

LEED-ND and Livability Revisited

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Abstract

This study examines LEED-ND's criteria for Neighborhood Pattern and Design (NPD). LEED-ND was developed as a system for rating new neighborhoods on the sustainability of their planning. However, it has increasingly been adopted by cities as a de facto measure of "livable" neighborhood design and used to accelerate development processes. We hypothesize that these criteria do not accurately capture livability as defined by residents. Our study area is Temescal, a gentrifying neighborhood in Oakland, CA. Temescal could not achieve LEED-ND certification due to technical disqualifications, yet residents of the neighborhood rated its livability very highly. Furthermore, residents consistently rated and ranked NPD characteristics quite differently than did LEED-ND, calling into question its validity as a universally codifiable rating system. We propose that a single set of weighted, prescriptive design guidelines may not be able to reflect the diverse values and desired amenities of different communities.

Introduction

Neighborhood livability and sustainability have shifted in meaning and importance throughout the history of city planning. The modern quest to define and codify these terms has been taken up in earnest by planners and designers, yet consensus is difficult. What exactly is livability? Is it a component of sustainability, or perhaps vice versa? Can there be a single, normative definition or are the values and desires of a multiplicity of communities simply too diverse to encapsulate?

LEED-ND is a system for evaluating neighborhood design that was developed in partnership with the Congress for the New Urbanism and the Natural Resources Defense Council. It poses a set of weighted criteria that communities and developers can use to evaluate new neighborhood design. While ostensibly meant for certifying sustainability, LEED-ND is increasingly being formally codified by cities, pitched as a development accelerator, and advertised as a creator of "livable" communities. The United States Department of Housing and Urban Development recently started requiring applicants to secure LEED-ND conditional approval for neighborhood revitalization projects to be considered for Choice

Neighborhoods Planning Grants (Chen 2012). Workshops are being pitched to cities, offering training on how to use LEED-ND to accelerate the development of sustainable communities (Smart Growth America 2013). The prominent New Urbanist practitioners who authored *The Smart Growth Manual* write that LEED-ND allows us to “objectively determine the degree to which proposed projects embody smart growth principles ... it is expected that LEED-ND will become a municipal standard for controlling the urban design of large-scale development” (Duany, Speck, and Lydon 2010, 6–8).

As LEED-ND grows more ubiquitous, it becomes imperative to understand its outcomes and impacts on communities. What is the relationship between LEED-ND and livability? Some of its codifiers indicate that its standards can in fact foster neighborhood livability. For example, in their discussion of the benefits of certification, the city of Charlottesville, Virginia, states that LEED-ND helps “create more livable communities” (City of Charlottesville 2013). Yet if livability is partly in the eye of the beholder, what exactly is a livable community? Different communities may prioritize different neighborhood amenities or designs over others, and a cookie-cutter certification system may not succeed as a one-size-fits-all tool. Can a community be considered livable by its residents without satisfying the normative design criteria of LEED-ND?

Several of LEED-ND’s criteria are quite prescriptive aesthetically. Consider the following from its handbook, accompanied by an illustration of a raised stoop: “If the project has ground-floor dwelling units, the principle floor of at least 50% of those units must have an elevated finished floor no less than 24 inches above the sidewalk grade” (USGBC 2012, 51). Is this necessary for livability or sustainability? While theorists such as Jane Jacobs (1992) and Christopher Alexander (1977) have argued in favor of traditional architectural elements like the stoop, such precise aesthetic mandates are susceptible to charges of design determinism (Knox and Schweitzer 2010) and prescribed homogeneity (Cabrera and Najarian 2013). LEED-ND has also been criticized for its complexity, subjectivity, and lack of empiricism (Ewing et al. 2013).

Beyond this hype and criticism of LEED-ND, there exist some gaps in the research literature. While LEED-ND attempts to standardize neighborhood sustainability, it is important to understand if its prescriptions are necessary or sufficient to create highly livable neighborhoods for residents. It is increasingly being codified in the name of livability, but can a single set of weighted criteria satisfy diverse values and preferences? Previous research has not explored resident attitudes toward livability and LEED-ND’s NPD criteria from the perspective of both longtime residents and newcomers in a diverse, gentrifying neighborhood. Our study area is the Temescal

district, a rapidly transitioning neighborhood in north Oakland, California, that exhibits the characteristics of traditional neighborhood design.

We hypothesize that:

- [H1]: The study area would be disqualified from LEED-ND certification.
- [H2]: The residents of the study area would, on average, consider their neighborhood to be livable.
- [H3]: The residents of the study area would weight the NPD criteria differently than LEED-ND does.

We first conducted a series of field observations in the study area to score the neighborhood against LEED-ND's NPD checklist. Then we administered a survey in each study area to determine how residents rate the importance of the different criteria and their own neighborhood's livability. This paper is organized as follows: first we provide an overview of LEED-ND and neighborhood assessment and then examine the relationship between LEED-ND and livability. Next we discuss our study area and research design and then analyze our results. The paper concludes with a discussion of our findings and a trajectory for future research.

LEED-ND and Neighborhood Assessment

History and Goals

The United States Green Building Council (USGBC) was founded in 1993 by Rick Fedrizzi, David Gottfried, and Mike Italiano to promote environmental values and sustainable design in the construction industry. The standards developed by USGBC are called the Leadership in Energy and Environmental Design standards (LEED). LEED's first pilot program was launched 1998 and its first official set of design standards were issued in 2000. It was updated in 2002 and 2005 (USGBC 2012). LEED for Neighborhood Development (LEED-ND) extends LEED's energy and environmental standards to the neighborhood scale. Many of its criteria, particularly site location and neighborhood pattern, reflect New Urbanist principles and are inspired by traditional neighborhood design (USGBC 2012). LEED-ND is not the only system for evaluating neighborhood sustainability. Sharifi and Murayama (2013) provided a comprehensive overview of alternatives when they reviewed LEED-ND alongside several other systems, including EcoCraft Communities, the UK's BREEAM Communities, and Japan's CASBEE-UD. Despite alternatives, LEED-ND is the most popular rating system in the United States.

