

PARKING POLICY AS AN INTEGRAL PART OF URBAN DEVELOPMENT OBJECTIVES

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The mathematical models of economics and transportation planning are utilized to establish that parking policy is an integral part of urban development objectives. Based on established mathematical models and transportation planning definitions, the effects of change in parking policy on trip-making characteristics within an urban area are identified. The planned application of parking policy as a tool to implement a growth concept for the Denver region is presented.

•PARKING is an everyday term and activity well-known and understood by virtually everyone in our society. In fact, it has become so common that most people forget that it is an integral and distinctive step in the process of making a trip within the community. As housewives go to the grocery store to do their shopping, they normally do not think of the element in their trip that involves parking their automobiles. Unless the cost is unusually high or parking spaces are difficult to find, a trip-maker rarely gives any thought to the element of his trip related to parking his car. The purpose of this paper is to place the activity of parking in perspective as it relates to the overall trip-making process within the community. By identifying fairly rigorous relations that affect trip-making characteristics, we can establish the effect of parking policy as an integral part of urban development objectives.

It is not the intent of this paper to identify potential or desirable solutions to the parking problem in urban areas. Ideas and concepts that have been developed or applied are discussed in other papers. There is considerable documentation on the success or failure of these approaches and techniques. The intent of this paper is to establish, as rigorously as possible, how parking policy can affect urban development objectives. It is hoped that the material presented in this paper will provide a general framework and background for the more detailed discussions in other papers.

WHAT IS PARKING ?

The dictionary definition of parking is to "set and leave temporarily." Perhaps oversimplified, parking is a temporary storage of automobiles not being used. The word "temporary" should be emphasized. Parking in this paper does not pertain to storage of vehicles in a garage or at some other location for an extended period of time. The concept of "temporary" is further defined when we place parking in the perspective of being a distinct element in the process of trip-making.

When we go back to the basic definitions of transportation planning, we remember that people make person-trips to move from one activity to another. For example, when a trip is made from home to office, the reason for the trip is to change from living at the home to working at the office. Most person-trips are made so that the trip-maker can change from one activity to another and not just for the sake of making a trip. Thus, the primary reason for making a person-trip is to change activities.

Consumer Perspective

From the consumer perspective, parking may have an out-of-pocket cost in terms of fees or it may require an investment in time to find a space and get the vehicle parked. If the dollar cost and time requirements are held to a minimum, then parking is a rela-

tively minimal element in the trip-making process. If, on the other hand, parking is expensive or time-consuming, it can be a very important element in the trip-making process.

Parking as an element in the trip-making process is shown in Figure 1. For the vast majority of trips in urban areas today, a person leaves an activity in his car, drives to the location of the next desired activity, parks his car, and undertakes the activity (Fig. 1a). If parking costs are high or it is difficult to find parking spaces, the consumer may choose to drive his car for only a portion of the trip, park his car, and ride public transportation to reach his desired activity location (Fig. 1b). In other cases, the consumer may choose to make the entire trip by transit (Fig. 1c). It is recognized that parking alone is not the only determinant in the trip-making decision process. The following discussion will, however, demonstrate how parking and parking policy can have a very strong and definite effect on the consumer's trip-making decision process.

Supplier Perspective

The supplier perspective on parking is related to the number and cost of parking spaces provided for the consumer. For example, in order to attract customers, the shopping center merchant must provide adequate parking at a reasonable cost. He must carefully balance the cost of providing the spaces against the potential revenue derived or lost by providing or not providing the space. Consumers will avoid shopping at a location where parking is difficult to find or expensive. The supplier soon learns that parking can have a direct relation to the level of activity (business) at his establishment.

One of the major problems in many of our urban areas today is related to the increasing cost of providing adequate parking. The supplier has a limit on what he can afford to spend on providing parking for his customers. If increasing land costs and congestion raise the supplier's cost of maintaining the spaces, then either the price to the consumer increases or the spaces are not provided. Either situation directly affects the level of activity at the location involved.

Economic Perspective

We can now state explicitly what has been implied in the previous discussion. Parking is an economic commodity and is subject to the basic laws of economics (Fig. 2). The number and cost of parking spaces provided are determined by the point of equilibrium where the cost of providing space from the supplier's perspective is equal to the price the consumer is willing to pay. This relation is considerably more complex than that described here. It is useful, however, to identify and understand this basic economic relation.

