

LEED FOR NEIGHBORHOOD DEVELOPMENT AND INFRASTRUCTURE INTEGRATION

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Abstract: The US Green Building Council, Congress for New Urbanism and the Natural Resources Defense Council, released the Leadership in Energy and Environmental Design for Neighborhood Development Rating System (LEED-ND) Pilot Version in February 2007. The new version, LEED-ND 2009, is now available after the input of nearly 240 pilot projects and public comment. Although registration for new projects is not yet open, cities, developers, and planners are already investigating how to implement LEED-ND. How does infrastructure play a part in realizing the goal of reducing vehicle miles traveled, encouraging efficient water and energy use, and optimizing foot and public transit travel? What does an infrastructure professional need to heed? This paper looks at the considerations by infrastructure teams when asked to evaluate projects for LEED-ND.

1 WHAT IS AND WHAT CAN BE

Across the globe, people are moving from the country and into the cities with the hopes of employment and a means to improve their lives. In some cases the older abandoned neighborhoods are available for newcomers as the wealthy move to what they believe is the countryside, only to be surrounded by more houses, just like theirs, within in a few years. The suburban setting, a familiar sight in the US, is also found in the most unsuspecting places such as Tashkent Uzbekistan. But we are in the midst of change. With the attention given to the ills of carbon emissions, auto dependency, obesity, and loosely woven family structures, a new approach is offered. The needed approach utilizes the lessons we have from successful, older, healthy neighborhoods. Some developers and urban planners have addressed the issues with new towns, many of them in Asia, promising to provide well being, access to education and jobs, and eco-friendly amenities. But what does well being and eco-friendly mean? How can it be measured? And if it these things are good, how can they be encouraged?

The US Green Building Council (USGBC), Congress for New Urbanism (CNU), and the Natural Resources Defense Council (NRDC) have joined forces to create a standard that uses principles of smart growth, New Urbanism, and green infrastructure and building; LEED for Neighborhood Development (LEED-ND). LEED-ND embraces smart growth, New Urbanism, and green infrastructure and building in an interlocking system. Smart growth developments focus on maintaining the fabric of downtowns. They orient development to encourage transit and pedestrian activity and utilize a variety of housing types for different income levels, typically with mixed use zones. New Urbanism lists walkability, connectivity, mixed-use and diversity, mixed housing, and density as key components that combine with traditional neighborhood structure, quality design, reduction in auto use and incorporation of sustainability to create a high quality of live that is inspiring. Green infrastructure offers high-performance and conserves resource such as energy, water, and materials. LEED-ND aims to provide guidance and acknowledgement to projects that provide quality of life while protecting the natural environment and putting systems in place to strengthen body and mind.

2 USGBC AND LEED

The USGBC formed in 1993 and started work on a measuring tool for green buildings. By 1998, a pilot program for the Leadership in Energy and Environmental Design (LEED) Green Building Rating System was launched for new building construction. The process includes registration of the project with the USGBC to show intent; working with the owner, designers and contractors to maximize efficiencies using the Rating System; achieving all prerequisites and selection of appropriate credits for points; submission of documentation for review; and clarification if needed. If everything is in place, the project achieves LEED certification. LEED registration and certification is handled by the Green Building Certification Institute (GBCI) on-line.

Now the fifth version, LEED for New Construction v3.0, is released along with LEED for Core and Shell, LEED for Existing Buildings: Operations and Maintenance, LEED for Commercial Interiors, LEED for Schools, LEED for Retail, LEED for Homes, LEED for Healthcare, and most recently, LEED for Neighborhood Development (LEED-ND). LEED-ND is not only a tool for smart growth, New Urbanism, and green infrastructure and building, but it is also a means to measure and it allows marketing well being and eco-friendly with values to back up the claims.

3 LEED-ND

In 2007 the pilot phase of Neighborhood Development opened with almost 270 projects ranging from less than 4,050 m² (an acre) to nearly 52 km² (12,800 acres). As of February 1, 2010, 63 projects received certification with others in process. Based on the feedback from the pilot projects, volunteer LEED-ND Core Committee efforts, consultancy work, and several rounds of public comment, the LEED-ND 2009 was released.

