AN INVESTIGATION OF THE USEFULNESS OF PARKING PRICE INCREASES AS PUBLIC POLICY FOR CONGESTION RELIEF IN VANCOUVER

by

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ABSTRACT

The purpose of this thesis is to investigate the usefulness of parking price increases for the relief of congestion in Vancouver. This investigation is set within the framework of public policy analysis in order to permit the examination of both the likely technical effectiveness of this idea, and the behavioural response of the political and administrative system.

Three basic information sources were utilized in the analyses. From the literature, two areas were reviewed: concepts and theories from the field of public policy analysis; our understanding of congestion and methods of its alleviation, especially congestion pricing. Interviews were conducted with local officials to provide data concerning the Vancouver context, current policies and likely response to a parking price increase program. A questionnaire survey was utilized to investigate potential behaviour of individuals in the target population.

Examination of previous experience with parking price increases offers the following reasons for the negligible impact upon congestion: strong opposition from business interests who feel shoppers are discouraged; exemption of non-commercial employee-oriented parking; insufficiently large price increases. Accordingly, increasing parking prices to those who work in congested areas has been proposed as a workable alternative to be explored in the Vancouver context.

The results of the questionnaire survey provide several observations about downtown workers who commute by car: many use employer-controlled facilities; many park free; a majority would
prefer to discontinue parking if prices were doubled; most parkers reacted to large incremental increases, not small ones; bus transit was the most popular alternative commuting mode.

It was found that the largest impacts of the parking price increase program would be: loss of profit experienced by the parking industry, at least in the short run; reduction of traffic volumes in and around the downtown during the rush hour. Reducing traffic volumes significantly while avoiding undesirable side effects depends upon the use of sufficiently large price increases and the assurance that these increases reach the bulk of auto commuters. A comprehensive administration of collection and enforcement procedures is therefore necessary.

It is concluded that a parking price increase program directed at downtown workers would make a useful contribution to the relief of congestion in Vancouver. Furthermore, the success of this program will depend not upon the basic mechanical capacity of this technique to reduce congestion, but rather upon the willingness of the implementing agency to demonstrate strong commitment to the program and the active co-operation of other public agencies.
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INTRODUCTION

Transportation is a very important concern in all major cities, and Vancouver is no exception. Without an adequate level of accessibility and mobility, the functioning of the modern urban region begins to break down. Urban congestion results directly in loss of time for both commuters and transients in all modes of urban transportation. It is also responsible for delays in urban goods movement. Urban congestion therefore plays a significant role in reducing accessibility and mobility in our urban centres.

There are other aspects of the urban transportation problem which are related to the problem of congestion. Recently, fuel consumption has become an important concern in North America. Another aspect of the problem is environmental quality. The exhaust emissions of motor vehicles contribute strongly to the detrimental effects of poor air quality upon plants, animals, and human beings. We suffer as well the undesirable noise and loss of visual amenity which arises from transportation activity. Motor vehicle accidents are another aspect of the urban transportation problem. Finally, since our transportation network is land-absorbing, and can be altered to change local accessibility, it has a major impact upon land use patterns and urban land values. As the level of congestion rises, the above-mentioned problems become aggravated. Consequently, congestion is seen to be a primary aspect of the urban transportation problem.
In the past, a number of approaches have been utilized to alleviate the problem of congestion, and failed to do so. These early solutions, such as roadway expansion and decentralization of activities, facilitated the growth of automobile traffic. It is felt by some authorities that our present urban transportation difficulties have become intensified by increased dependency upon the automobile.

Attention is now given to mechanisms which do not encourage automobile traffic: improvements to the public transit system; new transportation systems or technologies; tools to reduce the amount of travel, or shift the pattern or mode. In most cases new systems or technologies will not be available on a large-scale in the immediate future. However, it is still desirable to deal with these transportation problems as soon as possible. It is recognized that a 'balanced' transportation solution is called for. Reliance should be placed upon a variety of techniques that in themselves may have only narrow impact, but taken together will provide a well-rounded improvement to the situation.

Restraint techniques, which try to discourage demand, tend to have lower public costs than the other techniques, as well as possessing the advantage of quick application. Halting the physical growth of our major urban centres is beginning to become an important objective, and traffic restraint techniques provide transportation policy complementary to this goal.

It is therefore desirable to consider the usefulness of policy measures that will restrain traffic as an approach to the relief of congestion. Such measures are aimed directly at
changing human behaviour. Consequently, information concerning the likely behaviour of individuals who comprise the target population of restraint mechanisms will be crucial. Data from a study commissioned by the City of Vancouver is available concerning consumer response to parking charges. Primarily behavioural policy mechanisms have seldom been utilized by public agencies concerned with urban transportation problems. It will also be important to assess as far as possible the response of our administrative and political systems.

The objective of this thesis to evaluate, within the constraints of time and resources, the usefulness of parking price increases as a restraint measure for the relief of urban congestion in Vancouver. The evaluation is carried out within the framework of public policy analysis. This framework has been chosen because it provides the opportunity to study both the technical performance of parking price increases, and the behavioural response of our administrative and political systems.