There is a wide range of factors that can alter the supply-demand relation related to parking. If a parking policy is implemented, for example, that reduces the number of available spaces from the equilibrium quantity, then a new quantity and price are defined as shown in Figure 2. If a policy decision is made to provide fewer parking spaces, then a new equilibrium point will be established resulting in a higher price to the consumer for parking. We will see in this paper how this change in price potentially affects the decision process of the trip-maker. The important thing to recognize and establish is that parking is an economic commodity that is subject to the basic laws of supply and demand.

HOW DOES PARKING AFFECT TRIP-MAKING ?

Thus far we have established that parking is an element in the trip-making process and, as such, follows the basic economic laws of supply and demand. Fairly sophisticated computer and mathematical models have been developed to predict human behavior in the trip-making process. These models have been developed and refined over a period of time and are now established as reasonably accurate predictors of the trip-maker's response to differing conditions. The decision of where a person goes to find a desired activity is represented by a mathematical relation called the distribution

Figure 1. Person-trip alternatives.

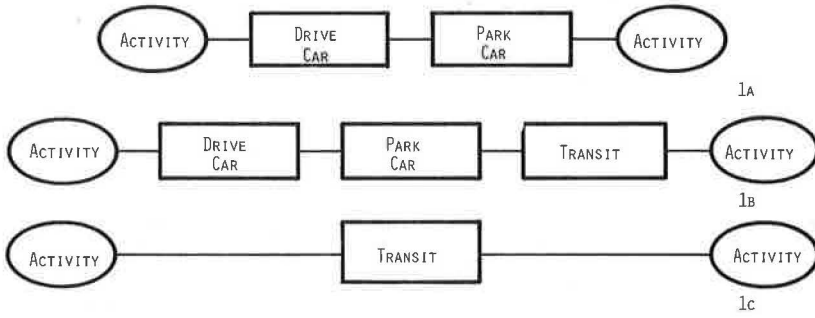


Figure 2. Parking supply and demand.

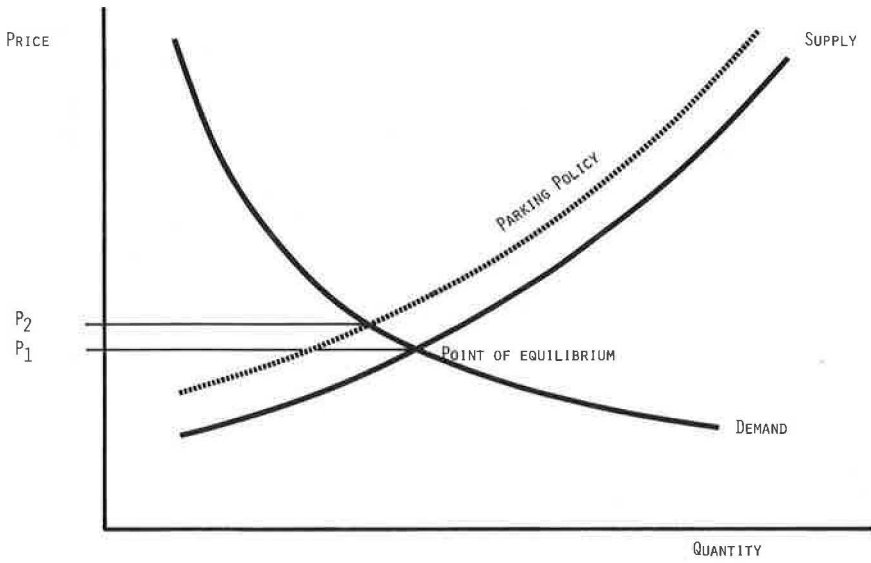
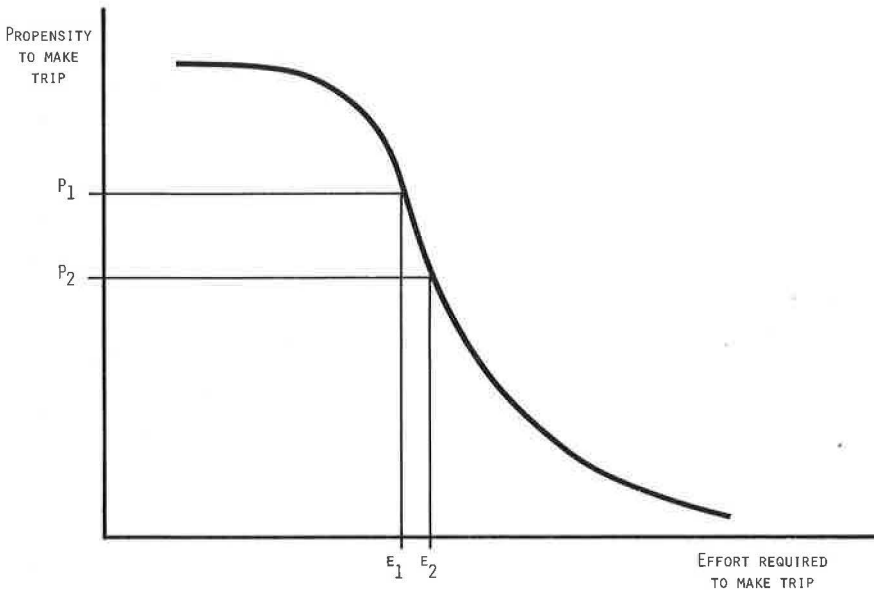


