Traveler Perspectives of Greenway Quality in Northern New England

Peter R. Pettengill, Brian H. Y. Lee, and Robert E. Manning

Greenways across a range of landscapes from urban to natural serve society as both transportation corridors and recreational pathways. Because of these dual functions, planning and management of greenways warrant an interdisciplinary approach that incorporates frameworks from the fields of transportation and outdoor recreation. Research was conducted to (a) investigate the relationship between transportation and recreation from a greenway user’s perspective, (b) consider and integrate transportation and recreation frameworks that measure quality of greenway travel, and (c) determine the significance of settings in user perceptions of quality. On-site surveys of users (n = 841) across three greenways in northern New England were administered to learn how travelers used and perceived the quality of these facilities. Findings showed that greenways were used primarily for recreation but often incorporated varying elements of transportation. Furthermore, traveler perceptions of quality differed across settings. Transportation and recreation planning frameworks can be integrated to provide a more holistic approach to greenway planning and management.

Greenways can serve society in numerous ways, including as conduits for nonmotorized transportation and as recreation opportunities. Greenways have been defined as “any natural or landscaped course for pedestrian or bicycle passage” (1, p. 1), classified as “shared pedestrian-bicycle facilities” by transportation engineers (2, p. 18­6), and referred to as “bicycle and pedestrian pathways” by outdoor recreation planners (3, p. 72). They may be found from Manhattan’s Central Park to the rim of Grand Canyon National Park. Greenways span urban, suburban, rural, and natural settings, and their users may ride horseback, cross-country ski, rollerblade, or skateboard. With concrete, asphalt, gravel, or natural surfaces, they have been called many names, from multiuse pathways and esplanades to towpaths and trails. Regardless of nomenclature, greenways as a rule are nonmotorized corridors separated from all motor vehicle traffic. However, exceptions may be made for emergency services, maintenance, and other case-by-case permitted access. For the purposes of this study, they provide opportunities to walk and bike for both pleasure and practical ends.

In the interest of promoting walking and biking, funding opportunities for greenway development have increased in recent years. In 1991, passage of the Intermodal Surface Transportation Efficiency Act provided new funding sources for bicycle and pedestrian facilities. The Transportation Equity Act for the 21st Century further increased this funding in 1998, and most recently the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users continued the trend in 2005. This funding has led to greenway growth in urban and natural settings and has enhanced both transportation and recreation opportunities. As greenways expand across landscapes, it is evident that the means to measure and manage their quality is important.

PREVIOUS GREENWAY RESEARCH

A number of studies have considered greenways, an evolving landscape form dating back more than 2000 years (4) and classified into three distinct historic generations (5), and have considered a landscape planning tool of substantial potential for the future (6). Greenways have been the focus of multiobjective planning scenarios in Concord, North Carolina, (7) and are a continuing challenge for collaborative planning and regional coordination in New England (8, 9). Yet there are few studies of user perceptions of greenway travel.

One study of user perceptions used on-site surveys at 13 greenway trails in metropolitan Chicago, Illinois. The study focused on perceived trail preferences and problems, and findings suggested how factors such as vegetation management and trail surfacing can affect user preferences (10). Another study, related to user perceptions and quality of life, focused on three urban settings in Texas (11). This study distinguished travelers on the basis of their use of greenways for commuting only, recreation only, or mixed uses. Findings suggested that recreational users believed greenways contributed to their quality of life most through health or fitness and the natural areas the greenways offer, whereas commuters most valued reduced pollution and transportation costs. Although both studies guide this paper, they were focused primarily on urban contexts. Furthermore, they tended to dichotomize trip purpose into transportation or recreation rather than considering the inherent relationship between the two (12).