There are five broad point categories in LEED-ND: Smart Location and Linkage (worth up to 27 points), Neighborhood Pattern and Design (worth up to 44 points), Green Infrastructure and Buildings (worth up to 29 points), Innovation and Design Process (worth up to 6 points), and a Regional Priority Credit (worth up to 4 points). The Neighborhood Pattern and Design (NPD) category—the subject of this paper—comprises the plurality of total available points. In addition to offering fewer points, the other major categories are not particularly relevant to measuring residents' perceptions of livability. While their success may be debatable by designers, engineers, and technicians, it is largely a technical debate, not a matter of taste or culture.

The Neighborhood Pattern and Design Criteria

On the other hand, the criteria in the NPD category are potentially subject to varied opinions regarding livability, and that variability may be based on individual idiosyncrasy, demographic characteristics (e.g., children in the household), broader cultural considerations, and other factors. NPD is the part of LEED-ND that speaks directly to urban design at the neighborhood scale. The New Urbanist design paradigm is unsurprisingly prominent in the criteria as the Congress for the New Urbanism collaborated in the criteria's development. Consequently, as prescriptive criteria, these standards may be susceptible to charges of environmental design determinism, elitism, and homogeneity (Cabrera and Najarian 2013).

The USGBC's handbook on LEED-ND emphasizes environmental, social, health, and equity benefits:

Green neighborhood developments are beneficial to the community and the individual as well as the environment. The character of a neighborhood, including its streets, homes, workplaces, shops, and public spaces, significantly affects the quality of life. Green neighborhood developments enable a wide variety of residents to be part of the community by including housing of varying types and price ranges. Green developments respect historical resources and the existing community fabric; they preserve open space and encourage access to parks. Green buildings, community gardens, and streets and public spaces that encourage physical activity are beneficial for public health. Combine the substantial environmental and social benefits and the case for green neighborhoods makes itself. (USGBC 2012, xi)

Prerequisites and Point Values

As Table 1 illustrates, the NPD criteria can be conceptually divided up into three tiers, determined by the weighting that LEED-ND implies with its point values. The highest tier contains prerequisites, the middle tier contains criteria worth multiple points, and the lowest tier contains criteria worth only one single point.

Many of the criteria are self-explanatory, but a few require additional description. Most of the possible points in the Mixed-Income Diverse Communities criterion come from calculating the diversity of dwelling types as a proxy (it is not an actual measurement of residents’ incomes) plus the inclusion of designated or subsidized affordable housing. The Street Network criterion refers not just to a classic grid layout, but also to block width. Connected and Open Community refers to the physical connectivity of streets and whether the development is open to the public (i.e., not gated)—not to its social connections. Additionally, in many cases, the standards are surprisingly particular. For example, the Walkable Streets criteria expect that 90 percent of entrances face public streets, 15 percent of street frontage has at least a 1:3 height-to-width ratio, ground floors be raised twenty-four inches above grade, sidewalks be at least eight feet wide on mixed-use blocks and four feet wide on all other blocks, and that no more than 20 percent of street frontage may be faced by garage openings. While LEED-ND’s authors claim the criteria should “not be considered a one-size-fits-all policy tool” (USGBC 2012), achieving certification requires developers and communities to adhere to very particular, prescriptive design criteria. Can such specificity create livability for different communities with different preferences and values?

LEED-ND Neighborhood Pattern and Design Criteria

Criteria	Points
Walkable Streets	Prereq
Compact Development	Prereq
Connected and Open Community	Prereq
Walkable Streets	12
Compact Development	6
Mixed-Use Neighborhood Centers	4
Mixed-Income Diverse Communities	7
Reduced Parking Footprint	1
Street Network	2
Transit Facilities	1
Transportation Demand Management	2
Access to Civic and Public Spaces	1
Access to Recreation Facilities	1
Visitability and Universal Design	1
Community Outreach and Involvement	2
Local Food Production	1
Tree-Lined and Shaded Streets	2
Neighborhood Schools	1
TOTAL	44

Table 1: LEED-ND Neighborhood Pattern and Design Criteria. Source: US Green Building Council.

LEED-ND and Livability

According to the most recent Community Preference Survey conducted by the National Association of Realtors, 60 percent of Americans prefer to live in a neighborhood with a mix of houses, stores, and businesses within walking distance of each other; 78 percent responded that the neighborhood in which they live is more important than the size of their house (NAR 2013). But how does one define a “mix of houses” or “within walking distance”? The quest to delineate “livable” and “livability” has been one taken up by planners and designers in an attempt to create successful, thriving, and healthy communities. Embodied in these terms are multiple factors including physical features, psychological associations, and personal preferences.

In the planning literature, there is some common territory around the discussion of livability. Definitions of livability arise out of decades of research that has progressively been incorporated into the urban design canon. According to one portrayal, “livable neighborhoods create lively, safe, and attractive streets, and provide public amenities such as parks, community centers and schools” (Macdonald 2005). This builds on Jacobs’s and Appleyard’s classic 1987 definition:

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).

These definitions imply the importance of physical design in fostering various aspects of livability. Within these definitions, special attention is paid to the pedestrian experience. Bosselmann et al. (1999) concluded with similar definitions of livability, placing an emphasis on safety, privacy, and protection from traffic, pollution, and noise. Bosselmann (2008) pointed out that “the original meaning of livability described conditions in neighborhoods where residents live relatively free from intrusions” (142) but that the term has been progressively broadened to include sustainability, safety, comfort, available services, walkability, and transit. Further, he explicitly differentiates the term from vitality and sense of belonging.

The LEED-ND Neighborhood Pattern and Design (NPD) criteria attempt to address these issues of livability in consideration with the overall sustainability of neighborhoods. The attempt to account for livability is particularly evident in the acknowledgement that “the character of a neighborhood, including its streets, homes, workplaces, shops and public spaces, affects the quality of life” (USGBC 2012, xi). By LEED-ND

definition, a neighborhood is “an area of dwellings, employment, retail, and civic places and their immediate environment that residents and/or employees identify with in terms of social and economic attitudes, lifestyles, and institutions” (USGBC 2012, xvi). By creating development guidelines for streets, public spaces, and services, LEED-ND’s NPD criteria seek to provide guidance for the creation of built environments that can positively impact the social qualities of a neighborhood.