The majority of people grow up in a neighborhood that includes homes, work places, shops, and civic places that can be identified through social, economic, institutional, and lifestyle aspects. LEED-ND applies to partial neighborhoods, whole neighborhoods, and multiple neighborhoods. There is no project size limit, but the program was developed around the premise that most people will walk a little over 400 meters (a quarter of a mile) for daily errands and up to 800 meters (a half-mile) to reach rail transit. The core committee's guidance for the upper limit of a LEED-ND project is 1.3 km² (320 acres).

Although registration under the updated program is not yet open, cities, developers, and planners are already investigating how to implement LEED-ND. Lippo Incheon Development Co., Ltd is one such developer now considering LEED-ND in connection with infrastructure for their Woonbook Leisure Complex at Youngjong Island in the Incheon Free Economic Zone (IFEZ), Republic of Korea.

3.1 Categories

LEED-ND has three main categories. Smart Location and Linkage (SLL) is intended to preserve natural open space and site projects at or near existing infrastructure. It is the "where" of the project. Neighborhood Pattern and Design (NPD) is set up to enhance the connection residents have to each other and their neighborhood. It is the "how" of the project. Green Infrastructure and Buildings (GIB) measures how the project maximizes efficiencies and how it minimizes negative environmental impacts. These categories work together to encourage a concentration of work, living, and civic functions so that residents can get where they want to go by foot or public transit in an efficient way with contextual variety. Project teams are awarded through the Innovation and Design Process (IDP) for achieving beneficial,

measurable results that are not captured in the system, or for exemplary performance of credits that are in the system. There is an opportunity to receive a credit by having a LEED Accredited Professional on the team. LEED Accreditation is achieved by passing an examination given by the GBCI and available at Prometric sites in most major cities. The last category is Regional Priority Credit (RPC), which encourages strategies, which will be listed on the USGBC website, that have been identified by local experts. Only US projects are eligible for the possible four RPC credits.

Within the categories, there are opportunities for infrastructure planners and engineers to make positive impacts. By understanding the requirements of the system, not only can optimizations be realized for the project, but the planning, design, and construction phases are more likely to run smoothly. Within the system, there are prerequisites and credits; their titles are indicated in bold font throughout this paper. All prerequisites must be met. The remainder of credits should be under the consideration of the team as a whole in order to identify which are feasible. There are a few credits that are worth multiple points and some allow exemplary performance. Some credits or even prerequisites may not be possible. Some may be a marketing investment and others may be easy to capture by following local codes or laws. Each project will likely have unique site and budget constraints as well as owner goals. After the first charrette, the team will have an idea of the point total. 20-49 points result in Certified. Silver is awarded with 50-59 points, Gold takes 60-79 points and Platinum is awarded to projects with 80 to 110 points.

3.1.1 Smart Location and Linkage

Smart Location and Linkage contains five prerequisites and nine credits that encourage building on sites that already have infrastructure, do not negatively impact sensitive ecological communities, conserve wetland and water bodies, conserve agricultural land, and avoid floodplains. Preference is given to projects on previously developed sites and infill sites, and to those with connectivity with neighboring land and in densely populated areas. The development of brownfields, support of reduced automobile dependence, increased bicycle networks, and proximity of housing and jobs are rewarded as are steep slope protection and the design for conservation and restoration for habitat or wetlands.

The infrastructure team often does not have input into where the site is located, but if brought into the project early enough, they may have the opportunity to consult the client to make a selection that works well with the LEED-ND goals. The prerequisite for **Smart Location** requires all projects to provide water and wastewater infrastructure through existing or new systems. Projects then have four compliance paths including locating on an infill site or an adjacent site (a site that is adjacent to previously developed land) with connectivity; locating near bus, streetcar, bus rapid transit, rail, or ferry terminals; or locating on sites with existing diverse neighborhood services. The definition for some of these terms has evolved within the LEED program and need to be understood.