Although previous studies considered user perceptions of greenway travel, this study is different in several ways. First, rather than dichotomizing trip purpose as either transportation or recreation, the presented study considers the relationship between the two and illustrates the often mixed nature of greenway use. Thus, the study begins to justify the incorporation of more experiential elements of transportation in addition to travel time, speed, and so forth. Second, rather than focusing on a single location or a number of locations within a similar context, this study encompasses a wider range of greenway opportunities. In this way, a comparative analysis between city (urban), village (rural), and national park (natural) contexts...
could be made. Third, although previous studies had developed models based on user perception for greenway travel, this is the first to use a framework from the field of outdoor recreation management. This indicator and standard-based framework is focused on user perceptions of quality and therefore provides an apt integration in the level of service (LOS) framework widely used in the transportation field.

As greenways continue to develop and expand across landscapes, the relationship between contextual settings, transportation, and recreation warrants further examination. Information about user perceptions of greenway travel will lead to improved planning and management of greenways, and by investigating a wider spectrum of greenway opportunities, a systematic approach to planning and managing diverse travel preferences may be achieved. Therefore, the purpose of this study was to (a) investigate the relationship between transportation and recreation from a greenway user’s perspective, (b) consider and integrate transportation and recreation frameworks that measure quality of greenway travel, and (c) determine the significance of settings in user perceptions of quality.

**CONCEPTUAL FRAMEWORKS FOR MEASURING QUALITY OF GREENWAY TRAVEL**

**Level of Service**

Level of service (LOS) is a conceptual framework that has guided transportation planning across the United States, and is reflective of the broader management objectives of the U.S. Department of Transportation: to “serve the United States by ensuring a fast, safe, efficient, accessible and convenient transportation system.” The framework is derived from the *Highway Capacity Manual* (HCM) and uses variables such as speed, travel time, freedom to maneuver, comfort, and convenience to describe operational conditions within a traffic stream (2, 13). Traffic conditions are defined with a letter grade system, A through F, where A represents the best operating conditions and F the worst. Figure 1 is a representation of this organizational framework for a pedestrian walkway facility. The LOS framework can be used for many types of transportation facilities but may apply different conventions for different uses. For example, some freeway segments may use speed, and intersections may use time delay. The intent for LOS was to create a familiar and widely understood tool for presenting transportation plans to the public (2, 13). However, the letter grade system has been criticized for lacking empirical links to user perceptions (14). Although recent research has undertaken a more comprehensive view of factors that are important to users and has led to explanatory variables used to develop LOS models (15), the LOS framework may not fully reflect experiential components of travel, especially in the context of greenways.

For instance, attempts to describe the quality of bicycle and pedestrian travel have focused primarily on user interactions rather than considering a more holistic set of experiential factors. The HCM bases the LOS for shared-use paths on hindrance, or the number of events (meeting or passing of users) a pedestrian or cyclist experiences while traveling on a greenway (2). Models applying this concept have been developed to incorporate hikers, bikers, and joggers but rely primarily on the number of overtakings between users (16). Although some studies have begun to incorporate real-time human perceptions into a bicycle LOS (17), these too have focused on impact of other road users, rather than elements such as the surrounding environment. Furthermore, it has been suggested that some modes of transportation, such as pedestrian activity, include a breadth of experience that has not yet been included in LOS measures (18). Conceptual frameworks from the field of park and outdoor recreation management aid identification of these experiential elements and their incorporation into management.

**Indicators and Standards of Quality**

Transportation management lacks a normative component (19, 20), from which it could benefit. Indicators and standards of quality use a normative approach and are widely applied in outdoor recreation management (21–24; 25, p. 28). Indicators are “measurable, manageable variables that help define the quality of parks and outdoor recreation areas and opportunities,” and standards define “the minimum acceptable condition of indicator variables” (26). Through the use of normative theory and associated empirical methods, standards of quality may be derived from social norm curves (27, 28). Methods for deriving norm curves originated in social psychology (29) but have been adapted and applied in research on outdoor recreation and natural resources (25, 27).