Aranoff et al. (2013) surveyed residents of a relatively wealthy San Francisco neighborhood, generally considered to be highly livable by both residents and canonical urban design standards. The study found that the LEED-ND NPD criteria “fell short of capturing the livability of the area selected” and also discovered “possible deficiencies in the ability of these criteria to truly represent and evaluate neighborhoods ... as ‘livable’” (163). The researchers concluded that the neighborhood, though considered to be highly livable by its residents, fails to meet the LEED-ND NPD standards for certification.

For the purposes of our study, we borrowed from the planning and design literature to define livability as the outcome of a set of physical characteristics that foster social stability and equity, personal safety and comfort, low dependence on the automobile, and sense of community. These characteristics include neighborhood pattern, transit proximity, walking access to a variety of amenities, and presence of nature. We have in turn defined sustainability as the capacity of a neighborhood to meet its residents’ needs into the future. This includes consideration of ecological systems, the built environment, social systems, economy, and livability. As noted earlier, the broader LEED-ND certification process, of which NPD is only a part, is chiefly concerned with the sustainability of new developments. However, a community must be livable in order to be sustainable for its residents. Though the topic has been approached in various ways, there is no single empirical definition of a “livable neighborhood.” With this in mind, we sought to determine if the criteria set forth by LEED-ND NPD accurately capture livability and the value of neighborhood characteristics as perceived by the residents of the neighborhood.

Study Site

For greater generalizability, Aranoff et al. (2013) called for future research in more diverse settings than their own wealthy central city study site. Accordingly, we selected a study site in the Temescal neighborhood in north Oakland, California. This area is more diverse in terms of race, income, and housing tenure. It saw economic decline during the late twentieth century but has been gentrifying and changing rapidly in the

last decade. Previous research has explored resident attitudes toward livability and LEED-ND but has looked far less at the perspectives of both longtime residents and newcomers in such a rapidly gentrifying, diverse neighborhood. Furthermore, its urban form and land use are that of the traditional neighborhood design that inspired the LEED-ND standards. Accordingly, this study area allows us to both expand from previous research and examine resident preferences in an area which demonstrates the traditional design that LEED-ND NPD seeks to emulate.

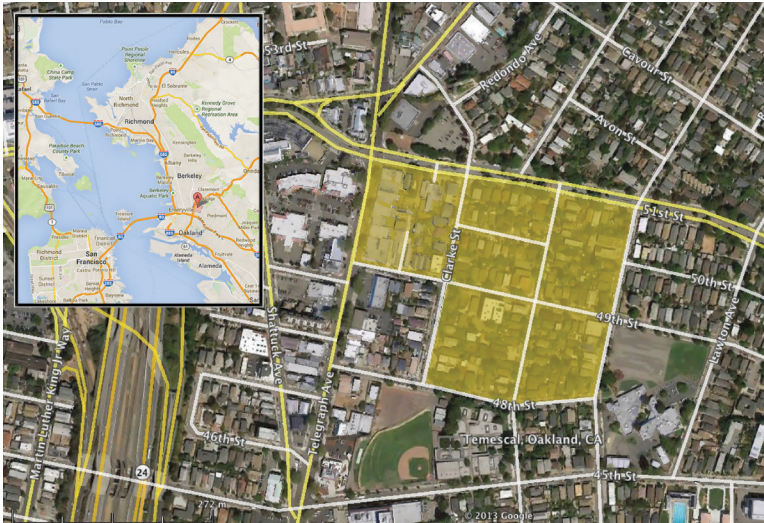


Figure 1: Map of the Temescal study site. Source: Google Earth.

The size of our study site is approximately 18.8 acres and was selected to contain a wide variety of traditional neighborhood design characteristics. Temescal was built mostly in the early twentieth century, though its settlement dates back to California's prestatehood era (Norman 2006, 1999). As one of the oldest neighborhoods in Oakland and an early streetcar suburb, it is a good example of traditional neighborhood design, in that it provides housing, employment, shopping, transit, and civic functions in a compact, connected, and diverse way. The LEED-ND rating system seeks to emulate such characteristics (USGBC 2012).

In recent years, the neighborhood has experienced an economic resurgence and has developed a reputation for its emerging art scene and growing number of popular restaurants. This shift has led to gentrification and an evolving demographic profile in the neighborhood. According to the US Census Bureau, between 2000 and 2010, Temescal experienced a 20 percent increase in its white population and a 24 percent decrease in its black population. Furthermore, the neighborhood experienced a 7.8 percent increase in its median household income.



Figure 2: A commercial sidewalk in the Temescal study area. Photo by the authors.

	Temescal 2000	Temescal 2010	% Change
Total Population	6439	6572	+2.1%
White (total) %	46.5%	55.7%	+19.8%
Hispanic %	10.2%	11.4%	+11.8%
Black %	28.9%	21.9%	-24.2%
Asian %	12.3%	10.4%	-15.5%
Median Household Income	\$51,028.81	\$55,033.50	+7.8%

Table 2: Temescal's demographic shift over the past decade. Source: US Census Bureau.

As previously noted, the Temescal study site lies near two bus lines as well as a BART station. The neighborhood also contains a thriving commercial corridor along Telegraph Avenue with shops, restaurants, cafes, a library, a post office, and a pharmacy. The site is near several public parks and two neighborhood schools. With these characteristics in mind, should Temescal be considered livable? The neighborhood's proximity to transit and access to a variety of amenities conforms to this study's definition of livability as the outcome of a set of physical characteristics that foster social stability and equity, personal safety and comfort, low dependence on the automobile, and sense of community.

