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Perception and use of a metropolitan greenway system for recreation

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Abstract

Greenway development efforts often give priority to corridor length and linkages as top selection criteria, but other factors are also critical in ensuring a successful network of greenways for recreation. On-site surveys of recreationists ($n = 2873$) who used a diverse sample of 13 greenway trails in metropolitan Chicago showed that trail location relative to home strongly influenced how a greenway trail was used, who used it, how often it was used, and other factors. "Local", "regional", and "state" trails are distinguished on the basis of use patterns, preferences, and perceptions, with each trail type filling a unique role within a metropolitan greenway system. In contrast to some greenway planning strategies, study data suggest that from a recreational use perspective, local rather than regional trails should form the basic framework of a metropolitan system. Study findings also demonstrate how vegetation management, trail surfacing, maintenance, and other factors can affect use patterns and preferences. Location, design, and management decisions that incorporate trail user information can help metropolitan greenway systems achieve a broad range of recreational, social, and environmental goals.

Keywords: Greenways; Perception; Recreation; Urban

1. Introduction

Greenways can fulfill a multitude of environmental and social functions, not the least of which are for linear forms of recreation such as walking and bicycling. The increase in these types of activities in the USA and other countries attests to the recreational potential of greenways: according to participation statistics compiled for the President's Commission on Americans Outdoors (1987), walking and bicycling were two of the top five outdoor activities, with more than 80% of Americans walking for pleasure and nearly half bicycling at least once during the previous year. When developed with bicycle-grade trails—trails separated from roadways with a surface suitable for riding comfortably on a narrow-tire bicycle—greenways can attract diverse users across a range of activities and seasons. Besides walking and bicycling, these trails host jogging, rollerblading, horse riding, cross-country skiing, and other activities, and they provide a safe, enjoyable setting for such individuals and groups as older adults, parents with babies in strollers, and wheelchair users.

The recreational potential of greenway trails is underscored in metropolitan areas, where large tracts of open land are scarce and often too expensive to purchase for public use. In these settings, open space planners have identified greenways in the form of stream corridors, powerline rights-of-way, street boulevards, and abandoned railroad corridors as the next generation of public open space (Little, 1990; Porter and Hastings, 1991). In urban as well as rural areas,

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greenway trails have become top development priorities for recreational providers at all levels of concern, whose goals often call for an interconnected network of long-distance trails (e.g. US Department of the Interior, National Park Service, 1990).

Greenway trail development in Chicago exemplifies trends found in other large metropolitan areas. Beginning with the rail-trail conversion of the Illinois Prairie Path in 1967, bicycle-grade trails have increased in number and popularity throughout the region. Trails today are the major recreation facility development priority for many park and forest preserve districts and, as of 1992, the metropolitan area had more than 30 trails, together totaling more than 300 miles (Illinois Department of Conservation, 1992). These trails range in character from highly urban to rural, are surfaced with asphalt or crushed aggregate, and range in length from a few tenths of a mile to more than 55 miles. A recent greenways plan for metropolitan Chicago examined the existing system, and found recreational benefits constrained by "a lack of connections and continuity within the existing system" (Northeastern Illinois Planning Commission and Openlands Project, 1993, p. 5). Recommendations called for expanding the present system, with priorities placed on linking local, regional, and possibly national trails to build a network of long-distance corridors.

To guide future greenway development efforts in Chicago and other metropolitan areas, we looked at how people currently perceive and use greenway trails for linear recreation. Study findings show that although trail users felt it was highly important to develop more trails and longer trails, and to link existing trails, use patterns and preferences suggest that these are only some of the ingredients in a successful metropolitan recreational greenway system. We found that trail location, design, and management factors, in particular, can have important effects on how a trail is used, who uses it, and why it is liked or disliked.

2. Research on greenway trail users

The construction and management of bicycle-grade greenway trails are fairly new activities for many public agencies and private organizations, and little research information has been available to help guide important development decisions (Klar and Kavanaugh, 1986). However, several recent studies have begun to shed light on such issues as the perceptions and preferences of trail users, the economics of trail use, and the opinions of adjacent landowners (Albrecht, 1992). Studies of trail user patterns have found that location plays an important role. Some rural trails such as the Elroy–Sparta State Trail in Wisconsin (Schwecke et al., 1988) and the Missouri River State Trail in Missouri (Bhullar et al., 1991) draw a large proportion of their user base from outside their county of location and beyond. Other trails such as the Raccoon River Valley Trail in rural Iowa (Robertson, 1992) and the North Branch Trail in metropolitan Chicago (Gobster, 1988) draw largely from within the region, and have a relatively small proportion of users that come from areas distant from the trail. Still other trails such as the Capital Area Greenway in metropolitan Raleigh, North Carolina (Furuseth and Altman, 1991), and the Lafayette–Moraga Trail in suburban Oakland, California (Moore et al., 1992), have a high local draw, and attract few users from beyond nearby neighborhoods.

