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Social Marketing Applications and Transportation Demand Management: An Information Instrument for the 21st Century

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Our troubled planet can no longer afford the luxury of pursuits confined to an ivory tower. Scholarship has to prove its worth, not on its own terms, but by service to the nation and the world.

—Oscar Handlin
Social Marketing Applications and Transportation Demand Management: An Information Instrument for the 21st Century

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Abstract

Concern has been expressed by planners and policy-makers that the “add capacity” strategy used in building more roads to resolve traffic-induced problems is no longer a feasible option. This article explores private transport behavior in understanding how users can be persuaded to adopt a more blended approach (i.e., integrating car, public transportation, and alternative modes on a daily basis). The research methodology adopted focus groups and travel diaries in presenting a number of social marketing message appeals aimed at inducing a change in participants’ travel behaviors. While weaknesses are identified in the social marketing materials, this research concludes that social marketing as a stand-alone intervention program is not capable of persuading people to alter their overdependency on car use. Nonetheless, participants did acknowledge that the messages were informative and helpful in educating them on transportation issues. The research suggests that social marketing programs could be of value as information instruments in support of transportation demand management (TDM) policies. Such programs can function as an effective channel of communication in building dialog and garnering wider public support of...
demand management policy and in delivering important transportation messages directly to commuters.

**Introduction**

Understanding a role for TDM is part of the problem facing policy-makers in truly determining the right course of action on transportation policy in the coming decades. How can TDM fit into the new horizon in dealing with transportation problems, given the perceived success to date of the “add-capacity” strategy? While there is an abundance of quantitative data available on this topic, in-depth qualitative data looking at the broader issues associated with transport behavior are somewhat scarce. This article attempts to contribute to the qualitative data construct by adopting focus group discussions and travel diary analysis as the methods of data collection.

An overview of the car industry in reference to its continued growth in numbers and applications worldwide is discussed. Social marketing theory is briefly reviewed in considering why the marketing principles adopted in everyday commercial applications cannot be used to better effect in situations where it may be particularly beneficial to society at large. In looking at the continued escalation of car use and associated travel behavior, this article presents a number of topics developed by the research participants as inhibiting their ability to more readily adopt other modes of sustainable transportation, such as public transportation, cycling, or walking.

**Transport Behavior**

In looking at concerns in the area of transportation, whether they are attributed to congestion, pollution, human health, or issues of safety, there are two general ways to reduce the economic, social, and environmental costs of transportation activities (Litman 2003). The first is to reduce impacts per unit of vehicle travel, generally in the form of developing engineering solutions by building more efficient road capacity or by other means, such as new innovative vehicle designs. The second approach is directed at the travel behavior element by either observing a reduction in total vehicle travel or by encouraging a reconfiguration of existing travel behavior in better utilizing the available transportation resources at hand. The general term for this is transportation demand management (TDM). This article focuses on the second approach in understanding how social marketing
can make a positive contribution in determining more sustainable travel behavior decisions.

The Car Industry
At the end of 2000, there were more than 24 million cars registered in the UK, double the number registered in 1975. Over 70 percent of British households had regular use of a car in 1998–2000, and ownership was well spread among different sectors of the population (Social Trends 2002). In North America, some 16.6 million new cars and light trucks were delivered in 2003 alone as the auto industry overcame major obstacles, such as the war in Iraq, global economic uncertainty, oil production shortfalls and price spikes, and overcapacity, to record its fourth best year ever in total sales (Brandweek 2004). From 1950 to 1990, the number of vehicles in use worldwide grew from approximately 75 million to around 675 million (OECD 1997). While this period coincides with an improvement in economic conditions enjoyed by industrialized countries, it could therefore be speculated that the growth in car ownership was primarily linked to advances in prosperity, independence, and security. However, this shift in modal choice has created numerous problems for the environment.

Motor vehicle use is now generally recognized as the source of more air pollution than any other single human activity (Wiederkehr 1995:4).

Between 1990 and 2002, the levels of greenhouse gas emissions decreased in most sectors across the 15 countries of the European Union (EU-15), namely energy supply, industry, agriculture, and waste management. However, greenhouse emissions from transport-induced behavior actually increased by 22 percent in this same period (European Environment Agency 2004).

In the first few years of the 21st century, aside from the yet-to-be measured impact on travel behavior from the recent increases in the price of oil resulting in higher gas prices at the pumps, there seems to be little evidence to suggest that this phenomenon is about to decline. On the contrary, all indicators point to a protracted upswing in the utilization of private transport over the coming decades with few ideas forthcoming on how this may be contained. To cater to this ongoing demand across Europe, the length of the motorway network in the EU-15 grew by more than 25 percent between 1990 and 1999 to total nearly 50,000 km in 1999. As for the length of the rail network, identified as an alternative sustainable mode of public transportation, it contracted by 4 percent in the 1990s and by 1999 was
just less than 154,000 km (Eurostat 2002). European statistics for 2000 record the
UK as having 419 passenger cars per thousand citizens while the EU-15 average for
the same year is recorded at 469 cars per thousand citizens (Energy & Transportation
DG 2002).

Another consequence of the continued growth in the use of private transportation is that individual access to motorized forms of transport has emerged as an
important icon of progress in modern democratic societies. Consequently, the
freedom of movement associated with access to this personal form of mobility is
hard to suppress without fear of a hostile response from users.

*Individual mobility is a cherished feature of the lifestyle in the economically
affluent societies, satisfied by the ownership of one or more automobiles* (Bauer

As a result national governments have been somewhat slow to challenge this
behavior and have sought to stay clear of any obvious assault (e.g., punitive restric-
tions) on those people who adopt private transportation. The introduction of
congestion charging, launched in central London in February 2003, was viewed as
an exceptional public policy decision in dealing with London transportation prob-
lems by the designated public authority (Transportation for London 2003).

Instead, many governments offer their continuous support of the add-capacity
strategy, namely the belief that transportation problems can be solved by simply building greater capacity into the infrastructure. However, recent evidence
compiled by the Texas Transportation Institute (2004) would contradict this. The
institute examined data collected from 1982 to 2002 in its analysis of 85 urban
areas situated across the United States. The institute concluded that there are only
a small number of areas, five in total, where travel demand was closely matched by
the ability to supply adequate road capacity to meet this demand (see Figure 1). In
the remainder of the areas, the Institute concludes that the level of demand has far
outstripped the ability to construct an adequate capacity of supply to sufficiently
meet this demand, allowing a 10-year timeframe from conception to completion
for the majority of major road construction projects. The research suggests that
there needs to be a corresponding growth in supply capacity at a rate slightly
greater than travel growth to maintain constant travel times. However, this is not
a workable solution, as it would require such road capacity to be constructed prior
to the demand forming. This also makes the assumption that the add-capacity
strategy is the only solution applied in attempting to address mobility concerns.
Many marketing academics believe that the adoption of marketing theory in programs of social change can enhance the potential for success and, in many cases, is actually an integral part of their success. How can marketing theory therefore help foster a modified change in travel behavior, particularly in regard to encouraging the adoption of sustainable modes of transportation? Before one can consider the answer to this question, an understanding of where this area of research lies within the general field of academic marketing needs to be considered.

Presently there is a plethora of marketing terms that could be used in reference to this article. Among the terms commonly used are ecological marketing, social marketing, sustainable marketing, environmental marketing, and green marketing. Definitions of each are listed in the Table 1.
Any of the terms in Table 1 could be applied to the main theme of this research. Kotler (1979) argues that the objective of social marketing “is not to maximize consumption, consumer satisfaction, or consumer choice: The objective is to maximize the quality of life” (p. 85). Social marketing in its own right has become recognized only in the past two decades and is identified as the sector of marketing most applicable to this topic of interest.

Attempting to modify or alter people’s behavior lies at the core of social marketing theory. In its formative years, social marketing was associated primarily with problems directly related to health. While much of the social marketing focus on health matters continues today, there have been continuing attempts to broaden its applications into other areas such as the planting of more trees, issues of child safety, and encouraging households to recycle (Andreasen 1995).

Implementing social marketing programs can be viewed as a policy option in fostering a sustainable transportation strategy. Such programs would be best
described as information instruments in comparison to alternative instruments such as economic, regulatory, or cooperation (United Nations 2002).

The choice of transport modes, the acceptance of policy measures and the use of vehicles can be improved through moral suasion and transport-related education (United Nations 2002).

Providing relevant information that is targeted at individual travel behavior decisions can serve as a basis for more rational transportation decisions, and this is a prime focus of such approaches as 511.org, a free phone and web service that is being rolled out across the United States. The program consolidates transportation information into a one-stop resource, providing up-to-the-minute local information on traffic conditions, incidents and driving times, schedules, route and fare information for public transportation services, instant carpool and vanpool referrals, and bicycling information. The service is available 24 hours a day, 7 days a week. By the end of 2005, it is estimated that 511 will be operating in 25 states and that 50 percent of the U.S. population will have access to it (511 Deployment Coalition 2004). Communication efforts are making the public more aware of the benefits offered by the 511 service. Information instruments embrace many elements of social marketing, including public awareness campaigns, information distribution, and monitoring public attitudes on the use of such instruments in support of TDM policy.

Research Methodology
The research described in this article specifically set out to examine the framework of decision making among transportation users when selecting a mode of travel. Could private transportation users be persuaded to consider alternative modes of travel in removing themselves from an existing habitual decision-making process (i.e., choosing to perform a behavior without deliberation)? Or could social marketing programs support demand management policies to become more effective in reducing total vehicle travel or in other ways encouraging alternative modes to be considered?

The empirical research and analysis was undertaken in the UK between 1997 and 2000, and the research methodology was divided into two phases over a period of 10 months. Phase 1 of the research program adopted focus groups as the research instrument. Phase 2 of the research entailed an in-depth examination of the participants’ travel behaviors in light of reviewing social marketing messages and was
undertaken by recording their travel experiences as written text in the form of a diary. It is acknowledged, for purposes of this research, that commuters did identify the car as their primary mode of transport in use.

**Site Selection**

South Buckinghamshire District, located in the south of England, was identified as a suitable location for a number of reasons.

- The District was located on the outskirts of Greater London and close to many other forms of transportation, including mainline rail, underground, bus, and airline.
- A number of significant motorways passed through or alongside the boundary of the District. There are approximately 487km of roads within the District and the M40, M25, and M4 motorways all pass through the District.
- It was determined that there would be a large commuting population living within and passing through the area.

Two parishes, Hedgerley and Gerrards Cross, were identified as research sites. See Figure 2 for a map of South Bucks District showing the parish boundaries.

**Phase 1**

Two focus group discussions were undertaken in each parish (four in total). The procedure for selecting participants was imparted to nominated parish coordinators, as they possessed knowledge of the local community and were familiar with the people who might participate in a research program. This kind of sampling is often referred to as judgmental or purposive sampling; that is, the sample elements are handpicked because it is expected that they can serve the research purpose (Churchill 1995). It was emphasized, through written guidelines passed to both co-coordinators, how essential it was for the selection procedure to be undertaken on an impartial basis as it was important to recruit a cross section of the population of interest. A broad cross section in age span was achieved, with ages ranging from 14 years to 76 years of age. Of the 34 people who participated in the research, 17 were female and 17 male—an equal split between genders. Overall, the sample set was deemed to be a fair representation of the demographic profile of each parish.
Figure 2. Map of South Bucks District

Source: South Bucks District Council
Phase 2
The primary objective of Phase 2 was to further advance the quality and depth of the data acquired in Phase 1. A total of 24 households agreed to participate in Phase 2. The households were drawn from the original sample of 34 respondents. The research instrument adopted for Phase 2 was a travel diary in which respondents recorded travel history and, where possible, provided a narrative of why certain travel choices were made. A 10-week research timeframe was adopted and each household was required to record approximately 4 weeks of travel behavior during the 10-week period.

Initially, participants were asked to fill out a one-week diary cataloging the household’s typical travel journeys. This task was intended to help participants focus on scrutinizing their existing patterns of travel behavior. The main part of the diary was concerned with determining cause-and-effect relationships between a mode of transportation and the rationale for that specific modal choice. This section was divided into three separate weeks and, at the beginning of each of these periods, household members were required to open a sealed envelope that contained social marketing material in the form of message appeals. Participants were asked to view the message appeals and to record to what extent the message appeal persuaded them to amend their travel behavior at that given moment in time. Even if the comments were negative (the message appeal had little or no effect), the household was still required to undertake three journeys within that week by adopting alternatives forms of transport to the car. The diary recorded the change of mode, purpose of journey, number of people traveling, and time of travel. There also were sections for the respondent to record positive and negative outcomes, along with the opportunity to explain whether the trip change would become permanent or remain temporary. It was critical for the success of the research that the households experienced other modes of transport not normally viewed as everyday choices. Based on these direct experiences, the respondents were encouraged to develop their thoughts and insights as written text in their diaries. Brief descriptions of the message appeals are presented below.

Message Appeal No. 1. Two versions of this appeal were distributed to the households, one aimed at promoting the annual Don’t Choke Britain (DCB) campaign and the second published by Friends of the Earth (FoE).

Don’t Choke Britain is a branded public awareness campaign that runs through the month of June each year. More than 300 local authorities take part in this
“month of action.” The Don’t Choke Britain marketing material adopted the following wording:

Don’t Choke Britain has simple aims: less traffic congestion and less pollution, particularly in our cities. Anyone can take part, very simply, by giving your car a holiday. Don’t Choke Britain invites you to find another way of getting around on at least one day a week during June. Take a bus or train, walk or cycle, or share a car—everyone can do it!

The campaign’s main message is to encourage participation in any one of the programmed events and thereafter to consider maintaining the resultant change in travel behavior. Examples of programmed events included:

- National Bike Week
- Green Transport Week (including Car Free Day)
- Walk to School Week

The second message appeal was in the form of a leaflet entitled “Cars Cost the Earth,” published by the FoE. The leaflet (see Figure 3), produced as part of the

![Figure 3. “Cars Cost the Earth” Front Cover](source: Friends of the Earth (England, Wales, and Northern Ireland) 1996.)
FoE’s 25-year celebration, was 20 pages in length and more detailed than the DCB material. The principal message it conveys is: “It is time to rethink the way we travel, to reduce the number of cars on the road and to improve facilities for alternative ways of getting about such as walking, cycling and public transportation.”

Message Appeal No. 2. This appeal consisted of a video entitled *There is Another Way: TravelWise*, which was produced by Buckinghamshire County Council and presented by the comedian Bill Oddie. The video is 10 minutes long and looks at traffic problems in the County of Buckinghamshire. Advice is provided on how to adopt a friendlier environmental mode of transport behavior. Most of the video was filmed in locations across Buckinghamshire, and this was considered beneficial if respondents, when viewing the video, identified locations with which they were familiar. A segment of the transcript is provided below.

> Consider using the bicycle as an alternative form of travel. More bicycle lanes are being built and are becoming popular for both recreational and commuter use. They offer you the freedom to avoid congestion and enjoy the outdoors in a very relaxed manner.

Message Appeal No. 3. The final appeal took the form of a poster. A random selection of two posters from a total of four was chosen for each household. Each poster depicted a different theme and graphical imagery and in all cases photography was used to emphasize or support the message content. Wording used in each of the posters is provided in Table 2.