This framework also has the advantage of encouraging the enumeration of all the analyses which can be envisioned as desirable to conduct in dealing with this problem. This provides a broader perspective for the evaluation of the parking price increase mechanism. Suggestive arguments can be made where analyses cannot be completely carried out and recognition of considerations outside the scope of this study can also be made. A number of definitions and concepts of public policy analysis are reviewed in Chapter I, and the public policy analysis framework for this study is outlined.
In Chapter II, the problem of urban congestion is examined. The concept of divergence between the private and social costs of transportation is utilized to describe this problem. A number of methods of alleviating urban congestion are enumerated. The methods of road pricing are discussed, especially with respect to the marginal cost pricing rationale.

Chapter III begins by reviewing the information available in the literature concerning parking price increases as a transportation planning tool. Following this the relevant physical, political and transport characteristics of the Vancouver situation are discussed. Utilizing this information a rationale for a methodology for a system of parking price increases for Vancouver is developed: a scheme of charges applied to downtown automobile commuters.

In Chapter IV, analysis is conducted to determine the likely performance of parking price increases under the assumption of successful implementation. An attitudinal questionnaire concerned with commuter response to parking price increases is described, and the results examined, in order to provide information concerning the likely behaviour of individuals in the target population. The conditions of successful implementation involved in the implementation and operation of this technique are discussed. Finally, the economic, environmental, physical and social impacts of this policy are discussed.

Chapter V is concerned with the assessment of the parking price increase system as public policy. A number of aspects of the behaviour of the administrative and political system will be
discussed to provide further input to the evaluation.

Chapter VI sums up the results of the study, offering final conclusions and recommendations for further action.
CHAPTER ONE: THE FRAMEWORK OF PUBLIC POLICY ANALYSIS

1.1. Introduction

A number of definitions and concepts basic to the field of public policy analysis will be reviewed from the literature. Next, an outline will be given of analyses that should be undertaken in a comprehensive public policy study dealing with the problem of relieving urban congestion. Finally a description of the analyses that will be conducted by this thesis will be given and some factors to be considered in the evaluation of the parking price increases technique will be mentioned.

The purpose of this chapter is to provide a framework, or perspective, for the research that was conducted in this study: within the field of public policy analysis, and within the conceivably desirable comprehensive analysis of urban congestion. The description of various concepts concerning the public policy formation process will be linked in a later chapter to particular aspects of the Vancouver context as it applies to the assessment of parking price increases. These descriptions provide some explanation of certain aspects of the policy problem, forming a base upon which to interpret the available information for the Vancouver situation.
1.2. **Public Policy Analysis: Some Concepts**

1.2.1. **Definitions**

Some definitions of commonly used words in the field of policy analysis are necessary. Policy has been defined by one author as those decisions "which have the widest ramifications and longest time perspective, and which generally require the most information and contemplation". Another author gives a more detailed view of the elements of policy, incorporating five main components: a particular set of objects which are to be affected; a desired course of events involving these objects; a selected line of action to bring about these events; a declaration of intent; an implementation of intent, that is, those actions actually undertaken. Public policy is simply that policy which is adopted and implemented by "those who engage in the daily affairs of a political system" and are recognized by most members of the system as having the responsibility for these matters and "whose actions are accepted as binding most of the time by most of the members so long as they act within the limits of their roles".

There are a number of other basic concepts used in the discussion of public policy which are worth taking the time to define clearly. It is important to distinguish between policy process and policy output. Policy output is also known as policy content and refers to the one alternative chosen from all the others and embodying the five attributes of policy described above. The policy process is composed of the actions and interactions that produce the public authorities final choice of the policy output. Finally, there is the concept of
Figure 1.1: The Policy Formation Process

Source: David Easton (1965), p. 32.
policy outcome, distinct from policy output, which is the way the course of events is in fact affected by the authorities actions, and the response of the 'set of objects'. Brought together, these concepts form the elements which make up the overall process of policy formation, as shown in the simplified model of a political system (Figure 1.1).

1.2.2. Types Of Public Policy Analysis

As a field of academic study, public policy analysis has been traditionally pursued primarily by political scientists and economists. From this tradition comes two main branchings in terms of the type of analysis objective pursued. One branch of analysis is concerned with the policy process, seeking to describe how the political system works. The other type of analysis concerns itself with the examination, evaluation and prescription of policy content, or policy output. There is also growing interest in and practice of public policy analysis which does not overemphasize one aspect of the other, but seeks to investigate both so that informed decisions can be made which will produce the desirable policy outcomes.

1.2.3. The Decision-making Process

The decision-making process can be regarded as a cross-section of the policy formation process, focusing upon the individual decision-maker(s). A simple model of the decision-making process is shown in Figure 1.2. Some ideas will be briefly described in the following sections to present some understanding of this process.
**Figure 1.2.: The Decision-making Process**

![Diagram of the decision-making process]

Source: adapted from Bross (1953), p. 29.