Although this research shows that these trails differ in the populations they serve, it is not clear if location relative to population centers is the sole criterion determining differences. In rural as well as metropolitan areas, some trails have mainly local significance, whereas others have significance on a regional scale or beyond. Because few, if any, studies have examined multiple trails within an area, it is difficult to determine if length, the environment surrounding a trail, or other factors contribute to this differential significance. More importantly, we do not know how different kinds of trails are used: how frequently users visit, how long people spend on the trail, how they get there, what activities they pursue, and what other trails they use. Answers to such questions would help us understand how trails within an area function as a system, set objectives for greenway development that serves a broad range of recreational users, and develop the recreational component of greenways in concert with other social and environmental goals.

Understanding use patterns can help trail planners locate trails that will meet user needs, but information on user perceptions and preferences is also needed to improve the design and management of trails for users. Some of the surveys mentioned above have attempted to address these issues, but again, without looking across a variety of trail types, it is difficult to assess

how design decisions such as paving trails with asphalt and management practices such as deferring maintenance might affect user perceptions and preferences.

The present study was designed to help address these questions. Specifically, the objectives of the study were as follows: (1) to identify a diverse range of metropolitan greenway trails for study; (2) to examine people's use patterns, perceptions, and preferences for these greenway trails; (3) to compare user information across trails to identify location, design, and management factors that can aid in development of a metropolitan system of greenways.

3. Methods

3.1. Sampling of trails

With these objectives in mind, we examined recreationists' use patterns and preferences for 13 greenway trails in the six-county Chicago metropolitan region. The trails formed the Chicago metropolitan portion of a study of trail users throughout the state of Illinois (Gobster, 1990). A panel familiar with Chicago area trails chose the sample to reflect the range of characteristics in the present metropolitan system: the 13 trails varied in length, surface type, intensity of use, and greenway type (e.g. river corridor, rail-trail conversion). The location of these trails is shown in Fig. 1, and their major characteristics are described in Table 1.

3.2. Sampling of respondents

3.2.1. Soliciting participation

Respondents were contacted on-site from survey stations located at strategic points along the trails. The number of survey stations ranged from one to four, depending on the length of the trail. The method of sampling trail users along a particular trail depended upon how busy the trail was. In cases of low trail use, survey assistants asked at least one member of every group who went by to complete a survey. On high-use trails, assistants attempted as much as possible to select users randomly at an interval in concert with the intensity of trail use. Assistants went through a comprehensive training session prior to sampling, and among other procedures were instructed to take special care not to select users preferentially from one gender, age group, or user type. Efforts were also made to reduce the rate of refusals by offering refreshments, maps, and information about area trail opportunities. The few refusals (less than 10%) tended to be from fast-moving bicyclists and runners who did not want to break stride.

3.2.2. Sampling schedule

The survey was conducted during weekends throughout the summer of 1989. A given trail was usually sampled over the course of 1 or 2 days (10:00–16:00 h). Trails with multiple survey stations were sampled over several weekend days if there were not enough assistants to staff the stations simultaneously. Confining sampling to a small number of observation periods per trail limited the generalizability of study results in one way but enhanced it in another. A design that sampled users over a long period of time including weekdays and different seasons would be more desirable if one were studying only a few trails, and might result in a slightly different pattern of findings (e.g. more local use, a greater diversity of user types, possibly more older users) than the design used in this study. Given the study objectives and time and funding constraints, an "extensive" sampling of many trails for a short period was chosen over an "intensive" sampling of only a few trails. This tradeoff should be recognized in interpreting the study results.

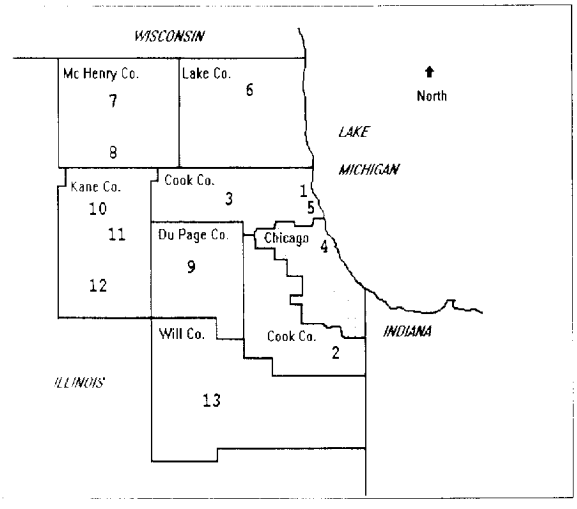

Fig. 1. Location of trail sample within the Chicago metropolitan region of northeastern Illinois.

Table 1
Description of trail sample

No. [1]	Trail name	Setting	Residential density	Length (miles)	Surface	Use level
Local trails						
2	Thorn Creek Trail	Suburban	Medium	8	Asphalt	Heavy
4	Chicago Lakefront Path	Urban	High	20	Asphalt	Very heavy
5	Green Bay Trail	Suburban	Low–medium	10	Aggregate	Moderate
9	Illinois Prairie Path	Suburban–rural	Medium	55	Aggregate	Moderate
12	Virgil Gilman Trail	Suburban–rural	Medium	11	Asphalt and aggregate	Light
Regional trails						
1	North Branch Trail	Urban–suburban	Medium	20	Asphalt	Very heavy
3	Busse Woods Trail	Suburban	Medium	11	Asphalt	Very heavy
6	Des Plaines River Trail	Suburban–rural	Low	7	Aggregate	Light
7	Moraine Hills State Park	Suburban–rural	Low	11	Aggregate	Light
8	Prairie Trail South	Suburban	Low–medium	1	Asphalt	Heavy
10	Fox River Trail	Suburban	Medium	35	Asphalt	Very heavy
11	Great Western Trail	Suburban–rural	Low	18	Aggregate	Light
State trail						
13	I&M Canal State Trail	Rural	Low	40	Aggregate	Light

Information taken from Illinois Department of Conservation (1989), Northeastern Illinois Planning Commission (1993), and communication with trail managers.
[1] Refer to Fig. 1 for mapped locations.

