Smart Location and Linkage focuses on selection of sites that minimize the adverse environmental effects of new development and avoid contributing to sprawl and its consequences. Typical sprawl development—low-density, segregated housing and commercial uses located in automobile-dependent outlying areas—can harm the natural environment: it can consume forestland, destroy or fragment wildlife habitat, degrade water quality by draining wetlands and increasing rainwater runoff, pollute the air and emit greenhouse gases through increased automobile travel, and often displace agriculture from prime farmland to locations where food production requires more energy and chemical inputs. In addition to these direct environmental effects, leapfrog development (a land-use pattern in which new development does not connect coherently to existing development, often leaving haphazard tracts of undeveloped land) can also harm the environment indirectly by promoting additional development in previously undeveloped areas.

Increased automobile travel is one of the most damaging consequences of sprawl. People living and working in outlying areas tend to drive greater distances, spend more time driving, own more cars, face a greater risk of traffic fatalities, and walk less. Vehicle emissions contribute to climate change, smog, and particulate pollution, which all are harmful to human health and natural ecosystems. In addition, the parking and roadway surfaces required to support vehicular travel consume land and nonrenewable resources, disrupt natural rainwater flow, and enlarge urban heat islands.

Choosing a smart location can make a substantial difference. Transportation surveys conducted by many metropolitan planning organizations across the country show that residents of close-in locations may drive only a third to half as much, on average, as residents of the most far-flung locations in a metro region.

To reduce the effects of sprawl and create more livable communities, preference should be given to locations close to existing town and city centers, sites with good transit access, infill sites, previously developed sites, and sites adjacent to existing development. Selecting these sites avoids development of outlying greenfield sites. In addition, these sites often have utilities, roads, and other infrastructure in place, reducing the need to build new infrastructure and minimizing the expansion of impervious surfaces that increase harmful rainwater runoff. In the locations that perform better environmentally, the benefits can often be multiple and reinforcing: convenient transportation choices, such as buses, light rail, heavy trains, car and van pools, bicycle lanes, and sidewalks, are generally more available near downtowns, neighborhood centers, and town centers, which are also the locations associated with shorter automobile trips. Research has shown that living in a mixed-use environment within walking distance of shops and services encourages walking and bicycling, which improve cardiovascular and respiratory health and reduce the risk of hypertension and obesity.

An additional benefit of locations that require less driving is that households may be able to own fewer automobiles and cut transportation expenses. For commercial development, fewer automobiles may mean less investment in parking infrastructure, which can reduce the amount of land needed for a project and lower construction costs. Abundant transportation choices can increase the value and marketability of a neighborhood development as well. More than 14.6 million households are expected to prefer housing within a half-mile of rail transit stops by 2025—more than double the number of households living in such locations today[1].

Beyond the environmental damage caused by increased automobile dependence, fragmentation and loss of habitat to sprawl are major threats to many imperiled species. Selection of sites that are within or adjacent to existing development can minimize habitat fragmentation and also help preserve areas for recreation. Wetlands and floodplains tend to be biologically rich, and their conversion presents particularly serious environmental challenges: in addition to altering wildlife habitat, it can reduce water quality and increase the likelihood of flooding and associated consequences, such as erosion and loss of property. Left alone, these natural areas retain rainwater and floodwater for slow release into river systems and aquifers, and they protect lakes and streams by trapping sediment.

Another important concern is development intrusion onto prime agricultural lands, which typically require less fertilization and irrigation and are therefore the most resource efficient and environmentally sound locations for farming. Leapfrog patterns of development not only take these lands out of agricultural production but can also fragment farming communities and consequently reduce the economic viability of the local agricultural economy.

Many potential building sites in urban locations have been abandoned because of real or potential contamination from previous industrial or municipal activities. Remediation and reclamation of contaminated brownfield sites make them safer for the community and can also contribute to social and economic revitalization of depressed or disadvantaged neighborhoods. Development of these sites spares greenfields and makes use of existing infrastructure.

Finally, smart location choice also offers opportunities to repair the fabric of communities that are disjointed and sprawling. Suburban locations typically contain excellent redevelopment opportunities on grayfield sites, such as old airports, abandoned or underutilized shopping malls, and closed factories.

