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LEED for Neighborhood Development: Does it Capture Livability?

By Miriam Aranoff, Hannah Clark, Ethan Lavine, Kanokwalee Mam Suteethorn

Abstract

Leadership in Energy and Environmental Design for Neighborhood Development (LEED-ND) is a fairly new system for rating neighborhoods on the sustainability of their design and planning. This study examines LEED-ND's criteria for Neighborhood Pattern and Design, starting with the hypothesis that these standards fall short of capturing the livability of a place as perceived by its residents. Noe Street in the Duboce Triangle neighborhood of San Francisco serves as the study site. Field measurements indicate that Noe Street is ineligible for LEED-ND certification. Survey results show that a majority of residents find it highly livable, nonetheless. When asked to consider life on their street, residents put different emphases on what makes a neighborhood livable than do the LEED-ND standards.

Introduction

Going beyond individual green buildings to the integration of sustainable design at the neighborhood scale is becoming a focus in real estate and policy circles alike. In 2007, in collaboration with the Congress for the New Urbanism (CNU) and the Natural Resources Defense Council (NRDC), the US Green Building Council (USGBC) introduced a new certification program called LEED for Neighborhood Development (LEED-ND), expanding certification beyond single buildings to include whole neighborhoods. The establishment of LEED-ND in 2007 and the USGBC's publication of the standards in 2009 contributed to the growing global field of assessment systems that comprehensively evaluate and rate the following on their overall impact on the environment and urban residents: neighborhoods, the built environment, environmental impacts, and infrastructure (Sharifi and Murayama, 2012; Haapio, 2011). As of May 2013, there are a total of 317 LEED-ND projects and plans in the United States, Canada, and other countries around the world. There is no size limit for LEED-ND projects, and they vary broadly from one-third of an acre to more than 1,000 acres (USGBC 2013).

The LEED-ND certification system evaluates neighborhoods on the basis of five considerations: Smart Location and Linkage, Neighborhood Pattern and Design, Green Infrastructure and Building, Innovation and Design Process, and Regional Priority. This study will evaluate the LEED-ND Neighborhood Pattern and Design (NPD) standards with regard to their potential for capturing a sense of livability. Specifically, we seek to understand how residents in an identified, existing, “livable” neighborhood would rate and rank the 15 criteria set forth in the LEED-ND Neighborhood Pattern and Design standards (see criteria in Figure 1). Our hypothesis was that residents in the identified livable neighborhood would rate and rank the criteria differently, and that the LEED-ND NPD criteria would fail to fully capture livability as perceived by residents. LEED-ND is the newest rating system from USGBC, and attempts to standardize a comprehensive approach to neighborhood-scaled sustainability. However, it is unclear if the design guidelines set forth in the rating system will adequately create what residents perceive as highly livable neighborhoods.

LEED-ND NPD Prerequisites and Credits		Point(s) Possible
PREREQ 1	Walkable Streets	Required
PREREQ 2	Compact Development	Required
PREREQ 3	Connected and Open Community	Required
Credit 1	Walkable Streets	12
Credit 2	Compact Development	6
Credit 3	Mixed-Use Neighborhood Centers	4
Credit 4	Mixed-Income Diverse Communities	7
Credit 5	Reduced Parking Footprint	1
Credit 6	Street Network	2
Credit 7	Transit Facilities	1
Credit 8	Transportation Demand Management	2
Credit 9	Access to Civic and Public Spaces	1
Credit 10	Access to Recreation Facilities	1
Credit 11	Visitability and Universal Design	1
Credit 12	Community Outreach and Involvement	2
Credit 13	Local Food Production	1
Credit 14	Tree-lined and Shaded Streets	2
Credit 15	Neighborhood Schools	1

Figure 1: LEED-ND Neighborhood Pattern and Design Criteria (USGBC, 2011)

Livability and LEED-ND

This study looks to understand how the LEED-ND Neighborhood Pattern and Design guidelines incorporate tenants of livability, and whether they fully cover the aspects of livability deemed important by residents. In LEED-ND’s 2009 guide, the words “livable” and “livability” are used only twice, and no formal definition of livability is put forward. However, the main tenets found in much of the literature on livability are echoed in LEED-ND’s goals and principles for green neighborhood developments. LEED-ND incorporates smart growth and New Urbanist-influenced neighborhood design patterns to “create a particular physical reality

and compel behaviors that have significant effect on the environmental performance of a given place" (USGBC 2012, xii). The major goals in the design of these neighborhoods are mixed-used centers, a sustainable urban form that provides: a safe, inviting, and vibrant public realm; walkable streets; and connections to surrounding areas (USGBC 2012).