### Table 2. Poster Wording

<table>
<thead>
<tr>
<th>Poster Number</th>
<th>Wording</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>Mummy, Why Do the School Run When We Can WALK? 50% of all car journeys are less than 2 miles.</td>
</tr>
<tr>
<td>2</td>
<td>Daddy, What Did You Do In the War Against POLLUTION? Cut car use, cut car pollution.</td>
</tr>
<tr>
<td>3</td>
<td>Get Home With Your Eyes Closed (Take the Train). Cut car use, cut car pollution.</td>
</tr>
<tr>
<td>4</td>
<td>When You Leave Your Car At Home, You Can Really Motor (by Bike). Cut car use, cut car pollution.</td>
</tr>
</tbody>
</table>
These posters were designed by the Essex County Council as part of their Travel-Wise public information program and were widely displayed on buses throughout the County.

**Data Analysis**

This author adopted the framework concept (Ritchie and Spencer 1994) for this research program. This analytical process involves a number of distinct though highly interconnected stages. It was developed for use with applied qualitative research through its requirements to meet specific information needs and its potential for actionable outcomes. The five key stages to qualitative data analysis involved in the framework concept are:

1. Familiarization
2. Identifying a thematic framework
3. Indexing
4. Charting
5. Mapping and interpretation

These five stages can act as pathways for the analyst to refer to during the ongoing analysis of the data. Constantly working and reworking the data by sorting, sifting, and charting will enable the analyst to be creative and imaginative yet still maintain control of the material. These stages can be presented in a number of different ways and include familiarization, cataloging, conceptualization, and linkages among others.

Ritchie and Spencer (1994) remark:

*...although systematic and disciplined, it (the “framework”) relies on the creative and conceptual ability of the analyst to determine meaning, salience and connections. Real leaps in analytical thinking often involve both jumping ahead and returning to rework earlier ideas* (p. 177).

When the focus groups were completed, the cassette tapes were given to a professional transcriber who converted the narrative to text. The author then started scrutinizing the text in detail to identify a thematic framework. This was undertaken using a color-coding system as a form of indexing. In each focus group, themes were identified and traced by marking the conversation with the same color throughout the body of the text. This was a very efficient way of pouring
over the text, as it was easy to make connections and offer up specifics in support of common themes. The diaries were examined in detail in a similar way to try and ascertain the nuances between family members when making decisions regarding specific journeys. The diaries were also analyzed to uncover what the reaction was when a specific message appeal was opened in front of all the family members. In many cases, comments and subsequent points were recorded in the diaries, allowing a rich vein of data to be gathered at that specific point in time. This information was expanded upon with further entries made in the following week.

Analysis of Feedback on Message Appeals

Of the three formats adopted in the message appeals, both the video and the posters achieved a reasonable amount of support, while there was negative commentary expressed about the leaflets.

Message Appeal No. 1

Comments made about both leaflets were generally discouraging, and the respondents offered numerous reasons for such responses. The Don’t Choke Britain leaflet received widespread criticism directed at what respondents referred to as the “flawed design” of the artwork. These comments implied that the visual component of the leaflet was not only poorly received but, to some extent, turned people off before they even began to interpret the message. Participants’ comments included:

• “Don’t Choke Britain suffers from a rather garish front cover that, at first sight, suggests that ferry boats, kites, and trains do something unpleasant to young children.”

• “I particularly dislike the Don’t Choke Britain Campaign leaflet. Bad colors, bad presentation on cover and totally alienating. I would not have bothered to read it if I had not been doing the research.”

Judging from the comments below, the “Cars Cost the Earth” leaflet was perceived by the participants as confusing.

• “Too much varied information to take in. Could have been better if they concentrated on a few main points.”

• “Interesting but too negative in just pushing pollution issue. If my car is wrong, then what about big business, worst pollutants.”
Message Appeal No. 2
The video format was strongly endorsed by households as a very effective means of transmitting the message. Comments included:

- “Video was good and put over with a sense of humor, which helped.”
- “Certainly made me think about opportunities to change. Given my travel profile, however, the only opportunity I have to change are trips to Gerrards Cross or church. Both of these I change when time permits. The pace of life demands at least reasonably fast transport times. Public transportation isn’t an option. Why isn’t there a train service to go around the M25?”

Message Appeal No. 3
The posters received the broadest level of acceptance and elicited very warm responses even though this format adopted only a maximum of 20 words with a creative piece of artwork. Comments included:

- “Brilliant message appeal. Clear and straight to the point.”
- “I like the school poster. That is a conscience pricker.”
- “Made me feel quite uncomfortable, at least in regard to transporting our children to school and my commuting. But did it do anything now? Not much!”
- “Does make you feel guilty about very short car journeys!”

It is not clear why the posters were so well received by a large section of the households. It could be that the message was plain, clear, and to the point and that this encouraged an immediate level of agreement from the respondents.

Research Findings
A review of the major findings identified in the research as having a significant bearing on travel behavior decisions is presented below.

The Responsibilities of Different Generations
What did the research have to say about “age” in the context of people’s transportation behavior? On the issue of risk, it was noticeable how the older participants viewed this theme as compared to that of the younger participants. On a number of occasions, the older participants asked the younger ones when they would begin to change their travel behavior! In one example, a 75-year-old participant verbalized this thought directly when he pointed to two of the younger partici-
pants across the table and said, “The ones that are going to make the decision for us are the two youngsters there because in my time it is just going to make no difference”.

There was agreement by many of the older participants on this point. They considered that the time left in their lives was too short to be of any benefit in solving the long-term problems ahead. Nonetheless, the younger participants quickly voiced their disagreement on this point. Use of a car was an expression of freedom for them, and it was their intention to get the opportunity to enjoy driving without any further restrictions being placed on them. During the discussions, many of the younger participants claimed they needed access to a car in order to lead a normal social life.

Judging from the dialog among the participants, one could surmise that the older participants are waiting for the younger ones to undertake the desired behavior changes, while the younger participants are waiting for the scientific community to come up with solutions to these problems. This is a further example of the disconnect between individual responsibility and a lack of understanding of the problems associated with this responsibility.

**A Sense of Powerlessness**

Participants expressed the belief that they are not consulted and therefore have no influence or power in addressing the transportation issues raised, specifically in regard to their own locality. They reflect on the fact that there are no provisions for them to either express their concerns or to put forward possible solutions. Acknowledgment of this during the discussions seemed to generate a degree of skepticism among the participants in their dealings with the authorities, particularly the local authorities. The participants believe that these authorities do not always take the correct action or, more importantly, take any action at all.

Examples of this sense of powerlessness abound in the discussions, especially regarding the performance of the bus companies. Many of participants are of the view that, as the bus companies are now privatized, the public has no voice or controlling power in setting the criteria for an acceptable level of service. Problems with the scheduling and canceling of services at short notice are one example, and it is continuously referred to as an issue of concern.

However, the local authorities may be doing their best to seek the opinions of the residents already. Publication of “The Draft State of the Environment Report” by the Bucks District Council seemed to be a genuine attempt at this endeavor. In
releasing the report, the Council held a public meeting and invited representatives from all the parishes within the District. The Council clearly requested people to respond to issues raised in the report, but it was obvious that the majority of the participants were unaware that this report had been published. The research concludes that the local authorities need to constantly review their efforts at communicating with the public on local transportation-related issues and to understand that there needs to be “buy-in” from the local community in decisions related to transportation policy. Ignoring the buy-in factor only leads to local people feeling frustrated and unwilling to support transportation policy at large.

**Poor Image of Public Transportation**

A key influence for the participants when considering alternative modes of travel was the poor image they held of public transportation. Many examples were recounted of buses not running, train timetables not being followed, and difficulties in finding fares for specific journeys. Such experiences caused much frustration and resulted in people not considering public transportation as an alternative modal choice.

This point is extended further by the continuous reference throughout the discussions on the issue of poor timetabling. The timetable was of importance because the participants interpreted it as a form of contract or as a declaration of commitment by the transportation company to provide them as passengers with certain travel services. However, the respondents quickly determined that the timetable was of little value as they confirmed that the bus companies rarely adhered to it with any sense of urgency.

This poor image of public transportation also seems to have generated a lack of trust among participants in the information being provided by the public transportation providers. Participants claimed they were initially prepared to work through difficult situations when adopting public transportation but that this had now become unworkable as they were being continuously “let down.” These problems had been ongoing for a number of years, and the participants expressed a degree of anger that they still had to hear the same excuses. The participants expressed reservations if public transportation could ever be adequately improved for them to adopt it with a degree of confidence.

**A Sense of Security or Lack of It**

The issue of security was identified as playing a significant part in influencing the decision to select a specific mode of transportation. All the participants enjoyed
the security and freedom associated with the adoption of private transportation. Through this mode, the participants had the freedom to decide when to travel and how long to take to get there (in normal circumstances), felt safer about undertaking the journey, listened to the radio, and yet could still make changes to their own itinerary if desired. The freedom associated with being able to choose the car lay at the core of the participants’ lifestyles and they all wanted to maintain it without any disruption.

It could be argued from the research findings that the issue of personal safety is one of the main reasons people are adopting private transportation in greater numbers. This was inferred in the discussions when reference was made to the fact that households were becoming “insular” in the way they lead their lives, or how “artificial bubbles” were being created to allow households to feel more secure when undertaking day-to-day journeys. While the participants expressed how difficult it is to feel completely safe in any mode of transportation, there was general consensus that private transportation provided the greatest sense of safety for those who consider it a priority. However, the issue of personal safety carried with it a negative consequence for many of the participants contemplating public transportation.

**Site Selection**

The households selected in the two parishes are not representative of the average UK household. The sites could be classified as a middle- to upper-class locations. As a result, it is accepted that the findings of this research are relatively unique to this research area. Does that make the evidence gathered of less consequence? The author strongly argues that this is not the case for the following reasons.

The focus group discussions raised issues that are commonly discussed on a day-to-day basis when it comes to problems of transportation. “The buses are late,” “the train is delayed,” “the cars are speeding,” or “the pollution is terrible” are comments that can be heard daily. Therefore, the opportunity to record such issues in depth in the Hedgerley and Gerrards Cross parishes was an invaluable source of data. And the availability of such data to the research community at large, while specific to this research site, would be of value in the search for long-term solutions.

The same can also be said of the diary panel data. The opportunity for people to self-report on their travel behavior over an extended period of time is an opportunity to collect valuable data. It would be reasonable to assume that there are
no two households in the UK that have the exact same demands on their time and how they make their journeys to work or school. However, having access to data that are self-compiled from within the household and that offer insights on journeys made under different modes of transportation can be very productive in contributing to the wider issues of the research.

Conclusions
This article explores the use of social marketing applications as information instruments in the field of transportation studies. Although the social marketing programs reviewed provided no evidence of prolonged mode change among the people studied, the participants did acknowledge that they considered the messages informative and helpful in educating them on some of the sensitive issues regarding transportation choices and the decision-making process involved. While the research did not record specific behavior change, it could be argued that participants may have subconsciously altered their transport behavior based on their participation in this research. One could conclude that such information can influence a participant’s psychological thinking in the form of previous held beliefs, attitudes, or habits.

It is too early to discount any future role that social marketing may play in the area of transport behavior. More primary data, accurately sourced and collected, are required from the appropriate audiences if successful campaigns are to be designed. These campaigns, in turn, require adequate funding to enable professionally-managed programs to be created. Only if these considerations are taken account can social marketing campaigns be truly tested in helping to change peoples’ attitudes and behavior toward transport.

At the outset of the research, an emphasis was placed on persuading car users to be more flexible with their travel needs and expectations, with the intention of promoting alternative modes of travel in their choice set. To do this successfully, and to be able to produce the appropriate social marketing appeals, the research has provided evidence that the designated authority must first gain a deeper appreciation of the issues facing the everyday commuter. The needs of the commuter can only be accurately appraised if research is undertaken that facilitates an extended period of consultation. This article suggests such research needs to be based on transportation behavior undertaken within local districts to fully understand the specific commuter dynamics associated with each district. Undertaking
research on a broader scale, either regionally or nationally, may be beneficial for statistical purposes. However, this wider approach can result in data becoming detached from the specific psychological issues at play that are closely connected to the physical environment of each district. Social marketers, primed with this in-depth knowledge, can create more effective social marketing programs in support of TDM policy with a greater potential to achieve the desired behavioral changes.

The topics examined in this article are an essential part of the dialog that needs to be generated with the relevant constituencies in discussing transportation and quality-of-life issues. The major findings of the research project could therefore be summarized as follows:

- There are different opinions from across the spectrum of participants as to what actions should be taken and who should bear the responsibility for undertaking them.
- The participants have a feeling of powerlessness and believe that there is no effective forum for them to express their views.
- The poor image of public transportation conveyed in the public domain is seriously undermining its consideration as an alternative mode of travel.
- There is a strong sense that private transportation provides a much greater degree of security and comfort than that provided by other modes of transportation.
- The research has taken into account that the residents of Gerrards Cross and Hedgerley are not representative of the average UK household.

Limitations and Future Research
The research emphasis was to acquire an awareness of the motivation that lies behind a person’s thinking when choosing a mode of transport. This required a methodology with no restrictions or boundaries on the data to be collected but rather the adoption of research instruments that would allow an open forum for participants to honestly discuss the topic. For the success of the study, it was essential that participants be allowed to elaborate on their own experiences within their own frame of reference. The combination of focus group and travel diary instruments was deemed suitable for this purpose. Nevertheless, there are obvious difficulties to be aware of when opting for qualitative research. The focus is on the use of language, and it is observed that there are no mechanical procedures available to interpret the findings. Consequently, labor intensity and the
possibility of researcher bias are genuine concerns associated with this research methodology.

What are the opportunities for further research in support of social marketing programs as information instruments? As a sequel to this article, it is appropriate to offer some suggestions in the form of recommendations that could be of assistance to academics, practitioners, and public agencies in the search for workable solutions. It is recommended that campaigns consider stressing the direct benefits of all modes of transport as appropriate to particular journeys or situations. In effect, this embraces the concept of intermodality to better package the desired behavior. It is not enough to expect commuters to switch from private transport to public transport just by producing negative advertising campaigns about the environmental damage generated by private transport. This is clearly an ineffective approach as the research has shown.

How commuters respond to current campaigns should be evaluated and incorporated into future social marketing programs. This is important as social marketing programs need to become more accountable in defending how well they meet their overall objectives. This requires social marketers to be more aware, for example, of how many people may hold a particular belief before they commit resources designed to rectify any associated behavior. In other words, hard background data need to be compiled prior to the commencement of any campaign so that accurate measurements of outcomes can be reviewed during or after a program has run. During the course of this research, there was little indication of any formative evaluation processes being practiced by any of the authorities concerned.

The research also recommends that a dual approach be considered when communicating with the public on this subject. A parallel strategy of informing the public of the benefits to be gained from adopting alternatives modes could be undertaken, while at the same time executing a program of communication designed to enhance the profile of the alternative modes on offer. The marketing of alternative forms of transport, especially public transportation, needs to be proactively branded among the traveling population rather than presented, or perceived, as a poor substitution to the automobile.

Finally, further research should attempt to augment the standing of social marketing in the specific area of transport behavior. Research emphasis should be placed on social marketing applications within the transport domain that show the most promise in engaging behavior change (i.e., target the resources wisely). In particu-
lar, this research could help to enlighten policy-makers who, while at the center of transport policy, could benefit greatly from understanding how social marketers can make a valuable contribution to this area of human behavior.