**THE DECISION MAKER**

Source: adapted from Bross (1953), p. 29.
1.2.3.1. **The Role Of Value Systems**

Considerable attention has been given to value systems in the literature; some of these observations are summed up by Karl Deutsch\(^5\). Beginning with the observation that people are more often interested in rewards than sacrifices, the concept of interest is described in its two aspects: the subjective, wherein people are interested in whatever they choose to pay attention to; and the objective, which is the actual probability of reward. Well-understood interest is the case wherein the distribution of attention and the probability of reward positively coincide.

Deutsch observes that politics deals with the interplay of interests; the claiming and distribution of rewards, that is, of values. Political theories of the past have sometimes been formulated in terms of a single value, such as power or justice. However modern theories postulate a plurality of needs: power, enlightenment, wealth, well-being, skill, affection, rectitude (justice and righteousness), and deference\(^6\). To this list, Deutsch adds the values of security of future attainment of desired values, and liberty to act in accordance with one's own personality. These values are not always wholly compatible with each other, which brings in the concept of legitimacy. The pursuit of a value can be said to be legitimate if, and only if, we have reason to believe that it will not inflict intolerable damage upon any other value held dear\(^7\). Since different people have different values, legitimacy becomes a relative concept. This can be applied to the public decision-making process. When public goals and practices are compatible with the private
values and personalities of individuals, then the government and its laws are legitimate in the eyes of the private citizen, who then cannot break the law without causing psychological self-damage. Consequently, the decision-maker will only produce decisions which will be effectively carried out or co-operated with when the value system utilized in the process contains a sufficient degree of legitimacy. One question which will be discussed later is whether a system of parking prices increases will be granted sufficient legitimacy to permit it to be effectively carried out.

1.2.3.2. The Problem Of Uncertainty

The decision-maker's model of the world, augmented by the data channelled to him, contains only a small portion of the relevant characteristics of the real environment. Information gathering to reduce uncertainty is costly. Consequently, most decisions must be made under conditions of uncertainty. To some extent, predictive systems are utilized by decision-makers and the analysts which aid them, in an effort to overcome knowledge deficiencies. In considering this aspect of the decision-making process, it cannot be overstated that the prediction of human behaviour is quite difficult.

A positive approach to this dilemma is to carry out policies which provide new understanding and information through their experience, but at the same time permit a change of policy direction after new understanding is gained. Recognizing the uncertainties associated with implementing new and different policies (the only kind which will produce new information),
this approach is a process of experimentation.

1.2.3.3. **Decision Methodology Of Public Administrators**

One area of concern for those who study the field of public policy has been the methodology used by decision-makers when they act to produce policy output. A number of theories have been developed which attempt to describe how policy formation and choice should be carried out. One model of decision methodology attempts instead to describe how public administrators actually carry out this process. This model is referred to as the 'strategy of disjointed incrementalism'. Although it will not be possible to examine here decision-making behaviour in depth, this model does provide some insight in this direction which will be useful in assessing the acceptibility of the parking price increase idea.

The attributes of this approach to problem-solving are summarized below:

"1. Choices are made in a given political universe, at the margin of the status quo.
2. A restricted variety of policy alternatives is considered, and these alternatives are incremental, or small, changes in the status quo.
3. A restricted number of consequences are considered for any given policy.
4. Adjustments are made in the objectives of policy in order to conform to given means of policy, implying a reciprocal relationship between ends and means.
5. Problems are reconstructed, or transformed, in the course of exploring relevant data.
6. Analysis and evaluation occur sequentially, with the result that policy consists of a long chain of amended choices.
7. Analysis and evaluation are oriented toward remedying a negatively perceived situation, rather than toward reaching a preconceived goal.
8. Analysis and evaluation are undertaken throughout society, that is, the locus of these activities is fragmented or disjointed."
It should be noted that Lindblom believes this approach to be fairly successful. The individual decision-maker faces a choice which has been simplified through this process such that he can deal with it. He is able to make his decision from a fairly well-informed base because the change from present practice is small. The dangers of numerous narrow-minded decisions are expected to be counteracted by the tendency for excluded concerns to be represented in the political system elsewhere.

This incremental approach has been criticized because it does not explain how fundamental changes of policy can be made, or how the overall direction of a series of incremental policy steps might be determined. Another theory, called mixed scanning, asserts that decision-makers occasionally make these fundamental decisions through a process of scanning, or exploring, the main alternatives seen in terms of the goals held by the involved actors. In this way, the tendency for incremental decisions to remain conservative, and the possibility of drifting without real direction, are overcome.

1.2.4. Public Agency Behaviour

In many public policy situations that are of concern in Western democracies, there are usually a number of public agencies which share responsibility for activities in that area. The behaviour of public agencies, and their interactions, have been studied and a number of observations have been made.

Public agencies can be said to have a policy space in which they are involved due to their various functions. This policy space is a territory in which there can be distinguished a
number of zones, where: it solely exercises determination of policy; it is dominant, but not alone; it has influence, but so do others; other agencies dominate; it has no influence. It is easily observed that when a department changes any conditions under its control, this change has an impact upon a large number of other agencies. There exists considerable struggle to influence and resist being influenced. There are good reasons for this behaviour: a small act today may grow to a major threat in the future. Ultimately, public agencies are concerned with survival; survival requires funding, and funding comes only through exercise of power over resources. The consequences of territorial struggle are important for the understanding of policy formation. Every large organization is in partial conflict with every other social agency it deals with; even if their relations as a whole are dominated by co-operation. Public agencies and departments do spend time in territorial struggles that create no socially useful products. Consideration shall be given later to this problem as it affects the parking price increase policy.