A hypothetical social norm curve could be developed to define the acceptability of encountering other groups along a hiking trail. Respondents could be presented with a range of conditions of the indicator variable (e.g., number of groups encountered along a trail per day) and asked to evaluate their acceptability on a scale of −4 to +4 (−4 being “very unacceptable” and +4 being “very acceptable”). The mean visitor evaluation ratings for the levels of the indicator variable could then be plotted to form a social norm curve. Such a hypothetical norm curve is illustrated in Figure 2 and suggests a range of acceptable conditions, as well as a minimum acceptable condition or standard.

**Relationship Between Service and Quality**

The relationship between LOS and indicators and standards of quality is expressed by the HCM’s interpretation of quality of service. The 2010 HCM states that quality of service “describes how well a transportation facility or service operates from the traveler’s perspective” (13, p. 5-1). Although the concept of quality of service was included in the 2000 edition of the HCM, its definition there focused on “quantitative measures to characterize operational conditions” (2, p. 2-2), rather than the traveler’s perceptions of those conditions. The LOS concept has always been represented in the HCM as the A-to-F stratification of quality of service, but only the most recent edition emphasizes including user perceptions for defining LOS. The introduction of numerous models based on traveler perceptions for describing LOS in the 2010 manual highlights the importance of this evolution of the LOS concept.

Similar to an approach based on indicators and standards, models based on traveler perception set thresholds derived from user perceptions of quality. Both the LOS and indicators and standards of quality present a continuum of conditions that represent a range of service quality. Indicators and standards of quality define a minimum acceptable condition, and most transportation planning efforts typically use LOS C or D to ensure an “acceptable operating service” (2, p. 2-3). Therefore, it follows that the integration of these frameworks be anchored around a minimum acceptable condition of quality equivalent to the standard between LOS D and E. That
FIGURE 1  HCM organizational framework for LOS (2, p. 11-9).
is, any of the conditions deemed acceptable by travelers would be represented by LOS A through D, whereas any of the conditions rated as unacceptable by travelers would be represented by LOS E or F. The strict standard between LOS D and LOS E indicates both a minimum level of acceptability from a traveler’s perspective and a LOS that transportation planners aim to exceed. Furthermore, standards for capacities not only distinguish red light thresholds but also establish yellow light warnings or cautionary standards (30). Figure 3 shows this relationship. This nexus between indicators and standards of quality and quality of service provides another means of incorporating user perceptions into the LOS.

METHODS

Study Overview

The presented study used on-site surveys from three greenways in New England. The surveys were designed to measure greenway users’ trip purpose, indicators of quality, and standards of quality for density of use along each greenway. Preferences for landscape character were also measured. Each survey used open- and closed-ended questions in addition to a series of visual simulations designed to elicit respondents’ perceptions of travel quality.

Study Locations

Greenway planning and development in New England exemplifies the potential for a system of nonmotorized travel networks that can satisfy both transportation and recreation demand. This was recognized by the 2007 Fábos Landscape Planning and Greenway Symposium, which outlined a cohesive network of greenways as part of a multistate regional system (9). The plan identified both current greenways and proposed critical connections. Although there is no regional governance and intergovernmental coordination would be required, there is an effort to maintain a New England greenway vision (8). The study presented in this paper considered the northern New England region (spanning the states of Vermont, New Hampshire, and Maine) and focused on three sites within the vision plan that represent greenways across a continuum of landscape development from natural to urban.

Acadia National Park was established in 1916 in recognition of the region’s scenic beauty, rich history, and recreational values. Located on the southeast coast of Maine, it is one of the most intensively used national parks in the United States with more than 2 million annual visits on only 35,000 acres (31). A 50-mi system of carriage roads is maintained in the park. Built for horse-and-carriage use in the first half of the 20th century, the system now is used primarily as a bicycle and pedestrian facility (32); it provides not only recreational opportunities but also a way to travel from one point in the park to another. For instance, although the carriage roads incorporate scenic vistas for an enjoyable journey, they also allow visitors to reach such park destinations as the visitor center and the historic Jordan Pond House.