Though the influence is not stated directly in the standards, the vision articulated for LEED-ND-certified neighborhoods strongly resemble influential writings about the livability of a place as described by Appleyard and Lintell (1972), Jacobs and Appleyard (1987), Bosselman, Macdonald, and Kronemeyer (1999), and Bosselmann (2008).

On its surface, the LEED-ND concept of livability does not differ much from definitions of livability coming out of the Berkeley School of Planning. Much of LEED-ND's concept of livability aligns with the definition proposed by Jacobs and Appleyard:

Most people want a kind of sanctuary for their living environment, a place where they can bring up children, have privacy, sleep, eat, relax, and restore themselves. This means a well-managed environment relatively devoid of nuisance, overcrowding, noise, danger, air pollution, dirt, trash, and other unwelcome intrusions (Jacobs and Appleyard 1987).

This definition builds upon the pioneering study that painted a livable street as a place that is seen as protected from negative urban stressors, such as traffic, noise, and pollution, but provides a setting for interaction between neighbors and fosters a sense of security and comfort (Appleyard and Lintell 1972). Additionally, the more recent livability study by Bosselmann, Macdonald, and Kronemeyer (1999) looks closely at how enhancements to the public realm influence the livability of a place. These definitions of livability emphasize quality of life factors including: protection from traffic and pollution; safety; and cleanliness. The definitions also seek to characterize the positive aspects of places according to which residents deem places livable, such as privacy, security, and a family-orientation.

LEED-ND's focus on the physical design are intended to create livable places and a high quality of life (USGBC 2012). In assessing this approach, Southworth describes this emphasis as a formalist model which focuses on aesthetic qualities of the built environment rather than social, political, or ecological factors. Innovation is possible only within the framework of the code, and the code is quite restrictive. Rather than starting with the locale and seeing what is right, the design code establishes the approach without question (Southworth 2003).

As emphasized by Southworth, this approach relies heavily on the hope that the physical design of a neighborhood will be able to influence the residential perceptions of livability, and foster a sense of community

facilitated by compact, small-scale development, walkable streets, a variety of inviting public spaces, and mixed land uses. The correlation between physical design and the corresponding perceptions of livability by residents is somewhat tenuous, however, and can be challenged by findings that such a perception of livability has been identified in areas that are seemingly anti-New Urbanist, such as single-family suburban developments (Talen 1999). However, other studies have found a link between urban forms that follow New Urbanist design principles and a stronger sense of community and livability. In a comparative study between a traditional neighborhood reflecting new urbanist design standards and a modern suburb, Lund (2002) argued that residents in the traditional neighborhood share a stronger sense of security and connection with their neighbors than those in a modern suburb. In this sense, this paper seeks to continue the exploration of the connection between the design of physical features of a neighborhood and how such features may influence how residents perceive the livability of the place and also rate the quality of life.

For the purpose of this study, a definition of livability was chosen that borrows concepts from the studies of Jacobs and Appleyard (1987) and Bosselmann, Macdonald, and Kronemeyer (1999) along with LEED-ND's approach to livability, emphasizing the design of the physical environment (USGBC 2012). In the context of this study, livability is defined as a *set of physical conditions that integrate the natural and built environments and create safety, and comfort, include engaging facades, and offer easy access to services and transit*. It should be recognized that this definition also draws a connection between livability and sustainability. This connection has begun to surface in more recent literature on livability that works to expand the definition to include aspects that are mainly associated with sustainable cities; these aspects include integration into the social and natural ecology as well as an emphasis on proximity to transit and alternative forms of transportation to reduce dependence on the automobile (Bosselmann 2008).

Moving into our discussion of site selection, methodology, and survey results, it is important to remain cognizant of the underlying assumption of LEED-ND: that the Neighborhood Pattern and Design standards put forward are capable of fostering a sustainable neighborhood.

Critical Research on LEED-ND

LEED-ND joins a number of other assessment tools that aim to quantitatively and qualitatively assess the overall sustainability of a neighborhood. This review studied the literature concerning the effectiveness of rating systems, and specifically how LEED-ND is beginning to be utilized in project design and development. While LEED-ND is still fairly new among sustainability assessment tools, several researchers provide insight into the theoretical

utility of the criteria and scoring systems, particularly in regard to their comprehensiveness in addressing a range of issues and their adaptability to localized contexts. An analysis of multiple sustainability assessment tools, including LEED-ND, by Haapio (2011), establishes the usefulness of the tools in facilitating cross-municipal comparison of projects, as well as the increasing focus on the importance of indicators and criteria in measuring sustainability. In their comparative analysis, Murayama and Sharifi (2012) highlight the significant shortcomings still present in “Neighborhood Sustainability Assessment” (NSA) tools, particularly in the social, economic and institutional aspects of sustainability. Furthermore, Murayama and Sharifi found ambiguities in the manner in which the NSA tools weighted, scored, and rated the indicators and criteria, stressing the need for greater local adaptability and participation. While these studies begin to provide insights into the role of rating systems in assessing sustainability, the research does not look further into how the real world application of these standards is currently taking place.

