Park-and-Ride in the Shirley Highway Corridor

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The market for fixed-route transit operations is not limited to travelers living within walking distance of transit stops. As demonstrated by the Shirley Highway Express-Bus-on-Freeway Project, well-planned park-and-ride operations can lead to sizable increases in bus patronage. Park-and-riders, commuters who travel by automobile to a bus stop and then by bus to work, greatly expanded the market for the fixed-route bus service in the Shirley Highway corridor. After briefly describing the park-and-ride arrangements in this suburban corridor, this paper presents the results of an investigation of the perceptions and mode choice influences of the park-and-riders at two new lots. On-board surveys were used to determine the importance of 12 factors in the commuter's decision to switch from automobile to park-and-ride bus service. The users' subjective satisfaction assessments for these factors and their reported travel-time and costs savings (or losses) were also obtained. These results suggest that several factors in addition to time and cost should be considered in planning park-and-ride facilities.

As traffic congestion and the demand for parking in the downtown sections of many large metropolitan areas have increased in recent years, alternatives to automobile commuting to and from work have become more popular. Park-and-ride transit where the automobile is used to travel to the bus stop is a promising alternative. This paper reviews the performance of a park-and-ride system in the Shirley Highway corridor of northern Virginia and presents a description of the commuters using it. The paper examines the user's perceptions of service features of the system and identifies the factors that influence commuters' mode choice decisions when park-and-ride is developed as an element of a comprehensive transit service improvement using exclusive bus lanes. While the results of this investigation apply directly only to the Shirley Highway corridor, this experience will be of use to transportation planners in the design of strategies to meet the growing demand for commuter transit service from distant suburban communities.

DESCRIPTION OF THE SYSTEM

Park-and-riders are an important portion (about 30 percent in November 1974) of bus commuters traveling within the Shirley Highway corridor. Figure 1 shows the area of influence of the bus-on-freeway project and the relative locations of the major park-and-ride lots. The area within the lines is the primary service area of the project routes.

One of the major elements of the project is residential fringe parking coordinated with new transit service on exclusive bus lanes (1). These well-planned park-and-ride facilities provide geographic flexibility for the transit operator by extending the market area of the bus system and increase operating efficiency by minimizing the slower (collection) portion of the trip. After the automobile access trip, commuters board express buses that travel over exclusive lanes to destinations in downtown Washington, D.C., the Pentagon, or Crystal City, Virginia.

These corridor park-and-ride services have been very successful in attracting automobile commuters. The estimated number of daily park-and-riders in the Shirley Highway corridor grew from 4100 in October 1971 to about 7500 in October 1974, and represents 25 and 30 percent of daily corridor bus ridership respectively. Of the more than 900 park-and-riders responding to a November 1973 survey of corridor bus commuters, about 65 percent indicated that they had commuted by automobile prior to using park-and-ride (about 50 percent had driven alone). Thus, in 1974, of 7500 park-and-riders, an estimated 4600 had formerly commuted to work by automobile.

Many transit planners contend that very few suburban commuters will use bus service if they are from multiple automobile-owning or high-income families. This certainly was not true for the park-and-ride bus commuters in the Shirley corridor (Table 1). Park-and-ride commuters have family incomes that are comparable to those of automobile commuters and substantially higher than those of walk-on bus commuters. Similarly, corridor park-and-riders are from families owning about the same number of cars as automobile commuters and considerably more than bus commuters. Park-and-riders and walk-on bus commuters had lower age distributions.

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than the automobile commuters. This increased tendency of younger persons to use the bus service was true even among those who had income distributions similar to those of automobile users.

There are many locations in the Shirley Highway corridor where commuters park-and-ride. However, only three lots have been developed as official park-and-ride locations. Two are in large shopping centers, Springfield Plaza and Shirley Plaza, and the other, Backlick (located at a future Metrorail stop), is a permanent parking facility built specifically to serve park-and-riders. The park-and-ride survey was conducted at the two largest lots—Springfield Plaza and Backlick. Although both the Backlick and Springfield lots are official park-and-ride lots, they are quite different with respect to the quality of service that they provide to bus users. The Backlick lot, which opened in October 1972, is away from shopping development. It has a capacity of 400 automobiles, a drop-off area, a bicycle rack, and a public telephone. However, it is somewhat inaccessible to Shirley Highway and beltway motorists, and the average walk from the automobile parking area to the bus boarding point is about 55 m (60 yd). The Springfield park-and-ride lot, which opened in June 1971, is a designated portion of a shopping center parking lot. It is accessible from Shirley Highway (I-95) via the Springfield exit, and the bus boarding point is near the designated park-and-ride spaces.