This perspective, like LEED-ND, focuses mainly on the built environment and land use. It is also important to note sociodemographic and economic factors as this study site is in a rapidly gentrifying neighborhood. Property values are increasing and some long-tenured residents are being priced

out while new wealthier residents are moving into this transitioning neighborhood. Crime and poverty may be concerns in residents' minds. These questions of equity, safety, and change are very relevant to the study of livable communities, yet measurement criteria such as LEED-ND tend to pay far more attention to built environment characteristics instead of these less tangible factors. Previous research has not explored resident attitudes toward livability and LEED-ND's NPD criteria from the perspective of longtime residents and newcomers in such a rapidly gentrifying neighborhood.

Temescal is a transitioning neighborhood whose urban form demonstrates traditional design and livability as defined in the literature and theory that inspired LEED-ND. In the next section, we will perform a series of field observations to see how this traditional neighborhood design scores on the NPD criteria.

Neighborhood Pattern and Design Calculations

We calculated the LEED-ND Neighborhood Pattern and Design score for our study area through a series of field observations and measurements to test our [H1] hypothesis. The scorecard is depicted in Table 3. Each neighborhood revealed interesting idiosyncrasies and possible shortcomings when compared to the prescriptive requirements of LEED-ND NPD.

The Temescal study area garnered 25 out of a total of 44 points. The site did not meet the prerequisite for Walkable Streets as it failed to have less than 20 percent of street frontage faced by garages. Approximately 23 percent of the streets were fronted by garages and driveways, which disqualified the study area from certification as a LEED-ND neighborhood. Temescal met the prerequisites for Compact Development, having significantly more than seven dwelling units per acre, and for Connected and Open Community. It should be noted, however, that while the study site specifically met the Connected and Open Community Requirement, areas directly adjacent to the study site would not meet the requirement due to the large distances between through streets.

For the four criteria worth four or more points, Temescal scored highest in Walkable Streets and Mixed-Use Neighborhood Centers, achieving 9 of 12 points for the former and all 4 points for the latter. Temescal only achieved 2 of 6 points for Compact Development because its estimated density was just 13 to 18 dwelling units per acre, caused by the low-rise commercial buildings (two or three stories) and the high number of detached single-family homes. The site only achieved 2 of 7 points for Mixed-Income Diverse Communities because there was no designated

LEED-ND Neighborhood Pattern and Design

Criteria	Possible	Temescal
Walkable Streets	Prereq	Failed
Compact Development	Prereq	Passed
Connected and Open Community	Prereq	Passed
Walkable Streets	12	9
Compact Development	6	2
Mixed-Use Neighborhood Centers	4	4
Mixed-Income Diverse Communities	7	2
Reduced Parking Footprint	1	0
Street Network	2	0
Transit Facilities	1	0
Transportation Demand Management	2	1
Access to Civic and Public Spaces	1	1
Access to Recreation Facilities	1	1
Visitability and Universal Design	1	0
Community Outreach and Involvement	2	1
Local Food Production	1	1
Tree-Lined and Shaded Streets	2	2
Neighborhood Schools	1	1
TOTAL	44	25

Table 3: LEED-ND NPD scorecard for the Temescal study area.

affordable housing within the site boundaries, nor were there any residential buildings of three or more floors. Temescal achieved one point each for Transportation Demand Management, Access to Civic and Public Spaces, Access to Recreation Facilities, Community Outreach and Involvement, Local Food Production, and Neighborhood Schools, and two points for Tree-Lined and Shaded streets.

The Temescal site fails to earn points in several categories. While Temescal has high access to transit lines, LEED-ND requires all bus stops to have covered bus shelters. Due to the lack of bus shelters, Temescal does not achieve any points for Transit Facilities. And while most automobile parking in Temescal is on-street parking, the lack of sheltered bike parking and storage caused the site to lose points in Reduce Parking Footprint. Due to the length of various blocks in the site—410, 420, and 435 feet—Temescal does not achieve any points for Street Network, which requires no blocks longer than 400 feet. Lastly, since most of Temescal’s homes predate the requirements of the Americans with Disabilities Act, we found that the site cannot achieve any points for Visitability and Universal Design.

Resident Survey Design

We conducted an anonymous residential survey in our study area to gather evidence regarding our [H2] and [H3] hypotheses. Do the residents of the study area consider their neighborhood to be livable despite its disqualification from LEED-ND? Do residents rate neighborhood pattern and design criteria differently than LEED-ND weights them? The NPD criteria consist of 15 point-based credits plus three prerequisites. Two of the prerequisites, however, are duplicated in the point-based credits, yielding a total of 16 unique items. The goal of the survey was to determine how residents rate and rank these 16 LEED-ND criteria for neighborhood pattern and design to see how they correspond with LEED's own implicit rankings of the criteria, as determined by prerequisites and possible points.

Addresses in the study area were randomly sampled to provide a representative distribution of residences in the site. Street blocks were coded by a small character written on the back of each envelope and were in turn categorized by intensity as either arterial-facing, arterial-adjacent, or interior residential blocks. We distributed 100 surveys, all of which were hand-delivered to the selected residential doorsteps. Stamped envelopes were included for return mailing.

The survey consisted of three parts. The first part collected general household information, including number of people in the household, household tenure in that particular location, the name of the neighborhood, owning or renting status, housing type, and mode of typical daily travel. The neighborhood name offers information on consistency between how residents of an area label their community. The travel mode is important as LEED-ND emphasizes reduced vehicle miles traveled and increased access to public transportation. The coding of blocks was used to analyze if there was any correlation between perceptions of neighborhood livability and the intensity of the household's immediate area.

The second part of the survey collected ratings for each of the 16 neighborhood pattern and design criteria on a five-point Likert-type scale. Prior to rating the criteria, respondents were prompted with the instruction: "Please circle one value on the scale from 1 (lowest) to 5 (highest) below for how important each of these characteristics is to you when considering the livability of a neighborhood in general. We are not asking you to rate your own neighborhood on this scale." This enabled us to capture residents' opinions on the value of these criteria in general without asking them to rate their own neighborhood's livability at this point. In order not to bias or confuse the respondents, the LEED-ND neighborhood pattern and design criteria were slightly rephrased and very briefly described in a short nonjargon sentence.