[1] *Center for Transit-Oriented Development, Hidden in Plain Sight: Capturing the Demand for Housing Near Transit (2004).*

Neighborhood Pattern and Design emphasizes the creation of compact, walkable, mixed-use neighborhoods with good connections to nearby communities. These vibrant neighborhoods provide many important benefits to residents, employees, and visitors and to the environment.

In particular, because compact neighborhoods use land and infrastructure efficiently, they avoid fragmentation of wildlife habitat and farmland loss, conserve economic resources, and slow the spread of low-density development across a region’s landscape. Residents enjoy convenient access to shops, services, and public spaces within walking and bicycling distance, and when people choose to drive, they take shorter automobile trips, saving time and avoiding emissions. Compact development also facilitates access to public transportation because transit becomes more economically viable when supported by higher concentrations of population.

In addition, the small block sizes associated with compact neighborhoods encourage walking and bicycling because of increased connectivity, shorter travel distances, slower automobile traffic, and a more inviting pedestrian environment. The slower traffic speeds typically found in dense developments also can reduce injury rates. The environmental and public health benefits that accompany increased transportation choices and reduced rates of driving are further discussed in the introduction to Smart Location and Linkage.

Features such as sidewalks and trails, street trees, inviting building façades, small setbacks, minimal parking lot area, and measures to slow automobiles also increase pedestrian activity. Public spaces, such as parks, plazas, and playing fields, can encourage social interaction and active recreation while helping control rainwater runoff and reducing urban heat island effects. Community gardens also promote social interaction and physical activity while increasing access to fresh, locally grown produce.

Communities with diverse housing types that accommodate a range of incomes, ages, and physical abilities permit residents to live closer to their workplaces, help the community retain residents, and allow families to remain in the neighborhood as their circumstances change over time.

A community's involvement in project design and planning can help the project complement adjacent neighborhoods, meet the needs of residents and workers, and nurture a cooperative relationship with the project's neighbors.

Green Infrastructure and Buildings focuses on measures that can reduce the environmental consequences of the construction and operation of buildings and neighborhood infrastructure. In the U.S., buildings account for large shares of energy consumption and water use. Globally, construction consumes a major part of the stone, gravel, sand, and virgin wood used in the world. Sustainable building technologies reduce waste and use energy, water, and materials more efficiently than conventional building practices.

Including certified green buildings in projects is one way to reduce negative environmental effects. These buildings achieve substantially better performance across a range of environmental measures, and in many cases the cost per square foot can be comparable to that of conventional buildings.

Energy efficiency is an essential strategy for reducing pollution and greenhouse gas emissions, which are possibly the most negative environmental consequences of building and infrastructure operation. Production of electricity from fossil fuels is responsible for air pollution, water pollution, and more than one-third of U.S. greenhouse gas emissions; hydroelectric generation plants can degrade river habitats; and nuclear power presents waste disposal problems and safety concerns. Building systems—electrical, lighting, heating, ventilation, air-conditioning, and others—can be designed to significantly reduce energy consumption compared with conventional designs and practices. The same gains are possible with neighborhood-scale infrastructure components like street lights, traffic signals, and water and wastewater pumps.

District heating and cooling systems are an example of neighborhood-scale infrastructure that can improve energy efficiency because large plants are typically more efficient than building-based equipment. District systems can also take advantage of waste heat from on-site energy generation, improving efficiency. On-site power generation is another energy management strategy for either individual buildings or neighborhood-scale installations. These systems reduce transmission losses, and they may increase power reliability and decrease energy costs by supplementing or replacing utility-supplied electricity. Use of renewable energy in onsite generation further reduces environmental harms.

Solar orientation can also reduce energy consumption in buildings through passive or active systems. And applications like photovoltaic systems can be scaled up to neighborhood levels. The environmental consequences of building construction can be lessened through the reuse of existing buildings. Reuse avoids the environmental effects associated with the extraction, manufacture, and transportation of raw materials, and it reduces the volume of construction and demolition waste, lowering disposal costs and extending landfill life. Reuse of existing components and infrastructure systems can also reduce the cost of construction.

Using materials with recycled content conserves raw materials and supports recycling of construction wastes so that they can be diverted from landfills. Many commonly used products are now available with recycled content, including metals, concrete, masonry, acoustic tile, carpet, ceramic tile, and insulation. Most recycled-content products exhibit performance similar to products containing only virgin materials and can be easily incorporated into building projects at little or no additional cost.