The Stowe recreation path in the tourism-based community of Stowe, Vermont, was completed in 1989 and extends 5.3 mi from the...
village center to a mountain resort and spa. The path traverses agricultural land, connects to occasional commercial services, and is the culmination of donated easements and town-acquired private lands. The recreation path provides a pastoral setting for visitors and provides both recreation and transportation to the community.

The bike path in Burlington, Vermont, has been called the city’s crown jewel. It connects the downtown of Vermont’s largest city to other communities in the county. Estimated to generate $4.5 million in tourism revenue a year, the path has its own 13-member task force that plans and manages transportation and recreation. The bike path is a major feature of a regional bicycle and pedestrian plan for Vermont’s only metropolitan planning organization.

**Sampling Sites**

Greenway users at the three study locations were surveyed during the summer of 2009. Choice of sampling locations was based on ease of access to visitors. Surveyors collected data during daylight and approached each group passing the survey site. Signs indicating that a research study was in progress were located approximately 50 yards along the trail before the survey site, and incentives of cold drinks and small candies were offered. A total of 249 questionnaires (94% response rate) were collected at the Acadia carriage Roads, another 274 (94% response rate) were collected at the Stowe recreation path, and 318 (88% response rate) were collected at the Burlington bike path.

**Survey Instrument**

**Measuring Trip Purpose**

The survey instrument was designed to measure the trip purposes of greenways users. Respondents were asked to rate the purpose of their trip on a scale of 1 (“purely transportation”) to 9 (“purely recreation”). A statement preceding the question read, “the purpose of using a greenway can range from purely ‘transportation’ (for example, to get from one place to another) to purely ‘rec­reation’ (e.g., to enjoy the journey), or it can be some combination of these purposes. Using the scale below, please indicate the purpose of your use of the greenway today.” Rather than dichotomizing trip purpose, this scale provided an opportunity for respondents to consider their trips as both functional and fun.

**Measuring Indicators and Standards of Quality**

The survey instrument was designed to measure indicators and standards of quality for each of the three greenways. The questionnaire included a section of open- and closed-ended questions, as well as a list of items that might be considered by respondents as desirable or undesirable components of a greenway. The open-ended questions were designed to identify indicators that affect a user’s travel experience. These questions asked respondents what they most and least enjoyed about their travel along the greenway. The closed-ended section included items that may be considered desirable or undesirable components of a greenway. Respondents were asked to rate the degree to which each item was desirable or undesirable by using a scale that ranged from −2 (“very undesirable”) to +2 (“very desirable”).

Normative research methods were used to measure normative standards of respondents for density of use along the greenway. A series of visual simulations presented visitors with a range of density conditions on each of the greenways; previous studies found visual simulation to be effective for measuring crowding standards. Each series of simulations was created specifically for the site (i.e., a series of photos of the Burlington bike path, a series of photos of the Stowe recreation path, and a series of photos of the Acadia carriage roads). For the Burlington bike path and the Stowe recreation path, a series of five photographs was constructed of a 125-m length of path, with the number of users ranging from 0 to 24 (Figure 4). Because the carriage roads are wider than the other greenways, a series of six photographs was constructed of a 125-m length of the path, with 0 to 36 travelers populating trail space with a comparable amount of use. Each series of visual simulations illustrated half pedestrian use and half cyclist use. Respondents were asked to evaluate the acceptability of each photograph on a scale of from −4 (“very unacceptable”) to +4 (“very acceptable”).

**Measuring Preferences for Landscape Character**

The survey was also designed to measure normative standards for the desirability for passing through different types of landscapes while traveling along the greenway. Landscape character was described as urban, suburban, rural, and natural (meanings of these terms were left to the respondents), and respondents were asked to evaluate the desirability of each type of landscape on a scale ranging from −4 (“very undesirable”) to +4 (“very desirable”). This segment of the survey did not exclude greenway development from certain settings but rather considered attributes of a greenway that may be measured, planned, and managed in a way that incorporates user preferences.