The third part of the survey gathered further open-ended information to better understand the respondent's perceptions. First, we asked the respondent to list their three most and three least important criteria. This information disambiguated those criteria that were the most and the least important in the event of several criteria being rated equally very highly or very lowly by the respondent. Respondents were not asked to rank their top and bottom three—rather they were asked merely to identify them.

The remainder of the survey gathered information about the respondent's perceptions of his or her own neighborhood. Respondents were asked to provide an open-ended answer regarding what they would miss the most were they to move away from their neighborhood—eliciting qualities they consider both desirable and somewhat unique to their current location. Next, they were asked to provide an open-ended answer regarding what they would hope to gain were they to move elsewhere—eliciting qualities or amenities they consider both desirable and somewhat lacking in their current location. Afterward, the respondents were asked to provide five words that best characterize their neighborhood. Finally, they were asked to rate the overall livability of their neighborhood on a five-point Likert-type scale from very unlivable to very livable.

Resident Survey Results

We received 43 responses from the Temescal study area, a 43 percent response rate. The housing type data is summarized in Table 4. Temescal has a nearly even split between renters and owners who responded to the survey. Furthermore, the Temescal sample is comprised of a diverse mix of apartment, condo, and detached-home dwellers. These findings correspond to the field observations conducted at the study site, as we observed that Temescal tended to have a diverse range of building types, sizes, and ages.

Percent of Respondents

Rent	49%
Own	51%
Apartment	28%
Condo	7%
Detached Home	56%
Other House Type	9%

Table 4: Housing type and owning/renting percentages in the Temescal study area.

The respondents from Temescal had high levels of diversity in mode of daily travel, with fewer than half claiming personal automobile use.

These numbers are depicted in Table 5. Respondents in Temescal reported having lived at their location for a mean of 8 years and 11 months with an average household size of 2.5 people, as depicted in Table 6.

Percent of Respondents

Personal Auto	46%
Bicycle	12%
Public Transit	26%
Walk	16%

Table 5: Primary mode of daily travel percentages in the Temescal study area.

Averages

Household Size	2.5 people
Tenure (months)	107.2 months

Table 6: Average household size and tenure by arithmetic mean.

Regarding the [H2] hypothesis, Temescal respondents rated their neighborhood's overall livability on average a 4.16, which falls between "livable" and "very livable" on our Likert-type scale. Interestingly, there was no correlation whatsoever between block intensity and how livable a respondent rated his or her neighborhood. In other words, respondents living along arterial roads rated the neighborhood equally as livable as those living on quieter interior blocks with less omnipresent automobile intrusion.

LEED-ND NPD Criteria Ratings

The analysis of Temescal's ratings for the LEED-ND NPD criteria revealed some interesting trends. The ratings appear in Table 7. Overall, residents considered each of the criteria important, with only the Reduced Parking Footprint criterion dropping to levels below the scale's midpoint of 3.0.

We determined the most common criteria, listed as either the most or least important, by the statistical mode of response where respondents were prompted to list their three most and three least important criteria. Comparing these responses to the weights given by LEED-ND to its NPD criteria, we can develop a sense of how well the weightings correspond with residents' perceptions of relative importance. These responses appear in Table 8.

Respondents most frequently listed Walkable Streets, Mixed-Use Centers, and Transit Facilities as the most important criteria. Only one of these—Walkable Streets—is in the NPD prerequisites and the high tier of LEED-ND point weighting. Mixed-Use Centers is in the middle tier of LEED-ND weighting with four possible points, and Transit Facilities

is in the lowest tier with only one possible point. Temescal respondents most frequently listed Universal Design, Reduced Parking Footprint, and Street Network as the least important criteria. Street Network is in the middle tier of LEED-ND weighting with two possible points, but Reduced Parking Footprint and Universal Design are both in the lowest tier with only one possible point each.

Criteria	Average Rating
Walkable Streets	4.51
Mixed-Use Neighborhood Centers	4.40
Tree-Lined and Shaded Streets	4.26
Compact Development	4.12
Connected and Open Community	4.02
Access to Civic and Public Spaces	3.84
Transit Facilities	3.84
Transportation Demand Management	3.80
Local Food Production	3.70
Access to Recreation Facilities	3.60
Neighborhood Schools	3.53
Mixed-Income Diverse Communities	3.47
Community Outreach and Involvement	3.26
Universal Design	3.26
Street Network	3.23
Reduced Parking Footprint	2.79

Table 7: Average ratings by arithmetic mean for each criterion in the Temescal study area.

Three Most Important Criteria:	Three Least Important Criteria:
Walkable Streets	Universal Design
Mixed-Use Neighborhood Centers	Reduced Parking Footprint
Transit Facilities	Street Network

Table 8: The most and least important criteria in the Temescal study area, determined by statistical mode of response where respondents were prompted to list their three most and three least important criteria.

Length of housing tenure was positively correlated with household size but negatively correlated with most of the NPD criteria, particularly Reduced Parking Footprint. In other words, shorter-tenured respondents generally rated the NPD criteria as more important to them than did longer-tenured residents. This finding is particularly interesting considering Temescal is gentrifying and there is often a contentious nature surrounding neighborhood change. Newer residents report these NPD criteria are more important, perhaps partly explaining why they are relocating to a neighborhood that features traditional design. We also

found that the larger the household, the longer the respondent has lived there and the higher they rated the neighborhood schools criterion. This is perhaps because larger households include school-age children.

The ratings for Tree-Lined and Shaded Streets and Walkable Streets were positively correlated (Pearson correlation coefficient of 0.79). Connected and Open Community and Mixed-Use Centers were also positively correlated (Pearson correlation coefficient of 0.69). These correlations indicate that respondents tended to rate these pairs of criteria highly or lowly in tandem. This possibly raises an argument that they should be present here in urban design as pairs too: alone each may be necessary but not sufficient. LEED-ND NPD does not currently link separate but related criteria together, potentially missing out on these interaction effects.