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References


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The Role of UK Local Authorities in Promoting the Bus

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Loughborough University, Leicestershire, UK

Abstract

To deal with rising city center congestion and its associated pollution, the UK government has proposed a number of policy measures. In particular, the 1998 White Paper indicated that “the bus industry will make an important and cost-effective contribution to tackling congestion and pollution at the local level.”

Since the privatization of the bus industry during the 1980s, local government—the primary agents of delivering transport policy objectives in the UK—have had relatively little control over the provision of bus services in their localities, particularly outside London. One area in which local authorities can exert influence, however, is through the promotion of buses among the general public.

So far though, little evidence exists to reveal the extent to which local authorities in the UK have actively promoted city bus services as part of an integrated solution to reducing traffic-related congestion in urban areas. This paper seeks to redress this issue.

The empirical evidence gained in this study suggests that only a few UK local authorities have actively promoted city bus services and that there are problems in establishing cohesive promotional objectives, budget setting, measurement activity, understanding of the promotional mix, and the benefits derived from promoting city bus services.
Introduction

Congestion is a problem not only for the individual motorist, in terms of delay, uncertainty and stress, but also for society as a whole. In particular, congestion has impacts on the environment in terms of higher emissions and pollutants, noise, vibration, and visual intrusion, and it has implications for public health and safety. Bonsall (2000) recognizes that policymakers have become increasingly focused on finding a solution to these escalating levels of urban traffic congestion. This is shown by the UK Department of Environment, Transport and the Regions’ White Paper, *A New Deal for Transport: Better for Everyone* (DETR 1998), which outlined the government’s approach in tackling current transport problems; and in *Transport 2010: The Ten-Year Plan for Transport* (DETR 2000), which set out how it would deliver this over the subsequent decade.

One key element was seen as the increased use of the bus. Indeed, in his foreword to the White Paper, UK Deputy Prime Minister John Prescott stated that congestion and pollution could be combatted by “persuading people to use their cars a little less—and public transport a little more.” The White Paper further noted that “the bus industry will make an important and cost-effective contribution to tackling congestion and pollution at the local level” (DETR 1998).

In a survey of local authorities, Ison and Wall (2002) found that 90 percent of the local authorities and academics surveyed believed improved frequency and reliability of public transport is an “effective” policy for dealing with traffic-related congestion, while 95.5 percent deemed improving public transport as the most “acceptable” policy option.

Crucially, local authorities are expected to “play a leading role” in delivering policies to mitigate congestion (DETR 1998). But, while in the capital the London Regional Transport Act (1984) placed most public transport under direct local government control (albeit with private operators), there is rather less scope for intervention elsewhere. This is because, in the rest of the country, the Transport Act (1985) abolished quantity regulation for the local bus industry and privatized bus operations. Enoch (1998) suggested that the role of the local authority was therefore “reduced to providing infrastructure, information and filling in ‘gaps’ in the commercial network.” Preston (2003) added that the deregulated system provides little capacity for government intervention.

Despite this, local authorities do still have a role to play in supporting bus services, and one way of doing this is through marketing and promoting bus services. This
The Role of UK Local Authorities in Promoting the Bus

is a particularly attractive option, not least since it can be seen as cost effective. For instance, the TAS Partnership (1998) found that for every £1.00 spent on “effective service promotion and branding,” the payback was £3.10. This ranks highly in comparison to the “hard” technology improvements, which produce yields ranging from £1.20 to £2.20, per £1.00 spent.

Table 1. Return Per £1.00 of Expenditure on Buses

<table>
<thead>
<tr>
<th>Measure</th>
<th>Approximate Return per Pound Spent (£)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Service simplification</td>
<td>3.50</td>
</tr>
<tr>
<td>Effective service promotion and branding</td>
<td>3.10</td>
</tr>
<tr>
<td>High-quality signage and information</td>
<td>2.80</td>
</tr>
<tr>
<td>Bus stop improvements</td>
<td>2.20</td>
</tr>
<tr>
<td>New buses</td>
<td>1.80</td>
</tr>
<tr>
<td>Bus priority measures such as bus lanes and signal priority</td>
<td>1.60</td>
</tr>
<tr>
<td>Real-time passenger information/automatic vehicle location equipment</td>
<td>1.20</td>
</tr>
</tbody>
</table>


Enoch and Potter (2002) indicate that, despite such evidence, examples of promotion and branding in the British bus industry have been “the exception rather than the rule.” Preston (2003) confirms this statement by suggesting, “Entrepreneurial scarcity has often been a problem in the bus industry.” Furthermore, Barta and Erl (2002) believe that many operators have neglected the “soft” measures (such as promotion) in favor of the “hard” measures (such as new vehicles).

Local authorities are, on the whole, “not-for-profit” organizations. Bean and Hussey (1997) indicate that, within the public sector, large investments in promotion may be seen as a waste of resources that could be spent on direct service delivery. This suggests promotional activities are therefore kept to a minimum. If councils want large numbers of private car users to shift to alternative modes of transport, such as buses however, they have “not only to build capacity in public transport ... they must also market it” (Meiklejohn 2003).
This article seeks to assess the role of UK local authorities in promoting the bus as an alternative to the private car and the issues this raises.

Promotion
Dommermuth (1989) indicates that promotion incorporates any technique, under the seller’s control, that communicates positive and persuasive information about the product to the potential buyer. In this case, local authorities need to communicate information to both users and nonusers of bus services.

Promotion can play an important role in marketing services. As stated by Jobber (1998), a customer may find difficulty in evaluating a service prior to purchase. The tangible cues used in promotion can therefore help the customer assess the service product. Gubbins (1996) indicates that promotion seeks to convert customer needs into positive patronage of a service.

Hibbs (1989) indicates that there are four “stepping stones” to successful communication with the chosen market, using the mnemonic AIDA: gain Attention, hold Interest, arouse Desire, and obtain Action from the potential customer. This continuous process is reflected in the promotional objectives and the chosen methods of promotion.

The six promotional objectives for a transport company put forward by Majaro (1974:121) are to:

- create awareness of a company’s services among potential users;
- generate detailed knowledge of the company’s products and services;
- improve the company’s image among existing and potential users so as to improve the customers’ attitude toward the company;
- eliminate perceived misconceptions;
- advise existing and potential customers of any special offers or modifications to the services; and
- advise the marketplace of new sales channels.

However, Jobber (1998) indicates that objectives set for a private sector company may not be transferable to nonprofit organizations. Bean and Hussey (1997) suggest that the public sector will often be motivated by the desire to:
increase public awareness of service provision;
• increase usage;
• demonstrate value for money; and
• educate users.

The marketing strategy (of which promotion is a key part) is the medium to long-term plan for meeting the specified marketing objectives. Within the public transport market, however, it would seem the use of general marketing strategies and plans “is not common” (Barta and Erl 2002).

For a promotional plan to be implemented, there must be supporting resources for the activities to be carried out; that is, a financial/manpower budget. The key question is: How much should the promoter invest? Wilmshurst (1993) suggests, “It is a particularly difficult question to answer.” Table 1 shows the effectiveness of spending on bus promotion. The spend/payback ratio could be used to assist in the development of the promotional budget.

Dommermuth (1989), however, indicates that, for firms with large advertising expenditures, the three most widely employed methods of budget calculation are arbitrary allocation, affordability, and percentage of sales. Wilmshurst (1993) recommends “aligning budgets to the competition.” Shimp (1993) puts forward the “objective and task method,” also noting that this is the most frequently used method by both consumer and industrial companies.

The Promotional Mix

The promotional mix is concerned with the methods available to communicate with customers. Different authors suggest different methods of promotion; there is no fixed mix. Wilmshurst (1993) advises that “the most appropriate promotional techniques must be chosen to build the best promotional mix.” The following list is based on the promotional mix set forth by Dommermuth (1989), Jobber (1998), Hibbs (1989), Lovelock et al. (1999), and Wilmshurst (1993).

• Advertising incorporates any paid form of communication within the prime mass media.

• Personal selling covers the face-to-face, two-way communication between the users/nonusers of the service and the promoter. Wilmshurst (1993) suggests this is more effective than advertising, but more expensive.
• **Sales promotion** utilizes incentives to encourage purchase and attempts to promote immediate sales of the product/service. Sales promotion seeks to produce activity and interest at the point of sale.

• The aims of **direct marketing** are to both acquire new customers and retain existing ones by distributing information and promotional benefits to target consumers through interactive systems of communication. Jobber (1998) suggests it is unlike other communication forms because it usually requires immediate response, facilitating effective measurement of success.

• Like advertising, **publicity** is directed at a nonpersonal mass audience. In this case, however, the promoter does not directly pay for publicity.

• **Good public relations** are based upon establishing communications and relationships with a range of stakeholders including employees, shareholders, the media, government, pressure groups, and the local community.

Overall, as stated above, the promotional mix seeks to gain attention, to hold interest, to arouse desire, and to obtain action from potential customers (Hibbs 1989:12).

**Research Method**

The Transport Act 2000 in England and Wales and the Transport (Scotland) Act 2001 in Scotland provided local authorities with the power to introduce schemes to charge for use of congested roads or workplace parking. Twenty-five authorities initially expressed an interest in charging and as such became part of the “Charging Development Partnership” (House of Commons Transport Committee 2003). Their interest in congestion charging suggested that they suffer from traffic-related congestion, a situation in which public transport could play an important role.

As such, the survey was sent to the local authorities throughout the UK who formed part of the Charging Development Partnership. Of the surveys sent, 15 were completed and returned. Although this is a small sample, it represents a significant proportion of the urban areas in the UK, providing a clear account of a number of the issues involved in terms of promoting the use of the bus. Named respondents include Bristol City Council, Devon County Council, Durham County Council, Edinburgh City Council, Greater Manchester Passenger Executive, London Buses/Transport for London, Milton Keynes City Council, Nottingham City Council, Reading Borough Council, Southampton City Council, Tyne and Wear Passenger Transport Executive and West Midlands Passenger Transport Executive.
In addition, three respondents requested anonymity. They are referred to as A1, A2, and A3. An electronic/postal survey was used to gather the data, which was of a semistructured design.

The survey constituted a mixture of closed questions, quick-response tick boxes, open-ended questions, and spaces for comments. The core of the survey centered on which elements of the “promotional mix” the local authority used, and how. Supplementary questions then probed for further supportive material surrounding the promotion of buses within local authorities. The most sensitive and probing questions, such as the promotional budget, were left until the end of the questionnaire.

**Survey Findings and Discussion**

From the survey, all but two of the local authorities promote the use of their city bus services. Two local authorities, A2 and Edinburgh City Council, do not use promotion, while of the remaining 13, all target nonusers of the service, and all except Southampton City Council, target existing users. Of those who do use promotion, A1 and London Buses/TfL are the only two authorities to use external companies to carry out promotional activities. Three authorities (A3, Nottingham City Council, and Tyne and Wear PTE) use a combination of “in-house” resources and external agencies, and the remaining eight authorities only use “in-house” resources.

**Objectives**

When asked about the objectives for promotional activity, all 13 authorities responded positively stating that their objectives were to:

1. reduce traffic congestion by directly reducing car use;
2. support other traffic measures such as road charging;
3. increase ridership/patronage;
4. influence modal shift in favor of public transport (not directly recognizing congestion);
5. support social policy; and
6. promote awareness of the bus services.
Only Durham and the West Midlands PTE revealed a direct link between their objectives for bus promotion and reducing traffic congestion in their urban areas.

The majority of the local authority activities were linked to awareness, increasing ridership, and influencing modal shift in favor of public transport, with no direct stated link to congestion reduction.

**Promotion**

Asked if their promotional activities were part of a wider integrated strategy such as reducing city center congestion, 12 authorities indicated that they were, of which 3 (Devon County Council, London Buses/TfL and Reading Borough Council) showed direct links to a reduction of traffic congestion. Gubbins (1996) suggests that promotion seeks to convert customer needs into positive patronage of a service. But, while 5 of the local authorities specify “increasing ridership/patronage” as one of their promotional objectives, only 2 authorities (A3 and London Buses/TfL) have increased patronage of their city bus services. The remaining 11 authorities are either unsure of growth patterns or have fluctuating, static, or negative growth in bus usage.

Aspects of Hibbs’s (1989) stepping stones to successful market communications were also investigated. The results reveal that all 13 local authorities that promote the use of their city bus services are fulfilling the first step to successful market communications, that of gaining attention (A), since all are actively seeking publicity and good public relations. Meanwhile, the final stepping stone suggested by Hibbs is to obtain action (A)—an action that can only really be measured by the level of promotional activity undertaken. From the sample of authorities who promote the use of the city bus services, only 8 assess their success in achieving action as a result of their promotional activity.

The second and third stepping stones, to hold interest (I) and to arouse desire (D), are more difficult to measure. This is because although all promotional methods contained within the promotional mix are designed to catch the public’s interest, the survey only provided a “snapshot” of current activities and did not ascertain the views of the general public. This is an area for further research.
Use of the Promotional Mix
As noted previously, the “best” promotional mix comprises advertising, personal selling, sales promotion, direct marketing, publicity, and public relations. Each local authority was asked whether they employed each of the promotional techniques. Of the 13 local authorities who indicated that they promote the use of the city bus services, 11 use advertising, 4 use personal selling, 9 practice sales promotion, 7 use direct marketing, and all use publicity and public relations.

Advertising
Of the 13 local authorities, 11 promote the use of bus services using various methods of advertising. Of these, 10 advertise city bus services in local and regional newspapers, 9 use billboard posters, 8 advertise via the radio, 8 advertise on board the bus, and 6 place promotional ads in magazines and make use of the side of buses. The cinema is used in a minority of cases, as are national newspapers, while none of the sample promote city bus services via TV advertising. Other methods of advertising, which were not part of the promotional framework, included use of bus stop display cases, timetables, local travel guides, free-standing advertising panels, posters on other city public transport, and free newspapers such as the London Metro.

Personal Selling
Of the 13 local authorities, 4 use personal selling to promote the use of the city bus services. Of these, 2 use shops and retail outlets, rely on employees of the bus service, and recognize customer “word of mouth” as a method of personal selling. None of the authorities make use of their city’s bus drivers at point of sale, nor do they promote bus usage through telemarketing sales teams.

Sales Promotion
Of the 13 local authorities, 9 use methods of sales promotion. Bulk ticket purchasing is the most commonly used (6 of the 9 authorities), while 4 offer free trial journeys for nonusers, 3 use prize promotions, 2 provide money off bus use, and 1 provides passengers with loyalty cards.

Direct Marketing
Of the 13 local authorities who promote the use of city bus services, 7 utilize direct marketing techniques, 9 use their website as a tool for direct marketing activity, 7 perform door-to-door leafleting, and 6 send direct mail and use inserts. Only 2 make use of email, while the same number suggested “other” methods of direct marketing including ticket wallets/cardholders and giveaways such as stress toys.
None of the respondents use interactive TV, outbound/inbound telemarketing, or direct response as methods of direct marketing to support the promotion of bus usage.

**Publicity and Public Relations**
All 13 local authorities use specific methods of publicity to secure good public relations, with the most common method used being press releases. A total of 5 partake in special events, are visible at exhibitions, and provide sponsorship.

**Promotional Budget**
A total of 11 of the authorities indicated that they have a budget for the promotional activities supporting the use of their city’s buses. Of these, 1 authority could not disclose the details, and another had no set amount for bus promotion within an “all mode” budget. The 9 authorities’ budgets, including details of budget spending, are shown in Table 2.

