.3.3 (5.3.3) Plants.

501.3.3.1 (5.3.3.1) Invasive Plants.

- a. *Invasive plants* shall be removed from the *landscaped areas* of the parcel of land and disposed of in a manner that prevents the plant from dispersing seeds or reproducing.

- b. *Invasive plants* shall not be planted.

Exception: Plants used as *turfgrass* or planted for the purpose of harvesting for human consumption shall not be subject to Section 501.3.3.1 (5.3.3.1).

501.3.3.2 (5.3.3.2) Greenfields. *Building projects on greenfields* shall comply with one of the following:

- a. Existing *native plants* shall be retained on not less than 10% of the area of the parcel of land.
- b. Not less than 20% of the area of the parcel of land shall be dedicated to *biodiverse plantings of native plants*.
- c. Not less than 30% of the area of the parcel of land shall be dedicated to *biodiverse plantings* other than *turfgrass*, and such plantings shall contribute to the local food web as determined by a *registered design professional*. The area of vegetated *roof* systems, vegetated terrace systems, and planters shall be permitted to meet not greater than 50% of the required area of *biodiverse plantings*.

501.3.3.3 (5.3.3.3) [JO] Plant Resiliency. Newly planted woody plants shall be *resilient plants*.

501.3.4 (5.3.4) Stormwater Management. Stormwater management systems shall be provided on the site. Except to the extent that other stormwater management approaches are required by a local, state, or federal jurisdiction, these systems shall be limited to one or more of the following management methods:

- a. Infiltration.
- b. *Evapotranspiration*.
- c. Rainwater harvesting.
- d. Stormwater collection and use.

501.3.4.1 (5.3.4.1) Projects on Greenfields. Projects on greenfields shall comply with at least one of the following:

- a. Stormwater management systems shall retain on site no less than the volume of precipitation during a single 24 hour period equal to the 95th percentile precipitation event. *Building projects* with stormwater management systems that are designed to retain volumes greater than that of the 98th percentile precipitation event shall conduct a hydrologic analysis of the building site to determine the water balance of the site prior to its development, clearing, and filling and to demonstrate that the stormwater management system will not cause ecological impairment by starving receiving waters downstream of the site.
- b. The stormwater management system design shall maintain site water balance (the combined runoff, infiltration, and *evapotranspiration*) based on a hydrologic analysis of the site's conditions prior to development, clearing, and filling. Postconstruction runoff rate, volume, and duration shall not exceed rates preceding development, clearing, or filling of the site.

501.3.4.2 (5.3.4.2) Projects on Greyfields. Projects on greyfields shall retain on site no less than the volume of precipitation during a single 24 h period equal to or greater than the 60th percentile precipitation event.

Exception: Where any fraction of the 60th percentile precipitation event cannot be retained, that fraction shall be treated to limit total suspended solids to 25 mg/L in the remaining discharge.

501.3.4.3 (5.3.4.3) Discharge Rate. Building projects shall be designed and constructed to comply with one of the following requirements:

- a. The discharge of the design storm shall occur over a period of not less than 48 hours.
- b. The discharge flow duration curve at any point in time shall be plus or minus 10% of the flow duration curve for channel-forming discharges for the parcel of land prior to its development, clearing, or filling.

501.3.4.4 (5.3.4.4) Adjoining Lots. The stormwater management system shall direct off-site discharge to avoid increased erosion or other drainage-related damage to adjoining lots or public property.

501.3.4.5 (5.3.4.5) Discharges from Contaminated Soils. Stormwater management systems on areas of brownfields where contaminated soils are left in place shall not use infiltration practices that will result in pollutant discharges to groundwater. Stormwater discharge from brownfields shall be treated to limit total suspended solids to 25 mg/L. Stormwater management systems shall not penetrate, damage, or otherwise compromise remediation actions at the site.