Newsham, Mancini, and Birt (2009) performed a reanalysis of 100 LEED-certified green buildings to evaluate their energy use, and determine whether energy-savings correspond to the level of LEED certification. While the findings are preliminary, the team identified that large discrepancies exist in the energy efficiency of the LEED buildings against their conventional counterparts. Additionally, they found that the energy performance of the LEED buildings had little correlation with their certification level, bringing into question the real effects of such standards subsequent to design. Their analysis sheds light upon one of the strong critiques of LEED—that the prescriptive design standards do not always provide the expected or desired results. However, these researchers do not provide an alternative approach to the rating system or revised guidelines.

While critical analysis has been conducted on the formulation of the LEED-ND standards there has yet to be a comprehensive analysis of the application of LEED-ND projects, and how the projects succeed in meeting the LEED-ND standards and goals. Garde (2009) performed an analysis of 21 US LEED-ND pilot projects prior to the formalization of the standards in 2009. He evaluated the implications of LEED-ND standards becoming formalized planning policy in municipalities and concluded that the criteria alone were not sufficient to address local planning and sustainability needs. Mapes and Wolch (2011) analyzed 29 US communities that have received accolades for sustainable design, but have not undergone a formal assessment, either according to LEED-ND standards or those of any other system. They found that the features were geared more toward the marketability of the development rather than long-term sustainability and livability of the community. In considering how LEED-ND may serve to standardize the designation of sustainable communities, they stress that while LEED-ND criteria and indicators provide a strong basis for planning

and design for long-term sustainability, focus on community infrastructure that would foster livability does not exist. However, while the studies of Garde and Mapes and Wolch present this deficiency in LEED-ND, their scope of research does not expand to the creation of a study to test the issues identified with the standards.

In the review of LEED-ND as a potential source of policy and regulation for the development of sustainable neighborhoods, both in the US and abroad, it has been noted that the standards are well on their way to being adopted as one of the top guides to “smart” urban development and growth (Mapes and Wolch 2010; Sharifi and Murayama 2012). Cities around the world will use this standard to develop neighborhoods. But perhaps other urban forms can create livability, and design is not the only influence that contributes to the creation of livable places. In light of these questions, this analysis examines how one place widely regarded as livable, San Francisco’s Noe Street, measures up against LEED-ND’s NPD standards. This study provides a first step to better understand how the neighborhood design and planning criteria in LEED-ND aims to foster a sense of livability in a project area.

Methodology

This study evaluates the LEED-ND NPD standards with regard to how well they capture a sense of livability. Specifically, we seek to understand how residents in an identified, existing “livable” neighborhood would rate and rank the 15 criteria set forth in LEED-ND’s Neighborhood Pattern and Design standards. The hypothesis of the study is that residents in the identified livable neighborhood will have differences with the LEED-ND criteria, and that these criteria will fall short of fully capturing livability as perceived by residents. We tested and evaluated this hypothesis through field measurements of the 15 LEED-ND NPD criteria and a residential survey on Noe Street in San Francisco. There were limits to the methodology in the decision to perform the analysis within a single geographic area and the low level of survey respondents ($N = 40$). These issues mainly arose from a time limitation, and we worked within this limitation to identify a location where we could fully and thoroughly apply all the research methods described in the following sections.

Site Selection

The area selected for our analysis is Noe Street, located within the Duboce Triangle neighborhood in San Francisco (see Figure 2). This area is generally regarded as a livable neighborhood among residents of San Francisco. It is bordered by the Lower Haight, Mission, and Castro neighborhoods. The

neighborhood is also well known as a green neighborhood, characterized by its many street trees, sidewalk plantings, and apartments and homes in Victorian style.



Figure 2: Duboce Triangle in San Francisco

Noe Street was selected within the Duboce Triangle because it exemplifies many of the elements that feed into perceptions of the neighborhood's livability (See Figure 3), which include walking access to stores and amenities, transit proximity, calm traffic, and the presence of nature.