1.2.5. The Formation Of Pressure Groups

As will be pointed out in Chapter III, the political influence of pressure groups is an important concern for the assessment of the parking price increase mechanism. It is worthwhile to examine the characteristics of these groups, in order to obtain some ideas of where to expect pressure to come from.

A very interesting theory concerning the organization of
collective action in our society has been formulated. It is asserted that those large groups which are organized (and some groups are unable to organize) and which do conduct lobbying activity, actually have no incentive to organize people solely on the basis of the collective good their lobbying strives to provide. The power of the group may come from a large, mobilized membership but from the individual's point of view, he gains just the same whether he himself actually joins or not. Consequently, for these groups to form and persist there must be some non-collective good which they can offer in order to achieve the large membership. This can be done either through the authority and capacity to be coercive, or through positive inducements.

In the case of smaller potential groups, such as the local business community, it is argued that they need not necessarily rely upon non-collective inducements. It is argued that some group members (at least one) will find their personal gain from the collectively-obtained good exceeds the total cost of providing some amount of that collective good. Furthermore, it is relatively easy to organize a small group, and non-collective inducements often exist anyway.

1.2.6. Types Of Policy Mechanisms

There can be identified three different types of solutions embodied in public policy: the technological fix, the cognitive fix and the structural fix. Essentially, the technological fix attempts to change the physical environment to solve the problem. This approach has appeal for public decision-makers
because: in the past, it has been highly successful; it incorporates a relatively higher degree of control in terms of knowledge, preciseness of application, comprehension of application; it attempts to circumvent the difficulties of dealing with human behaviour. Consequently, this approach currently enjoys considerable institutional support.

The cognitive fix views man as a fairly rational actor who will modify his internally controlled behaviour on the basis of new information. The methodology of this fix involves the transfer of information to the individual whose behaviour has been selected for change. This approach has appeal because it is cheap, and can be used when the physical environment is not susceptible to change. It has ideological appeals in Western democratic societies, where individuals are felt to be responsible for their own fate, have freedom of choice, and are supposed to contribute responsibly and freely to the greater good of society.

The structural fix attempts to modify individual behaviour by modifying the physical or social setting. In one sense, this approach can be seen to incorporate the tactics of both the other fixes, but the prime objective is one of behavioural change.

Each approach suffers from different shortcomings. The technological fix suffers from the adversity of second-order unplanned effects, such as pollution. Also this approach risks failure by making simple assumptions about human behaviour; often second-order unplanned social effects result as well. The cognitive fix is viewed as having severe shortcomings, since
attitudes are very difficult to change. Some authorities feel, in fact, that attitudes follow from behaviour\(^\text{18}\). Furthermore, it is recognized that, at best, man exhibits bounded rationality; that is, he uses a simplified model of the world, and strives for satisfactory, not necessarily optimal, behaviour. Consequently, he will not necessarily respond to a cognitive fix pointing to optimal behaviour. Finally, this approach cannot deal with the important problems related to collective behaviour, where individual rationality may not be desirable.

The structural fix then becomes appealing in the light of the shortcomings of the others. However, this approach lacks institutional support, and must fight institutional inertia. Of the three approaches, it would be the more likely to generate bureaucratic territorial struggles\(^\text{19}\). More so than the other approaches it may demand examination of objectives instead of alternative policies, because it focuses upon behaviour. The structural fix also suffers from ignorance of second-order effects.

1.3. A Desirable Comprehensive Analysis

It will be useful to consider at this point the entire range of analyses that would be desirable in order to provide information that would aid public decision-makers to make a well-informed choice of policies to deal with the problem of urban congestion. Although it was not possible to carry out here such an exhaustive study, its description will serve to provide some perspective from which to judge the investigations
that have been made.

Presumably, a comprehensive analysis would begin with the broad objective of assessing the advantages and disadvantages of reducing urban congestion to a number of different levels, through a number of different means.

The present state of the congestion problem should be analysed. It would be necessary to settle upon a definition of congestion and a method of measurement. The extent of congestion throughout the transportation system should be determined. It should be established what the sources are, and what their proportion of contribution to congestion is. The socio-economic and physical effects of congestion in Vancouver should be identified. This information describes the problem and gives the context against which alternative situations can be measured.

It would be desirable to identify those values which are considered worthwhile and relevant in the consideration of means to relieve congestion. A comprehensive approach would strive to recognize the range of values that are expressed in our society, so that the results of the study would present information relevant to any concern decision-makers may wish to consider. These values will be reflected in the selection processes which determine the limits of the study, and in the evaluation process as well.