Neighborhood Descriptions and Preferences

The responses to the open-ended question about what respondents would hope to gain if they moved elsewhere were coded and are depicted in Table 9. As discussed earlier, these indicate neighborhood qualities or amenities that respondents consider both desirable and somewhat lacking in their current location. Several common responses are already addressed by LEED-ND NPD. However, several common responses are not currently addressed, even though they exist within the domain of neighborhood pattern and design and largely in agreement with canonical urban design.

Accordingly, these topics may be considered areas of improvement for the LEED-ND criteria. “Quieter communities” could be addressed through urban design and would conform to the classical definition of livability as freedom from intrusion of automobiles. Dedicated bike lanes can be included in neighborhood plans. Furthermore, better views from windows fall under the auspices of development siting. One respondent said he or she would hope to gain “access to regional parks, trees, trails” if he or she to move elsewhere, and another simply listed the desire for “more trees.” Similar open-ended responses included “more nature” and “more open and green spaces.” Although Temescal received full points for the Tree-Lined and Shaded Streets criteria, its street trees and green spaces were inconsistent in some parts of the study area. LEED-ND could perhaps address this by making access to recreation or tree-lined streets worth more points in the scorecard, or change the criteria’s wording to ensure more consistent tree canopy coverage across the entire neighborhood to prevent uneven distribution.

Other common responses contradict the values of progressive urban design, smart growth (Duany, Speck, and Lydon 2010), New Urbanist

principles (Congress for the New Urbanism 1996), and LEED's organizational goals (USGBC 2012). Conflicting responses include a desire for more space and less density, more parking and wider streets, and more single-family homes with larger yards. Furthermore, there are several common responses that LEED-ND possibly cannot address either because they fall under other policy domains or because they are challenging to control or provide. Several open-ended responses highlighted the changing, gentrifying nature of the community that may

LEED-ND Addresses

- Walkable stores
- Less traffic
- More compact
- More parks and open green spaces
- More diversity
- More connected and open
- Better transit/closer walk to transit
- Local food production

LEED-ND Does Not Address

- Quieter
- Dedicated bike lanes
- Better views from windows
- More nightlife activity
- More space/less density
- Better streetlights at night
- Better ongoing maintenance
- More parking/wider streets
- Single family homes/bigger yards

LEED-ND Cannot Address

- More sociable, sense of community
- Less homelessness
- Closer to friends and work
- Warmer weather to have a pool
- Safety/less crime
- Affordability
- Better schools/government
- Better neighbors
- Cleaner

Table 9: Responses regarding what residents would hope to gain if they moved elsewhere, indicating qualities or amenities they consider both desirable and somewhat lacking in their current location. Some of the common responses are already addressed by LEED-ND NPD, others are not currently, and others cannot be because they fall under other domains or are difficult to control/provide.

lie outside of LEED-ND's scope. One respondent said he or she would hope to gain a "lower proportion of yuppies to non-yuppies" were he or she to move elsewhere. Another listed "more diversity of incomes and ethnicity," and another hoped for a "greater number of sophisticated residents." LEED-ND could assign more points to the Mixed-Income Diverse Communities criteria to encourage a greater diversity of housing prices and types of residents, but it is probably impossible to regulate resident sophistication and professionalism.

Temescal is a gentrifying, transitioning neighborhood, and crime and safety were commonly cited by respondents. Although these issues rely heavily on wider regional economic trends, policing, and governance, good urban design could also play a role in addressing these residents' concerns. Numerous survey respondents listed open-ended desirable characteristics including "less crime," "safer streets," "less people on streets that dig through trash," "feeling of safety," "more safety from crime, especially robbery, burglary, and home invasion," "respect for public and private property," "prevailing belief of equal entitlement to [a] clean, quiet, safe environment," "more people walking at night," and "better streetlights at night." The latter two are particularly relevant to this discussion as they could be addressed through supportive urban design and land-use policy, and could fall under the auspices of LEED-ND. For instance, the NPD standards could better promote sufficient street lighting at night as well as support a mixture of schedules to encourage business and social activity through the evening.

Homelessness, schools, and governance rely on complex city systems, economic patterns, and local characteristics and are beyond the reach of prescriptive design criteria. More sociable neighborhoods with a stronger sense of community rely on multiple complex factors that urban design alone cannot dictate (Putnam 2001). Proximity to friends and worksites can possibly be impacted with greater density or mixed-use zoning, but it is also determined by self-selection, the jobs-housing balance, and exogenous factors. However, LEED-ND could perhaps address some of these social or economic traits, at least in part. For instance, sense of community could be promoted by supportive urban design that encourages public activities and mingling on the street. Housing affordability can be supported in part by loosening supply restrictions and building homes for a diverse mix of incomes. Perhaps a more performance-based evaluation system for neighborhood development could better address these social and economic amenities. Future research could explore how to connect livability measures through a combination of prescriptive urban design criteria and socioeconomic performance.

Finally, a text analysis of how respondents characterized their neighborhood revealed trends that conform to our field observations.

Temescal was described as convenient, walkable, diverse, hip, accessible, and up and coming—largely in accordance with its status as a gentrifying and diverse urban neighborhood.

Discussion

Our results reveal four key insights worth highlighting. First, highly livable neighborhoods may not be LEED-ND certifiable because they do not conform to specific prescriptive minutiae within the NPD prerequisites. Temescal could not achieve LEED-ND certification due to technical disqualifications, yet the respondents from the neighborhood rated their livability very highly. It is hard to believe that residential garage doors and driveways are a decisive factor in the neighborhood's sustainability, livability, or vitality. Yet this characteristic proves to be a deal breaker for LEED-ND. This calls into question its role as a set of normative, prescriptive guidelines.

Second, newer residents rated the NPD criteria differently than longer-tenured residents did in this gentrifying, changing neighborhood. The study site's residents also rated and ranked the NPD criteria differently than the respondents in the study conducted by Aranoff et al. (2013) in San Francisco. This is unsurprising. It may be difficult for a single set of design guidelines to reflect the diverse values and desired amenities of different communities. It thus becomes problematic when LEED-ND's static weightings of different criteria imply some fixed rank or hierarchy of importance that is to be applied consistently across the evaluated neighborhoods. LEED-ND appears to ameliorate this concern by having a range of possible points for certain criteria and different thresholds (i.e., silver, gold, platinum) of certification based on total point accrual.