Conventional building practices typically alter watershed hydrology and impair local water resources and ecosystems. Changes to hydrology may deplete aquifers, reduce stream base flow, and cause thermal stress, flooding, and stream channel erosion. New developments can be designed to minimize changes to natural hydrology and stream health by reducing the velocity, volume, temperature, and pollutant content of rainwater runoff.

Urban heat islands are another consequence of standard development patterns and practices. The use of dark, nonreflective materials for parking, roofs, walkways, and other surfaces raises ambient temperatures when radiation from the sun is absorbed and transferred through convection and conduction back to surrounding areas. As a result, ambient temperatures in urban areas can be artificially elevated by more than 10°F (5.5°C) compared with surrounding undeveloped areas. This increases cooling loads in summer, requiring larger HVAC equipment and consuming additional electricity, which in turn exacerbates air pollution and contributes to the formation of smog.

Heat islands are also detrimental to wildlife habitat: plants and animals are sensitive to high temperatures and may not thrive when temperatures increase. Water use can also be reduced through improved design and technologies that conserve water and ease demands on water supply. Indoors, potable water consumption can be reduced by using low-flow plumbing fixtures and waterless urinals. Outdoor water use, primarily for landscape maintenance, accounts for a large share of U.S. water consumption and can be reduced through careful plant selection and landscape design. Wastewater can also be reused for landscape maintenance.

Water conservation protects the natural water cycle and saves water resources for future generations by reducing amounts withdrawn from rivers, streams, underground aquifers, and other water bodies. Another benefit of water conservation is reduced energy and chemical use at wastewater treatment facilities. In addition to conserving precious potable water, wastewater reuse reduces the amount of wastewater released into environmentally stressed streams and rivers and lessen demands on overburdened wastewater treatment systems.

Site design provides another opportunity to reduce the environmental consequences of development. Site plans should preserve the existing tree canopy and native vegetation to the extent possible while accommodating compact development. Preserving existing vegetation can reduce rainwater runoff, mitigate the urban heat island effect, reduce the energy needed for heating and cooling, and reduce landscaping installation and maintenance costs. Trees also reduce air pollution, provide wildlife habitat, and make outdoor areas more pleasant for walking and recreation.

The construction process itself is often damaging to site ecology, indigenous plants, and animal populations. This problem can be minimized by confining construction activities to certain areas on the site and restricting the development footprint. Protection of open space and sensitive areas through the use of strict boundaries reduces damage to the site ecology and preserves trees, native vegetation, and wildlife habitat. Construction can also cause soil erosion by wind and water, and soil that leaves the site can cause water and air pollution. Loss of topsoil may increase rainwater runoff, which pollutes nearby water bodies, and may necessitate use of more irrigation, fertilizer, and pesticides. These problems can be prevented by implementing an erosion and sedimentation control plan.

Innovation - Sustainable design strategies and measures are constantly evolving and improving. The purpose of this LEED category is to recognize projects for innovative planning practices and sustainable building features.

Occasionally, a strategy results in a project’s performance that greatly exceeds what is required in an existing LEED credit. Other strategies may not be addressed by any LEED prerequisite or credit but warrant consideration for their sustainability benefits. In addition, LEED is most effectively implemented as part of a cohesive team, and this category addresses the role of a LEED Accredited Professional in facilitating that process.

Regional Priority - Because some environmental issues are particular to a locale, volunteers from USGBC chapters and the LEED International Roundtable have identified distinct environmental priorities within their areas and the credits that address those issues. These Regional Priority credits encourage project teams to focus on their local environmental priorities.

USGBC established a process that identified six RP credits for every location and every rating system within chapter or country boundaries. Participants were asked to determine which environmental issues were most salient in their chapter area or country. The issues could be naturally occurring (e.g., water shortages) or man-made (e.g., polluted watersheds) and could reflect environmental concerns (e.g., water shortages) or environmental assets (e.g., abundant sunlight). The areas, or zones, were defined by a combination of priority issues—for example, an urban area with an impaired watershed versus an urban area with an intact watershed. The participants then prioritized credits to address the important issues of given locations.

The ultimate goal of RP credits is to enhance the ability of LEED project teams to address critical environmental issues across the country and around the world.