Practically speaking, it would be necessary to place some limit upon the areas of congestion to be investigated, and the number of levels of congestion that will be examined as potential policy objectives. Also, it must be determined what
sources of congestion will be considered in the search for means to reduce congestion. Quite possibly it would be desirable to investigate all sources, a number of different levels, and examine the entire urban area. At this point, selection of the range of alternative measures that would be examined should be carried out, utilizing the identified values as the basis for selection.

Once selection has been made, two behavioural analyses should be carried out: of the individuals whose actions cause congestion, or contribute to it; of those government agencies, private firms, and interest groups that are involved with the problem. These analyses should be concerned with both present behaviour and prediction of future behaviour under the various alternative measures. Examination of individual behaviour also concerns the socio-economic characteristics of each individual, while examination of entity behaviour should also identify the powers, domain of influence and policies of each entity.

Analyses must be conducted to assess the impact of the alternative policy mechanism, and to evaluate their usefulness in achieving the reduction of congestion to the preselected levels. Information of a number of types should be collected: economic costs and benefits; indicative economic information; environmental impact; social impact; income distributional effects. The evaluation should compare the different measures in order to establish their relative usefulness.

Finally, based upon the values identified earlier, the study should make recommendations concerning the policy objective for congestion relief which should be sought, and the
mechanisms which should be used to attain this objective.

1.4. Analyses To Be Conducted By This Study

It was possible for this study to conduct only a small portion of the investigation envisioned for a comprehensive study, due to the constraints of time and resources. The objective of this study will be to assess, as far as possible within these constraints the usefulness of a parking price increase program for the relief of congestion in downtown Vancouver.

The study begins with an investigation of the problem of congestion in the abstract, with reference to the available literature. Congestion is defined, and some methods of measurement are discussed. The costs of congestion are reviewed and a number of methods of alleviating it are discussed.

No explicit discussion of values will be undertaken, except in the sense that they are recognized in the discussion of the attributes of parking price increases and the factors that will be considered in evaluation.

The Vancouver context will be briefly described, thereby presenting some information concerning the existing congestion problem and its characteristics and the make-up of the political and administrative system as it is involved with this problem. Congestion in Vancouver will not be measured and therefore no attempt will be made to establish levels of congestion reduction as policy objectives.

The parking price increase mechanism will be examined in some detail. Information will be generated concerning its
impact upon the environment, social impact and income distribution effects. Some information concerning the costs of this technique will be discussed. The effectiveness of this policy, assuming successful implementation, will be assessed through the utilization of an attitudinal questionnaire to investigate the behaviour of the target individuals.

Although it will not be possible to analyse the behaviour of the political and administrative systems, the ideas from the field of public policy analysis will be combined with available information to produce suggestions concerning their likely response. Finally, the parking price increase policy will be evaluated in terms of its potential usefulness as public policy for congestion relief.

1.5. **Factors For Evaluation**

In considering factors for use in evaluation of parking price increases, it can be noted that there have been four categories of evaluation identified in the literature: assessment of the effort necessary to establishment of the measure; assessment of effect; assessment of the process as it would unfold in the socio-economic system; finally, the adequacy of the effect in terms of the total problem. This study shall attempt to investigate these considerations, and in the evaluation of the parking price increase program, assess the following factors:

a. Technical Performance

In this portion of the evaluation, it will be assumed that successful implementation of the parking
price increase system has been carried out. This measure will then be weighed in terms of its impact upon congestion, and other aspects of the urban transportation problem. Consideration will also be given to any adverse impacts that could develop.

b. Political and Administrative Behaviour

This criterion is concerned with the motivation this policy provides to several different groups: government agencies, private interests, and special interest groups. The behavioural response of these groups combine in determining to some degree the effectiveness of this policy.

c. Costs of Administration

Concern here is with the implementing mechanisms which are necessary to the successful application of parking price increase policy, and the implications these mechanisms have for administrative costs.

d. Income Distributional Effects

The costs and benefits of implementing parking price increases will be shared between many different groups in society. It will not be possible to obtain precise estimates, however, this study will attempt to suggest how these effects might be distributed. Unfortunately, although it would be desirable to do so, it does not appear as though it will be possible to evaluate the economic efficiency of this measure, due to the paucity of data available.
4. Ranney, pp. 9-13, neither branch disregards the other aspect entirely.
5. Deutsch, pp. 10-15, the following discussion summarizes Deutsch.
10. Lindblom, p. 81 notes the method called 'rational-comprehensive planning'.
15. the following discussion summarized from Downs, pp. 211-216.
16. the following discussion is summarized from Olson, pp. 5-52, 132-167.
17. the following arguments are summarized from Heberlein, "The Three Fixes: Technological, Cognitive And Structural", Unpublished, 1973.
CHAPTER TWO: MOTOR VEHICLE CONGESTION

2.1. Introduction

Traffic congestion is an occurrence that is easily experienced, and intuitively understood, in today's urban centres. Too many people attempting to use the transportation system at the same time limits the capacity of the system to provide mobility and accessibility for most users. In this chapter, the problem of congestion is examined. Definition and measurement is discussed. Its existence is explained in terms of the costs of road travel and its effects are enumerated. Some consideration will be given to available techniques which might be used to attempt a reduction in congestion, especially those techniques of road pricing. The parking increase mechanism is introduced.