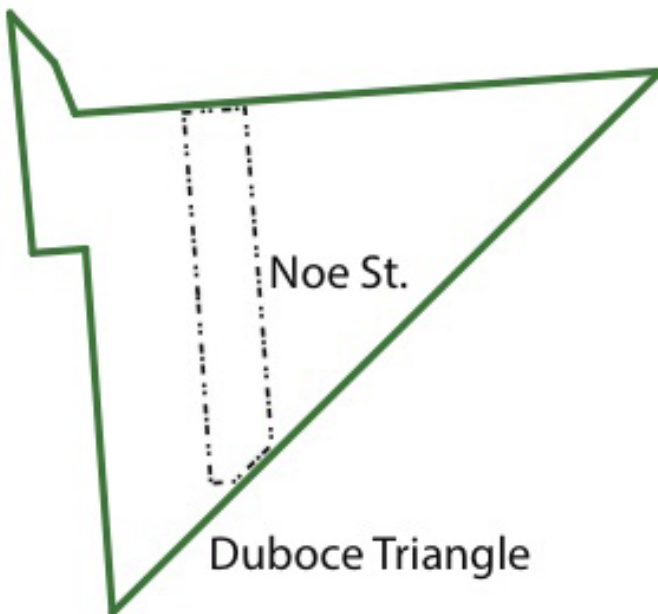


Figure 3: Noe Street in Duboce Triangle

Walking access to stores and amenities: Noe Street is in close proximity to major commercial corridors on Market Street and Church Street, providing residents with accessibility to groceries, pharmacies, restaurants, and bars. It contains a number of neighborhood stores, cafes, and restaurants, most of which are located at intersections, and several of which are clustered at the intersection with Market Street. Other amenities, such as schools and parks, are also close by. Noe Street intersects with Duboce Park, a dog-friendly park with a large green, a playground, and a tennis court.

Transit proximity: The Duboce Triangle is well served by public transportation, and Noe Street is particularly well situated. The N-Judah MUNI metro line stop is located in Duboce Park at the intersection of Noe Street and Duboce Street. The F-Market line stops at the intersection of Noe and Market, as do several major bus routes. Residents are equidistant to the Church and Castro MUNI stations, where they can access the J, K, L, M, and T train lines.

Calm traffic and the presence of nature: The Duboce Triangle is well known for sidewalk improvements that calm traffic and introduce plantings and trees into the streetscape. These improvements, now decades old, came about as a result of citizen activism. The effect is particularly pronounced on Noe Street, which is rich in street trees and sidewalk sitting areas complete with planters. At bulb-outs or curb extensions with seating areas, residents have supplemented plantings implemented by the city with plantings of their own. Cars are disciplined as a result of the corner bulb-outs and angled parking in place along much of the street.

Field Measurements: Applying LEED-ND NPD Standards to Noe Street

In order to be considered for points according to the LEED-ND NPD criteria, a development must meet three prerequisites: Walkable Streets, Compact Development, and Connected and Open Community requirements. After meeting these criteria, the development can then earn up to 44 points, distributed among 15 credits. The maximum number of points available under each credit varies. For example, a development can earn up to 12 points for meeting Credit 1, Walkable Streets, but only 1 point for meeting the criteria of Credit 13, Local Food Production.

This study used field observations, tape measure, GIS, and online resources such as the San Francisco Property Information Map, Google search, and Google Earth to determine the number of points Noe Street would receive for NPD. Noe Street failed to meet Prerequisite 3, Connected and Open Community compliance. This study, however, still measured Noe Street to

determine how many points it would earn otherwise. Noe Street earned 21 out of 44 available NPD points, as shown in Figure 4.