3.2.3. Sample size

To ensure reliable results for individual trails, survey assistants were instructed to collect a minimum of 100 surveys for each low-use trail and 200 for each high-use trail. This goal was achieved overall, but on some low-use trails even repeated sampling over consecutive weekends resulted in somewhat less than the desired goal. Respondent sample sizes ranged from a low of 33 on the Des Plaines River Trail (collected over three weekends) to 522 on the Illinois Prairie Path. In all, 2873 usable surveys were collected from respondents on the 13 trails, an average of 221 respondents per trail. The small sample for some trails was another limitation of the "extensive" design chosen, but data are pooled for this analysis to describe major trail types instead of individual trails. Nonetheless, this limitation should be recognized in the study results.

3.3. The survey instrument

The self-administered survey included 26 items and a number of sub-items covering topics such as trail use, trail perceptions and preferences, opinions on future trail development issues, socio-demographics, and economics of use. This paper focuses on questions relating to use, preferences, and perceptions. Full details of survey methods and results have been given by Gobster (1990), or are available by contacting the author directly.

3.4. Data analysis

Group comparisons were made using χ^2, one-way analysis of variance, and Spearman rank order correlation tests. Predictors of trail satisfaction were estimated using simple regression analysis (Hays, 1994). Owing to the large overall sample size, a conservative probability value of $P < 0.001$ was chosen to report significant differences between trail types.

4. Results

4.1. Trail location and use patterns

The typical user on the 13 trails sampled could be characterized as one who used one primary trail, bicy-

cled to reach the trail, and bicycled on it every week or more often. Median distance to reach the trail was 4 miles, and average length of stay was 2.4 h.

These statistics are useful in portraying a generalized picture of metropolitan use patterns, but they mask some important variation among trails which results from the distance of trails from those who use them. In examining the distribution of distances people traveled to reach trails in metropolitan Chicago, we found three distinct groups, similar to those found in the trail user studies discussed previously. On the basis of this evidence, we classified trails in the sample under the following definitions: local trails—trails where more than 50% of the respondents came to the trail from a distance of 5 miles or less; regional trails—trails where more than 50% of the respondents came to the trail from a distance of between 6 and 20 miles; state trails—trails where more than 50% of the respondents came to the trail from a distance of more than 20 miles.

Five trails in the sample were classified as local trails, seven as regional, and one as state (Table 1). The number of recreationists sampled on these trail types included 1193 on local trails, 1605 on regional trails, and 75 on state trails. The use characteristics of the single state trail differed sufficiently from regional trail use patterns to warrant separate discussion. However, because of the single example and its relatively low number of respondents, findings should be interpreted cautiously.

Fig. 2 is a plot of the reverse cumulative frequency distributions for respondents who traveled a given distance to reach each of the three trail types. The curves portray the relative "distance decay" function for each trail type, and illustrate the attractive power of each in terms of how far people traveled to use it. The curve for local trails drops very steeply; only 21% of the sample came from distances greater than 5 miles from the trail, and only 3% came from distances greater than 20 miles from the trail. This contrasts markedly with regional trails, where 53% of the sample came from distances over 5 miles and 12% came from over 20 miles, and it also contrasts with state trails, where 81% came from over 5 miles and 51% came from over 20 miles.

Fig. 2 makes a strong case for the existence of different types of metropolitan trails based on the distance most people travel to use them, but it does not explain why certain trails attract mainly local use whereas others draw users from the surrounding region and beyond. One likely reason for this difference is the density of the population immediately surrounding the corridor, and the data on residential density in Table 1 provide partial support for this explanation. Further examination of Table 1, however, shows a heterogeneity in other characteristics for local and regional trails with respect to length, surface type, and use levels. Both local and regional trails range in length from relatively short to long, are paved with either asphalt or crushed aggregate, and have use levels that range from relatively light to very heavy. Based on this small sample of trails, these characteristics do not appear to help distinguish among trail types.

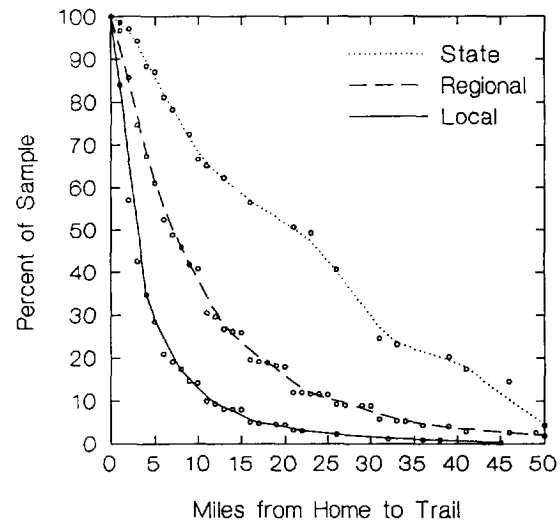

Fig. 2. Distance decay for trail visits as a function of trail type.