### Table 2. Local Authority Budgets and Promotional Spending per Capita

<table>
<thead>
<tr>
<th>Authority</th>
<th>Prior Year (£)</th>
<th>Current Year (£)</th>
<th>Population Size</th>
<th>Promotional Spending per Head (£)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Southampton City Council</td>
<td>3,000</td>
<td>5,000</td>
<td>215,000</td>
<td>0.02</td>
</tr>
<tr>
<td>Tyne &amp; Wear PTE</td>
<td>(+) 30,000</td>
<td>(+) 30,000</td>
<td>1,075,000</td>
<td>0.03</td>
</tr>
<tr>
<td>Nottingham City Council</td>
<td>50,000</td>
<td>N/A</td>
<td>750,000</td>
<td>0.07</td>
</tr>
<tr>
<td>Bristol City Council</td>
<td>44,570</td>
<td>45,460</td>
<td>402,300</td>
<td>0.11</td>
</tr>
<tr>
<td>A3</td>
<td>100,000</td>
<td>100,000</td>
<td>355,000</td>
<td>0.28</td>
</tr>
<tr>
<td>Milton Keynes City Council</td>
<td>Not known</td>
<td>(c.) 90,000</td>
<td>approx. 200,000</td>
<td>0.45</td>
</tr>
<tr>
<td>London Buses/TfL</td>
<td>(c.) 5,000,000</td>
<td>(c.) 5,000,000</td>
<td>7,000,000</td>
<td>0.71</td>
</tr>
<tr>
<td>Devon County Council</td>
<td>130,000</td>
<td>130,000</td>
<td>110,000</td>
<td>1.18</td>
</tr>
<tr>
<td>Durham County Council</td>
<td>50,000</td>
<td>50,000</td>
<td>40,000</td>
<td>1.25</td>
</tr>
</tbody>
</table>
A total of 10 authorities commented on the basis for setting the annual bus promotional budgets. Affordability was mentioned by 8 of the respondents, 4 had budgets dependent on objectives/task, and one had a budget based on a percentage of sales. A total of 3 of the respondents used a combination of criteria to set their promotional budgets.

Shimp (1993) indicated that the objective and task method was the most frequently used technique by both consumer and industrial companies, but it would seem that, for UK local authorities, affordability was the most commonly used basis for setting the budget for bus promotion. Interestingly, none of the authorities surveyed supported Wilmshurst (1993), who suggested another method was to match spending to the competition. This is likely due to the fact that the competition in this case would be the car industry, which spends heavily on promotional activities to support the sale of cars.

Barta and Erl (2002) raise the question, Who is responsible for marketing public transport? There would appear to be confusion surrounding ownership responsibilities, with a lack of consistency across the UK.

Within the local authorities, promotion is carried out by a variety of departments ranging from transport planning, transport policy, and transport strategy, to dedicated marketing, promotions, and advertising executives. Making contact with the correct department and responsible persons was difficult due to this inconsistency.

The survey respondent’s job titles/roles also varied. The majority were completed by individuals in public/passenger transport departments. This high percentage supports Vigar and Stead (2003), who indicate that local authorities may lack experience and expertise when implementing marketing schemes to increase bus patronage, in this case promoting the use of buses. The research revealed that a minority of the responses were from advertising/promotions or marketing managers.

The variance in scope for local authority promotion within the two regulatory structures of the bus industry was noted earlier. London Buses/TfL verified this by suggesting “one of the big advantages we have in London (as part of the Greater London Assembly) is control over public transport (i.e., we can set service levels and monitor performance).” Perhaps unfortunately, within the UK this is a unique situation, as elsewhere “…under the Transport Act 1985, the council’s influence
Conclusions and Recommendations

The research revealed that local authorities in the UK claim to be promoting the use of city buses. There would appear, however, to be a lack of organizational consistency within the authorities surveyed and uncertainty as to who is responsible for bus promotion, whether it be the operator or the authority.

There would also appear to be a dearth of cohesive promotional objectives in support of local authority bus promotion. This lack of clarity leads to unclear strategies and, in turn, unclear choices of promotional mix elements and consequent plans.

Budgets are essential if promotion is to be actively carried out. The research has revealed that further assistance may be required to support the development of local authority promotional budgets. The benefits of investing in bus promotion have, in general, not been realized. Affordability is the main driver and does not reflect an aim/cost-benefit budget.

Only 6 of the 13 respondents measured the effectiveness of promotion before and after activity/spending. Subjective assessments revealed a general lack of confidence in their promotional success.

From this limited, targeted sample, generalizations should be treated with caution. The authors suggest, however, that the findings have validity and that a number of recommendations can be made.

First, in terms of central government, a supportive framework stemming from central government should promote bus use as part of an overall strategy to manage demand for the private car.

Central government policy clearly stresses the need to reduce traffic-related congestion within the UK. Various solutions to this problem are provided, including promoting the use of public transport. For these solutions to be executed at the local level and fully integrated with government policy, authorities need to be provided with methods and guidance on how to design and implement the solutions.
Second, there is clearly a need for more consistency in terms of the authorities/ departments responsible for promoting the use of city bus services across the UK. However, as the Royal Commission on Environmental Pollution report (1997) noted, “restructuring government departments does not in itself guarantee that coherent policies will emerge.”

Third, as for local authorities, it is suggested that they consider the following issues:

- the need to integrate local bus promotion with central government policy;
- the need to identify clear promotional aims and objectives;
- the importance of establishing an appropriate budget/spending; and
- the need for measurement before and after the promotional activity to appraise whether the objectives have been met and aid continuous improvement in the planning processes.

The promotion of buses, not least in supporting the reduction of traffic congestion, is a noncompetitive activity. Local authorities should be aware of the opportunities for best practice information sharing between like-minded professionals for the common benefit of users and potential users of the bus services. It is important to note, however, that following deregulation, it is difficult for local authorities to get too involved in any aspect of service provision. How local authorities can promote the use of the bus without jeopardizing the requirement for public sector neutrality is an area requiring further research.

**Acknowledgments**

The authors would like to thank all those interviewed during the course of this research.

**Endnote**

1 The reason for this could be that there are two competing bus companies, making it difficult to preserve neutrality. This has relevance for other localities.
References


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Public Transport Reforms in Seoul: Innovations Motivated by Funding Crisis

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Abstract

On July 1, 2004, the Seoul Metropolitan Government introduced a wide range of reforms to its public transport system: it completely reorganized bus services, installed Bus Rapid Transit (BRT) corridors, improved coordination of bus and metro services, and fully integrated the fare structure and ticketing system between routes as well as modes. This article describes the public transport reforms in Seoul and assesses their impacts on safety, speed, costs, passenger levels, and overall customer satisfaction.

Introduction

Problems can sometimes generate solutions that yield long-term benefits. That appears to be the case in Seoul, Korea, where congestion, air pollution, traffic injuries, and increasingly serious funding shortages have forced government officials to introduce a range of innovative transport programs. Most recently, the acute funding crisis of Seoul’s public transport system has prompted a complete reexamination of ways to improve service quality while keeping costs and subsidies affordable.
This article examines the public transport reforms introduced in Seoul in July 2004 and reports on their impacts over the first few months. The reforms increased public control of bus services and reorganized the entire bus system into four divisions. The restructured bus system now includes a network of Bus Rapid Transit (BRT) routes scheduled to expand greatly in the coming years. Thanks to the reforms, bus services are now much better coordinated with each other and with Seoul’s extensive metro rail system, both in their physical interchanges and in fare structures and ticketing procedures. We describe these and other complementary changes in transport policies intended to improve the performance of Seoul’s public transport system. First, however, we provide a brief overview of the transport situation in Seoul, and in particular, public transport developments over the past few decades.

**Impacts of Population and Economic Growth on Travel Demand**

Seoul has been one of the fastest growing cities in the world. Indeed, the Greater Seoul metropolitan area quadrupled in population between 1960 and 2002 (Korea National Statistical Office 2005). With more than 22 million residents, it is now one of the world’s largest and fastest growing megacities. More people obviously generate more trips and more overall travel demand. In addition, however, rapid economic growth has yet further stimulated travel. In constant, inflation-adjusted 2004 US dollars, per-capita income in South Korea rose from only $311 in 1970 to $2,044 in 1980, $7,378 in 1990, and $12,531 in 2002 (Korea National Statistical Office 2005; see Figure 1). That represents a 40-fold increase in real per-capita income in only 32 years. Such dramatic economic growth generates large increases in both freight and passenger transport. It also makes private cars more affordable. While only a tiny percentage of Koreans owned cars in 1970 (2 cars per 1,000 persons), the rate of car ownership rose to 215 per 1,000 persons by 2003 (Ministry of Construction and Transportation 2003; see Figure 1).

Increased use of private cars has caused serious traffic congestion, especially on the radial arterial highways connecting the suburbs to the central city. Average roadway speeds are only 20 km per hour overall, and only 17 km per hour in the city’s two central business districts (Kwon 2004; Kyung 2004). Such congested roads slowed down buses even more than cars and greatly impaired overall bus service quality. Increased car use has also caused dangerously high levels of air pollution, noise, and traffic accidents as well as excessive use of scarce land for roadways and parking facilities (Ahn and Ohn 2001; Hwang 2001; Kim and Jung 2001).
Reliance on Metro System to Solve Transport Problems

Until 1974, Seoul was almost entirely dependent on bus services. Sharply rising roadway congestion, reduced bus speeds, higher passenger volumes, and longer trip distances increased the necessity for an urban rail system (Hwang 2001). Seoul constructed its first metro line in 1974. From the modest 8 km of that initial line, the Seoul metro rail network has expanded to a total of 487 km in 2004, with 13 lines and 389 stations. Indeed, the urban and suburban rail network in Greater Seoul is now one of the largest in the world and carries 8.4 million passengers per day—more than twice the daily passenger volumes on the New York subways and the London underground (Kim and Rim 2000; Seoul Metropolitan Rapid Transit Corporation 2005).

While the construction of Seoul’s metro system has been an impressive accomplishment, it has come at high cost. The cumulative construction debt has now...
reached almost $6 billion and represents 80 percent of the city’s total debt. Moreover, passenger fares only cover about 75 percent of operating costs, with the remaining 25 percent subsidized through various programs by the city government. The annual operating deficit in 2003 was $634 million. Financing both construction costs and operating deficits has put an enormous financial burden on the city. Although the central Korean government had provided fairly generous financing (40% to 50%) of metro construction costs, the rising funding needs have become overwhelming. Thus, the central government has sharply restricted its funding for any new or extended metro lines—increasing the financial burden for the Seoul Metropolitan Government, which is already deeply in debt (Lee, C. 1999; Lee, J. 2003; Hwang 2002; Seoul Development Institute 2003b).

In short, both central and local government officials have been seeking more affordable ways to expand urban public transport services to meet the rising travel demands of a growing megacity. That financial pressure to seek cost-effective alternatives to metro expansion was the main impetus to the far-reaching reforms of Seoul’s public transport system introduced in July 2004. As described below, the main strategy was to rely more heavily on lower-cost bus services but to greatly enhance their speed, connectivity, comfort, and overall attractiveness. Such quality improvement was desperately overdue, as described below.

**Bus Service in Seoul Before 2004 Reforms**

The first public bus services in Seoul began in 1953 and remained the principal mode of public transport until the mid-1990s. Bus usage rose rapidly with the growth of Seoul in the 1960s, 1970s, and early 1980s, but began a long-term decline around 1985. Bus services lost both overall market share as well as total passengers (see Figures 2 and 3). Buses had to compete with ever-expanding metro services as well as rising car ownership. Just as buses were faced with increased competition from metros and cars, bus services declined in quality due to roadway congestion that slowed down buses and made them less dependable. They also suffered from highly inefficient, uncoordinated, and dangerous operating practices of the many private bus companies who ran the services (Kim and Rim 2000; Hwang 2001).

For decades, bus services in Seoul were operated by a large number of private firms, with virtually no government control of routes, schedules, or other aspects of service. Only the fares were determined by the Seoul Metropolitan Government, which also provided increasing operating subsidies to cover growing operating
Figure 2. Trends in Modal Shares of Total Trips in Seoul, 1980–2002
(percent of trips by each type of transport)


Figure 3. Trends in Bus, Metro, and Taxi Passengers in Seoul, 1980–2002
(millions of passenger trips)

deficits that were causing many firms to go bankrupt or curtail the quality of their services. Each bus company operated different routes, with no competition on any particular route. Because there was no coordination among the different bus companies, many routes were highly circuitous, overlapping, and not adequately integrated with metro services and the routes of other bus companies.

Most of the private bus firms sought only to maximize profits (or minimize losses) while disregarding rider safety and comfort. Thus, an official report of the Seoul Metropolitan Government sharply criticized the private bus companies for encouraging truly outrageous bus driving behavior (Seoul Metropolitan Government 2004). To squeeze as many passengers as possible into a bus, bus drivers slammed on their brakes or suddenly and repetitively braked to jolt standing passengers further back into the bus. Bus drivers would recklessly race other buses to pick up passengers waiting at bus stops, but they deliberately avoided picking up elderly or disabled passengers to save time. In addition, bus vehicles were old, poorly maintained, and did not meet international standards. Service was dangerous, slow, uncomfortable, and unreliable.

As shown in Figure 4, the number of bus companies has fallen considerably in recent years, from 89 in 1995 to 58 in 2002 (Seoul Development Institute 2003b).

Figure 4. Numbers of Bus Companies, Registered Buses, and Passengers

Source: Seoul Development Institute 2003b.
To some extent, the decline was due to some firms going bankrupt. But the Seoul Metropolitan Government had also encouraged the consolidation of bus firms to eliminate duplication, reduce overhead costs, and improve coordination of services. That did not, however, solve the increasingly serious financial problems of the bus companies. As bus passengers continued to decline, there were fewer passengers per bus, less fare revenue per bus, and escalating operating deficits. For example, the average number of total daily passengers per bus fell from 1,093 in 1989 to only 494 in 2002 (Korea Transport Institute 2005).

The local government subsidy required to keep private bus services running rose from only $9 million in 1999 to $110 million in 2002. Although bus services covered a higher percentage of operating costs from passenger fares than metro services (85% vs. 75% in 2003), the sharply rising subsidy needs of bus services became a grave concern. The increasing subsidy burden of bus services was especially problematic on top of the enormous funding problems for metro services (Seoul Development Institute 2003a, 2003b).

The main problem, however, was sharply declining bus service quality over the past two decades, which drove away many bus passengers and encouraged more car use, congestion, and pollution. Although it did not deal with the core problem of unregulated, uncoordinated private bus firms until 2004, the Seoul Metropolitan Government made several attempts over the past two decades to speed up bus services and thus increase bus usage. To protect buses from worsening roadway congestion, the first curbside bus lanes were installed in 1984 and expanded to 89 km by 1993, 174 km by 1994, and 219 km by 2003 (Kim and Rim 2000; Seoul Metropolitan Government 2005c). The network of reserved bus lanes helped speed up bus travel somewhat, but it did not succeed in raising bus use. Clearly, more drastic changes were necessary.