501.3.4.6 (5.3.4.6) Coal Tar Sealants. The use of tar sealants shall be prohibited in any application exposed to stormwater, wash waters, condensates, irrigation water, snowmelt, or icemelt.

501.3.5 (5.3.5) Mitigation of Heat Island Effect.

501.3.5.1 (5.3.5.1) Site Hardscape. At least 50% of the building project hardscape that is not covered by solar energy systems shall be provided with one or any combination of the following:

- a. Existing trees and vegetation or new *biodiverse plantings of native plants* and *adapted plants*, which shall be planted either prior to the final approval by the *AHJ* or in accordance with a contract established to require planting no later than 12 months after the final approval by the *AHJ* so as to provide the required shade no later than ten years after the final approval. The effective shade coverage on the *hardscape* shall be the arithmetic mean of the shade coverage calculated at 10 a.m., noon, and 3 p.m. on the summer solstice.
- b. Paving materials with a minimum initial *solar reflectance index (SRI)* of 29. A default *SRI* value of 35 for new concrete without added color pigment is allowed to be used instead of measurements.

- c. *Open-graded (uniform-sized) aggregate, permeable pavement, permeable pavers, and porous pavers (open-grid pavers).* Permeable pavement and permeable pavers shall have a percolation rate of not less than 2 gal/min × ft² (100 L/min × m²).
- d. Shading through the use of structures, provided that the top surface of the shading structure complies with the provisions of Section 501.3.5.3 (5.3.5.3).
- e. Parking under a building, provided that the *roof* of the building complies with the provisions of Section 501.3.5.3 (5.3.5.3).
- f. Buildings or structures that provide shade to the *hardscape*. The effective shade coverage on the *hardscape* shall be the arithmetic mean of the shade coverage calculated at 10 a.m., noon, and 3 p.m. on the summer solstice.

Exception: Section 501.3.5.1 (5.3.5.1) shall not apply to *building projects* in Climate Zones 6, 7, and 8.

501.3.5.2 (5.3.5.2) Walls. Building projects shall comply with the provisions of ASHRAE/IES Standard 90.1, Section 501.5.3.2.2 (5.5.3.2.2).

501.3.5.3 (5.3.5.3) Roofs. This section applies to the building and covered parking roof surfaces for building projects in Climate Zones 0, 1, 2, 3, 4A, and 4B. A minimum of 75% of the roof surface area shall be covered with products that:

- a. Have a minimum three-year-aged *SRI* of 64 in accordance with Section 501.3.5.4 (5.3.5.4) for *roofs* with a slope of less than 2:12.
- b. Have a minimum three-year-aged *SRI* of 25 in accordance with Section 501.3.5.4 (5.3.5.4) for *roofs* with a slope 2:12 or greater.

The area occupied by one or more of the following shall be excluded from the calculation to determine the *roof* surface area required to comply with this section:

- a. *Roof* penetrations and associated equipment.
- b. *On-site renewable energy systems*, including photovoltaics, solar thermal energy collectors, and required access around the panels or collectors.
- c. Portions of the *roof* used to capture heat for building energy technologies.
- d. *Roof* decks and rooftop walkways.
- e. Vegetated terrace and roofing systems complying with Section 501.3.5.5 (5.3.5.5).

Exceptions:

1. *Building projects* where an annual energy analysis simulation demonstrates that the total annual building energy cost and total annual CO₂e, as calculated in accordance with Sections 701.6.1 (7.6.1) and 701.6.2 (7.6.2), respectively, are both a minimum of 2% less for the proposed *roof* than for a *roof* material complying with the *SRI* requirements of Section 501.3.5.3 (5.3.5.3).
2. Existing buildings in Climate Zones 4A and 4B undergoing alteration, repair, relocation, or a change in occupancy.
3. *Roofs* used to shade or cover parking, and *roofs* over *semiheated spaces*, provided that they have a minimum initial *SRI* of 29. A default *SRI* value of 35 for new concrete without added color pigment is allowed to be used instead of measurements.
4. Ballasted *roofs* in Climate Zones 4A and 4B having a stone ballast of not less than 17 lb/ft² (83 kg/m²) or a paver ballast of not less than 23 lb/ft² (112 kg/m²).