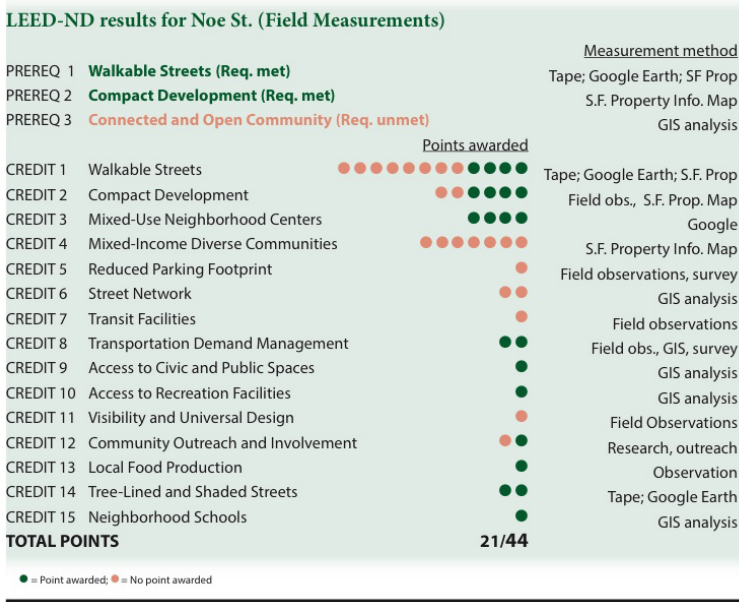


Figure 4: Noe Street LEED ND NPD Measurements

The strict form of LEED-ND measurements accounts for some of Noe Street’s failures to receive NPD points. Noe Street came just under the minimum for Prerequisite 3, which requires that there be 90 intersections within a quarter mile radius of the project area. Noe Street has only 82 intersections within a quarter mile. Similarly, Noe Street lost points in Credit 1, Walkable Streets, because, while LEED-ND stipulates that crossings with driveways can take up no more than 10% of the sidewalk, Noe Street driveways take up 16%. Likewise, Noe Street came shy of meeting walkability standards in on-street parking, commercial window display, and functional entries.

Residential Survey

We conducted a residential survey on Noe Street in order both to answer the research question of how residents in an identified highly livable neighborhood would rate and rank LEED-ND’s 15 criteria for Neighborhood Pattern and Design, as well as to test our hypothesis that the criteria set forth in these standards would not fully capture livability and the manner in which it is perceived by residents. The addresses were selected to provide an even distribution of surveys over the four blocks of Noe Street located in the Duboce Triangle. All surveys were mailed to the selected residences, and stamped return envelopes were included.

Although Noe Street has mixed-uses, only residential units received the surveys, because the study sought to test the residential perception of livability on Noe Street. All selected residences received identical survey forms.

The survey consisted of questions about neighborhood perception, LEED-ND criteria rating, and demographic characteristics. The open-ended questions were placed at the beginning of the survey, and asked background information on how long the residents had lived in the Duboce Triangle or on Noe Street. The questions then prompted them to describe their perceptions of livability both in general and on Noe Street.

The second portion of the survey consisted of a Likert Scale rating of the 15 LEED-ND criteria for Neighborhood Pattern and Design. Respondents were asked to rate 25 listed neighborhood design and planning features selected from LEED-ND NPD standards, on a five-point scale, with one being “very undesirable” and five being “very desirable.” As to not bias results, the statements residents rated were rephrased from LEED-ND criteria to be more accessible to the general public. Additionally, while LEED-ND criteria for Neighborhood Pattern and Design only consist of 15 credits, because some credits contain multiple components, such as Walkable Streets, this study added additional criteria for respondents to rank under the Likert Scale section to reflect this aspect of LEED-ND. Following their rating of the 25 neighborhood design and planning features, respondents were asked to go back to the list of the criteria and circle the top three features that were most important to them in terms of neighborhood pattern and design. Respondents were not asked to rank their top three, only to identify what was most important to them, making this a non-weighted ranking.

The final portion of the survey consisted of multiple-choice questions to allow us to better understand the respondents’ transportation choices and financial stability. As LEED-ND places much emphasis on reduced vehicle miles traveled and increased access to and use of public transport, this study felt it was important to evaluate respondents’ main form of transportation. This section contained questions relating to owner versus renter status and household income to allow us to evaluate if this information collected from the survey aligned with the secondary data we found from the US Census on housing stability and income. Finally, the survey included a question on the number of residential units in their building to analyze if there was a correlation in terms of livability and the density of a residence.

Analysis of Survey Results

Out of the 137 surveys sent out to Noe Street residents, 40 valid responses were received. The surveys were sent to 50% of the total residents, distributed to every other house on the street. From these surveys we also received some background information on the respondents. On average, respondents had lived in both the Duboce Triangle and Noe Street for 10 years, with the shortest period being 4 months and the longest period 45 years. Exactly half of the residents owned their residence; half rented. A plurality of respondents' households (40%) earn about \$150,000, followed by 28% of households earn between \$100,000 and \$150,000, 20% earn between \$50,000 and \$100,000, and 10% earn less than \$50,000. Out of the residents surveyed, 93% reported feeling very happy about Noe Street as a place to live.

Neighborhood Preference Question Results

Noe Street Survey respondents were asked to answer a series of open-ended questions beginning with their general preferences of a neighborhood they would like to live in. Following the general question on desirable aspects of a livable neighborhood, the survey prompted respondents to answer the following questions regarding Noe Street specifically:

- What are the first three things that come to your mind about Noe Street as a place to live?
- Would you change anything about Noe Street if you could? If so, what would you propose?
- If you were to move away, what would you miss most about living on Noe Street?

From Figure 5, it is possible to analyze the hypothesis in regards to respondents bringing in aspects of livability not found in the LEED-ND criteria. As highlighted on the chart, residents' responses relating to atmosphere and social factors, as well as aspects of landscape architecture such as "sitting outside" and "more places to sit" fall outside of LEED-ND NPD. The importance residents placed on the Atmosphere and Social Factors of the street and how it enhances livability is particularly interesting, as while LEED-ND criteria for neighborhood pattern and design lacks this aspect, LEED-ND's goals very much speak to the importance of a feeling of community in the developments that utilize those standards.