**Data Analysis**

Mean evaluations of respondents were used to derive standards of quality for each site. Social norm curves were developed from the mean evaluations for each photograph and description of landscape character. Comparisons across greenway contexts were made with a one-way analysis of variance and post hoc Tukey tests. Because of the modest sample size for each context, a probability value of .05 was used for reporting significant differences between greenways.

**RESULTS**

**Purpose of Trip for Greenway Users**

Consistent with previous studies, most travelers used greenways for recreational purposes. However, this was less true in the urban context of the Burlington bike path. Figure 5 shows the relationship between transportation and recreation across greenways. Those who responded with a 1 on the nine-point scale were considered to have a purely transportation purpose, and those who responded with a 9, a purely recreational purpose. Respondents who gave rankings of from 2 to 8 were grouped as having a mixed use. The mean score of users’ trip purpose ratings with the nine-point scale was calculated, and a significant difference was found between users of the Burlington bike path and other users. The mean values for the mixed-use travel groups were 5.76 for the Burlington bike path, 6.26 for the Stowe recreation path, and 7.15 for the Acadia carriage roads.
Greenway Users’ Perception of Quality

Responses to open-ended questions asking visitors what they enjoyed most and least about their greenway travel revealed several potential indicators of quality for greenway planning and management. For instance, scenery and views were most frequently cited as what greenway users enjoyed most about their trip (34% for the Acadia carriage roads, 35% for the Stowe recreation path, and 31% for the Burlington bike path). Previous research measured visual preferences and offered management strategies such as opening views and increasing visual screening to maintain scenic viewing opportunities (38). Therefore, because landscape character and scenic views are measurable and manageable, they make potentially good indicators of quality for greenway design. Furthermore, when given a list of
attributes that could be desirable for their greenway experience, visitors chose “scenic views” as an attribute. Average respondent ratings on a five-point desirability scale (ranging from $-2$ to $+2$) were 4.88 for the Acadia carriage road and 4.81 for both the Stowe recreation path and the Burlington bike path. These values were based on calculations where $-2 = 0$ and $+2 = 5$ and confirm scenery and views as an important indicator of quality for greenway travel.

A second indicator that arose from the study was related to the physical quality, condition, and design of the greenway. For instance, good path quality was frequently cited as what users enjoyed most (18% for the Acadia carriage roads, 17% for the Stowe recreation path, and 8% for the Burlington bike path). Poor path quality was frequently cited as what users least enjoyed (14% for the Acadia carriage roads, 28% for the Stowe recreation path, and 27% for the Burlington bike path). Many strategies could be used to measure and manage the quality of pavement, surface type, lane widths, and so forth. These results reinforce that the physical quality, condition, and design of greenways are important indicators of travel quality. Although this study focused on deriving standards of quality for greenways, it did not consider these physical aspects of travel experience. Further research is needed to develop standards for this indicator.

A third indicator that was established from responses to the open-ended questions addressed the density of use along the greenway. For instance, crowding and other users along the greenway were frequently cited as what respondents enjoyed least (22% for the Acadia carriage roads, 26% for the Stowe recreation path, and 32% for the Burlington bike path).

Density of use is a potentially good indicator because it is both measurable and manageable. It may be measured, as in this study, by the number of users along a predetermined length of path at any one time. Density may be managed with a variety of strategies; for example, a greenway could be widened, extended, or incorporated into other greenway networks to distribute use over space and time; this action would alleviate congestion or crowding effects. Furthermore, when given a list of attributes that could be desirable to their greenway experience, visitors chose “few people on the greenway” as an attribute. Average respondent ratings on a five-point desirability scale (ranging from $-2$ to $+2$) were 3.82 for the Acadia carriage road, 3.69 for the Stowe recreation path, and 3.47 for the Burlington bike path. These values were based on calculations where $-2 = 0$ and $+2 = 5$ and confirm density of use as an important indicator of quality for greenway travel.