Infill site: may meet any of four conditions. 1) At least 75% of the boundary borders parcels that are each at least 50% previously developed and in aggregate are at least 75% previously developed. 2) The site and bordering sites form an aggregate with a boundary that is 75% bounded by parcels that are each at least 50% previously developed and that in aggregate at least 75% previously developed. 3) A minimum of 75% of the land area within a 0.8 km (0.5 mile) distance from the project boundary is previously developed, exclusive of rights-of-way. 4) The land within a 0.8 km (0.5 mile) distance from the project boundary has a pre-project connectivity of at least 140 intersections per 2.6 square kilometer (square mile).

Adjacent site: parcels with at least 25% of its boundary bordering parcels that are at least 75% previously developed. Exclusions include waterfronts other than streams and undeveloped permanently protected land with an average width of 122 meters (400 feet) and a maximum width of 152 meters (500 feet).

Connectivity: the number of publicly accessible street intersections per 2.6 square kilometer (square mile).

Previously developed: current or previous site alterations with paving, construction or land use that would have require regulatory permitting. Previously developed sites include platted lots with a building for lots under 4,046 m² (one acre) and the development footprint, or impervious surfaces, for lots over 4,046 m² (one acre). Altered landscapes from current or past clearing or filling, bio use, or preserved natural areas are not considered previously developed. They are considered undeveloped land. For projects that are on reclaimed sites, the options for compliance may be limited. For example, Songdo International Business District in South Korea, which is built on land that was reclaimed from the sea by the Incheon government, is considered undeveloped. The clearest conformance path may be the fourth option, with a minimum of 140 intersections within 0.8 km (0.5 mile) of the boundary.

The **Bicycle Network and Storage** credit provides a point for projects that can connect to existing bicycle networks. If the project team decides to take this credit, coordination with utilities and other new infrastructure such as streets or rail is required. Design and construction of new bicycle networks will not be awarded this credit.

For the civil engineer, **Steep Slope Protection** provides a method to preserve steep slopes in a natural and vegetated state with the intent of minimizing erosion and protecting habitat. The proper stabilization also reduces stress on natural water systems. To earn this credit, all projects must protect existing slopes. Beyond that requirement, the project must adhere to one of three options; do not disturb slopes over 15%, restore previously developed slopes over 15% with native or adaptive vegetation, and for slopes of 15% or more that are undeveloped, guidelines must be followed depending on the slope.

3.1.2 Neighborhood Pattern and Design

The planner and infrastructure engineer will coordinate efforts for **Walkable Streets**. In this prerequisite, the project will receive credit by promoting walking and reducing vehicle miles traveled (VMT) by following four requirements. Functional entries must face public spaces, at least 15.25 meters (50 feet) wide, other than a parking lot on 90% of new building frontage. They must have a 1:3 building-height-to-street-width ratio for at least 15% of street frontage within and bordering the project. Continuous sidewalks are needed for 90% of the streets or frontage, and no more than 20% of frontage may be faced by garage and service bay openings. In order to earn this credit, close coordination is needed with the building planners to maintain the required ratio. Further enhancing the concept of walkable streets is the promotion of projects that have frequent multiple internal and external connections through the **Street Network** credit. The intent of this credit is to allow for connections between projects. New projects should have through-street and or non-motorized right-of-way intersections that reach the project boundary every 122 meters (400 feet) or meet the existing adjoining intersections. The shortest interval is required. For 90% of new cul-de-sacs, which are generally discouraged, a pedestrian or bicycle path must continue through for connectivity. If connections cannot be made due to obstructions, they must be noted in the documentation.

3.1.3 Green Infrastructure and Buildings

The Green Infrastructure and Buildings section provides the most opportunity for infrastructure planning and design to impact the successful certification of the project.