Figure 3. Person-trip distribution model.



model. The decision of how a person will make his trip (by what mode) is represented by a mathematical relation known as the mode-of-choice model. The following sections will discuss each of these mathematical models and how the effect of parking can be traced by their application.

Where Will the Trip Go?

As discussed earlier, trips are made in order to reach a location where a desired activity can take place. In deciding where to go for the desired activity, the trip-maker must first identify the alternative destinations throughout the community where the activity is located. For many trips, there is only one possible destination. An employee with a regular office position can only travel to a single location to carry out his work. He does not make a decision each morning as to where he will go to work that day. Many trips, on the other hand, can be made to a number of different locations where virtually identical activities can be found. Perhaps the best example is the housewife going to the grocery store. In most cases, numerous alternatives exist for her to do her grocery shopping. Parking can affect a person's trip-making decision only if alternative locations are available for the same activity.

When alternative locations for the same activity exist, the trip-maker usually selects the location that requires the least effort on his part to make the trip. If a housewife can travel two blocks and find the grocery shopping facilities she needs, she will not travel 5 miles across town for the same facilities. It is important, of course, to emphasize that true alternatives must have the same activities. If a particular location does not have the desired activities, then it will certainly not be selected as the destination of the trip.

The mathematical relation known as the distribution model relates the level of effort required to make a trip to the propensity of the trip-maker to travel to that destination. It is not important for purposes of this paper that the exact mathematical form of the model be presented or understood. The relation defined by the distribution model is shown in Figure 3. Perhaps oversimplified, the distribution model indicates that, as more effort is required to make the trip, the propensity to make the trip is reduced. An example best explains this relation. If a consumer has to travel on local streets for perhaps 5 miles to reach a regional shopping center, he would have a relatively low propensity to make such a trip. If the amount of effort required to make the trip is reduced by putting in a new freeway system or providing rapid transit service, then the consumer's propensity to make such a trip is increased. The distribution model relation for trip-making has been applied for a number of years and established to be a fairly reliable predictor of where people will go to find the activities desired.

The distribution model can be utilized to identify the effect of parking on a person's trip-making decisions. Figure 3 shows this potential effect. The level of effort required to reach a particular destination is represented by E_1 . Related to this level of effort is a propensity P_1 that the consumer will make the trip to that particular destination. Let us assume that a parking policy to provide fewer parking spaces has been implemented as we discussed earlier in reference to the supply and demand relation. Through economic analysis, we have already established that the price of parking spaces to the consumer would increase. This increase in parking cost represents an increase in the level of effort required on the part of the consumer to obtain the desired activity at the same location. The new increased effort is represented by E_2 . As shown in Figure 3, a new and lower propensity P_2 is now related to the same location. Because of the lower propensity due to increased effort required, the consumer may decide that an alternative destination is more desirable.

Using a standard transportation planning model, we have now been able to identify at least one potential impact of parking on a person's trip-making decision process. It should be emphasized that parking is not the only element that can increase or decrease the level of trip-making effort that in turn affects the trip-maker's choice of destination. Many other factors, such as travel time, quality of activity, habit, and personal preference, can also affect the decision process. If the effort required to park is minimal with respect to other elements of the trip, it will probably have little impact on the trip-

making decision process. If, on the other hand, parking requires major effort in terms of either time or out-of-pocket cost, then it can have a substantial effect on where a person goes to find the activities desired.

How Will the Trip Be Made?