4.2. Duration and frequency of use

Perhaps a more important set of questions to ask about local, regional, and state trails relates to how these trails are used. By looking at trail users' responses to questions about their patterns of use, we found great differences among trail types. First, we found that users of local trails tended to make shorter, more frequent visits than users of regional or state trails. Average time spent on the trail was 2.1 h for respondents on local trails, 2.6 h for those on regional trails, and 2.8 h for those on the state trail. Frequency of use of the trail on which people were surveyed was assessed on a six-point ordinal scale. On local trails, only 10% of the

respondents were "first-time users" vs. 24% and 36% of respondents on regional and state trails, respectively. Conversely, on local trails 59% of respondents said they used the trail "virtually every week" or "virtually every day", whereas only 34% of respondents on regional trails and only 25% of respondents on the state trail made these claims. Total number of trips on all trails used in the past year ranged from an average of 71 for local trail users to 42 for regional and state trail users. Statistical differences in these responses between groups were significant at the $P < 0.001$ level.

4.3. Travel to and on the trail

Users of local trails most frequently reached the trail by bicycle or on foot, with only about 24% of respondents coming by automobile. This contrasts with respondents on regional and state trails, of whom 54% and 77%, respectively, came by automobile. There was a corresponding difference in activities pursued while on the trail, with 35% of local trail users walking or running on the trail and 64% bicycling, vs. a 13% and 84% distribution of pedestrian vs. bicycle use on regional trails and a 23% and 76% distribution on the state trail. We also queried respondents about their use of the trail for commuting, and here again the differences were distinct: 12% of the respondents on local trails were using them for commuting that day, compared with 6% and 4%, respectively, of respondents on regional and state trails. Again, differences by trail type for these use characteristics were significant at the $P < 0.001$ level.

4.4. Trail use diversification and substitutability

Study findings also showed that local trail users tended to be more "brand loyal" to their trail, and were less likely to use a substitute trail if the one they were on were not available. For local trail users, nearly two-thirds had not used any trails in the past year other than the one they were on, and only 22% said they would use a substitute trail. For regional trail users, nearly 50% mentioned they had used one or more other trails during the past year and 43% said they would use another trail if the one they were on were not available. For state trail users, 47% mentioned they had used one or more other trails during the past year and 38% said they would use a substitute trail (differences significant, $P < 0.001$).

4.5. Social and demographic aspects of trail use

Users of local, regional, and state trails differed little in age, gender, income, education, or occupation. As for social group differences, there did tend to be more solo users and couples on local and regional trails and more organized groups on the state trail. This translated to a slightly higher average group size of 2.8 on the state trail vs. 1.9 on local trails and 2.3 on regional trails (differences significant, $P < 0.001$).

4.6. Trail preferences and perceptions

4.6.1. Positive and negative trail attributes

Respondents were asked in two open-ended questions what they liked and did not like about the trail they were using. Although many categories were developed to classify these comments, most responses fell into only a few major categories (Table 2). The attributes respondents liked most about the trail they used fell into two major clusters: those relating to the natural environment, and those relating to the trail itself. In the first cluster, the "scenic beauty" of the trail environment was mentioned most frequently, accounting for about 32% of all comments. Other frequently mentioned attributes in this cluster included "nature", "trees", "water bodies", and "hills and rolling topography". Attributes relating to the trail itself were topped by "smooth trail surface", with nearly 16% of all comments, followed by "good maintenance", "personal safety", "being away from cars and traffic", "peace and quiet" and "closeness to home". There were some significant differences in the frequency of mention by trail type, but the differences seemed to be more relative than absolute. Spearman rank order correlations of attributes between trail types were all above $r_s = 0.81$, suggesting a close overall correspondence in the frequency with which positive attributes were mentioned.

Top negative responses also clustered around two major concerns. The major cluster of attributes related to the trail and trail-related facilities. "Rough trail surface and potholes" was by far the most frequently mentioned dislike, accounting for 25% of all comments. Other dislikes included "horse damage" (to the surface and manure on the trail), "numerous street

Table 2
Top attributes mentioned by respondents (by percent) for each trail type and overall