Water-Efficient Landscaping allows one credit for limiting or eliminating the use of potable water for landscape purposes. Some strategies include using captured rainwater, recycled wastewater, city-supplied treated non-potable water, stormwater, or civic fountain drain water. A city-wide greywater supply, similar to that used at the IFEZ Songdo International Business District, can contribute to this credit. For projects that use irrigation, a 50% reduction from calculated midsummer baseline case will need to be demonstrated while projects that use no new or existing irrigation are automatically compliant. **Stormwater Management** involves retaining stormwater on site to assist in infiltration, reducing pollution and flooding and working to reproduce natural systems. Up to four points can be achieved by retaining 80%, 85%, 90% or 95% of the rainfall event. The rainfall volume is based on the development footprint, areas that are graded such that are impervious, and areas that receive fertilizers or pesticides, which are considered pollution-generating pervious surfaces. For this credit, LEED-ND stipulates, “the percentile rainfall event is the total rainfall on a given day in the record that is greater than or equal to X percent of all rainfall events over a 20-to 40+-year period.” If two or more credits are earned, an additional credit can be awarded through a previously developed site, a brownfield site, or by being transit ready. For a project to be considered transit ready, the site may utilize **Walkable Streets, Compact Development, and Mixed-Use Neighborhood Centers**. The maximum amount of points available for this credit is not clear and will be flushed out when projects register and submit Credit Interpretation Ruling requests.

Solar, Geothermal, wind, hydroelectric, and biomass renewable energy generation can contribute to the project’s points. **On-site Renewable Energy Sources** garners one to three points depending on the percentage of annual and thermal energy cost for 5%, 12.5%, and 20% of new buildings, respectively. Passive strategies and geoexchange systems are not eligible nor are biofuels such as forest biomass, municipal solid waste, or treated or coated wood. A related credit is **District Heating and Cooling**. For this credit, an energy modeler will be needed to determine the project’s annual heating and cooling load for new buildings, which must perform better than 10% above the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) Standard 90.1-2007, for each new building system. The new buildings are to be supplied the district heating and cooling for at least 80% of the demand. **On-site Renewable Energy Sources** and **District Heating and Cooling** calculations are preformed using an accepted building energy performance simulation tool. LEED-ND does not list the tools, but ASHRAE 90.1-2007 provides guidance on acceptable simulation tools. Where new energy infrastructure is built, if a 15% annual energy reduction below the estimated baseline energy use can be met, then a point for **Infrastructure Energy Efficiency** may be garnered. Infrastructure energy-consuming equipment outside the building is only considered. Baseline is calculated by using the lowest cost infrastructure equipment based on the assumption that the lowest cost equipment is the least efficient. If the project has no new infrastructure, this credit cannot be captured.

Non-governmental organizations (NGOs) and governments anticipate fresh water shortages to overcome energy shortages. With this in mind, we have the power to design for water conservation with infrastructure and at the building level. **Wastewater Management** gives credit to projects that treat wastewater onsite and reuse it to replace potable water. The calculations from the prerequisite **Minimum Building Water Efficiency** are used to determine if 25% reuse will earn one point or if 50% can be reached for two points.

Strategies include natural and mechanical systems such as anaerobic biological treatment facilities and constructed wetlands.

Most of us are living in communities that require or at least promote recycling. With these large-scale efforts, the materials end up being used in products, which we as construction professionals can promote through our project specifications. LEED-ND gives a credit to projects that can show that 50% of the mass of infrastructure is recycled content or in-place reclaimed materials. Post-consumer content can provide 100% of its mass value to the calculation while pre-consumer content is only allowed to provide 50% of its mass value.

Recycled Content in Infrastructure calculations should include paving, water tanks and vaults, base and subbase materials, and piping for stormwater, sanitary sewer, steam energy distribution and water piping. ISO 14021, Environmental Labels and Declaration Package, shall be followed for recycled content definitions, but certification is not required.