501.3.5.4 (5.3.5.4) Solar Reflectance Index (SRI). The *SRI* shall be calculated in accordance with ASTM E1980 for medium-speed wind conditions using a convection coefficient of 2.1 Btu/h × ft² × °F (11.9 W/m² × °C) for the following conditions:

- a. For materials other than *roofs*, the *SRI* shall be based on solar reflectance, as measured in accordance with ASTM E1918 or ASTM C1549, and the thermal emittance, as measured in accordance with ASTM E408 or ASTM C1371. The values for solar reflectance and thermal emittance shall be determined and certified by an independent third party.
- b. For roofing products, the *SRI* values shall be based on a minimum three-year-aged solar reflectance and thermal emittance, as measured in accordance with CRRC S100, and shall be certified by the manufacturer.

501.3.5.5 (5.3.5.5) Vegetated Terrace and Roofing Systems. Vegetated terrace and roofing systems, where provided in accordance with Section 501.3.5.3 (5.3.5.3), shall comply with the following:

- a. All plantings shall be capable of withstanding the microclimate conditions of the vegetated area, including, but not limited to, wind, precipitation, and temperature. Plants shall be selected and placed to provide foliage coverage of not less than 50% of designed area of vegetation based on the anticipated plant growth within two years of the issuance of the final certificate of occupancy. *Construction documents* shall be submitted that show the planting location and anticipated two-year foliage coverage of the plantings. Duplicate coverage shall not be credited where multiple plants cover the same area. *Invasive plants* shall not be planted.
- b. The growing medium shall be designed for the physical conditions and local climate to support the plants selected. The planting design shall include measures to protect the growing medium until the plants are established. The maximum wet weight and water-holding capacity of a growing medium shall be determined in accordance with ASTM E2399.
- c. Nonvegetated clearances and borders shall be provided in accordance with the *International Fire Code*, Section 317.

- d. Plantings shall be capable of maintaining the function of the vegetated *roof* or terrace as required by Section 1001.9.1 (10.9.1).
- e. Irrigation of the vegetated *roofs* and terraces shall comply with Section 601.3.2.4 (6.3.2.4).
- f. Installation of plantings shall be in accordance with the *roof*-covering manufacturer’s installation instructions.

501.3.6 (5.3.6) [JO] Reduction of Light Pollution.

501.3.6.1 (5.3.6.1) Backlight, Uplight, and Glare (BUG) Ratings. Exterior luminaire backlight, uplight, and glare (BUG) ratings shall be in accordance with IES TM-15. Luminaire mounting heights shall be determined as the distance between the lowest point of a luminaire and the ground. All exterior lighting shall comply with items (a) through (c).

- a. Backlight: Building-mounted exterior lighting with backlight oriented towards the building is not required (NR) to have a maximum backlight rating. All other exterior lighting not building-mounted and building-mounted where backlight is not oriented towards the building shall have a backlight rating that is no greater than the maximum backlighting rating value in Table 501.3.6.1 (Table 5.3.6.1) that is a function of the horizontal distance between the *luminaire* and closest property line in multiples of *luminaire* mounting height and the *lighting zone*. *luminaires* not building mounted and located within two mounting heights of the nearest property line shall be oriented so the back-light portion of light output is oriented perpendicular toward the closest property line.
- b. Uplight: Exterior *luminaires* shall have an uplight rating that is no greater than the maximum uplight rating value in Table 501.3.6.1 (Table 5.3.6.1) for the *lighting zone*.