Planning and Implementing Bus Reforms in Seoul

The new city mayor, Myung-Bak Lee, and the Seoul Development Institute (SDI) were crucial in researching, developing, and implementing far-reaching reforms of Seoul’s public transport system. Prior to becoming mayor, Lee had been the chief executive officer of Korea’s largest corporation (the Hyundai Engineering and Construction Corporation), with a reputation for being energetic, innovative, and gifted at negotiating and facilitating change (Choi 2005). When elected in June 2002, Lee promised to improve the problem-ridden public transport sys-
tem in Seoul. He commissioned a series of comprehensive studies performed by the research division of SDI. The studies resulted in detailed reports published in December 2003 recommending coordination and modernization of the metro and bus fare structures and payment systems, better integration of bus and metro services, an expanded network of reserved bus lanes, and a complete overhaul of the organization and operation of bus services (Seoul Development Institute 2003a; 2003b). The transport specialists at SDI, led by Dr. Gyengchul Kim and Dr. Keeyeon Hwang, were the main technical advocates for these changes, while Mayor Lee and his staff provided the necessary political support.

Starting in January 2004, the mayor and staff of the Seoul Metropolitan Government conducted an intensive public relations campaign to explain through the mass media the need for the proposed reforms and the benefits that would result from them. They also announced the July 1, 2004, start date for implementation of the reforms (Seoul Metropolitan Government 2004). Since travel conditions in Seoul had been steadily deteriorating, both for motorists and transit riders, there was considerable public support for improvements, although not necessarily for the specific measures advocated by the mayor and SDI. Thus, much of the media campaign was focused on explaining and defending the specific measures to be implemented.

**Bus Services in Seoul After 2004 Reforms**

July 1, 2004, marks a milestone in metropolitan Seoul's transport policies, especially those affecting bus services. Perhaps most important, the Seoul Metropolitan Government greatly increased its control over bus routes, schedules, fares, and overall system design. It introduced what it calls a “semi-public operation system” that retains private bus firms but leaves route, schedule, and fare decisions to the Seoul Metropolitan Government. Moreover, it now reimburses bus firms on the basis of vehicle km of service instead of passenger trips, which should increase incentives to improve service quality and reduce incentives for speeding, reckless driving, and discriminating against elderly and disabled passengers (Eum 2005; Kim, G. 2004; Seoul Development Institute 2003a, b; Seoul Metropolitan Government 2004).

One of the first major changes was an entire redesign of the bus route network to better structure and integrate more than 400 different bus routes. All bus services are now grouped into four types, with buses color-coded to help passengers dis-
tistinguish between them. Blue buses are long-distance express buses that connect outlying suburbs with each other and with the city center. Red buses are long-distance express buses that connect the satellite cities (planned new towns) with the city center. Green buses provide local services throughout the metropolitan area to feed metro stations and express bus stops. Yellow buses provide local services within the city center (Kwon 2004; Kyung 2004).

To coordinate bus services on a truly comprehensive, systemwide basis, the Seoul Metropolitan Government set up a new Bus Management System (BMS) using advanced intelligent transport system (ITS) technology. Global positioning system (GPS) terminals located in every bus now permit a central bus control center to monitor all bus locations and speeds, adjust the number of buses assigned to any given route, communicate with bus drivers, and provide real-time information to passengers waiting at bus stops or checking bus schedules on the Internet (Seoul Development Institute 2003a). The new BMS facilitates more dependable, on-time bus service while also providing better, real-time information for passengers. It also helps optimize service distribution by adjusting bus assignments and scheduling to conform better to the different travel demands on different parts of the extensive bus network.

In addition to the complete redesign of the route network, the system of dedicated bus lanes was expanded and upgraded. The length of curbside bus lanes was increased from 219 km to 294 km, with more expansions planned. Most significant, however, is the development of a true BRT network with dedicated bus median lanes, high-quality median bus stops, real-time information for passengers and system operators, and new, state-of-the-art buses. By February 2005, there were already 36 km BRT services spanning 4 different corridors. During 2005 and 2006, there will be an additional 62 km of BRT over 7 more corridors. BRT route expansion is likely to continue after that. Seoul’s BRT services benefit from an increasing number of new buses. By 2006, there will be more than 300 low-floor buses, mostly running on CNG (compressed natural gas). Of those, about 20 will be articulated buses. Eventually, all the blue and red express buses will be CNG and low-floor, and all red buses will also be articulated. With level boarding platforms at BRT stops, getting on and off express buses will be easier, faster, and safer. The Seoul Metropolitan Government now views BRT as a much cheaper and quicker way to provide express public transport services than metro expansion, which can take many years to construct and requires much more capital investment (Seoul Metropolitan Government 2004).
Figure 5. Bus Median Lanes
Nevertheless, the extensive urban and suburban rail lines in Seoul remain the backbone of Seoul’s public transport system. Thus, it is crucial to better integrate both local and express bus services with the metro. Bus routes and stops have already been relocated to facilitate short and easy transfers between the bus and metro. To further facilitate bus-metro transfers, the city is now constructing 22 major transfer centers that will offer passengers convenient, sheltered bus stations providing real-time information about metro as well as bus services.

In addition to these major service improvements, the Seoul Metropolitan Government introduced a unified, coordinated fare structure that integrates both bus and rail services (Seoul Development Institute 2003b). Fares are now based only on distance traveled, with free transfers permitted between bus lines as well as between metro and bus. Although the overall fare level was increased, the distance zones that had previously only applied to metro fares were enlarged to permit longer trips without the distance surcharge. Equally important, there is now a multipurpose, stored-value smart card (called “T-Money”) that can be used for all bus and rail services, greatly enhancing ease of payment for the traveler. Also, for the first time there are now monthly commutation tickets that offer discounts to regular travelers.

**Impacts of the Reforms**

In the weeks immediately after implementation of the July 2004 reforms, there was great disruption, confusion, and dissatisfaction among passengers. As shown in Figure 6, more than half of all passengers surveyed in early July were very dissatisfied with the changes. Roughly 70 percent said they were dissatisfied with the new fare structure, and about 60 percent were confused about the new bus routes. The only aspect of bus services that appears to have immediately improved was the performance of bus drivers, since passenger satisfaction with driver behavior almost immediately improved on July 1, when the bus reforms came into effect. As very clearly shown in Figure 6, customer satisfaction dramatically improved in subsequent weeks and months, as passengers were better informed about the new bus routes and schedules, and technical problems were worked out with the new smart card. Overall passenger dissatisfaction fell from a high of 56 percent on July 8 to 44 percent on July 29 and only 13 percent on October 28. Thus, within four months of the thorough reform of bus services and fares, almost 90 percent of customers expressed general satisfaction (Seoul Development Institute 2004).
One reason for the rising customer satisfaction might be the dramatic increase in bus speeds on BRT corridors (see Figure 7). Between June 2004 and December 2004, average bus speeds doubled in the Dobong-Mia BRT corridor (from 11 to 22 km/hr) and increased by 64 percent and 33 percent in the other two BRT corridors (Seoul Development Institute 2004). Even more impressive, average bus speeds are now only slightly lower than average car speeds. Car speeds have also increased in BRT corridors, since the removal of buses from the general traffic has reduced the disruption caused by buses zigzagging across lanes to and from the curbs to pick up and drop off passengers. The greatest improvement in speed, however, has been for buses, and on average, each BRT median lane now carries six times more passengers than other lanes in the same corridor.

Bus speeds are likely to rise even further with implementation of Transit Signal Priority (TSP), which will facilitate bus turns and reduce waiting times for buses crossing intersections. TSP in Seoul was delayed while waiting for installation and full functioning of the citywide Transport Operation and Information Service (TOPIS). Inaugurated in July 2005, this fully computerized system coordinates roadway traffic as well as public transit vehicles, thus permitting the optimization of traffic signals to speed up buses (Korea Times 2005).
Another benefit of the bus reforms has been an impressive decline in bus-related accidents and personal injuries. As shown in Figure 8, both the number of bus accidents and the number of personal injuries in bus accidents have fallen by about a third since implementation of the bus reforms. The improvement in bus safety may be attributed to better driver performance as well as greater right-of-way separation for buses in the BRT corridors.

Rising bus passenger levels are perhaps the best indicator of the success of the reforms (see Figure 9). Only in the first month of the reform (July) was the number of bus passengers less than the same month a year earlier (in July 2003) prior to the reforms. That was due to widespread disruption, confusion, and malfunctions as the new service and fare systems were introduced. By comparison, daily bus ridership increased by 406,000 passengers per day between September 2003 and September 2004 (+9%) and by 705,000 passengers per day between March 2003 and March 2004 (+14%) (Seoul Metropolitan Government 2005b). Metro ridership remained roughly constant before and after the bus reforms, as shown in Figure 9.
Figure 8. Decline in Monthly Bus Accidents and Injuries in Seoul, 2003 to 2005

![Figure 8](image)


Figure 9. Trends in Average Daily Bus and Metro Passengers Before and After July 2004 Reforms (in millions)

![Figure 9](image)

The new T-money fare collection system permits far more up-to-date monitoring of passenger levels than ever before. Figure 10 shows average daily bus passenger levels reported on a week-by-week basis, with only a few days lag, and accessible on Seoul’s public transport information website (http://bus.go.kr). With the exception of two major holiday periods, when many Seoul residents are on vacation, the general trend of bus ridership is definitely upward. From early January to late May 2005, the number of bus passengers rose by almost a million passengers a day—an increase of about one fourth (Seoul Metropolitan Government 2005a).

The reforms appear to have considerably increased overall service quality, but they have failed to curtail subsidy needs. Indeed, as part of the bus system reorganization, the Seoul Metropolitan Government signed a contractual agreement with the private bus firms to cover their full operating deficits. This action has required an operating subsidy of $135 million in the six-month period after the reforms,

Figure 10. Trends in Average Daily Bus Passengers in Seoul, Week-by-Week, from Sept. 2004 to July 2005 (in millions)

Source: Seoul Metropolitan Government 2005b.
which would entail an annual operating subsidy of almost $270 million just for bus services—almost three times as much as the annual bus subsidy prior to reforms (Kim, K. 2005).

The sharp increase in bus subsidy needs is alarming, but must be considered in light of substantial increases in the overall quality of bus services, including new buses, new shelters at bus stops, and the installation of BRT services to augment the existing bus services. Moreover, the alternative would be expanding the much more expensive metro services, which would have required even larger subsidy increases.

Most of the planned expansion of Seoul’s public transport system involves BRT, since it is by far the cheapest form of express transit service. Almost everywhere in the world where BRT has been implemented, it has been only a fraction of the cost of rail transit. The U.S. General Accounting Office (2001), for example, estimated the average construction cost of full-scale BRT (as in Seoul) at about $9.4 million per km, compared to $23 million per km for Light Rail Transit (LRT) and $87 million per km for metro rail.

Moreover, BRT can be implemented much more quickly than any form of rail transit, and is also far more flexible in terms of adapting to future changes in travel patterns. It has the added benefit of eliminating many transfers, since buses can run express on the high-speed median lanes and then branch off into lower density areas to provide local feeder and distribution service to outlying neighborhoods.

**Light Rail Transit Plans**

Seoul, like many Korean cities, has tentative plans to build several new LRT lines. While LRT costs much more than BRT, it cost less than building or extending metro lines. Park and Han (2003), for example, estimate that the cost of constructing new LRT lines ranges from $20 million to $50 million per km, compared to a range of $80 million to $100 million for metro lines. For LRT lines that are fully underground, the cost difference is much less, however. For example, the LRT line currently being constructed in the southern Korean port city of Busan is costing $63 million per km. It is the only LRT line in Korea already under construction. The proposed underground LRT line in northeastern Seoul would cost $65 million per km, just about the same as in Busan (Kang 2005). Both of these LRT lines are cheaper substitutes for previously planned metro extensions. The Seoul Metropolitan Government estimates that the full-scale metro version of the northeastern
A rail line would cost $107 million per km, almost twice as much as the LRT version of the same line, and more than 10 times as expensive as the per-km cost of BRT. The planned LRT line in northeastern Seoul is only one of many lines that have been proposed for Greater Seoul. Not a single line has yet been started, however. The limiting factor has been insufficient financing. In virtually every proposed new rail project, local and central government officials are hoping for private investors to finance at least half the total construction costs. So far, however, private investors have not come forth with the necessary funding. If they eventually do, the Korean central government (through the Ministry of Construction and Transportation) and Seoul Metropolitan Government would each bear about a fourth of the construction cost, provided they both give their official approval of each specific project.

Conclusions

The path-breaking reforms of July 2004 completely restructured bus services in Seoul and increased public control over routes, schedules, and other aspects of service. In addition, they integrated bus routes, schedules, and fares with the metro system, thus providing a far superior overall public transport system. Central to the reforms was the introduction of an entirely new system of BRT routes, with fully separate median lanes for express buses.

In the first month of the reforms, there was tremendous disruption, confusion, public discontent, and political uproar. Clearly, more time was needed to ensure a smooth transition to the completely new bus routes, fare structure, and fare payment system. In particular, there should have been a trial period to test new technologies on a selective basis instead of immediately adopting them system-wide. Moreover, the widespread confusion among transit riders indicates that more time and effort was needed to distribute the appropriate information to the public before implementing the reforms.

In spite of these temporary, transitional problems, the reforms appear to have become a huge success. Already by October 2004, almost 90 percent of Seoul residents expressed general satisfaction with the restructured bus services and new fare system. Average bus speeds increased by 33 percent to 100 percent in the BRT corridors. Total bus accidents and injuries on all routes combined (express and local) have fallen by about a third. Month-by-month comparisons of total bus use
before and after the reforms indicate more than 700,000 additional bus passengers a day, while metro use has remained just about constant.

The looming financial crisis of Seoul’s public transport system was the driving force behind the drastic reforms of July 2004. Shortage of public funds continues to force Seoul transport planners and public officials to seek solutions that are as cost-effective as possible, providing the best possible service to the most passengers at the lowest possible fares and government subsidies. BRT appears to fit those requirements better than metro expansions or new LRT lines.

While Seoul can boast a fast, extensive metro system, it cannot afford to expand it much further, since metro construction debts already greatly burden the Seoul Metropolitan Government’s finances. The extension and continual upgrading of BRT is likely to be the most cost-effective approach to providing the additional public transport services needed throughout the greater metropolitan area. Studies of existing BRT systems around the world demonstrate that they can provide excellent express service at a fraction of the cost of new metro construction. The experience with BRT in Seoul so far has also been a resounding success. Indeed, the International Association of Public Transport recently honored Mayor Lee and the Seoul Metropolitan Government with a special award for “extraordinary success at implementing so many transit reforms in such a short period of time, integrating innovative technologies with new infrastructure” (Kim, T. 2005).

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A Regression Model of the Number of Taxicabs in U.S. Cities

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Abstract

In cities that control the number of taxicabs by law or regulation, setting the number of cabs is one of the most important decisions made by taxicab regulators and elected officials. Licensing either too many or too few cabs can have serious deleterious effects on the availability and quality of service and the economic viability of the taxi business. Yet local officials often have difficulty quantifying the demand for taxi service or tracking changes in demand.

Multiple regression modeling of the number of cabs in 118 U.S. cities identifies three primary demand factors: the number of workers commuting by subway, the number of households with no vehicles available, and the number of airport taxi trips. These results can be used to identify peer cities for further comparison and analysis and to guide regulators in measuring changes in local demand for cab service.