Both of these park-and-ride lots are served by the same bus route operated by the Washington Metropolitan Area Transit Authority. At the time the survey was conducted (February 1973), the route began at the Backlick lot and picked up passengers at the Springfield Plaza lot before entering the highway at the Springfield entrance. Thus riders from Backlick were assured of a seat while some riders at Springfield had to stand. (This route was modified in March 1973, reversing the sequence of service at the two lots.) Service is provided by new buses with special interior features (wider seats and carpeted walls and floors). Bus headways in February 1973 averaged 15 min (service is offered only during the peak periods), and travel times between Farragut Square in downtown Washington, D.C., and the Springfield Plaza and Backlick park-and-ride lots averaged 32 and 39 min respectively for trips of 24.5 and 26.5 km (14.7 and 15.9 miles) respectively.

PROJECT SURVEY

Procedure

Surveys to obtain information about the influence of selected features of the park-and-ride service on commuters' mode choice decisions were conducted during the first week of February 1973 at the two major lots—Backlick and Springfield Plaza (designated 1 and 2 respectively in Figure 1). The first 47 passengers boarding each bus were given questionnaires and asked to complete and re-
Table 1. Distributions of selected demographic characteristics of corridor commuters.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Percentage of Users of Transit Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Park-and-Ride Users ($)</td>
</tr>
<tr>
<td>Annual household income ($)</td>
<td>62</td>
</tr>
<tr>
<td>Under 5000</td>
<td>4</td>
</tr>
<tr>
<td>5001 to 15 000</td>
<td>35</td>
</tr>
<tr>
<td>15 001 to 30 000</td>
<td>36</td>
</tr>
<tr>
<td>Over 30 000</td>
<td>100</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
</tr>
<tr>
<td>Mean automobiles/household</td>
<td>1.78</td>
</tr>
<tr>
<td>Age (years)</td>
<td>56</td>
</tr>
<tr>
<td>Under 21</td>
<td>4</td>
</tr>
<tr>
<td>21 to 30</td>
<td>60</td>
</tr>
<tr>
<td>30 to 40</td>
<td>36</td>
</tr>
<tr>
<td>Over 40</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
</tr>
<tr>
<td>Sex</td>
<td>56</td>
</tr>
<tr>
<td>Males</td>
<td>52</td>
</tr>
<tr>
<td>Females</td>
<td>38</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
</tr>
<tr>
<td>Number of observations</td>
<td>910</td>
</tr>
</tbody>
</table>

*November 1973 survey of bus commuters in the Shirley Highway corridor.

The survey form had four sections printed on a stiff paper folder for easier writing while riding the bus. After completing the introductory section dealing with the details of his previous transit mode, the park-and-ride opened the folder to the main section of the questionnaire. [Copies of these questionnaires are presented in another report (2).] The second section focused on the bus service-related features people considered when first deciding to change the way they commute to work and asked the park-and-ride to assign an importance rating to each of a list of such features. (The order of the list was reversed on half of the forms to minimize order effects.) The next section solicited user satisfaction ratings of the same features by asking the rider to assign a satisfaction rating to each of them. The fourth section of the survey form requested detailed travel time and cost information for the previous and present trip, demographic data, and how the user first heard of the bus service at the lot.

Characteristics of Park-and-Riders

Using the Service

The survey provided considerable information about the demographic characteristics and trip making behavior of the park-and-riders (2). The characteristics of the former all-automobile commuters, the former regular bus riders, and the users of ad hoc park-and-ride locations are similar (Table 1).

Access to the two lots is primarily by automobile—about 70 percent of the riders drive alone, about 10 percent drive with passengers, and about 4 percent are dropped off. Over 10 percent park near the lots, indicating that some people may have shorter walking distances that way. About 80 percent of the park-and-riders use the lots 5 days/week. The major destination of those boarding at Springfield is downtown Washington (88 percent) while the Pentagon and downtown Washington, with 45 and 41 percent respectively, share the market from Backlick. About 80 percent of the former all-automobile commuters drove alone before using the lots, while over 30 percent car pooled before taking the bus. A third of the former bus commuters walked to a bus boarding point and almost a third parked near a bus stop before using the lots.