Exceptions:

- 1. Lighting in LZ3 and LZ4, solely for uplighting structures, building façades, or landscaping.
- 2. Lighting in LZ1 and LZ2, solely for uplighting structures, building façades, or landscaping, provided the applicable lighting power densities (LPDs) do not exceed 50% of the *lighting power allowances* in ANSI/ASHRAE/IES Standard 90.1, Table 9.4.2-2.
- c. Glare: Building-mounted exterior lighting with forward light oriented toward the building is not required (NR) to have a maximum glare rating. All other building-mounted lighting shall have a glare rating that is no greater than the maximum glare rating value in Table 501.3.6.1 (Table 5.3.6.1) as a function of the horizontal distance between the *luminaire* and closest property line in multiples of *luminaire* mounting height and the *lighting zone*. All exterior lighting not building-mounted shall have a glare rating that is no greater than the maximum glare rating value in Table 501.3.6.1 (Table 5.3.6.1) for the *lighting zone*.

Exceptions:

- 1. Specialized signal, directional, and marker lighting associated with transportation.
- 2. Advertising signage or directional signage.
- 3. Lighting integral to equipment or instrumentation and installed by its manufacturer.
- 4. Lighting for theatrical purposes, including performance, stage, film production, and video production.
- 5. Lighting for athletic playing areas.
- 6. Lighting that is in use for no more than 60 continuous days and is not reinstalled any sooner than 60 days after being uninstalled.
- 7. Lighting for industrial production, material handling, transportation sites, and associated storage areas.
- 8. Theme elements in theme/amusement parks.
- 9. Roadway lighting required by governmental authorities.
- 10. Lighting classified for and used in hazardous locations as specified in NFPA 70.
- 11. Lighting for *pools* and water features.

TABLE 501.3.6.1 (TABLE 5.3.6.1) MAXIMUM ALLOWABLE BACKLIGHT, UPLIGHT, AND GLARE (BUG) RATINGS ^{a,b,c,d}					
LIGHTING ZONE	LZ0	LZ1	LZ2	LZ3	LZ4
Allowed Backlight Rating—Building Mounted and Backlight Oriented Towards Building ^e	NR	NR	NR	NR	NR
Allowed Backlight Rating—All Other <i> luminaires</i>					
>2 mounting heights from property line	B1	B3	B4	B5	B5
>1 to 2 mounting heights from property line	B1	B2	B3	B4	B4
0.5 to 1 mounting height to property line	B0	B1	B2	B3	B3
<0.5 mounting height to property line	B0	B0	B0	B1	B2
Allowed Uplight Rating—All Exterior Lighting	U0	U1	U2	U3	U4
Allowed Glare Rating—Building-Mounted and Forward Light Oriented Towards Building ^e	NR	NR	NR	NR	NR

TABLE 501.3.6.1 (TABLE 5.3.6.1) MAXIMUM ALLOWABLE BACKLIGHT, UPLIGHT, AND GLARE (BUG) RATINGS^{a,b,c,d}—continued

LIGHTING ZONE	LZ0	LZ1	LZ2	LZ3	LZ4
Allowed Glare Rating—All Other Building-Mounted Lighting					
>2 mounting heights from property line	G0	G1	G2	G3	G4
>1 to 2 mounting heights from property line	G0	G0	G1	G1	G2
0.5 to 1 mounting height to property line	G0	G0	G0	G1	G1
<0.5 mounting height to property line	G0	G0	G0	G0	G1
Allowed Glare Rating—All Other <i>Luminaires</i>	G0	G1	G2	G3	G4
<p>a. Except where installed on a building surface, <i>luminaires</i> that are located at a distance of two times the mounting height of the <i>luminaire</i> or less from a property line shall have the backlight of the <i>luminaire</i> aimed toward and perpendicular to the nearest property line. Backlight is that part of the <i>luminaire</i>'s lumen output that was used to determine the backlight rating in its final angular position.</p> <p>b. For property lines that abut public walkways, bikeways, plazas, and parking lots, the property line may be considered to be 5 ft (1.5 m) beyond the actual property line for the purpose of determining compliance with this section. For property lines that abut public roadways and public transit corridors, the property line may be considered to be the centerline of the public roadway or public transit corridor for the purpose of determining compliance with this section.</p> <p>c. If the <i>luminaire</i> is installed in other than the intended manner, or is an adjustable <i>luminaire</i> for which the aiming is specified, the rating shall be determined by the actual photometric geometry in the aimed orientation.</p> <p>d. Backlight, uplight, and glare ratings are defined based on specific lumen limits per IES TM-15 Addendum A.</p> <p>e. NR = not required.</p>					