However, the absolutism of the prerequisites remains problematic: the percentage of sidewalks intersected by driveways could disqualify a neighborhood whose residents simply do not need or even care about these marginal benefits. This is important considering that LEED-ND certification is increasingly being used to expedite permitting processes, reduce local fees for development, and appeal to prospective residents. Communities that codify these NPD standards may be imposing an inflexible, costly, or perhaps even inappropriate template on their urban form, excluding creative variations and local tailoring. The mandatory nature of the prerequisites makes them particularly normative for communities seeking certification, despite the fact that residents in our study area did not rank these criteria as relatively important.

Third, residents and urban designers seem to largely agree that these criteria are worthwhile, even though the relative value of the

prerequisites does not line up. The respondents consistently rated the NPD criteria highly, with only one criterion (Reduced Parking Footprint) dropping below the midpoint of our Likert-type scale. This is possibly the case because of endogeneity: according to our field observations, the neighborhood exhibits many LEED-ND characteristics, and residents who find these characteristics desirable might self-select to live there if possible. The endowment effect could also be at play as people may ascribe more value to things they already have. However, these same respondents consistently rated and ranked livability characteristics differently than did LEED-ND's weightings and prerequisites, calling into question its validity as a universally codifiable rating system.

Temescal was rated very livable by its residents, yet it only received 57 percent of the possible NPD points according to our field measurements. We are thus left to conclude that adhering to LEED-ND criteria is not the only path to neighborhood livability. In fact, the criteria may overprioritize certain physical design characteristics that do not reflect livability as perceived by residents. This study has focused on human perceptions of the local built environment, but developers seeking LEED-ND certification may not place as much weight on the quotidian human experience.

Fourth, it is difficult to propose specific universal improvements to LEED-ND because of the second and third points above. Several of the items we identified previously in Table 9 that LEED-ND does not (but possibly could) address—such as more parking, wider streets, and less density—are contradictory to other criteria and to the organization's larger goals. Furthermore, many desirable neighborhood characteristics—such as safety or affordability—can only be addressed partly by LEED-ND, as discussed, because they fall under other policy domains or rely on larger city and regional systems.

However, LEED-ND could possibly be improved by simplifying its requirements and toning down the doctrinaire aesthetics. Prescriptive design can have unpredictable or undesirable outcomes. Perhaps flexible criteria and customizable point weightings could be tailored at the local or regional level during initial community meetings and charrettes before design work begins. Critics may charge that these would water down the certification's value and interpretability, but its essential components could be preserved and its weightings could better reflect local and regional values. The prerequisites in particular are currently problematic because seemingly trivial deficiencies could thwart a LEED-ND certification for an otherwise certifiable neighborhood, as was seen in Temescal. Certifications carry far-ranging significance in the minds of city government officials, residents, developers, and investors. Their impacts must be carefully considered.

Conclusion

More and more municipalities are adopting LEED-ND, and it is increasingly being framed in terms of fostering livability. This study examined its NPD criteria and their relationship with livability perceptions. We conducted field measurements and administered surveys in Temescal, a diverse, gentrifying, and traditionally designed neighborhood in Oakland. We hypothesized that:

- [H1]: The study area would be disqualified from LEED-ND certification.
- [H2]: The residents of the study area would, on average, consider their neighborhood to be livable.
- [H3]: The residents of the study area would weight the NPD criteria differently than LEED-ND does.

The preceding analysis provided evidence in support of these hypotheses. Our field measurements and observations confirmed [H1] and the survey provides evidence that supports [H2] and [H3].

Although Temescal was disqualified from our LEED-ND certification for failing to meet a minor technicality within the Walkable Streets prerequisite, its traditional neighborhood design is a general example of the pattern and design that LEED-ND NPD seeks. Its residents prioritized Neighborhood Pattern and Design criteria differently from LEED-ND. The neighborhood was highly rated in terms of overall livability, and respondents on average tended to rate each NPD criterion as at least somewhat important. However, respondents in the neighborhood listed several qualities or amenities that they would be pleased to gain were they to move away from the neighborhood. This suggests that certain factors that contribute to neighborhood livability or desirability are not currently present in the study area. Some of the factors respondents identified are currently addressed by LEED-ND; others are not at present but perhaps should be, while yet others likely cannot be addressed by LEED-ND.

As discussed earlier, LEED-ND is increasingly being wrapped in the language of livability when it is presented to stakeholders. Our findings complicate the sometimes oversimplified question of how to create sustainable and livable communities. LEED-ND risks promising the false hope of environmental and design determinism. A neighborhood's livability may be influenced in part by its pattern and design—but also by exogenous factors and the wider landscape of city and regional systems. It is impossible to imagine a livable and sustainable neighborhood that

is not supported by a robust infrastructure that extends beyond the neighborhood boundaries. Prescriptive design alone cannot reduce crime or induce walking trips to stores, and it requires more than LEED-ND's current prescriptions to produce a livable neighborhood. This is not to say that LEED-ND and its goals are bad. Rather, they simply may not be sufficient for all communities seeking to develop a good neighborhood. LEED-ND's prescriptive nature may also result in communities being designed according to the letter of the law rather than the spirit of the law. An eight-foot sidewalk width or twenty-four-inch elevations above grade may not be necessary or appropriate in a particular neighborhood, yet developers seeking certification must design accordingly.

Ultimately, LEED-ND has stemmed from an attempt to inject environmental awareness into a process that has often previously proceeded with little thought given to sustainability. There is certainly a place for standards that incentivize sustainable development patterns. However, the danger of an overly prescriptive and reductionist system of green development is that communities could lose the ability to imagine innovative and forward-looking designs and ignore highly livable alternative models that already exist but do not conform to the single prescriptive formulation. It also risks losing the heterogeneity of neighborhoods and the freedom of residents to choose the environments in which they want to live and to shape those environments once they have moved into them.