The opening of the Backlick lot was accompanied by a concerted advertising campaign that included newspaper advertisements and mass mailings. Accomplishments included a third of the users at the lot first heard of the service through the mail advertisements, another third heard by word of mouth, 17 percent saw the newspaper advertisements, and 10 percent saw the roadway signs indicating the location of the lot. Over half began using the lot when it first opened, 22 percent during the first month, and about 10 percent each succeeding month.

The distributions of access trip distances and travel times indicate how far the bus market can be extended in a suburban area. For the majority of the users of the bus service, the distance between home and the lot was greater than 3.2 km (2 miles); for 20 percent of the park-and-riders, it was as much as 8 km (5 miles). However, even with this large market area, the access time was only about 25 percent of the total door-to-door time. Thus, automobile access can extend bus service over large areas with relatively small time penalties for the commuter.

Factors Influencing Automobile Commuters to Change to Bus Service at Park-and-Ride Lots

The Importance of Service Features

Many factors are important to people when they change their modes of commuting to work. The development of a high-quality park-and-ride service at the two lots provided an opportunity to examine new commuters' assessments of the factors that were important when they first decided to change from all-automobile commuting to bus service at the lots. This study of mode choice behavior relied on the users' perceived values of 12 characteristics of the available modes. Although no attempt was made to develop a quantitative model of park-and-ride mode choice, the results provide insight into the variables that should be considered when suburban park-and-ride facilities are developed.

Table 2 ranks these features based on the percentage of respondents indicating either of highest importance or very important (2). Former automobile commuters at both lots agreed on the relative importance of the 12 features. About 80 percent rated the same 3 features highly: (a) stress and frustration of commuting, (b) schedule reliability, and (c) convenience of arrival and departure times. Over 50 percent rated parking convenience and the difference in door-to-door travel time very high. Seat availability was ranked fifth by the Backlick lot users and seventh by those at Springfield.

Former automobile users at the two lots differed in their assessment of differences in travel time. Forty percent of the Springfield riders and only 33 percent of the Backlick riders rated this high. This may reflect the destinations of the users, for about 90 percent of the Springfield riders but only 40 percent of the Backlick riders work in downtown Washington where parking charges are high.
Only 40 percent of the former all-automobile commuters rated availability of evening bus service and security of the parking lot very highly. Riders at both lots gave low ratings to the same three features: (a) making the automobile available to other members of the household, (b) the difference in the amount of walking required, and (c) shelter at the boarding point.

The variations among the importance responses of different sex, age, and income groupings of former automobile users at Backlick were also studied. This analysis indicated that the rankings of the responses of each group were similar to those of its counterpart (e.g., rankings of responses of male commuters were similar to those of female commuters). Former bus users were in general agreement with former all-automobile commuters on the relative importance of the 12 features.

Table 2. Percentage of respondents in February 1973 park-and-ride survey indicating features that were of highest importance or very important.

<table>
<thead>
<tr>
<th>Feature</th>
<th>Backlick Lot</th>
<th>Springfield Lot</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Former Users</td>
<td>Former Users</td>
</tr>
<tr>
<td></td>
<td>Bus Users</td>
<td>Users</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Users</td>
</tr>
<tr>
<td>Difference in the level of stress and frustration of commuting</td>
<td>83</td>
<td>71</td>
</tr>
<tr>
<td>Schedule reliability</td>
<td>80</td>
<td>76</td>
</tr>
<tr>
<td>Convenience of bus arrival and departure times</td>
<td>78</td>
<td>77</td>
</tr>
<tr>
<td>Parking convenience</td>
<td>58</td>
<td>35</td>
</tr>
<tr>
<td>Seat availability</td>
<td>54</td>
<td>66</td>
</tr>
<tr>
<td>Difference in door-to-door travel time</td>
<td>54</td>
<td>51</td>
</tr>
<tr>
<td>Availability of late evening bus service</td>
<td>44</td>
<td>60</td>
</tr>
<tr>
<td>Security of this parking lot</td>
<td>39</td>
<td>21</td>
</tr>
<tr>
<td>Difference in total daily commuting cost</td>
<td>33</td>
<td>23</td>
</tr>
<tr>
<td>Shelter at bus boarding point</td>
<td>25</td>
<td>22</td>
</tr>
<tr>
<td>Difference in required walking</td>
<td>22</td>
<td>19</td>
</tr>
<tr>
<td>Making automobiles available to others</td>
<td>12</td>
<td>—</td>
</tr>
</tbody>
</table>

The satisfaction responses to service features are a subjective assessment of the quality of the service provided at the park-and-ride lots. They are, therefore, affected by the service provided at the lots (e.g., actual bus adherence to schedule times) as well as the perceptions of the persons surveyed.