Resident Characterizations of Noe Street by Number of Iterations

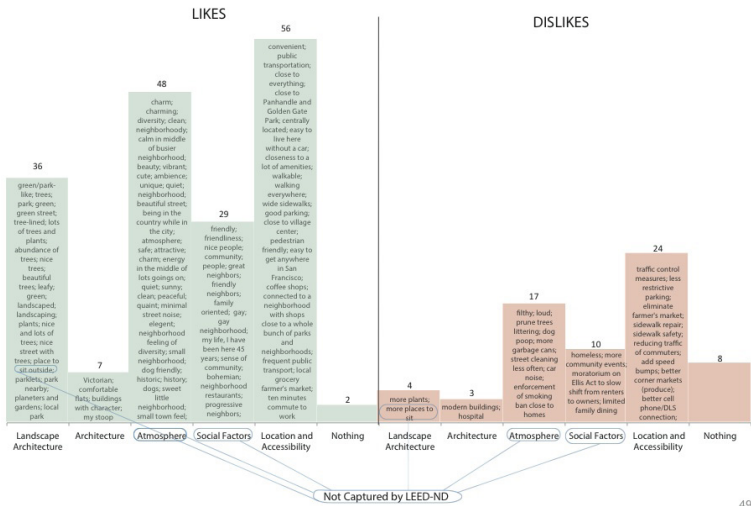


Figure 5: Resident Open Answer Survey Response

While “atmosphere” and “social factors” were often mentioned in the residents’ responses, the aspects of livability that the majority of respondents spoke to were “location” and “accessibility and landscape architecture.” Geographic location, accessibility, and landscape design are aspects covered by LEED-ND NPD standards, and residents’ comments referred to NPD credits such as connected and open community, walkable streets, mixed-use neighborhood centers, tree-lined and shaded streets, and transportation demand management. An additional point of note is that even though our study marked envelopes by blocks for the survey, no significant differences were found between residents’ perceptions of livability and their location on Noe Street.

LEED-ND Criteria Rating Survey Results

As shown in Figure 6, survey respondents were presented with 25 criteria that described the 15 credits in LEED-ND NPD. The respondents were presented with a Likert Scale from one to five with one being “very undesirable” and five being “very desirable.” Respondents were asked to rank the 25 criteria as they corresponded to the residents’ idea of the desirability of certain neighborhood design and planning features.

LEED-ND Neighborhood Pattern and Design Credits	Corresponding Survey Questions and Likert Scale Rating	Overall Likert Scale Rating for LEED-ND NPD Credit
Credit 1: Walkable Streets	<ul style="list-style-type: none"> • The presence of sidewalks (4.9 – very desirable) • Streets narrow enough to see both sides of the street (4.2 – desirable) • Entries elevated at the ground floor to maintain residents' privacy (3.9 – desirable) • Multiple entries and windows along the sidewalk (as opposed to solid walls) (3.1 – neutral) • Building entrances in close proximity to sidewalk (small building setbacks) (3.1 – neutral) • Clear glass in commercial operations that allow for visibility from the sidewalk (4.1 – desirable) 	3-neutral
Credit 2: Compact Development	<ul style="list-style-type: none"> • Availability of on-street parking (4.3 – desirable) 	3.1 – neutral
Credit 3: Mixed-Use Neighborhood Centers	<ul style="list-style-type: none"> • Minimal space between buildings (3.1 – neutral) • A mix of residential and commercial uses within the neighborhood (4.4 – desirable) • Proximity to amenities (e.g. markets, shops, pharmacies, etc.) (4.9 – very desirable) 	4.6 – very desirable
Credit 4: Mixed-Income Diverse Communities	<ul style="list-style-type: none"> • Diversity in types of housing (e.g. single-family homes, apartments, and condos) (4.1 – desirable) • A mix of affordable and market-rate housing (3.7 – desirable) 	3.9 – desirable
Credit 5: Reduced Parking Footprint	<ul style="list-style-type: none"> • Few parking lots and parking garages directly in front of building entrances (3.4 – neutral) 	3.4 – neutral
Credit 6: Street Network	<ul style="list-style-type: none"> • Streets connecting to adjacent neighborhoods and commercial centers (4.1 – desirable) • Frequent intersections (3.3 – neutral) 	3.7 – desirable
Credit 7: Transit Facilities	<ul style="list-style-type: none"> • Nearby, safe, convenient, and comfortable transit waiting areas (4.7 – very desirable) 	4.7 – very desirable
Credit 8: Transportation Demand Management	<ul style="list-style-type: none"> • Public transportation and car-sharing options (4.9 – very desirable) 	4.9 – very desirable
Credit 9: Access to Civic and Public Spaces	<ul style="list-style-type: none"> • Access to public spaces and institutions (e.g. parks, plazas, houses of worship, libraries) (4.2 – very desirable) 	4.7 – very desirable
Credit 10: Access to recreation facilities	<ul style="list-style-type: none"> • Access to indoor and outdoor recreational facilities (e.g. 'tot lots,' swimming pools, and sports fields) (4.2 – desirable) 	4.2 – desirable
Credit 11: Visitability and Universal Design	<ul style="list-style-type: none"> • Residences and public buildings designed for accessibility to people with physical limitations (4.1 – desirable) • Public input in new development and plans for the neighborhood (4.5 – very desirable) 	4.5 – very desirable
Credit 12: Community outreach and involvement	<ul style="list-style-type: none"> • Access to fresh, local food from community gardens, farmers' markets, and/or community-supported agriculture (CSA) (4.5 – very desirable) 	4.7 – very desirable
Credit 13: Local food production	<ul style="list-style-type: none"> • Tree-lined streets (5 – very desirable) • Shaded streets (4.4 – desirable) 	3.6 – desirable
Credit 14: Tree-lined and shaded streets	<ul style="list-style-type: none"> • Proximity to schools (3.6 – desirable) 	3.6 – desirable
Credit 15: Proximity to schools		