The second basic decision a trip-maker must make to complete a trip is deciding which mode he will use to make the trip. Will he travel on foot, on a bicycle, by automobile, or by public transportation? This decision, again, is related to the relative level of effort required to travel by each available mode. The mathematical model that has been developed to represent this element of the trip-making decision process is called the mode-of-choice model. Numerous mathematical forms have been developed in recent years. One such relation is shown in Figure 4. The mode-of-choice model indicates that the difference in effort between making the trip by transit and making the trip by automobile defines a certain probability of the trip being made by transit.

Perhaps the best way to explore this relation is to once again turn to our previous example. For a particular trip, the difference in effort required to go by transit as compared to automobile is D_1 , which results in a probability P_1 of making the trip by transit. Returning to the example used earlier, we can now trace the impact of reducing parking supply. The economic analysis indicated that a reduction in parking supply results in an increase in parking cost based on the supply and demand relation. Because parking is a part of the trip-making process when the trip is made by automobile, then the total effort required to make the trip by automobile increases and the difference in effort (transit minus automobile) decreases to level D_2 as shown in Figure 4. Based on the mode-of-choice relation, a new and higher probability P_2 is now defined for making the trip by transit. In other words, the increased effort required for parking resulted in an increased probability that the trip would be made by transit rather than by automobile.

We have now established how parking can affect both where the trip-maker will go to find his desired activity and how he will travel. The examples presented were admittedly oversimplified, and certainly the decision-making process is considerably more complex. The transportation planner is limited, however, by the tools available to him. Based on the relations established previously, we have a reasonable capability of tracing out the potential impact of changes in parking policy on trip-making characteristics.

It is important now to go back to the discussion that related trip-making to activities. People make trips to engage in the activities that they find at their destinations. As we affect their trip-making characteristics, we affect the level of activity. As we alter parking policies, we can affect the amount of activity that will take place and how people will travel to reach an activity. In an extreme case, for example, we could eliminate all parking from a regional shopping center and provide no alternative means of traveling to that facility. The effect would be an immediate total decay of activity at the center. This is, of course, an exaggerated example, but it serves to prove a point. Parking and parking policy can directly affect the level of activity for a particular land use. We must, therefore, recognize and utilize parking as one of many available tools that can be applied to accomplish our urban development objectives. As indicated in this paper, rigorous modeling techniques are available to assist us in predicting the potential of alternative parking policies.

EFFECT OF PARKING POLICY

With the relations established in this paper, we are now able to identify the potential effect of parking policy on the achievement of urban development objectives. The relations and potential effect are shown in Figure 5. Parking policy is composed of two basic elements: number of spaces provided (quantity) and cost to the consumer (price) for utilizing each space. Parking policy can be implemented to affect either one or both of these elements, resulting in a new point of equilibrium based on the economic relation of supply and demand. Utilizing the distribution and mode-of-choice models, we can then trace out the effect of this parking policy in four major impact areas: social, behavioral, economic, and environmental-land use. A given parking policy

Figure 4. Mode-of-choice model.

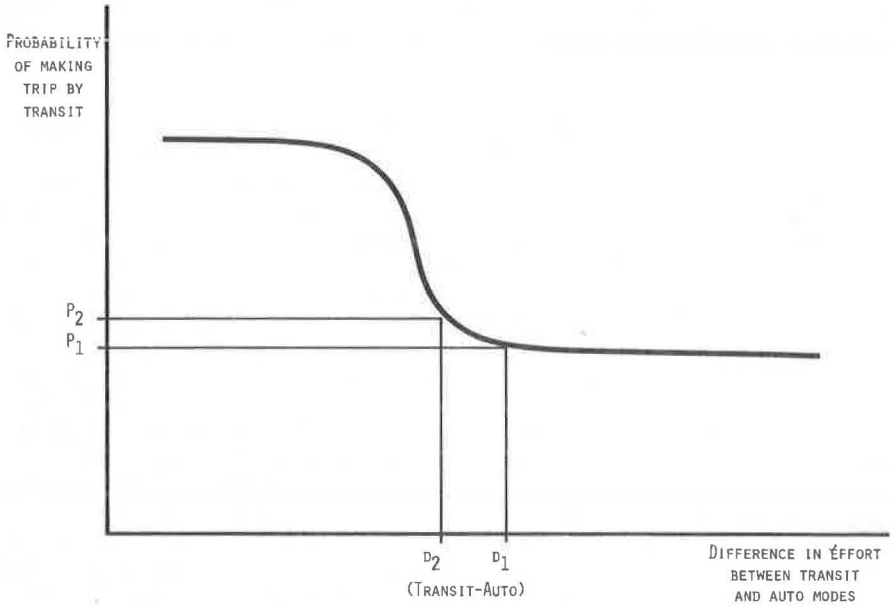
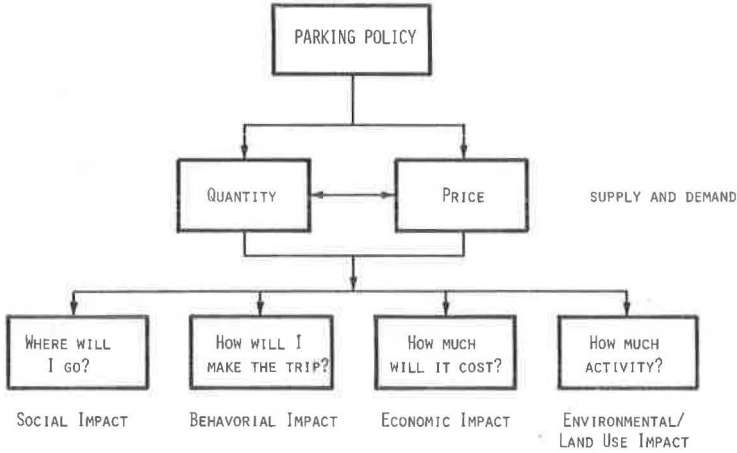