A summary of the satisfaction responses of the former automobile users and users of the prior bus service is given in Table 3. Except for seat availability and parking convenience, park-and-riders at the Backlick lot were generally satisfied with the park-and-ride service. The former bus users were less critical of seat availability, perhaps because they are more accustomed to crowded buses than are former automobile users. Similarly, former automobile commuters, accustomed

Figure 2. Importance versus satisfaction responses of former automobile users at Backlick.
to the parking situation in downtown Washington, appre-
ciated the availability of parking at the lot more than did
former bus users.

Satisfaction responses of former automobile users at
Springfield Plaza differ from those of their counterparts
at Backlick. In contrast to the relatively high degree of
satisfaction with schedule reliability and seat availability
reported by the former automobile users at Backlick, 
former automobile users at Springfield reported less
satisfaction with the reliability of the bus service pro-
vided them and substantially less satisfaction with the
availability of seats. Another difference was the lower
satisfaction with the walking distance to the boarding
point shown by former automobile users at Backlick.
In general, the differences in the satisfaction responses
of former automobile users are consistent with the dif-
fences in the services provided at the two park-and-
ride lots. The rankings of the satisfaction responses
varied only slightly with age, sex, or income.

Satisfaction Versus Importance Responses

Commuter satisfaction and importance ratings were
correlated to investigate further actions that might at-
tract automobile commuters to bus service at park-and
ride lots. The satisfaction and importance responses
can be interpreted in the following way.

1. If bus commuters indicate that a feature is rela-
tively unimportant, then any related improvement in this
feature should have a low priority even if commuters
have expressed dissatisfaction.

2. If bus commuters express dissatisfaction with a
feature and place relatively high importance on it, re-
lated improvements should be assigned high priorities.

3. If the importance and satisfaction responses of a
feature are high, new bus patrons will be attracted and
retained.

The relationship of satisfaction and importance re-
sponses of former automobile users at the Backlick
parking lot is presented in Figure 2. Points in the lower
left correspond to features that were rated as unimport-
ant and with which commuters were dissatisfied. Points
in the upper right correspond to features that were rated
as highly important and with which commuters were sat-
sfied. In general, the former automobile users were satis-
sfied with bus service features that were important
to them.

The largest patronage increases would result from
strategies directed at interpretation 2 above. For ex-
ample, at the time of the February 1973 survey, former
automobile users at Springfield were dissatisfied with
seat availability, which they rated high in importance.
At that time, there were about 125 and 250 cars respec-
tively parking in the Springfield and Backlick lots during
the peak period. In March 1973 the order of bus service
at the two lots was changed so that seat availability and
schedule adherence were improved for riders boarding
at the Springfield lot. This reduced travel time for
riders boarding at the Backlick lot from 39 to 35 min
and increased travel time for riders boarding at Spring-
field from 32 to 44 min.

A second survey identical to the first was conducted
at the two lots during the last week of March 1973. At
Springfield satisfaction responses of persons not sur-
veyed during the first survey indicated a marked change
in rider approval of the availability of seats and bus
schedule reliability. At Backlick satisfaction with bus
schedule reliability did not change, but satisfaction with
the availability of seats declined slightly.

By June 1974 the number of cars parking in the
Springfield lot during the peak period had increased to
more than 325. Peak-period parking at the Backlick lot
remained constant at approximately 250 cars. Some of
the increase in the use of the Springfield lot can be attrib-
uted to improvements in schedule adherence and seat
availability. However, it is also likely that some of the
increase at Springfield has occurred because the lot is
visible from the Shirley Highway and more accessible to
the southern part of the corridor.

Influence of Travel-Time and Parking
Cost Savings

Travel-Time Savings for Former
Automobile Users

Most inquiries into travel behavior have found that com-
muters consider travel time and cost as important fac-
tors in their mode choice decisions. A comparison of
the reported times and parking costs required in com-
muting by automobile with those required by the present
park-and-ride system provides some insight into the sig-
nificance of these factors for the Shirley Highway corri-
dor commuter.