Attribute	Local	Regional	State	All	χ^2
Positive attributes					
Scenic beauty	25.7	35.9	31.4	31.6	27.12 *
Nature	6.4	6.8	7.8	6.6	0.27
Trees	11.6	8.0	7.8	9.5	8.40
Water bodies	13.1	7.7	21.6	10.2	25.81 *
Topography	2.4	5.9	2.0	4.4	16.86 *
Smooth trial	15.5	23.6	9.8	20.0	26.28 *
Good maintenance	5.2	4.8	2.0	4.9	1.16
Safe	5.4	5.2	2.0	5.2	1.18
No cars	8.3	5.1	5.9	6.5	9.62
Peaceful	6.2	4.6	5.9	5.3	2.72
Close to home	13.0	7.4	7.8	9.7	20.26 *
Negative attributes					
Rough surface	26.4	22.0	68.2	25.0	49.44 *
Horse damage	7.4	0.3	0.0	3.5	70.86 *
Street crossings	11.7	10.2	0.0	10.6	6.51
Too narrow	1.9	2.7	0.0	2.3	2.30
Too short	0.7	2.1	0.0	1.4	6.78
Lack of facilities	3.2	3.0	2.3	3.1	0.19
Litter and glass	9.0	3.8	2.3	6.1	22.63 *
Poor signage	1.9	3.4	2.3	2.7	3.81
Crowding	8.1	16.5	0.0	12.4	35.54 *
Lack of police	4.9	1.8	0.0	3.1	15.96 *
Rude users	4.3	8.0	0.0	6.2	13.62

* $P < 0.001$.

crossings", "too short", "too narrow", "drinking water and restroom facilities needed" and "better signage needed". A second cluster of negative comments related to the presence and behavior of other trail users. Topping this cluster was "crowding", mentioned in more than 12% of all comments. Other frequently mentioned items in this cluster included "rude or inappropriate behavior of other users" and "more police patrols needed". It is difficult to tell if the lack of negative attributes mentioned by respondents on the state trail was because few of these problems existed or because there were few respondents in the sample to answer this open-ended question. However, significant differences in individual attributes and a lower rank order correlation between local and regional trails of $r_s = 0.59$ hint that there may be some systematic differences in preferences owing to trail types.

4.6.2. Perceived trail problems

Some of the uncertainty in the analysis above was reduced in a more quantitative assessment of respondents' perceptions of trail problems. In a closed-ended question, respondents were asked to evaluate how much of a problem each of 14 potential issues was for the trail they were using (Table 3). The magnitude of problems was low to moderate for most items, with facility-related problems such as "lack of restrooms", "lack of drinking water" and "lack of services such as food and bike repair" rating among the greatest problems over all trails in the sample. Pairwise significance tests showed that the largest differences were in comparisons of the state trail with local and regional trails, where the former had significantly lower perceived problems with respect to crowding, user conflicts, reckless behavior, and dangerous road intersections. On other items the differences were not as large, seldom amounting to more than half a point on a five-point rating scale.

4.6.3. Trail development issues

A final set of items evaluated respondents' perceptions of the importance of future trail development issues (Table 3). The issues were stated for trails gen-

erally, and were not tied to the specific trail users were on that day. Results showed that most of the eight items included in the question were rated on an average of "partially important" to "important" (the two highest categories), with "building more trails", "building longer trails" and "link together existing trails" receiving the highest mean ratings by respondents on all trails combined. As one might expect with a non-trail-specific question, differences by trail type were minor, with all items having at least two non-significant pairs.

4.6.4. Trail surfacing issues

Although dividing trails into local, regional, and state types sheds some light on how metropolitan trails are perceived, it is not the only way to look at differences in trail perceptions. Trail surfacing is one particularly important design-related issue in metropolitan areas, about which different users disagree. For example, many respondents felt that paving trails with asphalt was desirable, and "rough trail surface" was an important problem on selected trails in the sample. Looking at these items by trail user type, however, gave us a different perspective on the issue of paving. Bicyclists rated rough trail surface significantly higher as a problem than did pedestrian trail users, and felt that paving trails with asphalt was a higher development priority. The small sample of horse riders ($n=44$) included in the analysis was not at all keen on paving trails, and rated this item the lowest of all user groups (group differences significant, $P<0.001$).

Further insight into the paving issue was gained by comparing the data for trails paved with asphalt vs. those surfaced with crushed aggregate. Although the sample size of only 12 trails (one trail had both kinds of surfaces and was left out of the analysis) makes any

Table 3
Mean ratings of trail problems and development issues, by trail type and overall

Problem issue	Mean score rating [1]				F
	Local	Regional	State	All	
Perceptions of trail problems					
Too crowded	1.89	2.22	1.14	2.06	43.74 *
Conflicts with other trail users	1.75	1.82	1.13	1.78	12.73 *
Reckless behavior of trail users	1.81	1.87	1.16	1.83	12.11 *
Inadequate police or safety patrols	2.04	1.78	1.45	1.88	21.98 *
Rough trail surface	2.39	1.94	2.69	2.14	46.15 *
Narrow trail width	1.92	1.85	1.65	1.87	2.87
Trailside litter	2.06	1.69	1.70	1.84	35.14 *
Dangerous road intersections	2.32	2.16	1.40	2.21	18.80 *
Trail vandalism	1.79	1.55	1.32	1.65	23.77 *
Personal safety	1.91	1.58	1.30	1.71	39.69 *
Lack of restrooms	2.65	2.06	2.12	2.30	68.54 *
Lack of drinking water	2.58	2.38	2.69	2.47	7.61
Lack of services (food, bicycle repair)	2.24	2.27	2.21	2.26	0.18
Lack of trail direction signs	2.01	1.93	1.89	1.96	1.71
Importance of future development issues					
Build more trails	3.70	3.91	3.69	3.82	8.13 *
Build long-distance trails	3.61	3.79	3.52	3.71	6.53
Link together existing trails	3.81	3.97	3.69	3.90	6.23
Pave trails with asphalt	2.91	3.66	3.19	3.34	82.59 *
Designate streets and roads as routes	3.07	3.09	3.01	3.08	0.10
Develop bicycle commuting facilities	2.81	2.93	3.07	2.88	2.54
Develop trails close to home	3.09	3.38	3.42	3.27	12.69 *
Publish low-cost trail map guides	3.24	3.50	3.34	3.40	10.17