The **Solid Waste Management Infrastructure** credit requires that four of five conditions be met and publicized to encourage citizens to use the systems put into place. The first is a recycling or reuse station or recycling services. A drop-off point for hazardous wastes or collection service is the second condition. The third condition is a compost station or service, which could tie into the **Local Food Production** credit. The fourth condition is to provide city-wide recycling containers on non-residential blocks for city pick-up. The last condition is to recycle or salvage 50% of the construction and demolition debris. For the first three, either providing the centers or placing the project in a location where the local government jurisdiction provides the service is acceptable. Some projects may be challenged to get early buy-in from the local government or regulatory agencies if these systems are new to the area.

Infrastructure teams do not act alone and have a grand opportunity to make a positive impact on the quality of life and protection of resources. While some infrastructure professionals may be responsible for particular prerequisites or credits, others may be leading the planning effort and be in charge of the LEED-ND certification. The administration of LEED-ND registration and certification of the project is done on-line through the GBCI while the documentation is handled locally with the design and construction team.

3.2 Registration

LEED-ND registration is done through the GBCI website, typically by the LEED Administrator. Registration for LEED-ND 2009 is advertised to open in 2010, but no date is set as of February 2010 nor has the registration fee structure been released. After registration, projects are eligible for the GBCI to run a Smart Location and Linkage prerequisite review. This will help teams determine the possibility of the project receiving certification before committing to full documentation. Since fees are non-refundable, this optional step will save time and money in the event that the GBCI determines that the project is not eligible for the prerequisites.

3.3 Documentation

The GBCI website will provide the detailed documentation requirements for each prerequisite and credit. Project teams must determine the responsible parties for the early in the project. For some prerequisites and credits, multiple disciplines or companies may be required to deliver documentation with a single person responsible for checking and approving the materials before uploading to the GBCI.

3.4 Credit Interpretation Rulings

At times the team may need clarification on the interpretation of the LEED-ND Rating System. The GBCI has an avenue for teams to receive Credit Interpretation Rulings via the GBCI website. All other LEED programs have a similar avenue for a fee, which is expected to be replicated with the LEED-ND program.

3.5 Certification

Registered projects go through stages of certification depending on the phase of development.

3.5.1 Stage 1

Stage 1 certification is for a conditionally approved plan. It is for projects prior to completion of entitlements or the public review process and may help projects receive recognition for their intent, receive government support and positive interest from the community. If the project has more than 50% of the new or renovated square footage already entitled they must start their certification documentation submission with Stage 2.

3.5.2 Stage 2

The pre-certified plan is for those projects that have received full entitlement. The project may or may not be in construction. If more than 75% of the project is constructed, then the project must complete construction and submit for Stage 3.

3.5.3 Stage 3

In the final stage, all prerequisites and credits can be submitted. At this point certificates of occupancy and acceptance have been issued. Once documentation is fully reviewed by the GBCI and approved, then certification is awarded based on the points received.

4 CONCLUSION

The pilot phase of LEED-ND is closed and LEED-ND 2009 is issued. Although the GBCI has not opened registration for new projects, developers, planners, engineers, and governments across the globe are evaluating the applicability of this third-party rating system as an international standard for measuring the well being and eco-friendly qualities of their projects. Using best practices and maximizing the integrated cooperation of the USGBC, CNU, and NRDC, this tool allows infrastructure planners and engineers to make a positive impact on new and existing developments. LEED-ND is an evolving program. The USGBC welcomes public involvement through their Neighborhood Development Update and the LEED for Neighborhood Development Committee.

5 REFERENCES

Green Building Certification Institute (GBCI). Available from: <<http://www.gbci.org/>>. [14 February 2010].

New Urbanism. Available from: <<http://www.newurbanism.org/>>. [14 February 2010]

Smart Growth Network. Available from: <<http://www.smartgrowth.org/>>. [14 February 2010]

US Green Building Council (USGBC). Available from: <<http://www.usgbc.org/DisplayPage.aspx?CMSPageID=148>>. [14 February 2010].

US Green Building Council (USGBC), *LEED Reference Guide for Neighborhood Development, 2009 Edition*, USGBC, Washington, D.C, USA.