The perceived or reported travel-time distributions
for the various components of the present park-and-ride
commute trip and the former automobile trip for the
Backlick lot users are presented in Table 4. (The dis-
tributions were almost identical at Springfield.) Most
of the park-and-riders used less than 20 min to drive
to the lot, waited less than 10 min for a bus, spent less
than 30 min on the bus, and had an average total travel
time of 49.7 min. Previously, they had driven and parked
in an average of 46.9 min, and walked to the office in
about 6 min. Thus, on an average, the door-to-door
time saving was only 3 min for a 50-min trip. A more
detailed picture of the door-to-door travel time savings
for both Backlick and Springfield users can be seen in
Table 5. Sixty-eight percent of the users at both lots had
a perceived time saving for the trip while the remainder
had increased travel times. The reported travel times
of the travel time conscious group (survey respondents
who rated travel time as of highest importance or very
important) are also presented in Table 5. Even for this
group, about 30 percent lost time by using park-and-
ride.

Other factors such as stress and frustration and bus
service quality were perceived as very important by
most park-and-riders. Nonetheless, reported travel-
time savings were significant for a majority and cannot
be neglected when developing park-and-ride facilities.

Parking Cost Savings for Former
Automobile Users

Since parking is free at the park-and-ride lots, downtown
automobile commuters often save parking charges when
they use the lots. Almost two-thirds of the Backlick
riders had previously parked free, but the average cost
for those who did pay was $28.70/month. At Springfield,
only 29 percent had previously parked free, and the rest
paid an average of $29.38/month (Table 6). For com-
parison, the monthly bus fare was about $29.

The difference in total daily cost to commute was
rated more important by the Springfield riders than by
the Backlick users. The reported parking costs of the
cost conscious group (survey respondents who rated dif-
ference in total daily commuting costs as of highest im-
portance or very important) are also shown in Table 6.
At both lots, this group saved more in parking charges
than other, less cost-sensitive park-and-riders.
SUMMARY OF MAJOR FINDINGS

1. The coordinated development of park-and-ride facilities with express bus lanes and high-quality transit service extended the transit market area and substantially increased transit ridership within the Shirley Highway corridor. The number of daily park-and-ride users increased from an estimated 4100 in October 1971 to 7500 in October 1974. Bus commuter surveys have shown that park-and-ride use increased from about 25 percent of the corridor bus ridership in 1971 to about 30 percent in 1974.

2. The majority of corridor commuters are from the higher income, multiple automobile-owning households that are usually associated with all-automobile commuting. Over 80 percent of these former all-automobile commuters drove alone before using the official lots, and about 30 percent car pooled before taking the bus.

3. The surveys at the two major lots suggest the following considerations for the planning and development of suburban park-and-ride facilities:
   a. The lot should be served by high-quality bus service to encourage the use of transit. Bus service features such as schedule reliability, convenience of arrival and departure times, and seat availability should be given planning priority.
   b. The lot location must be convenient.
   c. The lot location and the high-quality bus service must be perceived by the new user as reducing the level of stress and frustration of commuting.
   d. For relatively affluent commuters, the perceived travel-time difference between automobile and bus may be more important than the cost difference.
   e. Convenience items such as bus shelters, minimal walking distances, car security, and the availability of late-evening bus services are not perceived as very important features.

4. The perceived satisfaction ratings for various features of the park-and-ride service indicated that the former all-automobile commuters are satisfied with the bus service features that are important to them.

5. Satisfaction responses of park-and-riders differed according to their former mode of transit. Former automobile commuters were less sensitive to parking arrangements at the lot and more sensitive to the availability of a seat than were users of the previously existing bus service.

6. Commuters' reactions to the park-and-ride service were independent of age, sex, or income.

CONCLUSIONS AND THOUGHTS FOR FUTURE RESEARCH

In terms of developing suburban park-and-ride facilities to attract former automobile users, the following planning considerations are suggested by this survey: Bus service at the lot should be of high quality to encourage the use of transit. Bus service features such as schedule reliability, convenience of arrival and departure times, and seat availability are all very important to a potential park-and-rider. The lot location and the bus service must be perceived by new users as reducing the level of stress and frustration and providing convenient parking. For affluent commuters, the perceived travel-time difference is more important than the daily cost difference. Lot convenience items such as bus shelters and minimal walking distances, car security, and the availability of late-evening bus service are much less important for new park-and-riders. [Several additional planning guide-

Table 4. Percentage of former automobile commuters at Backlick lot by travel time for trip components.