2.2. Definition Of Congestion

Congestion can be said to exist when the costs of two or more vehicles using the given facility are more than the addition of the costs of each of them using it alone\(^1\). Costs in this case would include non-monetized costs such as time loss.

Although the above definition is rather straightforward, it is too simply stated to be very useful in a practical way. Another definition can be made in terms of loss of time: congestion is the difference between the actual time taken by vehicles travelling on the road, and the time that they would take under light traffic conditions. This base measure
represents an attempt to define a lower bound for the existence of congestion: under light traffic conditions, one extra vehicle imposes little time loss on other vehicles². This definition recognizes that some congestion will exist in the best of conditions in our urban centres and attempts to provide some guide for what is desirable or acceptable.

2.3. Measurement Of Congestion

The useful measurement of congestion is not an easy matter. Part of the problem lies in the manner in which congestion is defined. Measurement of all the costs incurred by one vehicle trip is difficult, due to the individual nature of each vehicle, and the infeasibility of measuring some of these costs (see 2.4.). On the other hand, any attempt to measure solely 'loss of time' must establish the trip times expected under light traffic conditions. Determination of light traffic conditions depends upon a number of factors: the composition and size of the road network, particularly the number and type of intersections; the type of vehicle using it, and their capabilities; the speed of travel generally sought by road users; the number of vehicles attempting to use the network. Establishment of some standard for this variable involves large-scale information collection, and some factors change their condition quickly and often. Nevertheless, a number of different methods of measuring congestion have been developed, all of which determine some basic level for 'zero' congestion.

One approach begins by determining the number of vehicles that a specified road network can accommodate. This calculation
is based upon a standardized figure for a single road's flow per hour, and a standardized length of journey within a typical town centre. By utilizing estimates concerning the proportion of the road system effectively used by peak hour traffic, the number of vehicles travelling, and the area of the specified road system, it becomes possible to calculate the number of vehicles that can use a town centre at various speeds, and also a value for maximum speed at light traffic conditions. Using the definition of congestion as loss of time, it is then possible to calculate the measure of congestion that exists utilizing the formula developed. Unfortunately, this formula is not directly applicable to North American conditions.

In North America, a somewhat different approach to the measurement of congestion has been developed. Traditionally the road system has been discussed in terms of the capacity of the parts and the whole to accommodate a certain flow of traffic. A closer examination of capacity as defined indicates that this concept alone is not sufficient for the measurement of congestion. This concept is linked with the idea of 'level of service' which has been developed to convey a qualitative measure of a number of factors: "speed, travel time, traffic interruptions, freedom to maneuver, safety, driving comfort and convenience, and operating costs". In practice only selected 'levels of service' are derived for certain limits of several factors included in the measurement.

The Highway Capacity Manual (HCM), using standards developed from a large number of empirical studies, has described a ranking of levels of service for urban and suburban
arterials. After the base maximum level of service is defined at the standard legal speed, successive degradation of service is described in terms of increasing delay and lower speeds, high load factor, and other indicators. Congestion is mentioned in the qualitative description of service at the capacity of the road network. Although this manual is much more reticent to provide the same gradings for busy downtown streets, it is possible to regard each decreasing level of service as an increase in congestion. In this way, a very rough measure of time delay, and other costs of congestion, can be provided.

One final approach to the measurement of congestion is suggested by a study attempting to assess the effects of traffic management techniques upon road system capacity and travel times. This study compares actual journey times with what is called airline speed-flow capacity; that is, travel time from origin to destination calculated at the legal operating speed over a straight-line route. A similar calculation, but following major travel routes, could be used in a study to provide a base figure for estimating time loss through congestion.

In sum, the methods of measurement of congestion discussed here all will likely provide a rough idea of the extent of congestion for a specified road system under varied traffic conditions. However, for this study to utilize any one of them would require a great deal of data collection and analysis beyond that which is already intended.
2.4. Costs Of Congestion

In this section the social cost viewpoint of congestion developed in the field of economics will be reviewed. The effects of congestion will be briefly described. The problems of congestion pricing will be introduced.

2.4.1. Social Cost Theory

Congestion can be described in terms of costs both to the individual traveller and society as whole. Each traveller can be said to experience some private costs in any given trip. The demand for transportation can be said to be a function of the cost of trip-making as perceived by the individual. A summary of these private costs can be seen in Table 2.1.

In the short-run situation, the costs of making a trip are determined by the fixed physical characteristics of the system (i.e. a fixed distance, speed limit, etc.) and are independent of the volume of traffic. Therefore the perceived costs of an additional trip (marginal private cost) are: perceived out-of-pocket money costs; travel time; a qualitative disutility (discomfort, inconvenience). The marginal private cost (MPC) is fairly constant up to the point where increasing traffic volumes bring about congestion.