Introduction

Most taxicab regulatory authorities control market entry into the taxi business, according to Gilbert et al.’s 1998 survey of taxi operators (2002). The decision by taxi regulators as to how many cabs to license is one of the most important decisions that they make. If regulators allow too few taxicabs, the resulting undersupply will create lengthy waits for cab service and sometimes prevent customers from obtaining service at all. Conversely, an oversupply of cabs can lead to service
problems such as aging and ill-kept cabs and high turnover among underpaid and poorly qualified drivers.

The general public as well as social service agencies and other transportation providers can be adversely affected by oversupply or undersupply of cab service. Social service agencies that subsidize taxi trips for seniors and disabled persons can find that these clients, who tend to take short trips and often need assistance, have difficulty obtaining cab service. Transit agencies that could achieve cost savings by contracting a portion of paratransit trips to taxi companies may find that the companies lack adequate capacity or are unable to provide the desired quality of vehicles and drivers.

Various methods are used in U.S. cities and counties to set the number of taxi licenses. The simplest (and most arbitrary) method is to freeze the number of cabs in operation at the time the decision is made—a policy adopted in Boston, Chicago, New York, and other major cities during the 1930s. Another common approach is to require taxicab companies to show the “public convenience and necessity” (PCN) of increasing the size of the industry. Sometimes the PCN standard is married to a periodic review that may produce regular expansion of the industry in accord with growing demand. A related approach is to set a ratio between the number of cabs and an index based on population, taxi trip volumes, or other factors.

Whichever method is chosen, taxicab regulators and elected officials need a means to objectively assess the appropriate number of cabs for their jurisdiction. This assessment should consider the availability of cab service, the effectiveness of company dispatch operations, the industry’s financial condition, and changes in taxi demand in recent years. It can also be valuable to compare the number of cabs locally with the number in comparable cities—an analysis often requested by elected officials.

This article addresses two elements of this assessment. Using a multiple regression model of the observed number of taxicabs in 118 U.S. cities and counties, the article identifies the primary factors that generate demand for taxicab service in the United States. These results can help regulators build a time-series analysis of changes in local demand for cab service. Second, the model results can be used for benchmarking purposes to make comparisons between comparable cities or counties.
Model Specification
The most obvious factor associated with taxi demand is population. In general, larger cities have more cabs. Regulators often compare the number of cabs in their jurisdiction with the number of cabs in cities or counties of about the same size. They may also compute the ratio of taxicabs to population and compare ratios among different cities.

The shortcoming of population and population ratios is the lack of a standard ratio of taxicabs to population. Figure 1 graphs the wide variation in the ratio of taxis per 1,000 population in 118 U.S. cities.

![Figure 1. Ratio of Taxis per 1,000 Population in 118 U.S. Cities](image)

Recognizing the need to take into account additional factors that are more closely related to taxi demand, regulators have used employment, transit ridership, and indicators of tourism, business visitors, and convention activity to evaluate the need for issuing additional taxicab licenses. Regulators also sometimes use factors endogenous to the taxi industry, principally the number of trips or ratio of trips to taxicabs.
A few formal studies have assessed determinants of taxi demand, although no previous study involves the number of cities in the model reported in this article. Time-series models have been estimated for London, New York, and Toronto. These models found population, employment, visitation, taxi fares, transit ridership, and seasonal factors to be statistically significant variables explaining changes in taxi demand (Beesley 1979; Schaller 1999; Economic Planning Group 1998). Other studies using a sample of cities add low-income persons, motor vehicle operating costs, and bus service miles as influences on taxi demand (Hara Associates 1994; Fravel and Gilbert 1978). Notably, transit ridership is found to be a complement to taxi use rather than a substitute (Economic Planning Group 1998; Fravel and Gilbert 1978).

Determinants of taxi demand can be organized into seven conceptual variables, each of which can be operationalized with one or more variables, as shown in Figure 2.

Data

The dependent variable in the model is the number of taxicabs in 118 U.S. cities and counties with 100,000 or more population. The primary data source is the Taxicab, Limousine and Paratransit Association’s (TLPA) 2002 Fact Book (2002), supplemented by newspaper articles and the author’s first-hand knowledge. Livery cabs that serve the taxi market are included in the taxi vehicle counts for New York City, Newark (New Jersey), and Phoenix.

Ideally, taxi demand would be measured by service miles (i.e., trips or trip requests rather than the number of cabs). Unfortunately, such data are not available for a sample of cities. Interpretation of results should thus bear in mind that the dependent variable (licensed cabs) is subject to government regulation and that taxi vehicle utilization levels vary significantly from one city to the next. The impact of using the number of cabs rather than a more ideal measure of taxi demand will be assessed later in this article.

Independent variables tested in the model were:

- Employment, measured as resident workers in each city (source: 2000 U.S. Census).
- Vehicle ownership, measured as households with no vehicles available;
Figure 2. Conceptual Model of Factors Influencing Taxi Demand

- City size
  - Population*
  - Employment*

- Availability and cost of privately owned autos
  - No-car households*
  - Visitors without a car available*
  - Parking cost and availability
  - Cost of auto ownership

- Use of complements to taxicabs
  - Subway commuters*
  - Bus commuters*
  - Light rail commuters*

- Cost of taxi usage
  - Taxi fare*
  - Waiting time to obtain a cab

- Taxi service quality
  - Driver courtesy
  - Driver geographic knowledge
  - Driver English proficiency
  - Safe driving
  - Vehicle condition

- Competing modes
  - Sedan ridership

- Special populations
  - Senior taxi programs
  - Disabled taxi programs

*Variable tested in model.
households with one vehicle available, and aggregate vehicles available to households (source: 2000 U.S. Census).

- Transit use, measured as resident workers commuting by public transportation, by subway, by light rail, and by bus. For cities with a net inflow of transit commuters, commuters by place of work was substituted for resident commuters (source: 2000 U.S. Census).

- Airport passenger volumes, measured as air travelers using taxicabs after arriving by air; and air travelers using shuttles or limousines after arriving by air. These variables include trips by both residents of the metropolitan area and visitors. The variable was calculated based on calendar year 2000 air passenger enplanements at U.S. airports (Federal Aviation Administration 2004), estimated percentage of nonconnecting passengers at each airport (based on various sources), and percentage of air passengers using taxicabs, shuttles, and limousines (unpublished data from the 1995 American Travel Survey). A few airports (Cincinnati/Northern Kentucky, Dallas/Fort Worth, Minneapolis, Raleigh-Durham, and Reagan Washington National) are served by taxicabs from multiple jurisdictions. Taxi, shuttle, and limousine passengers are allocated among the jurisdictions in these cases.

- Taxi fares, calculated as the fare for a 5-mile trip with 5 minutes of waiting time, not including surcharges (based on the rates of fare in TLPA's 2002 Fact Book).

Except for taxi fares, the independent variables are measured in thousands.

These variables are available for the dataset of 118 cities and counties. Other logical independent variables, such as parking cost or availability, waiting time to obtain a taxi, taxi service quality, demand from programs for seniors and disabled persons, and sedan ridership, are not available and thus are not tested in the model. The transit commuter variables are likely to capture, at least to a degree, variations in parking cost and availability since transit use is heavily correlated with parking supply and cost (Taylor and Fink 2003). Transit ridership variables thus serve both as a factor directly influencing demand for taxi service and as a proxy for parking cost and availability.

Due to lack of data availability, airport taxi trips is used as an independent variable even though, ideally, measures that capture underlying generators of airport demand for cab service would be used. Given the use of airport taxi trips to predict the total number of taxicabs citywide, airport taxi trips should be viewed as essen-
tially a control variable in the equation, which is focused on explaining nonairport sources of taxicab demand.

The dependent variable (taxicabs) is for 2002, while independent variables are from 2000. This two-year lag is intentional, recognizing that some jurisdictions issued taxi licenses in the context of the late-1990s’ economic expansion. These issuances reflect attempts to meet demand at the peak of the economic boom in 2000.

Model Estimation

As the first step in model development, the correlation between each independent variable and the number of taxicabs was examined. Three variables showed correlations of 0.77 or greater: subway commuters, airport taxi trips, and no-vehicle households. A multivariate linear model with these three variables was then developed and tested with other potential variables. In testing, population, workers, one-vehicle households, aggregate vehicles owned by households, airport shuttle/limousine trips, light rail commuters, bus commuters, total transit commuters, and taxi fares did not add to the explanatory power of the model.

Taxi fares were not statistically significant even though it is a precept of economic theory that price affects demand. The lack of statistical significance appears to stem from the relatively small variance in taxi fares in relation to the other independent variables. It is also possible that the effect of fares on the number of cabs is confounded if, in some cities, low fares induce taxi owners to lobby for restrictions on the number of cabs to increase fare revenue on a per cab basis.

Finally, based on testing of the model, a dummy variable for cities with more than 19,000 no-car households was added to the model. The dummy variable is set to 0 where the number of no-car households is less than 19,000 and set to 1 otherwise. The need for the dummy variable may owe to threshold effects. Cities with relatively few no-car households may lack the critical mass of demand for taxi service that is needed for a taxi company to provide reasonably prompt service. The threshold of 19,000 was determined based on examination of error terms when the model was run without the dummy variable. Without the dummy variable, the predicted number of cabs is consistently higher than the actual number in cities with fewer than 19,000 no-car households.
Table 1 presents summary statistics for variables in the model. The final model is:

\[
\text{TAXI} = 31.4 + 21.8\times \text{SUB} + 5.1\times \text{NOVEH} + 0.64\times \text{AIRPORT} + 129.9\times \text{DUMMY} + \text{error term}
\]

where:

- **TAXI** is the number of licensed taxicabs
- **SUB** equals subway commuters by residence or place of work (whichever is higher)
- **NOVEH** represents no-vehicle households
- **AIRPORT** equals air travelers exiting the airport by taxi
- **DUMMY** is set to 1 if jurisdiction has 19,000 or more no-vehicle households

### Table 1. Summary Statistics

<table>
<thead>
<tr>
<th>Including NYC (n=118)</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Taxis</td>
<td>873</td>
<td>3,728</td>
<td>6</td>
<td>39,600</td>
</tr>
<tr>
<td>Subway commuters</td>
<td>15.6</td>
<td>111.7</td>
<td>0.0</td>
<td>1,199.2</td>
</tr>
<tr>
<td>(thousands)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Airport taxi trips</td>
<td>350.6</td>
<td>844.8</td>
<td>0.0</td>
<td>7,150.7</td>
</tr>
<tr>
<td>(thousands)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No-vehicle households</td>
<td>43.2</td>
<td>158.0</td>
<td>1.1</td>
<td>1,682.9</td>
</tr>
<tr>
<td>(thousands)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dummy for no-vehicle</td>
<td>0.4</td>
<td>0.5</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>households less than</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Excluding NYC (n=117)</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Taxis</td>
<td>542</td>
<td>988</td>
<td>6</td>
<td>6,900</td>
</tr>
<tr>
<td>Subway commuters</td>
<td>5.5</td>
<td>20.4</td>
<td>0.0</td>
<td>131.3</td>
</tr>
<tr>
<td>(thousands)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Airport taxi trips</td>
<td>292.4</td>
<td>563.8</td>
<td>0.0</td>
<td>3,078.8</td>
</tr>
<tr>
<td>(thousands)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No-vehicle households</td>
<td>29.2</td>
<td>42.5</td>
<td>1.1</td>
<td>306.3</td>
</tr>
<tr>
<td>(thousands)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dummy for no-vehicle</td>
<td>0.4</td>
<td>0.5</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>households less than</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 2 reports the results of the linear model for the entire dataset of 118 U.S. cities and counties. The adjusted $R^2$ for the model is 0.989, indicating that the model explains 98.9 percent of the variance from the mean. The F-statistic of 2,568.9 is also quite high.

Subway commuters, no-car households, and airport taxi trips are statistically significant at the 95 percent confidence level. There is no indication of multicollinearity between independent variables, based on Variance Inflation Factor (V.I.F.) scores.

The coefficient for no-car households is 5.1, indicating that a change of 1,000 no-car households is associated with a change of 5 taxicabs in the observed cities and counties, other factors being held constant. The coefficient for subway commuters is 21.8, indicating that a change of 1,000 subway commuters is associated with a change of 22 taxicabs. For airport taxi trips, the coefficient is 0.64, indicating that each 1,000 annual airport taxi trips accounts for 0.64 taxicabs.

These results indicate that an increment of 1,000 subway commuters is associated with four times more additional taxicabs as compared with an increment of 1,000 no-car households. The subway commuter variable is most likely playing a strong proxy role for parking costs and availability and, more generally, the degree of density and urbanization of cities with large subway systems, as well as direct demand from subway commuters’ use of cabs.

Table 2. Estimation Results Including New York City

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>St. Error</th>
<th>t-statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subway commuters</td>
<td>21.81</td>
<td>1.72</td>
<td>12.7</td>
</tr>
<tr>
<td>No-vehicle households</td>
<td>5.14</td>
<td>1.29</td>
<td>4.0</td>
</tr>
<tr>
<td>Airport taxi trips</td>
<td>0.64</td>
<td>0.09</td>
<td>7.2</td>
</tr>
<tr>
<td>Dummy for no-vehicle households greater than 19,000</td>
<td>129.95</td>
<td>92.02</td>
<td>1.4</td>
</tr>
<tr>
<td>Constant</td>
<td>31.42</td>
<td>48.84</td>
<td>0.6</td>
</tr>
<tr>
<td>Observations</td>
<td>118</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adj. $R^2</td>
<td>0.989</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F statistic</td>
<td>2,568.9</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The airport taxi trip coefficient implies a ratio of one cab per 1,562 airport taxi trips annually. Assuming 310 days of operation per year (85 percent utilization rate), 1,562 trips averages to 5 trips per day per cab. This figure is on the low end of the range of 5 to 8 airport trips per cab typically experienced. As expected, the airport taxi trip variable is reflecting not simply demand from airport-originating passengers but also demand for trips to the airport and trips around town during nonresidents’ stay in the locale.

The dummy variable for jurisdictions with more than 19,000 no-car households is not statistically significant but improves the predicted values for cities with fewer than 19,000 no-car households and slightly improves the $R^2$ and thus is retained in the model.

The dataset includes one extreme value, New York City, which has five to nine times as many taxicabs, no-car households, and subway commuters as any other city in the dataset. There is thus a need to assess the impact of New York on the model.

Table 3 reports the results of the model with New York City excluded. Coefficients in the non-New York City model are quite similar to those in the model with the city included. The coefficient for subway commuters is almost identical, a rather remarkable outcome given New York’s influence on the model when it is included. Coefficients for no-car households are slightly lower and for airport taxi trips are slightly higher with New York excluded. The $R^2$ drops to 0.84 and the F-statistic to 153.4, but these are still quite high considering that the number of cabs is an inexact proxy for taxi demand, as discussed earlier.

The model described here utilizes each variable without any transformations. As a check on the form of the equation, the model was run using two transformations. Transforming each variable (except the dummy variable) to logs produced results in which each variable is statistically significant with the expected sign, but with a somewhat lower $R^2$. A nonparametric regression using each city ranked from highest value to lowest for each variable also produced statistically significant coefficients for each variable and the expected signs, with about the same $R^2$ as for the model that excludes New York City.
Evaluating Model Results

How well does the model predict the number of cabs in various cities? Does the use of the number of taxicabs as the dependent variable, subject to local regulation and variations in utilization rates, bias the results?