<table>
<thead>
<tr>
<th>Trip Component</th>
<th>0 to 10</th>
<th>11 to 20</th>
<th>21 to 30</th>
<th>31 to 45</th>
<th>46 to 60</th>
<th>61 to 75</th>
<th>75</th>
<th>Avg Travel Time (min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preserved park-and-ride trip</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Home to bus stop</td>
<td>58</td>
<td>29</td>
<td>10</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td></td>
<td>13.1</td>
</tr>
<tr>
<td>Waiting for bus</td>
<td>98</td>
<td>12</td>
<td>45</td>
<td>10</td>
<td>15</td>
<td>2</td>
<td></td>
<td>28.2</td>
</tr>
<tr>
<td>Line haul</td>
<td>36</td>
<td>13</td>
<td>13</td>
<td>13</td>
<td>2</td>
<td>2</td>
<td></td>
<td>28.2</td>
</tr>
<tr>
<td>Walk to work</td>
<td>94</td>
<td>13</td>
<td>13</td>
<td>13</td>
<td>2</td>
<td>2</td>
<td></td>
<td>28.2</td>
</tr>
<tr>
<td>Door-to-door</td>
<td>9</td>
<td>13</td>
<td>13</td>
<td>13</td>
<td>2</td>
<td>2</td>
<td></td>
<td>28.2</td>
</tr>
<tr>
<td>Former automobile trip</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Home-to-work (park)</td>
<td>1</td>
<td>2</td>
<td>16</td>
<td>33</td>
<td>4</td>
<td>4</td>
<td></td>
<td>49.7</td>
</tr>
<tr>
<td>Walk to work</td>
<td>90</td>
<td>10</td>
<td>13</td>
<td>13</td>
<td>2</td>
<td>2</td>
<td></td>
<td>28.2</td>
</tr>
<tr>
<td>Door-to-door</td>
<td>9</td>
<td>13</td>
<td>13</td>
<td>13</td>
<td>2</td>
<td>2</td>
<td></td>
<td>28.2</td>
</tr>
</tbody>
</table>


Table 5. Percentage of former automobile commuters by time saved and lost.

<table>
<thead>
<tr>
<th>Survey Lot and Group</th>
<th>Time Saved (min)</th>
<th>Time Lost (min)</th>
<th>Avg Time Saving (min)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>30 30 to 21 20 10 to 1</td>
<td>0 1 to 10 11 to 20</td>
<td>31</td>
</tr>
<tr>
<td>Backlick</td>
<td>5 8 10 11 17 10</td>
<td>5 8 10 17 10</td>
<td>8 10</td>
</tr>
<tr>
<td>All (91)</td>
<td>9 12 14 16 20</td>
<td>15 17 20 23 24</td>
<td>24</td>
</tr>
<tr>
<td>Travel time conscious group (49)</td>
<td>9 15 15 18 18</td>
<td>12 15 18 21 24</td>
<td>24</td>
</tr>
<tr>
<td>Springfield</td>
<td>9 12 14 16 20</td>
<td>15 17 20 23 24</td>
<td>24</td>
</tr>
<tr>
<td>All (134)</td>
<td>9 12 14 16 20</td>
<td>15 17 20 23 24</td>
<td>24</td>
</tr>
</tbody>
</table>

Table 6. Percentage of former automobile commuters by monthly parking costs.

<table>
<thead>
<tr>
<th>Survey Lot and Group</th>
<th>Free 0 to 10 11 to 20 21 to 30 31 to 40 41</th>
<th>More Than Cost ($</th>
<th>Avg Cost ($</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Backlick</td>
<td>64 12 2 6 8</td>
<td>8 8 8 28.70</td>
<td>28.70</td>
<td></td>
</tr>
<tr>
<td>All (91)</td>
<td>17 23 15 23 28</td>
<td>28 35.07</td>
<td>35.07</td>
<td></td>
</tr>
<tr>
<td>Travel time conscious group (49)</td>
<td>15 23 15 23</td>
<td>28 35.07</td>
<td>35.07</td>
<td></td>
</tr>
<tr>
<td>Springfield</td>
<td>20 14 11 11 20</td>
<td>15 29.38</td>
<td>29.38</td>
<td></td>
</tr>
<tr>
<td>All (134)</td>
<td>8 15 23 38</td>
<td>16 31.35</td>
<td>31.35</td>
<td></td>
</tr>
</tbody>
</table>
lines based on the experience of park-and-ride lots throughout the United States are discussed (3).

This study has focused on the perceived reactions of new users of park-and-ride bus service. An additional approach would be to survey nonusers to obtain their preferences about park-and-ride as a commuting mode. An analysis of the two assessments would then provide considerable insight into mode choice decisions. This survey methodology could also be applied at park-and-ride lots in different suburban environments to develop a comprehensive set of planning guidelines and, perhaps, a mode choice model applicable to different types of commuters and a wider range of park-and-ride service levels.

ACKNOWLEDGMENTS

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REFERENCES