501.3.7 (5.3.7) Mitigation of Transportation Impacts.

501.3.7.1 (5.3.7.1) Pedestrian and Bicycle Connectivity.

501.3.7.1.1 (5.3.7.1) Pedestrian Walkways. Each *primary building entrance* shall be provided with a pedestrian walkway that extends to either a *public way* or a transit stop. Walkways shall not be less than 5 ft (1.5 m) in width and shall be clearly delineated.

A public-use walkway shall be provided along the length of the adjoining public-way frontage of the building project, and such walkways shall connect to adjacent public-use walkways.

501.3.7.1.2 (5.3.7.1.2) Bicycle Paths. On-site bicycle paths shall be designed to connect bicycle parking areas to existing and planned off-site bicycle paths adjacent to the *building project*.

501.3.7.2 (5.3.7.2) Bicycle Parking.

501.3.7.2.1 (5.3.7.2.1) Minimum Number of Spaces. Bicycle parking spaces shall be provided for at least 5% of the *occupant load* of each building but not fewer than two parking spaces. Occupants who are nonambulatory, under restraint, or under custodial care need not be included in the total *occupant load* for the building. *Building projects with dwelling units* shall be provided with at least 0.5 bicycle parking spaces per bedroom for each building but not fewer than two parking spaces.

Exceptions:

1. *Building projects with dwelling units* that provide each unit with a private garage or private, locked storage space of sufficient size to store a bicycle.
2. The number of bicycle parking spaces shall be allowed to be reduced where a transportation plan, prepared by a *registered design professional*, that demonstrates the likelihood that building occupants will use public transportation and/or walk to the site has been *approved*.

501.3.7.2.2 (5.3.7.2.2) [JO] Location. Not fewer than two bicycle parking spaces shall be located within 50 ft (15.2 m) of, and be visible from, the *building entrance* being served. All other bicycle parking spaces shall be located inside the building, or the nearest point of the bicycle parking areas shall be within 50 ft (15.2 m) of the *building entrance* being served. Bicycle parking shall not obstruct pedestrian access to the building.

501.3.7.2.3 (5.3.7.2.3) [JO] Horizontal Parking Racks. Horizontal bicycle parking racks shall provide a space for each bicycle that is not less than 18 in. (305 mm) in width and not less than 72 in. (1829 mm) in length. Each space shall provide at least two points of contact between the bicycle frame and rack. Each space shall have access to a clear exit pathway not less than 36 in. (914 mm) in width.

501.3.7.2.4 (5.3.7.2.4) Ability to Lock. Each bicycle parking space shall be provided with a securely mounted rack or other facilities for locking or securing a bicycle. A rack shall allow the locking of the frame and the front or rear wheel of the bicycle to the rack using a U-shaped shackle lock.

501.3.7.2.5 (5.3.7.2.5) [JO] Security and Visibility. All bicycle parking spaces shall be visible from the entrance being served; secured in a locker, cage, or room; or provided with valet service or security cameras. Signage shall be provided to identify parking that is not visible from the *building entrance*.

501.3.7.2.6 (5.3.7.2.6) Documentation. *Construction documents* shall include plans and details showing compliance with Sections 501.3.7.2.1 (5.3.7.2.1) through 501.3.7.2.5 (5.3.7.2.5).