Inspection of predicted and actual values for cities in the dataset, using the results without New York City, suggests that the model works quite well. The predicted number of cabs closely matches the actual number in cities that, based on separate information, appear to have an appropriate number of cabs. These include Denver, Los Angeles, San Diego, St. Louis, and several smaller cities or counties. Differences between predicted and actual number of cabs is within 10 percent in these jurisdictions, differences that could easily stem from differing vehicle utilization rates.

Notably, model predictions are within 7 percent of the actual number of taxicabs in several jurisdictions that do not regulate the number of taxicabs (so-called “open-entry” cities). These include Orange County (California), Phoenix, Newark, and New York City (the latter three cities including open-entry livery vehicles in the vehicle count). Thus, regulatory limits on the number of cabs do not appear to bias the coefficients of the independent variables.

The model also predicts 29 to 55 percent fewer cabs than are actually licensed in Dallas, Houston, and Washington D.C., cities in which there is reason to believe that an oversupply of cabs exists. Conversely, the model predicts 79 to 128 percent

---

### Table 3. Estimation Results Excluding New York City

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>St. Error</th>
<th>t-statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subway commuters</td>
<td>19.72</td>
<td>2.47</td>
<td>8.0</td>
</tr>
<tr>
<td>No-vehicle households</td>
<td>4.47</td>
<td>1.41</td>
<td>3.2</td>
</tr>
<tr>
<td>Airport taxi trips</td>
<td>0.70</td>
<td>0.11</td>
<td>6.7</td>
</tr>
<tr>
<td>Dummy for no-vehicle households greater than 19,000</td>
<td>145.79</td>
<td>92.85</td>
<td>1.6</td>
</tr>
<tr>
<td>Constant</td>
<td>36.10</td>
<td>48.92</td>
<td>0.7</td>
</tr>
<tr>
<td>Observations</td>
<td>117</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adj. $R^2$</td>
<td>0.840</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F statistic</td>
<td>153.4</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
more cabs in Boston, Montgomery County (Maryland), and San Francisco, jurisdictions that have historically limited the number of cabs below market demand.

**Developing Local Models for Tracking Taxi Demand**

One application of model results is to provide guidance for the development of a taxi demand model in specific locales, which regulators can use to assess changes in demand over time.

The model of U.S. cities indicates that the following variables should be included in the development of local time-series models. The variables used in a given locality will depend on data availability and local conditions. Several alternative measures are suggested for each conceptual variable.

- Households or residents without a car available. The cross-sectional model of U.S. cities uses the number of no-car households from U.S. Census data. Localities may not have this statistic available on an annual or monthly basis, as would be desirable for time-series modeling. Alternatives would be auto registrations or the ratio of automobile registrations to population. Another alternative would be bus ridership, which in the cross-sectional data is highly correlated with no-car households.

- Subway commuters. Local data on subway ridership is generally available at the city or county level. The cross-sectional model uses subway commuters, but total subway ridership may be an equal or better substitute. Analysis of ridership on weekdays versus weekends would help to distinguish the relevance of work versus nonwork trips.

- Airport taxi trips. Airports sometimes keep exact counts of the number of taxi trips dispatched from their on-demand taxi lines. If that is not available, the number of airport enplanements is available for all U.S. airports. Care has to be taken, however, if there are changes in the percentage of connecting passengers or in taxis’ share of the airport ground transportation market.

- Taxi fare for an average trip, adjusted for inflation.

Other variables that would be potentially valuable in the model are:

- Number of visitors, convention delegates, or hotel room nights occupied in downtown hotels.

- Demand generated by programs for seniors or disabled persons.
• Ratio of parking spaces to downtown employment.
• Response times for taxi service.
• Average age of taxicabs in service.
• Number of cold-weather days, for northern climates.

Development of a model also requires identification of a variable for taxi demand. Measures of demand to consider are the number of calls received by cab companies requesting service, number of taxicab pickups at cab stands, and taxi utilization indicators (e.g., paid miles or percent paid miles). Where the number of cabs is constrained by regulatory caps, vehicle utilization rates can capture changes in demand, as illustrated for medallion taxis in New York City (Schaller 1999).

**Benchmarking with Other Cities**

The model is also a useful benchmarking tool for cross-city comparisons. These comparisons should not be the only basis for evaluating demand in a given city. One should not expect comparisons to suggest an exact number of cabs in a given locale. With these caveats, benchmarking can provide useful perspective on local industry size.

An example illustrates the use of model results to identify peer jurisdictions for detailed comparisons. The number of taxicabs in Montgomery County, Maryland, has been restricted to 580 cabs since the early 1990s. Analysis of public complaints and of cab company computerized dispatch data concluded that demand has been depressed due to unreliability of pickups and excessively long response times (Schaller 2002).

The dataset of 118 jurisdictions identified three suburban jurisdictions for comparison: Fairfax County, Virginia; Prince Georges County, Maryland; and Cambridge, Massachusetts. These jurisdictions are fairly densely developed suburbs with a substantial number of residents commuting by subway but without an airport. Due to its much smaller land area and the presence of two major universities, however, Cambridge was not felt to be a good comparison with Montgomery County, leaving Fairfax and Prince Georges Counties for comparison.

Inspection of the independent variables shows that Montgomery County has the largest number of subway commuters of the comparison counties and is second to Prince Georges County in the number of no-car households. On this basis, one would expect Montgomery County to have substantially more cabs than Fairfax.
County and somewhat more cabs than Prince Georges County. The fact that Montgomery County has fewer cabs than either Fairfax or Prince Georges Counties thus supported the other evidence that demand for cab service in Montgomery County was depressed by service quality problems.

Conclusions
The model presented in this article identifies factors that explain most of the variation in the number of taxicabs among 118 U.S. cities and counties. Three strong factors were identified:

1. The number of workers commuting by subway, which is both a direct generator of demand for cab service and also a proxy for parking costs and availability and overall urban density, factors that are not separately accounted for in the model.
2. The number of no-car households.
3. Taxi usage for airport taxi trips, which are themselves a direct measure of demand for service, and also captures demand for trips to return to the airport and local taxi trips by visitors.

Each of these independent variables measure the number of people not using privately owned vehicles. Notably, two oft-mentioned variables—population and employment—did not prove to be significant factors after subway commutation, no-car households, and airport taxi trips are taken into account.

Results from the model show, for the first time, determinants of taxi demand for a broad cross-section of U.S. cities. Results are useful at the local level to identify variables for a time-series model of local taxi demand that can form a valuable analytic basis for assessing changes in demand for service. Results are also useful for identifying peer cities for further comparison and analysis.
References


About the Author

**Bruce Schaller** (schaller@schallerconsult.com) is principal of Schaller Consulting. He has consulted on taxi and transit issues for local governments, transit agencies, the federal government, and industry groups in the United States, Canada and Moscow, Russia. He is a nationally recognized expert in taxicab regulatory issues and also specializes in providing market research to improve transit services and attract transit users. He has written extensively in both areas, with articles published in *Transportation*, *Transportation Quarterly*, *Transportation Research Record*, and the *New York Transportation Journal*. 
Prior to establishing his consulting practice in 1998, Mr. Schaller was Director of Policy Development and Evaluation at the New York City Taxi and Limousine Commission and Deputy Director of Marketing Research and Analysis at New York City Transit. He has a BA from Oberlin College and Masters of Public Policy from the University of California at Berkeley.
Parking Policy for Transit-Oriented Development: Lessons for Cities, Transit Agencies, and Developers

Richard Willson, California State Polytechnic University, Pomona

Abstract

Parking policy is an important element of transit-oriented development (TOD). It shapes travel behavior, community design, and development economics; it can improve the performance of both rail transit and TOD. This article is based on the study of residential TODs, office TODs, and joint development of transit agency station parking in California. The research includes surveys of travel behavior, station-area characteristics, parking supply, interviews with real estate developers, and studies of replacement parking issues at joint development sites. Research results show that TOD parking supply and pricing policy seldom are structured to support transit ridership goals. Policy recommendations for improving parking policy for TODs are offered to transit agencies, cities, and developers.

Introduction

Transit-oriented development (TOD) has the potential to address pressing transportation, housing, and environmental issues in U.S. cities (Bernick and Cervero 1997; Cervero, Ferrell, and Murphy 2002; Porter 1997). TOD can reduce vehicle miles traveled (VMT) since residents and workers generally have higher transit mode shares than comparable areas (Lund, Cervero, and Willson 2004; Cervero 1993; Cervero 1994). However, the performance of both rail transit and TOD is
uneven (Pickrell 1992; Bae 2002). TOD potential has been explained by factors such as system design and siting, development control issues, and public finance (Loukaitou-Sideris and Banerjee 2000; Boarnet and Crane 1998; Willson and Anderson 1993).

Parking policy is an important determinant of travel behavior, regardless of proximity to transit (Shoup and Pickrell 1980; Shoup and Willson 1992; Willson 1992a, b, 1997; Hess 2000). Critics argue that parking is generally oversupplied and under-priced (Shoup 2005). Researchers have called for reforms in minimum parking requirements and the cashing out of parking subsidies (Shoup 1995, 1997, 2005; Willson 1995, 2000). Finally, developers report that parking is one of the most important issues to be resolved in proposing TODs.

Research on TOD policy and parking policy has largely proceeded on parallel tracks. This article connects these themes by examining parking requirements and policies at a series of TOD settings in California and asking whether current parking policies support transit and TOD outcomes. This question is addressed in terms of residential and office TODs, real estate issues, and replacement parking for joint development.

Methodology
The article draws information and insights from three efforts, summarized in Table 1.

Parking Supply and Policy in Residential TODs
Twenty-six residential sites were studied in the 2004 Travel Characteristics of Transit-Oriented Development in California (referred to hereafter as the Bay Area Rapid Transit district [BART] study). Fifteen of those sites are grouped into five station areas that have common characteristics (rail technology and station context) and sufficient response rates for statistical validity. The remaining 11 sites are shown in the “other” category, which includes a variety of rail transit modes.

Parking Supply
Parking supply levels at the California TODs studied are somewhat less than typical levels in the cities in which those TODs are located. The average parking supply per unit is 1.41, including visitor parking. Parking supply varies from 0.47 to 2.68 spaces per unit with a standard deviation of 0.5. The ratio of 1.41 spaces per unit means that the square footage of parking exceeds the square footage of living area.
Table 1. Summary of Studies

<table>
<thead>
<tr>
<th>Study</th>
<th>Rail System Studied</th>
<th>Methodology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Travel Characteristics of Transit-Oriented Development in California, Lund, Cervero, Willson (2004), Caltrans Statewide Planning Studies Grant, carried out under the auspices of the Bay Area Rapid Transit District</td>
<td>Sacramento LRT, Bay Area Rapid Transit District heavy rail, Caltrain commuter rail (northern California), San Jose VTA light rail, Los Angeles Metrolink commuter rail, Los Angeles Blue Line light rail, Los Angeles Red Line heavy rail, San Diego Coaster commuter rail, and San Diego Trolley light rail</td>
<td>Study of 36 TODs using mail-back questionnaires of residents, employer-distributed worker questionnaires, studies of site and context analyses, regional characteristics, and parking policies. Study sites were non-CBD TOD locations within one-half mile of a transit station</td>
</tr>
<tr>
<td>The Pasadena Gold Line: Development Strategies, Location Decisions and Travel Characteristics along a New Rail Line in the Los Angeles Region, Lund and Willson (2005), Mineta Transportation Institute, San Jose State University</td>
<td>Los Angeles–Pasadena Gold Line light rail</td>
<td>Study of 37 residential TODs along the Gold Line. Data collected using mail-back questionnaires of residents, site and context analyses, measures of regional land-use and transportation characteristics, and interviews of developers and property owners</td>
</tr>
</tbody>
</table>

unless the unit is greater than 493 square feet. A 1,000 square foot unit would require an additional building area amount of about 50 percent to accommodate parking. Table 2 summarizes the results.

Table 2 also shows the reported transit shares for journey-to-work trips and all “main” trips. For the five station groupings, there is a 0.98 correlation between transit mode share and percent of households with less than one vehicle per driver. Lower car availability means greater transit use. However, the correlation between parking supply (spaces per unit) and the journey-to-work transit share is -0.26. This is the expected sign (greater parking supply is associated with less transit use) but is not statistically significant.

Why was there not a statistically significant relationship between parking supply and transit share? First, and most importantly, most units had more than one space per unit. Most projects had plentiful supply. Parking was so generously supplied that the sensitivity of mode to parking supply could not be tested. Second, this analysis did not consider the availability of on-street parking as an alternative.
Available on-street parking might make parking supply a weaker influence on mode choice.

The lack of a statistically significant relationship between supply and mode choice is of interest to planning regulation and development practices. Looking at the relationship in the other causal direction, projects with higher levels of transit use did not have statistically significant lower parking supplies. In other words, those projects oversupplied parking for the level of transit use, either as the result of city codes or developer/investor preferences.

Oversupplying parking in TODs uses scarce land for which there are better community uses. It also drives up occupancy costs (since parking is bundled with rent payments) and/or lowers return on investment. It encourages developers to build larger residential units so that they can amortize the cost of required parking across a greater per unit rent stream (Hitchcock 1999; Litman 1998), further harming housing affordability. Finally, unused spaces in residential projects are rarely shared with other uses because of the desire to control access to the parking. Excess residential parking rarely contributes to a district area parking supply.

Table 2. Parking Supply and Pricing in Residential Buildings (n=26)

<table>
<thead>
<tr>
<th>Station Area (n)</th>
<th>Parking Spaces per Unit</th>
<th>Percent Households with &lt; 1 Vehicle/Driver</th>
<th>Transit Share (%) JTW/All trips*</th>
</tr>
</thead>
<tbody>
<tr>
<td>BART: Pleasant Hill</td>
<td>1.08</td>
<td>24.0</td>
<td>20.8 / 19.2</td>
</tr>
<tr>
<td>(4)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BART: So. Alameda</td>
<td>1.31</td>
<td>30.6</td>
<td>29.9 / 27.4</td>
</tr>
<tr>
<td>County (4)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LA Blue Line: Long</td>
<td>1.25</td>
<td>16.7</td>
<td>2.8 / 2.2</td>
</tr>
<tr>
<td>Beach (2)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SD Trolley: Mission</td>
<td>1.92</td>
<td>21.5</td>
<td>10.5 / 11.3</td>
</tr>
<tr>
<td>Valley (2)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Caltrain: Commuter</td>
<td>1.35</td>
<td>21.6</td>
<td>11.0 / 11.3</td>
</tr>
<tr>
<td>Rail (3)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other (11)</td>
<td>1.42</td>
<td>39.2</td>
<td>28.0 / 25.4</td>
</tr>
<tr>
<td>Average (unweighted)</td>
<td>1.41</td>
<td>26.4</td>
<td>22.4 / 20.7</td>
</tr>
</tbody>
</table>

* The “All trips” category asked respondents to report on three main trips taken that day. It is not based on a full travel diary inventory.
Parking Pricing
Results from the BART survey indicate that apartment managers “bundle” parking charges with rent, providing free parking along with the rental unit. None of the residential projects had a separate charge for parking, independent of the lease rate. Bundled parking is problematic in all locations, but is particularly problematic for TODs. First, tenants receive no market signal about the cost of providing parking and are likely to have higher automobile ownership for that reason. Developers have no information on tenants’ willingness to pay for parking. In the location where the greatest investment in transit has been made, residents perceive parking to be “free.”