[1] for trail problems: 1 ('not a problem') –5 ('a major problem'). For development issues: 1 ('not important') –5 ('very important').
* $P<0.001$.

statistical tests suspect, a qualitative comparison of data in Table 1 showed that asphalt-paved trails were consistently described by managers and in published materials as having use levels of "heavy" or "very heavy" whereas those surfaced with crushed aggregate had use levels of "light" and "moderate". The effects of this association were further assessed through a quantitative comparison of respondents' ratings of trail conditions. Respondents were asked to rate on a seven-point scale ("poor"–"excellent") their satisfaction with the trail they were on that day compared with others they had used in the past. Those on the asphalt surface rated their trails slightly better than those who were on trails surfaced with crushed aggregate. However, those on asphalt trails also tended to report a significantly higher degree of problems with crowding, user conflict, and reckless trail users than those on the trails surfaced with crushed aggregate ($P < 0.001$).

Although surfacing might be seen at the outset of trail development as a design issue, maintaining that surface once a trail is developed also makes it an issue of management. We found that of the 14 perceived trail problems included in our study, a "rough trail surface" best predicted overall "trail satisfaction", with $R^2 = 0.22$. This relationship held for those who rated trails that had asphalt as well as crushed aggregate surfaces.

5. Discussion

5.1. Location considerations

Findings from this study showed that the location of greenway trails was an important factor in how they were used. Local greenway trails—those where most users traveled only a short distance to use the trail—tended to have users who came alone or in pairs to the trail under their own power, walked or ran on the trail in short but frequent trips, were "brand loyal" to the trail and tended not to use or consider other trails as substitutes, and more often used the trail for commuting than did those who used regional and state trails. Users of local trails contrasted markedly with users of regional and state trails, the last two groups of whom more often drove to and cycled on the trail, were more often first time visitors to the trail, and diversified their use of trails within and beyond the metropolitan region. The single example of a state trail within the sample made it difficult to identify use patterns definitively, but beyond the major difference in distance traveled, state trail users seemed to spend a longer time on the trail, came in larger groups and in organized groups, tended to hike as well as bicycle along the trail, and were much more likely to be only occasional visitors.

These differences in how metropolitan trails are used should be taken into account in the development of a greenway system for recreation. Although survey findings showed that building more trails, longer trails, and linking existing trails were top development priorities for many respondents, planners may neglect important segments of the trail user population if they do not also consider trail location. The issue of location is most important for local trails, and on the basis of our study findings, we feel a reasonable guideline would be to develop local trails so that they can be reached from a distance of 5 miles or less. For some types of local trail users, this 5 mile maximum will still be too far. Older adults (55+ years), for example, are particularly distance sensitive in their use of trails, and in a previous analysis of these data, we found a much more conservative service radius of 1 mile may be needed to make trails reasonably accessible for this group (Gobster, 1991).

Regional and state trails are often developed to provide the "backbone" to a trail system, with an emphasis on creating a network of long-distance trails to which local trails can connect. Findings from this study strongly support development of regional and state trails, but suggest that local trails should provide the framework for a metropolitan trails system because they can more consistently meet people's everyday needs for recreation, commuting, and access to nature. Local trails might be linked to help meet functional needs, but simply linking trails to create an uninterrupted network of long-distance trails would be missing the point of what local trails provide. In some cases, small loop trails through existing parks and neighborhoods might be more useful on an everyday basis than long-distance trails, and would be more cost effective in crowded areas where linear greenways would be difficult to develop. In other cases, boulevards or dedicated cycle lanes on streets that run alongside actively used rail and powerline corridors might form the basis for narrow "mini-greenways", and provide a safer route than regular streets for non-motorized commut-

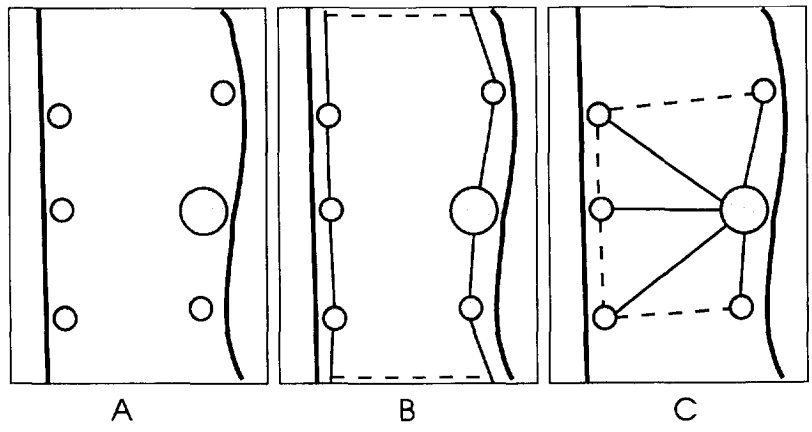

Fig. 3. Hypothetical trail development within a metropolitan region. (A) Origin–destination points (circles) along two linear resource features (bold lines). (B) "Regional development strategy" where first-priority trails (continuous lines) and second-priority trails (broken lines) maximize a long-distance greenway trail network. (C) "Local development strategy" where trails maximize functional ties between origin and destination points.

ing, while also providing a catalyst for reclaiming ribbons of nature throughout metropolitan areas.