Further research is required in order to determine the role that a codified standard such as LEED-ND can or should play in the development of neighborhoods. Our exploratory results indicate that livability is not always fully or accurately captured by the LEED-ND Neighborhood Pattern and Design criteria. Future research should include a range of neighborhood types and larger sample sizes, and should examine a wider range of characteristics of livable neighborhoods and more flexibility in terms of criteria weight. Such a study might look at age brackets to see if NPD characteristics are valued differently by seniors than by millennials, for example. How can NPD be used as a set of malleable criteria that can be better tailored to different communities' preferences and different designers' creativity? It would be useful to survey residents across a spectrum of neighborhood types—for instance, an exurban neighborhood or an impoverished inner-city community that falls far outside common definitions of livability—to understand what is and is not considered livable by different people. Many unsustainable neighborhoods—or even neighborhoods considered totally unlivable by canonical urban design standards—may be considered highly livable by their current residents. What then is the role of LEED-ND certification as either a diagnostic or normative tool? To inform? To judge? To alter? To forbid?

We do not argue that residents' preferences are inherently good. For example, self-selection into racially segregated, restrictive communities is problematic, and it may be a key role of urban planning to counter such tendencies. However, LEED-ND and its prerequisites risk becoming an absolutist tool that is decoupled from residents' diverse perceptions of livability. LEED-ND assesses neighborhoods according to certain patterns and designs that are popular among smart growth advocates and the New Urbanist community. However, the diverse values and desires of different communities cannot be captured precisely in a single set of weighted criteria that may produce homogeneity counter to their stated goals. The criteria rely on faith in deterministic design to create aspects of livability that quite possibly rely more on emergent characteristics and exogenous factors of the wider urban and regional system. LEED-ND may be a useful tool for some communities, but it is not presently a sufficient, robust, and flexible measure of livability.

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References

- Alexander, Christopher, Sara Ishikawa, Murray Silverstein, Max Jacobson, Ingrid Fiksdahl-King, and Shlomo Angel. 1977. *A Pattern Language*. New York: Oxford University Press.
- Appleyard, Donald, and Allan Jacobs. 1987. "Toward an Urban Design Manifesto." *Journal of the American Planning Association* 53 (1): 112–20.
- Aranoff, Miriam, Hannah Elizabeth Clark, Ethan Lavine, and Kanokwalee Mam Suteethorn. 2013. "LEED for Neighborhood Development: Does It Capture Livability?" *Berkeley Planning Journal* 26 (1): 150–67. <http://escholarship.org/uc/item/18z547tr#>.
- Bosselmann, Peter. 2008. *Urban Transformation: Understanding City Design and Form*. Washington, DC: Island Press.
- Bosselmann, Peter, Elizabeth Macdonald, and Thomas Kronemeyer. 1999. "Livable Streets Revisited." *Journal of the American Planning Association* 65 (2): 168–80.
- Cabrera, Joseph F., and Jonathan C. Najarian. 2013. "Can New Urbanism Create Diverse Communities?" *Journal of Planning Education and Research* 33 (4): 427–41. doi: 10.1177/0739456X13500309.
- Chen, Adelaide. 2012. "LEED-ND and Affordable Housing: Can the Two Go Together?" *Sustainable City Network*. http://www.sustainablecitynetwork.com/topic_channels/building_housing/article_97e1a89a-93ae-11e1-a83f-0019bb30f31a.html.
- City of Charlottesville. 2013. "Charlottesville : Benefits of Being a LEED Certified Community." <http://www.charlottesville.org/Index.aspx?page=2499>.
- Congress for the New Urbanism. 1996. "Charter of the New Urbanism." http://www.cnu.org/sites/www.cnu.org/files/charter_english1.pdf.
- Congress for the New Urbanism, Natural Resources Defense Council, and the US Green Building Council. *LEED 2009 for Neighborhood Development*. US Green Building Council.
- Duany, Andres, Jeff Speck, and Mike Lydon. 2010. *The Smart Growth Manual*. New York: McGraw-Hill.

- Ewing, Reid, Michael J. Greenwald, Ming Zhang, Meghan Bogaerts, and William Greene. 2013. "Predicting Transportation Outcomes for LEED Projects." *Journal of Planning Education and Research* 33 (3): 265–79. doi:10.1177/0739456X13482978.
- Jacobs, Jane. 1992. *The Death and Life of Great American Cities*. New York: Vintage Books.
- Knox, Paul, and Lisa Schweitzer. 2010. "Design Determinism, Post-Meltdown: Urban Planners and the Search for Policy Relevance." *Housing Policy Debate* 20, no. 2: 317–27. doi: 10.1080/10511481003738617.
- Macdonald, Elizabeth. 2005. "Street-facing Dwelling Units and Livability: The Impacts of Emerging Building Types in Vancouver's New High-density Residential Neighbourhoods." *Journal of Urban Design (IURD)* 10 (1): 13–38.
- National Association of Realtors. 2013. NAR 2013 Community Preference Survey. <http://www.realtor.org/articles/nar-2013-community-preference-survey>.
- Norman, Jeff. 2006. *Temescal Legacies*. Oakland, CA: Shared Ground.
- Norman, Jeff. 1999. "The Legacy of Vincente Peralta," *Alameda County Historical Society Quarterly* Fall 1999. <http://www.temescalcreek.org/vicente.html>.
- Putnam, Robert D. 2001. *Bowling Alone: The Collapse and Revival of American Community*. New York: Simon & Schuster.
- Sharifi, Ayyoob, and Akito Murayama. 2013. "A Critical Review of Seven Selected Neighborhood Sustainability Assessment Tools." *Environmental Impact Assessment Review* 38, 73–87.
- Smart Growth America. 2013. "Using LEED-ND to Accelerate the Development of Sustainable Communities." http://www.smartgrowthamerica.org/documents/using_leeed-nd.pdf.
- US Green Building Council (USGBC). 2012. *LEED 2009 for Neighborhood Development*.