Figure 6: LEED ND Likert Scale Survey Results

Figure 6 breaks down each of the 15 LEED-ND credits by their corresponding survey questions measured on the Likert Scale, and includes their averaged desirability rating from the 40 respondents. These results from the survey help answer our research question in regards to residents' ratings of livability criteria and how it may differ from the manner in which LEED-ND places emphasis on its credits. Noe Street residents placed higher desirability on features such as tree-lined and shaded streets, transit facilities, and access to civic and public spaces, and less emphasis on credits such as Walkable Streets and Compact Development, two areas that LEED-ND highly emphasizes. Also notable is the fact that certain aspects of the LEED-ND credits appeal more to residents than others, particularly in the Walkable Streets credit. While most residents found sidewalks to be a very desirable feature of the streetscape, aspects such as multiple entries and windows and entrances with close proximity to the sidewalk were deemed less desirable.

Rethinking LEED-ND NPD Standards Based on Residents' Rating and Ranking of Criteria

Figure 7 illustrates a rethinking of the weighting of the LEED-ND credits based upon residents' responses from the LEED-ND Criteria Rating section of the survey, as well as from their answers when prompted to circle the top three qualities most important to them. As mentioned earlier, residents did not rank their top three selections. The new LEED-ND chart has Tree-Lined and Shaded Streets, Mixed-use Neighborhood Centers, and Access to Civic and Public Spaces as the prerequisites for the standards, replacing

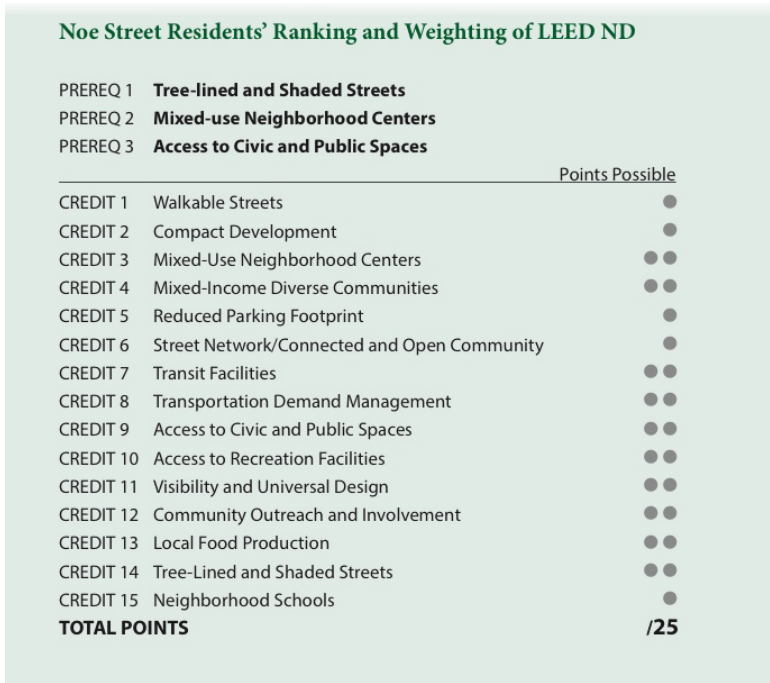


Figure 7: LEED ND Reimagined

This “reimagined” LEED-ND NPD chart helps to answer the study’s research question that residents in an identified “highly livable” neighborhood such as Noe Street would both rate the standards differently than LEED-ND, and places a different weight on what was considered most important in achieving a livable neighborhood.