Congestion adds to the costs perceived by each traveller in terms of longer travel time, increased discomfort, and increased gasoline costs. Consequently, the marginal private cost (MPC), as shown in Figure 2.1., rises dramatically with increasing traffic volume. When demand for travel is low \( (D^1) \) then the corresponding volume \( (Q^1) \) and cost \( (C^1) \) are low. As
<table>
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<tr>
<th><strong>PRIVATE COSTS</strong></th>
<th><strong>Fixed</strong></th>
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<tr>
<td>Vehicle purchase</td>
<td>Annual Licence Tax</td>
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<td>Gasoline</td>
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<td>Parking Charges</td>
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<td>Comfort, Convenience</td>
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<th><strong>SOCIAL COSTS</strong></th>
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<td>Aesthetic Aspects Of Fixed Structures</td>
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Source: Hansen, p.52.
the demand increases \( (D^2) \), and the units travelling begin to suffer congestion, the trip costs \( (C^2) \) increase. The point \( Q_{\text{max}} \) indicates the maximum capacity for the transportation section. If the demand exceeds this volume of traffic \( (D^3) \), the volume \( (Q^3) \) becomes such that there is a decrease in the carrying capacity of the system; that is extremely slow traffic and long queues at the entrance points\(^{13} \). This raises the private cost of making an additional trip even higher \( (C^3) \).

It can be argued that the cost of a trip as perceived by the individual does not reflect all the costs his trip imposes upon himself, other travellers, and the rest of society. Looking at Table 2.1., a number of these private costs and social costs can be identified. Clearly, a traveller rarely considers vehicle purchase and licence costs in each trip decision. At the same time, he is even more unlikely to consider the costs that his trip inflicts upon others: pollution and road maintenance for example\(^14 \). This viewpoint is illustrated by Figure 2.2., which indicates the flow that would exist if the cost perceived by the road user was the marginal social cost.

2.4.2. Congestion Effects

For the purposes of evaluating parking price increases in the Vancouver situation, it will be useful to attempt to assess what form the costs of congestion take, and what their magnitude is. Therefore, it is worthwhile to enumerate what the effects congestion are. The private costs of other travellers are increased by congestion: gasoline, maintenance, travel time,
Figure 2.1: Short-run Private Trip Costs

Source: Hansen, p. 33.

Figure 2.2: Flow At Marginal Social Cost

Source: Beesley, p. 224.
comfort and convenience costs\textsuperscript{14}. Other social costs that affect larger segments of society are also increased by congestion. Emissions of carbon monoxide and hydrocarbons from automobiles increase as speed drops\textsuperscript{15}. Emissions of oxides of nitrogen from diesel engines appear to increase dramatically at low speeds or under stop and go conditions\textsuperscript{17}. These three pollutants are often major concerns in urban areas, and motor vehicles are the primary sources\textsuperscript{18}. It is felt that congestion may have a positive relationship with the number of traffic accidents,\textsuperscript{19} but there is little evidence to prove or disprove this conjecture\textsuperscript{20}. Some of the social costs associated with operating the road system, such as road maintenance and particularly policing, would be likely to increase as congestion becomes more severe.

2.4.3. Congestion Pricing

A number of economists have proposed that marginal cost pricing should be applied to the transportation sector\textsuperscript{21}. Under the marginal cost pricing principle road users would be charged according to their liability to cause social costs to themselves and others, and thus road users who value their trips at less than the private and social costs of their trip would be denied travel. According to the marginalist viewpoint, pricing at the marginal cost should produce more efficient allocation of scarce resources,\textsuperscript{22} and therefore this approach will produce the best use of road space.

Practically speaking many social costs are 'intangibles' or are presently not susceptible to estimation of costs; discomfort
is an example of the former, and air pollution of the latter. It has been common practice, in both abstract and applied road pricing investigations, to utilize congestion costs as substitute for all social costs, or focus solely upon this cost as the object of pricing. There are two reasons for this practice: congestion, for all its problems with respect to measurement, can be approximately estimated, while this may not be possible for other social costs; congestion has long been a concern as a transportation problem. This emphasis upon congestion costs permits the pricing scheme to be directed at a number of different markets, providing it is possible to separate the market on both the supply and demand sides. There are a number of opportunities to discriminate among different markets: different parts of the road network, and different times of the day; different prices for different modes; different prices for different trip purposes.

2.4.4. Problems Of Congestion Pricing

Without considering any particular application of congestion pricing, it is possible to mention a number of problems that are associated with this idea, and have been raised in the literature. First a very simple point: it is not practical technically to charge an additional user the costs of his trip, but rather each road user must bear an equal portion of the social cost.

Marginal cost pricing which approximates only a portion of the social costs in only one sector of the economy runs into the criticism outlined in the theorem of the second-best. There is
no theoretical guarantee that marginal cost pricing when applied to one or a few sectors of the economy will result in an improvement in the allocation of resources in the economy\textsuperscript{28}. However, it is certainly possible to make a good case for local improvement in welfare from congestion controls\textsuperscript{29}.