Because parking was bundled in all the cases studied, it is impossible to test the sensitivity of TOD residents to home-based parking charges. The cost of providing this parking is $16,920 per unit (estimated at the 1.41 space per unit ratio and a per space cost of $12,000). This cost is reflected in either higher rents or a reduction in land value.

As reported in the literature (Willson 1992a), worksite parking policies have a strong influence on the level of transit use among TOD residents. The BART study found that free parking at work is a significant predictor in the binomial logit model developed for that study. It is likely that the combination of parking charges at the residence and the workplace would have an even larger impact on increasing transit use.

Parking Supply and Policy in Office TODs
Parking Supply
Table 3 indicates that the TODs studied had an office parking supply that is generally lower than the 4.0 spaces per 1,000 square feet convention for office projects. However, since the average utilization of office projects nationwide is 2.84 occupied spaces per 1,000 square feet gross floor area (Institute of Transportation Engineers 2004), parking is still generously supplied in these projects. The projects studied averaged well over one space per reported worker. It is important to note that most of these projects were built prior to the 1990s, when workplace parking requirements were not an important public policy issue. Therefore, we should not expect to see an anticipation of transit access effect on parking demand in older projects.
The project level groupings shown in Table 3 did not produce a positive and statistically significant correlation between supply and transit mode share. Every project had at least one space per worker, so there was no availability constraint that would affect supply. The BART project was an outlier in that it had the highest transit share and high parking supply (the project was built in 1971).

### Parking Charges in Leases and to Workers

Arrangements for office parking charges varied more than those observed for residential units. In some situations, the cost of providing parking was bundled into lease payments, while in other situations there was a direct pass-through of parking charges to employees. However, many TOD employers offered their employees free parking. Table 4 summarizes the BART TOD study data according to station groupings. Several measures of parking cost are provided. The second column provides the market parking price determined in site research, which average $49 per month at the 10 sites. There is a 0.73 correlation between market price and transit share, indicating that higher parking prices are associated with a higher transit share. Of course, market price is not a reliable indicator of the price commuters actually pay, since it is common practice for employers to subsidize parking (Shoup 1997).

The third column lists the parking pricing policy reported by the property owners. This generally indicates subsidy policy, but may not reflect variation among employers or variation in benefits offered to different classes of employees.
Table 4. Parking Prices, Terms, and Transit Share

<table>
<thead>
<tr>
<th>Location</th>
<th>Monthly Market Parking Price</th>
<th>Parking Payment (from Site Survey)</th>
<th>Daily Reported Price Paid (by Those Who Drove)</th>
<th>Employer Provides Free Parking (Employee Response)</th>
<th>Transit Share</th>
</tr>
</thead>
<tbody>
<tr>
<td>BART: Berkeley (1)</td>
<td>$125</td>
<td>Paid by worker</td>
<td>$4.94</td>
<td>33.3%</td>
<td>38.5%</td>
</tr>
<tr>
<td>BART: Walnut Creek/Freemont (2)</td>
<td>$34</td>
<td>Employer invoiced, free</td>
<td>$2.50</td>
<td>76.5%</td>
<td>19.2%</td>
</tr>
<tr>
<td>LA Red Line: Hollywood (2)</td>
<td>$85</td>
<td>Bundled in tenant leases</td>
<td>$3.33</td>
<td>89.2%</td>
<td>7.5%</td>
</tr>
<tr>
<td>SD Trolley: Mission Valley (1)</td>
<td>$0</td>
<td>Free</td>
<td>$3.00</td>
<td>82.9%</td>
<td>2.9%</td>
</tr>
<tr>
<td>Sacramento LRT (2)</td>
<td>$50</td>
<td>Paid by worker, free</td>
<td>$4.71</td>
<td>24.6%</td>
<td>22.8%</td>
</tr>
<tr>
<td>Metrolink: Anaheim (1)</td>
<td>$25</td>
<td>Bundled in tenant leases</td>
<td>$0</td>
<td>86.5%</td>
<td>13.0%</td>
</tr>
<tr>
<td>San Jose VTA: Baypointe (1)</td>
<td>$0</td>
<td>Free</td>
<td>$0</td>
<td>100%</td>
<td>9.5%</td>
</tr>
<tr>
<td><strong>Average (unweighted)</strong></td>
<td><strong>$49</strong></td>
<td><strong>$2.64</strong></td>
<td><strong>70.6%</strong></td>
<td><strong>16.3%</strong></td>
<td></td>
</tr>
</tbody>
</table>

The fourth column shows the reported price paid by those who drove. Because respondents who do not drive often do not know what their parking costs would be, the survey instrument was not able to collect reliable individual level data on the price of parking for all commuters. We cannot assume that transit users faced the same parking price as those who drove (either due to differential policies among employee classes or different choices about parking location).

The fifth column indicates the percentage of employees who said that their employer offers free parking, which averaged 70.6 percent. The correlation between the percentage reporting free parking and transit use is -0.80, indicating that free parking undermines that transit access advantages that TODs provide. Parking charges are a source of potentially large gains in station area ridership.

Among the office sites surveyed, the California Department of Conservation building in downtown Sacramento had the highest transit share—41.3 percent. This is achieved on a light rail system that is relatively new and limited in scope. Parking is $100 per month, with a reserved space costing $130 per month. There are other transit-supporting factors present as well—the project is located in a dense,
mixed-use downtown with high employment density (37.6 workers per acre) and is within 165 feet of a light rail station.

Real Estate Aspects of Parking Supply and Policy

Parking Supply

Research on parking utilization and pricing often concludes that conventional practice results in the oversupply and underpricing of parking (Willson 1995, 2000). Furthermore, parking policies often favor automobile access and automobile-oriented land-use planning in a way that has a self-reinforcing effect of discouraging transit use. Planners often point to developer and lender “rules of thumb” for supply (e.g., 1.0 space per bedroom for residential and 4.0 spaces per 1,000 square feet for offices) and leasing arrangements (bundling the cost of parking with rent) as part of the problem. Eleven telephone interviews were conducted with developers working on residential projects in the Los Angeles-Pasadena Gold Line TOD study in July/August 2004 to better understand their perspectives and practices (Lund and Willson 2005).

Although most developers expected light rail proximity to influence the travel behavior of their tenants, they were cautious about predicting effects on parking demand. Most developers did not systematically collect data on rail ridership, mode choice, or levels of car ownership. An intuitive sense that rail and TOD were well suited seemed to drive their decision-making. Importantly, the rail/TOD connection also facilitated the process of obtaining development entitlements, making it easier for developers to justify additional density to the community and decision-making bodies.

The interviews did suggest that parking practice is changing, albeit slowly, with some developers reducing the number of free parking spaces provided with a unit, and renting additional spaces at a market price. The change is most pronounced in downtown areas, where parking is being decoupled from rent or purchase price and where some cities have eliminated traditional minimum parking requirements.

Jurisdictions in the Gold Line corridor provide relief from conventional parking requirements through TOD specific plan provisions and/or variances. In one case, a developer reported that the City of Pasadena requested that the developer seek a variance to their own code to reduce parking supply to 1.5 spaces per unit. In another Pasadena case, the developer did not seek to build below code require-
ments but exceeded them, building 1.7 spaces per unit despite the fact that the underground spaces cost an estimated $30,000 per space. Explanations for this approach include the fact that the Gold line was untested when the parking supply decisions were being made and that the income profile of the expected residents was higher than the average apartment unit. Remaining prominent in developers’ and investors’ minds is the perception of market risk associated with a project being undersupplied with parking in comparison to its competitors.

Interviews suggest that the development community is becoming more favorable to rationalizing parking supply and using unbundling strategies. However, developers need market-specific experience and examples before they consider meaningful reductions in parking supply. Leasing agents must be convinced that they can market projects with less parking and/or unbundled parking. This must be supported by project planning, design, construction, and sales processes that are better integrated in terms of parking. Developers indicated that projects get locked into parking ratios early on in ways that inhibit innovations in parking management and pricing.

Because parking is so expensive to provide, parking ratios and pricing policies strongly influence developers’ ability to provide affordable housing. Most of the projects surveyed provided little affordable housing, despite this issue being high on the priority list of many cities and regional agencies. TODs’ location efficiency should be carefully worked into minimum parking requirements and other parking policies to ensure that savings on parking are realized and are passed on to residents.

**Impact of Parking on Joint Development on Transit Agency Land**

The case of TOD construction on transit district land presents special parking challenges. Unlike office and residential TODs, transit station area parking is frequently fully utilized during peak hours. In the Bay Area, BART has long had a practice of requiring one-for-one replacement of station-area parking. Developers were required to build to city code requirements for the TOD and replace all surface commuter spaces for BART patrons. The reason for this practice was to ensure that existing patrons were not lost because of a reduction of commuter parking. There are some problems with this practice. For example:

- It is a financial and site design impediment to joint development projects.
- Private and/or public resources are not available to fund replacement parking.
• The 1:1 replacement approach focuses on only one access mode (those who drive and park).

• Parking generates less net return than development.

BART has adopted a broader approach to access and replacement parking, aligned with the following principles: support ridership; improve the agency’s fiscal condition; reduce the share of station access by those who drive alone and park; support the management of system and station capacity; and support the broader goals of the transit agency, local cities, and regional entities.

A methodology was developed to deal with the replacement parking issue. It addresses riders potentially lost due to space reductions, plus riders gained from joint development (Willson 2005). New attention is given to the fiscal impacts of alternatives to 1:1 replacement. The following categories are considered in terms of revenue gains or losses:

- fare revenue (net ridership gain or loss, considering new riders from the joint development, any lost riders associated with reduced commuter parking supply, impact of parking charge programs and other access programs);
- parking revenue associated with new parking charge programs (net of collection costs, plus amortized equipment cost);
- parking operating costs (associated with a change from surface to structure spaces);
- transit system operating costs (related to greater ridership, changes in peaking of ridership, etc.);
- ground rent from the joint development; and
- grant revenue and revenue from potential partnerships with other parties (e.g., cities, transit operators, regional agencies, etc.).

The revenue bottom line is considered along with other key objectives listed above to generate a matrix display of the performance of alternative joint development/replacement parking scenarios. BART has conducted tests with the replacement parking methodology on four stations and has adopted this methodology. The key initial findings suggest the following:

• Requiring less than 1:1 replacement of commuter parking produces gains in ridership and revenues and fulfills most BART goals as compared to requiring full replacement parking. Development feasibility improves as replacement parking requirements are relaxed.
• Aggressive development scenarios that include no replacement of parking, the institution of parking charges, and more intensive development produce the net greatest benefits, although less ridership gain them moderate alternatives. These types of scenarios generate more than $1 million per year, per station, in net proceeds for BART, funds that are ongoing and unrestricted in use. In contrast, 1:1 replacement of commuter parking, combined with lower density joint development and no use of parking charges, produce negative results for BART.

• The right decision about replacement parking is dependent on station context. For example, parking at end-of-the-line stations provides an important source of ridership, while mid-line stations are much less dependent on parking for their ridership. The availability of alternative access modes is critical as well.

• A wide variety of alternatives for replacement parking are available, including relocating it off site or at an underused station, or not fully replacing it and instead funding alternative access improvements.

Conclusions and Policy Recommendations
Current parking supply and pricing policies do not support the transit objectives of TOD. Although planners often emphasize urban design qualities, streetscapes, feeder bus services, and the like, they should not ignore parking policy. Initiatives in this area should include local governments, transit agencies, and developers. Now that transit systems are maturing and the market for TOD has strengthened, local planners should team up with transit agencies and developers to ensure that parking policies support high transit ridership.

The process of adjusting parking supply and policies from status-quo, parking-focused approaches is different in each community. Some communities embrace these changes, while others doubt the impact of rail transit on travel behavior and automobile ownership. If TODs are transit adjacent but not functionally related, developers and cities have justification in being cautious about reducing parking supply. Fortunately, the growing body of evidence about the types of circumstances where TODs substantively change mode choice and automobile ownership will help communities assess their own conditions. It is also important to recognize that many existing regulations and building practices have the effect
of creating a self-fulfilling prophecy—high parking requirements mean low or zero parking prices, which undermine the realization of full transit or TOD benefits.

The following sections provide a series of suggestions for cities, transit agencies, and developers, based on the research reviewed above.

**Suggestions for Cities**

- Adopt *demand-based, locally-calibrated TOD parking requirements* that reflect expected transit shares and automobile ownership in the particular TOD under consideration. The data provided in this article and Lund, Cervero and Willson’s (2004) report will soon be supplemented by data on TOD parking generation from other studies (Institute of Transportation Engineers, California TOD studies, etc.). Alternatively, cities can deregulate parking in transit districts if they properly manage on-street parking. The City of Los Angeles, for example, recently had success in partially deregulating parking in its Adaptive Reuse Ordinance. This approach puts decisions about parking supply for housing and offices in the hands of developers, who assess market demand and prices in determining the best use of capital.

- Adopt a district-based approach to assessing parking demand and require *shared parking*. Create urban design standards that make the sharing of parking resources possible. Use in-lieu provisions to create district-based parking facilities. Find ways to reduce developers’ risks of undersupplying parking on a particular project through shared parking and district parking resources.

- Pursue *partnerships with transit agencies* for shared station-area parking planning and supply, and use legal arrangements, such as joint powers authorities, to implement multiagency and multiproperty owner strategies.

- Encourage/require *unbundling* of parking charges from space leases in agreements for residential and office developments.

- Encourage/require employer tenants to *cash-out parking* in office developments.

- Actively manage *on-street parking* to control overspill parking and encourage rapid turnover of on-street spaces. Prioritize on-street parking for short-term, visitor parking. Show community groups how parking management can manage demand and provide a revenue stream for neighborhood improvements.
• Consider the economic impact of parking requirements on housing affordability in station areas.

**Suggestions for Transit Agencies**

• Design stations and station-area parking in a way that places housing and mixed-use development in convenient proximity to stations. Alignment and station location planning should consider how parking affects the walkability of the station vicinity and possibilities for shared parking.

• Convert park-and-ride surface lots to TODs with less than full replacement of parking. Consider development schemes that coordinate multiple property owners and optimize land allocation. Assess the degree to which replacing parking with TOD reduces the demand peaks on the transit system.

• Partner with local jurisdictions in developing parking requirements and policies that support transit use, adopting an access perspective rather than a parking-supply perspective.

• Partner with local jurisdictions, employers, and other transit agencies to support growth in the capacity of nonautomobile station access modes, such as feeder bus services, bicycle, and pedestrian facilities, etc.

**Suggestions for Developers**

• Align parking supply with actual demand when the parking is priced at its true cost. Supply parking to average demand, not peak demand, using shared parking to accommodate demand peaks. Design projects so shared parking can be realized and modified with ease.

• Unbundle parking from space rent or sales price.

• Pursue shared parking opportunities, in terms of legal agreements and design features.

• Involve project architects, market researchers, and leasing agents in early conversations about ways to alter conventional parking supply and leasing practices.

Parking in TOD provides a critical connection between design characteristics and transportation behavior, yet stakeholders have been slow to address this issue. Careful design of both parking supply and policy holds great promise to improve the outcomes of TOD. These transit districts provide just the ridership characteristics that rail transit operators seek, with a high transit share, multiple trip purposes, multidirectional trips, and a broad time-of-day distribution.
References


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