Figure 5. Effects of parking policy.



will influence the trip-maker's ultimate answer to each of the following questions that relate to the specific areas of impact:

1. Social—where will I go?
2. Behavioral—how will I make the trip?
3. Economic—how much will the trip cost?
4. Environmental-land use—how much activity will take place?

PLANNED APPLICATION IN DENVER

Planners in the Denver region have recently undertaken a very extensive land use and transportation planning study to produce land development and transportation plans for the year 2000. To accomplish this task, a joint regional planning program was organized and carried out by the Regional Transportation District, the Colorado Department of Highways, and the Denver Regional Council of Governments. The potential effects of parking policy on urban development have been explicitly recognized and applied in the process of alternative plan testing and final plan selection.

The Denver region is one of the fastest growing areas in the country. Because of its unique environmental setting, the inhabitants of this region are very concerned that growth be accommodated in a properly guided and acceptable form. For this reason, an extensive environmental resources inventory was undertaken early in the planning process. Based on a set of criteria developed from this and other inventories within the region, a growth concept for the region was established. The resulting growth concept represents a bold and vigorous approach to future development within the region based on very specific guidelines and objectives.

Considerable effort was spent in identifying steps that can be taken to make the plan become a reality. Parking policy will be one of the tools applied to implement the plan. This relates most specifically to the development of carefully selected community service centers where high-density activity can and should occur. The concept is to provide many activities within a short distance of the consumer. Stated differently, the objective is to reduce the level of effort required for a consumer to find his desired activities. Provision of parking will be a key element in making these community service centers a reality. By substantially limiting or reducing the amount of parking, a greater percentage of available land can be utilized for construction of buildings that provide activities desired by the consumer. Parking lots will be replaced with additional residential, commercial, and employment activities. The level of activity will therefore increase.

As indicated earlier in this paper, the removal of parking spaces will result in trips going elsewhere unless a reasonable mode of travel alternative is provided. A key element in implementing the plan will be a personal rapid transit system that will provide fast and efficient access to and within each center. A parking policy of providing limited parking capacity within these centers will encourage transit use and make more land available for development. The added development will, in turn, result in a higher and a greater variety of alternatives within easy access to the consumer.

Computer simulation of this approach indicates potential for affecting and accomplishing the urban development objectives identified in the regional growth concept. The real impact of this approach will, of course, not be completely defined and understood until implementation of the plan begins and consumer reaction can actually be observed.

CONCLUSION

From the discussion presented in this paper, we conclude that parking policy is an integral part of urban development objectives. Parking is one element in the automobile trip-making process. Trip-making, on the other hand, has a direct impact on the type and level of activity at a particular location of land use. The relations identified and presented in this paper establish that, as we alter parking policy in terms of quantity or price, we affect the consumer's travel patterns. Parking policy is therefore a strong and controllable tool available to land use and transportation planners in accomplishing urban development objectives.

As we proceed to explore and experiment with alternative approaches to parking and parking policy, we must keep in mind the relations presented in this paper and how we are potentially affecting the trip-making process. Parking can be used as an effective tool in accomplishing our urban development objectives if we fully understand these relations and properly use the tools. Just as a master craftsman must know and understand the characteristics and proper use of each tool, so we as land use and transportation planners must know and understand our tools and how they can work for our benefit if properly used.