Fig. 3 provides a conceptual illustration of the differences between a metropolitan greenway trail system built on the basis of maximizing long-distance regional linkages and one more functionally oriented to serving local trail user needs. Fig. 3(A) shows the "existing" situation, where two undeveloped linear resource features (e.g. a river and an abandoned railway) are located with respect to several origin–destination points within a hypothetical metropolitan area. The size of the points reflects their relative importance, and could represent neighborhoods, or places of work, shopping, or leisure. Fig. 3(B) illustrates a regional trail development strategy, where regional trails (represented by the continuous lines) are first developed along both of the resource features, with linkages (represented by the broken lines) built later to form a long-distance network. Fig. 3(C) illustrates a local trail development strategy, where a series of local trails is first built to connect each smaller origin–destination point with the larger one, and subsequent trails are built to connect the smaller origins and destinations. Thus formed, the local trail network allows more meaningful options, including trip length and route alternatives, while securing much of the land along the resource features offered by the regional development strategy.

As well as illustrating regionally and locally based trail network development strategies, this abstract example also greatly simplifies the realities of metropolitan greenway development. In many cases, a host of additional goals (e.g. biological diversity, flood control, esthetics) and constraints (e.g. costs, land availability, political and public sensitivity to trails) drives the decision-making process. Nevertheless, findings from this study underscore how a local use perspective might affect the location and sequence of development of a metropolitan trail network.

5.2. *Design considerations*

Beyond the location of trails relative to population centers, this study did not provide strong evidence for why some trails were primarily local, whereas others catered more to regional use and beyond. Both local and regional trails differed in length and type of surfacing, and responses to open-ended questions about preferred trail attributes showed a demand for nature, facilities, and good maintenance across all trail types. In developing a metropolitan greenway trail system, perhaps a better strategy might be to ensure that a spectrum of quality trails is available to meet people's diverse preferences and needs. This spectrum might include the following design considerations.

5.2.1. *Trail surfacing*

Study findings on the surfacing of trails suggested a dominant preference for having more asphalt-paved trails in the metropolitan area. This feeling was not universal, however, and pedestrians, horse riders, and

some bicyclists felt less enthusiastic than the bicycling majority about the subject of paving. This was reflected in statistics presented above, and written suggestions by respondents provide further ideas for trail development:

I think runners, joggers, and walkers would appreciate part of this trail to remain gravel, otherwise it would be just like running on the street./

Leave the Pratt–Wayne Woods section of the trail more natural. Keep it wild, not a road./

Develop mountain bike off-road trails./

Forest Preserve trails can become overcrowded. More dirt trails for running would be greatly appreciated./

Study findings also hinted that the choice of trail surfacing might help control use problems. For example, crushed aggregate surfacing may reduce the number of cyclists who ride fast or recklessly, and might also control crowding by eliminating cyclists who would not consider riding on surfaces other than asphalt. On the other hand, paving trails with asphalt may make them more appealing to special user groups, such as those in wheelchairs and families with babies in strollers.

5.2.2. *Enhancing the natural environment*

A top reason why people liked greenway trails was to come into contact with the beauty of nature. Strategies for nature enhancement depend largely on the potentials of the corridor, and could range from planting trees along a street boulevard to shade bicycling commuters, to full-scale vegetation management along a more natural section of trail, to open views and create a diversity of vegetative heights, forms, colors, and textures. The straight corridors of rail-trails pose special challenges to trail designers, and vegetation management is one of the few cost-effective tools available to introduce natural variety and interest along the trail. Trees and shrubs can be planted so they might reduce the long viewing distance without compromising safety, and, depending on the setting, wild or ornamental patches of flowers can provide small-scale visual interest. Where the right-of-way is wide enough, slightly realigning the trail may help reduce the extreme linear feel of the corridor (Talbot, 1993).

5.2.3. *Provision of trailside facilities and services*

Respondents saw a strong need to improve facilities and services along most of the trails in our sample, and designers should locate drinking water and clean restroom facilities at reasonable intervals along the trail. If this is not feasible at trailside, information should be posted telling where public facilities are available within a reasonable distance. Along some of the trails in our sample, the private sector has been instrumental in providing services to trail users that would be too expensive or inappropriate for public agencies to provide. On the west suburban Fox River Trail in particular, trailside restaurants and stores have embraced their trail-using clientele with such services as a secured bicycle area, bicycle rental and repair, and a shipping service so trail users do not have to carry their purchases with them.