**Greenway Standards and Levels of Quality**

Traveler acceptability ratings for the visual simulations that showed a range of users per 125-m length of greenway are given in the social norm curves in Figure 6. The LOS conceptual framework has been overlaid to portray the relationship between LOS and normative standards of quality. The norm curves show that as the number of users on each greenway increases, acceptability decreases. Average respondent ratings fall out of the acceptable range and into the unacceptable range at approximately 20 users per 300 m$^2$ of path for the Burlington bike path, 15 users per 300 m$^2$ of path for the Stowe recreation path, and 10 users per 300 m$^2$ for the Acadia carriage roads. The most acceptable condition varies across greenway contexts. For instance, in the more urban context of the Burlington bike path, other users along the greenway (six per 300 m$^2$) is perceived...
by travelers as more acceptable than sharing the path with no other users. This is in contrast to the other greenway contexts, where the zero condition was considered optimal.

**Traveler Preferences for Landscape Character**

Traveler ratings for the desirability of various landscapes along a greenway are illustrated in the social norm curves in Figure 7. The norm curves show that as the level of development increases, acceptability decreases. Average respondent ratings for the Acadia carriage roads and Stowe recreation path fall out of the acceptable range and into the unacceptable range as the landscape character changes from rural to suburban. Users of the Burlington bike path approached the threshold of acceptability in the urban context but ultimately found all types of landscapes acceptable within the context of their greenway experience. Furthermore, significant differences were found among the greenways when both suburban and urban landscape types were evaluated.

**DISCUSSION OF RESULTS**

Study findings corroborate earlier greenway research. As in past studies (11), the presented research found that greenways are used primarily for recreation. This research considered a broader spectrum of greenway opportunities, however, and revealed that the trip purposes of greenway users may be context sensitive. For instance, the more urbanized setting of the Burlington bike path revealed a significantly higher proportion of users engaging in greenway activities that were not purely recreational but that included at least some element of transportation. This relationship between recreation, transportation, and contextual settings is also in keeping with previous research (39). The recreational nature of greenways suggests that planning may benefit from conceptual frameworks developed in the field of park and outdoor recreation management.

This study adapted a framework widely used in park and outdoor recreation management to seek indicators of quality for greenway travel. Findings suggest that density of use is important to greenway travelers; this finding is in keeping with the literature on both transportation (2, 13, 15) and parks and outdoor recreation (25). Moreover, findings illustrate that measures of density are relevant indicators of quality for managing transportation across a number of greenway contexts and that normative research can be used to derive standards of quality for density-related indicators.

Study findings illustrate the ways in which the two conceptual frameworks used in the study are compatible. LOS implicitly uses indicators and standards by suggesting that concerns such as density of use (i.e., indicators of quality) are important to travelers and that there is a wide range of conditions (i.e., standards of quality) for these indicators. The normative data on standards of quality offer an empirical approach to informing LOS, including identifying a threshold of acceptability—the minimum level of an indicator of quality that is acceptable to travelers. Building on the nexus between these conceptual frameworks, and given what is often the recreational purpose of greenway travelers, LOS may benefit from being extended and revised to include indicators of quality that incorporate experiential components of travel.

