EF 12: REDUCE SUMMER HEAT WITH COOL, SHADY BUILDING LOTS

New York City Building Code
Proposal developed by the Site & Site Stormwater Committee

Summary

Issue:
Unbuilt areas on private building lots make up approximately one third of New York City’s space. Because these areas are often covered in dark, unshaded pavement, they contribute to the city’s heat island.

Recommendation:
Require light-colored pavement, trees or plantings on 50% of the unbuilt areas of building lots.

Proposed Legislation, Rule or Study

Amendments to the New York City Building Code

1. Add a new Chapter 34 as follows:

CHAPTER 34
SITE AND LANDSCAPING

SECTION BC 3401
GENERAL

3401.1 Scope. The provisions of this chapter shall govern the materials, design, construction and quality of the site and landscaping.

SECTION BC 3402
DEFINITIONS

3402.1 Definitions. The following words and terms shall, for the purposes of this chapter, have the following meanings.

HARDSCAPE. Non-built area that is impervious, such as roads, walks, courtyards and parking lots.

OPEN-GRID PAVEMENT. Pavement that is at least 50% pervious and contains vegetation in the open cells.

NON-BUILT AREA. The area of a site that does not include the building footprint or any area used exclusively for athletic activities, such as ballfields, tennis courts, basketball courts or swimming pools. This definition includes turf grass areas that may be used for multiple purposes, including athletic activities.

PERVIOUS. The surface area of a paving material that is open and allows moisture to pass through the material and soak into the earth below the paving system.

SHADE TREE. A tree with a spreading canopy that screens the sun, such as honey locust, sweetgum, elm, linden, maple and oak.

SOLAR REFLECTANCE INDEX. A measure of the ability of a material to reject solar heat as calculated using ASTM E1980.

SECTION BC 3403
PAVED AREAS

3403.1 Cooling and shading. Any site, except any site subject to Section 3403.2, shall provide any combination of the following for fifty percent (50%) of the site hardscape:

1. Paving material with a solar reflectance index of 29 or greater;
2. Shading from plants or other landscaped features such as trellises; or
3. Open-grid pavement.

The shade attributed to plants, including trees, hedges and shrubs, shall be based on an estimate of plant coverage after 5 years and the shade provided at 12:00 P.M. on June 21 of such year.

3403.2 R-3 Buildings. This section shall apply to any site on which more than fifty percent (50%) of the uses of a building, measured in square feet, are classified in occupancy group R-3. If at least fifty percent (50%) of the non-built area is hardscape, such site either comply with the provisions of Section 3403.1 or provide one shade tree per 1,000 square feet of non-built area.

3403.3 Exceptions. Sections 3403.1 and 3403.2 shall not apply to any site in which:

1. At least seventy-five percent (75%) of the non-built area is shaded at noon on June 21; or
2. The non-built area is less than 500 square feet.

Supporting Information

Issue - Expanded

The term “heat island” describes built up areas that are hotter than nearby rural areas. The annual mean air temperature of a city with one million people or more can be 1.8–5.4°F (1–3°C) warmer than its surroundings. In the evening, the difference can be as high as 22°F (12°C). Heat islands increase summertime peak energy demand, air conditioning costs, air pollution and greenhouse gas emissions, heat-related illness and mortality, and water quality. The Lawrence Berkeley National Lab researchers estimate that about 10% of current U.S. air conditioning demand results from the urban heat island.

In addition, asphalt that is exposed to direct sunlight and high temperatures wears quicker. High temperatures lead to volatilization of asphalt binder and oxidation, which causes progressive hardening of the pavement and fatigue cracking. Cracking leads to water infiltration that can weaken the layers underneath. Higher surface temperatures also make asphalt pavement more prone to rutting. A study conducted in Modesto California showed that asphalt roads with shade required resurfacing every 12 years whereas unshaded roads required resurfacing every five years. This resulted in a savings of $.66/SF over a 30 year period compared to an unshaded street.

Environmental & Health Benefits

Reducing the heat island effect will reduce the need for air conditioning in the summer, thus reducing energy consumption, decreasing greenhouse gas emissions, and improving air quality.

Lower temperatures also reduce a series of negative health impacts - during periods of elevated temperatures, human health and comfort are compromised; respiratory disorders are exacerbated and vulnerable populations, such as children and the elderly, suffer disproportionately. Elevated air temperatures resulting from the heat island effect also increase the rate of ground level ozone formation.

This proposal was found to have a low, positive environmental impact per building and to impact a small number of buildings. It was thus given an environmental score of 1.

This proposal was found to have no significant positive health impact.

Cost & Savings

This proposal is not expected to have any significant impact on capital costs.

Precedents

Several small jurisdictions in the United States require site shading or limit pervious surfaces. For example, Altamonte Springs, Florida requires 15% shade coverage within five years over private property. The ordinance gives shade values and points for different tree species. Kinston, North Carolina requires 20% shade coverage for all parking spaces, drives, walks and loading areas within private property. The State of North Carolina prohibits more than 80% of the surface area of a “vehicular surface area” from being an impervious material if the vehicular surface area exceeds one acre.

LEED

The following LEED credits address mitigating the heat-island effect through the use of light-colored/high-albedo materials:

- LEED NC-SS cr. 7.1 Heat Island Effect, non-roof
- LEED CI-SS cr.1D Heat Island Effect, non-roof
- LEED EB-SS cr.6 Heat Island Reduction
- LEED for Schools SS cr.7.1 Heat Island Effect, non-roof
• LEED for Homes SS cr.4.1 Surface Water Management
• LEED ND-GCT cr.10 Heat Island Reduction (pilot program).

This measures outlined in this proposal will positively impact achieving these LEED credits across the various rating systems.

Implementation & Market Availability
There are no known implementation issues for this proposal.

Many high albedo pavement options, including cement concrete and whitetopping, light-colored unit pavers, and pervious concrete pavers, are widely available and are being implemented for a full array of applications. Others, such as high albedo asphalt, are not as widely used but are beginning to be used in NYC for bike and bus lanes.

Notes
The committee considered requirements for light-colored asphalt aggregate given that roads represent a large portion of the city’s dark surfaces. This issue is currently being investigated by the NYC Department of Transportation and it remains a challenge to source and transport such aggregate. For these reasons, the committee declined to recommend any course of action regarding light-colored aggregate.

ENDNOTES:

1 CITY OF ALTAMONTE SPRINGS, LAND DEV. CODE., art. VIII (1993)