Summary of Findings

The findings of this study can be interpreted as evidence that our initial hypothesis is correct: LEED-ND criteria for NPD fell short of capturing the livability of the area selected for the study. While this conclusion and confirmation of the hypothesis was mainly supported by the study’s survey and analysis of residents’ responses, the measurements first conducted on Noe Street of the LEED-ND NPD criteria also pointed to possible deficiencies in the ability of these criteria to truly represent and evaluate neighborhoods, such as the Duboce Triangle neighborhood and Noe Street in particular, as “livable.”

This study evaluated Noe Street as a new LEED-ND project, and redistributed points for the three NPD prerequisites and 15 credits, with the area receiving 21 out of the 44 possible points. We found that Noe

Street is ineligible for LEED-ND certification due to its failure to meet Prerequisite 3, Connected and Open Community, which requires the project area to display a high degree of connectivity to the community at large (measured by the number of intersections falling within a 1/4 mile of the site). However, because it fell eight intersections short of the required 90, Noe Street did not meet this prerequisite, and thus failed to achieve consideration for LEED-ND certification. Slight deficiencies such as these were found regularly as the study conducted the measurements, thus the study was able to highlight that the LEED-ND NPD criteria may place too much emphasis on certain design and planning patterns that do a poor job of reflecting the livability of a place.

In the open-ended portion of the survey, residents revealed their preference for tree-lined and shaded streets, mixed-use neighborhood centers, access to civic and public spaces, and transportation demand management. They placed less emphasis on criteria heavily pushed by LEED-ND, such as walkable streets, connected and open community, and compact development. The survey served as an important tool in the confirmation of the hypothesis and critical analysis of LEED-ND, and for a better understanding what aspects residents in a recognized highly livable neighborhood most attribute to creating a sense of livability.

Conclusions: Policy Implications and Future Research

This study's measurement of Noe Street according to LEED-ND standards shows that even a place that is commonly considered highly livable fails to be livable under the LEED-ND rating system. This study found that despite the lack of NPD points, Noe Street residents are very happy living there. Similarly, in their characterizations of Noe Street, they describe a large number of qualities relating to atmosphere and social factors. It is not clear whether these factors are design-related or a product of other variables. Yet, regardless of the causes, it is not sufficient to meet LEED-ND NPD criteria.

Cities must carefully consider the value they place on LEED-ND's prescriptive standards. LEED-ND certification is increasingly used to expedite the approval process, reduce local fees, or both. The certification also appeals to buyers and renters. However, it is our major concern that codifying LEED-ND standards as they are will impose an inflexible template on the urban form to the exclusion of variations, such as those modeled on Noe Street.

If Noe Street was rated as highly livable by its residents but received only half of the possible NPD points, one must conclude that conformity to LEED-ND standards are not the only means for achieving livable

neighborhoods. However, it should also be recognized that the study design was meant to provide a means to best understand the perceptions and opinions of Noe Street residents with regard to livability. Noe Street was highly representative of a livable neighborhood in San Francisco, and although our results are geographically limited, we do provide a strong case study into a highly livable place in the context of LEED-ND NPD standards. The results were analyzed with the understanding that the survey would provide a geographically-specific understanding of livability, and that, if given to residents of different neighborhoods, results could vary greatly. It should also be noted that while this study spoke mainly to the residents' perception of livability, the LEED-ND standards apply mainly to the physical design and layout of projects, and thus do not specifically address how residents will interact with the design. Therefore, while this study placed heavy emphasis on the human perception of livability, when developers and designers are applying the standards they may not be attributing as much weight to the overall human experience of the project.

Further tests of LEED-ND NPD are required to truly understand the value of these standards. While our analysis provides a perspective that can begin to address the relationship between LEED-ND's Neighborhood Pattern and Design standards and livability, it is imperative that we stress the need for further studies to allow for a higher level of generalizability. "Future studies may include: a survey of residents in a LEED-ND certified development; a survey of residents in a development that comes very far from meeting LEED-ND standards, such as in a gated suburban community; and a survey of a place that is known not to be livable, so that we can learn about livability from what people *do not* like. Upon the completion of studies in both similar livable neighborhoods and places considered "non-livable" as defined by the literature, a more complete picture of LEED-ND NPD standards and livability can be presented.

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