For example, LOS conventionally addresses the issues of efficiency in transportation (i.e., travel delays), but in the context of parks and outdoor recreation, it has been suggested that additional variables may be needed when managing for high-quality transportation experiences (39). The presented study corroborates previous research and extends it to greenways across a range of settings. For instance, opportunities to walk or ride slowly, to stop when desired, and to travel under low levels of use so that travelers can see and experience the landscape may be more important than traditional measures of efficiency. Other indicators of quality for transportation in parks and outdoor recreation might address issues such as character of surrounding landscape, types of vehicles allowed, and litter. Moreover, standards of quality may be integrated into conventional HCM LOS guidelines to ensure they are appropriate in a variety
of contexts. For example, the curve in Figure 6 indicates that the maximum acceptable number of users on the Burlington bike path is approximately 20 per 300 m². For the Stowe recreation path, however, LOS E is approximately 15 users per 300 m². Another example of context sensitivity is in the social norm curve for the Acadia carriage roads, which are twice as wide as the other study greenways. After the LOS overlay was reregistered for this spatial differential, approximately 10 users per 300 m² is the maximum acceptable condition for density of use. Although a constant relationship of density was held for this study, width could be an important variable for measuring acceptability and warrants further research. Still, it is clear that greenway users’ perceptions of acceptable conditions vary across contexts. Context sensitivity is also illustrated by traveler evaluations of the zero user condition. In this case, travelers in urban settings may feel less comfortable or unsafe if no other users are on the path. Yet the data illustrate that travelers in rural or natural settings may think of encountering no other users as an optimal scenario. Additional research is needed for continued testing of the relationships between the LOS framework as used in the HCM and indicators and standards of quality as used in the park and outdoor recreation literature. The standards of quality explored in this study could vary substantially depending on the types of users on greenways (e.g., pedestrians, joggers, cyclists, equestrians).

**IMPLICATIONS AND LIMITATIONS**

This study has a number of implications for greenway planning and management. It offers planners a methodology for creating a user-based LOS that incorporates important elements of greenway facilities that previously may have been overlooked. These experiential components may then be integrated into planning to enhance and improve the travel experiences of greenway users. For example, because greenway users indicate a preference for natural surroundings, planners may zone or manage greenway corridors to preserve rather than develop them. Greenways are appropriate not only in natural settings; even in urbanized settings, natural landscaping and design is preferred. Planners could encourage the development of these natural attributes regardless of the setting, thereby providing an overall higher level of quality for greenway travelers. If demands for facility improvement, including paving and signage, arise in survey responses, planners will have established a rational basis for investing in these as well. However, further research (including viewshed analysis) that engages both transportation and recreation users could further clarify traveler preferences for greenway design.

This study also illustrated that the minimum acceptable condition for density of use along a greenway can vary across contextual settings. Although the three study sites in this research represent a spectrum of greenway opportunities, they are all in the same region of the country and do not reflect a full range of urban to natural environments. To create a more generalized set of standards for other greenways, further research will flesh out a spectrum of contexts. This paper offers planners an indicator- and standards-based methodology for developing context-sensitive series of LOS standards appropriate for other locations. However, as more results are compiled with the methodology, a comparative analysis across sites may reveal more options for generalization.

Finally, the framework based on traveler perception that was developed in this study is in keeping with the intent of the HCM: “The LOS concept was created, in part, to make presentation of results easier than if numerical values of service measures were reported directly” (13, p. 17–38). Although the letter grade system has been used effectively to demonstrate results to the public, the methodology presented here more transparently conveys results. For instance, visual simulations of travel conditions may be used along with their corresponding LOS grades to clarify the quality of service concept for affected communities and constituents. Furthermore, visual simulations may be used to address other considerations related to greenway planning and management. For example, the visual simulations in this study were populated with small groups

**FIGURE 7  Social norm curves for landscape character.**
and an equal number of cyclists and pedestrians, which may not be representative of real-world conditions, such as large platoons of pedestrians that take up more space or make up the majority of greenway users. Greenway monitoring before the simulations are developed could help create more realistic conditions, and survey results may then elucidate perceived conflicts between user types. The potential for addressing conflict between user types may be guided by visual research methods. For instance, the acceptability of management techniques, such as use of striping and signage to separate uses, could be tested.

CONCLUSION

Greenways are an increasingly important component of transportation networks. The conceptual frameworks of LOS and indicators and standards of quality can be integrated to measure and manage transportation and recreation for dual-purpose greenways. Such an approach was applied to three greenways in two states in northern New England. More research is needed to identify additional indicators and standards of quality for greenway travel and to extend and register LOS guidelines in this new context.

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REFERENCES


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