5.3. *Management considerations*

5.3.1. *Maintenance*

A major problem that concerned users on many trails was poor maintenance of the trail surface. Whether as a result of potholes and cracks in the asphalt or washed-out aggregate, a rough trail surface was the strongest predictor of poor trail satisfaction ratings in the survey. Trails with crushed aggregate surfacing can be groomed cheaply on an as-needed basis, but maintenance costs can be formidable for asphalt beds that require reconstruction. The reconstruction and widening of older trails often represent a tradeoff with new trail development for the limited funds available. Because of the rising costs of acquisition and the chance of losing opportunities to protect corridors up for sale, most managers would probably opt for developing new trails. The local trail users, who may have to put up with poor maintenance day-in and day-out, often end up the losers in such decisions. If possible, managers should look for the right balance between new trail development and maintenance, and pursue expansion of the trail network while taking care of what is already in place.

Other maintenance problems of concern to users on some trails included litter, glass, and vandalism. Managers should provide adequate garbage containers at trailheads and other convenient pickup points, and police these regularly. Expedient cleanup is often the best method to prevent further littering, as well as graf-

fiti and other forms of vandalism (e.g. Christiansen, 1984). The Chicago Lakefront Path, one of the trails in our sample that is heavily used by commuters, has begun a successful regular program of trail sweeping to keep the path free of glass and debris.

5.3.2. Dealing with use and safety problems

Crowding and conflicts tended to occur on high-use trails in the survey. Although there are no definitive management solutions to these problems, widening problem portions of a trail or providing a separate path for pedestrians at problem stretches has alleviated the problems in some cases. Encouraging responsible trail behavior through bicycle clubs and outreach materials might also be effective in countering the reckless behavior of users, many of whom might be unaware of their impact on other users (Mozer, 1989).

Lack of personal safety on some local and high-use regional trails was cited as a problem by only a small proportion of respondents, but it is not an issue to be taken lightly. In the last few years, several trail authorities within the metropolitan area have commissioned special trail police officers, who patrol trails on bicycles or off–road vehicles. Their presence can help to increase the actual and perceived safety of trail users. Where this is not possible, local police should be notified of problem trail stretches, and park or trail maintenance personnel should be encouraged to arrange their work schedules to show a greater presence to trail users. Seeing other users on the trail can have a similar effect, and sponsored events and "crime watch" programs that have been an effective crime deterrent in urban parks might also be successfully applied on problem trails (Castellano, 1984). In other cases, selective cutting of trees and shrubs along the trail can reduce fear of crime as well as accidents by giving users a better field of vision (Schroeder and Anderson, 1984).

6. Conclusions and future research directions

This research provides one of the first comprehensive assessments of how metropolitan greenways are perceived and used, and how trails function together as a system. Responses from more than 2800 users on 13 trails in the six-county Chicago region showed that although it is important to work towards a goal of establishing an interconnected network of long-distance trails, it is also important to develop a hierarchy of trails that meet people's needs and preferences at the local, as well as regional and state levels. Urban, suburban, and rural greenway corridors can be greatly improved for recreation in metropolitan regions. By recognizing the importance of location, design, and management factors discussed in this paper, planners and managers can better set objectives for greenway development that will serve a broad range of recreational users.

More research is needed to understand how the location, design, and management of metropolitan trails affect use patterns, perceptions, and preferences. A more definitive study of neighborhoods surrounding trails could provide managers with information on the accessibility of trails by various user groups, as well as some of the physical and social barriers. Some work in this vein has been done to understand non-use of trails (Bialeschki and Henderson, 1988), but in-depth investigations are needed to address use issues such as commuting, personal safety, and diverse populations that come to the forefront in metropolitan settings. In addition to on-site surveys, visual simulations (e.g. Wiberg-Carlson and Schroeder, 1992) and verbal descriptions (e.g. Westphal and Lieber, 1986) have been used effectively to identify design and management attributes related to peoples' preferences and choices. Little work, however, has been done to examine how such attributes affect use patterns. The present study provided the inklings of what such an assessment might reveal in terms of a potentially important relationship between surface type and use levels. By gathering use data over a large sample of trails, one might gain a more comprehensive understanding of how length, alignment, width, surfacing, vegetation management, and other design and management factors might affect such aggregate use patterns as total use levels, the average trail speed of bicyclists, and the relative proportion of wheeled, pedestrian, and other group types. Such information would be valuable for designing trails for specific uses and purposes, and for controlling use-related problems.

Finally, it must be stressed that recreational greenway development must be evaluated in light of other environmental and social goals. Greenways are often developed to provide multiple benefits and functions, including habitat protection and preservation of regional biodiversity, air and water quality improvement, flood and stormwater management, cultural and historic resource conservation, esthetics and the

enhancement of quality of life, transportation alternatives, and the promotion of environmental awareness and regional identity (Northeastern Illinois Planning Commission and Openlands Project, 1993). By focusing on one of these—linear trail recreation—this study identified some important factors to think about in greenway location, design, and management. When implemented in the context of a comprehensive greenway goal assessment, these factors will help to ensure that metropolitan greenway systems achieve their full potential.

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