The question of investment in transportation facilities is one aspect of congestion pricing which has received a lot of attention in the literature\textsuperscript{30}. Some have been concerned with congestion charges as an agent for producing revenue for re-investment in roads, while others have been concerned with the problem of recognizing the market signal to increase capacity as it would exist under this program. There has been a lot of confusion in this area; under perfect competition re-investment should occur once the short-run marginal cost exceeds the average cost\textsuperscript{31}. McGillivray had this to say:

"Under congestion, a road becomes subject to decreasing returns to utilization. Then it may be the case that the road capacity should be increased, the high short run marginal cost flagging the fact that there is excess or unsatisfied demand. But the criterion for investment does not rest on the price or congestion level; it is a question of maximizing net benefit given all options. Even if a road is subject to sharply increasing short run average and marginal costs this is not sufficient evidence by itself to justify further investment. Further, existence of decreasing returns to utilization is not evidence that there are also decreasing returns to scale in the industry. For a given road system there might be increasing short run costs so that optimal levels of congestion would require tolls. There may be at the same time decreasing long run average costs, possibly due to investment being available only in individual lumps such that by considering all non-market benefits no feasible investment is worth its salt!"\textsuperscript{32}

Lastly there is the problem of income redistribution effects. These considerations are important in the assessment of any public policy mechanism, but in the case of parking price
increases these effects are a primary characteristic. Some people suffer higher costs than in the past so that the community may gain. However, it seems likely that there will be some uneven distribution of the benefits and costs. For example, it has been argued that lower income drivers would suffer more from a congestion charge, since they may have poorer choices for alternatives. On the other hand, special groups may benefit, such as those whose occupation places them under some of the social costs of traffic continually, such as taxi cab drivers. Another aspect of this question is whether the new costs that will be borne by some user may exceed the benefits of decongestion. The values that are held to be relevant play an important role in assessing the extent of significant inequities, and a number of authorities view these charges with dismay for this reason.

2.5. Methods Of Alleviation

A large variety of techniques have been formulated to deal with various aspects of the urban transportation problem, and many of these techniques are supposed to have a positive effect upon the problem of congestion. Still, it is generally recognized by transportation planners that no one technique can be regarded as a panacea for congestion. It is worthwhile to review these techniques in terms of their basic characteristics in order to achieve some perspective upon the attributes of parking price increases in comparison.

A list of presently known techniques that could be used to alleviate urban congestion is presented in Table 2.2.
Table 2.2: Methods Of Alleviating Road Congestion

A. Increases To System Capacity

1. New Technologies
   - rapid transit, personal rapid transit, subways, dual mode systems, urban jitneys, freeway meter and monitor control systems, auto driver direction systems, mini-cars

2. Traffic Management
   - improvements to existing control systems, bus scheduling, intersection and turning controls, changes to existing road use, such as bus lanes, reversible lanes, curb parking, pedestrian walkways

3. Improvements To, Or Combinations Of Existing System Components
   - roadway expansion, new 'busway', roads more buses (increased frequency, new routes), line haul feeder systems, park 'n' ride systems, high capacity buses, more taxis, freeway bus

4. Volume Redistribution Techniques
   - subsidization of transit, taxis, techniques of moral suasion, organized car pooling, staggered hours, dial-a-bus, bus priority systems

B. Traffic Restriction
   - partial or complete road closure, driver licensing restrictions, route restrictions, area permits or prohibitions

C. Traffic Restraint*

1. Through The Price Mechanism
   - taxation: parking, auto imports and sales, mileage, gasoline
   - fees: vehicle registration, parking, driving, area permit, bridge use

2. Through Capacity Control
   - limits on roadway expansion, control of parking availability, control of quantity of taxis, or area permit to enter licenses

D. Traffic Avoidance
   - strategic land use planning, enhanced electronic communications systems, encouragement of 'in-home' working, concentration of urban functions that generate transportation demand among themselves

*Normally, techniques of group 1 and 2 would be combined in programs of traffic restraint; as well, strong enforcement activities would be promoted.

Sources:
- Low Cost Urban Transportation Alternatives, Pratt
- Techniques Of Improving Urban Conditions By Restraint Of Road Traffic, OECD
- Methods Of Traffic Limitation In Urban Areas, Thomson
- Urban Transportation Innovation, Brand
- Urban Transport: Studies In Economic Policy, Beesley
down into four main categories according to the primary effect (or intended effect) of each technique. If it is presumed that urban centres will continue to grow in the next 20 years or so, then relief of congestion will undoubtedly have to occur through utilization of techniques which emphasize increases in system capacity. From this perspective, new technologies are likely to be highly favoured since they are likely to lead to larger long-term increases in capacity than many other techniques. Some of the traffic management techniques, for example, are suitable only for small-scale, short-run relief. Roadway expansion, while capable of equally increasing capacity, continues to be out of favour due to its association with the encouragement of automobile traffic. Besides the new technologies, there is some interest in techniques which increase capacity through redistribution of traffic volume. These techniques seek behavioural change by making improvements to the main alternatives to automobiles, or by other mechanisms aimed at automobile users. Generally speaking, these methods involve considerably smaller cost than new technologies, and have a more immediate impact. They also have the advantage that they do not consume more land in transportation activity. These volume redistribution techniques can be categorized as incentives aimed at automobile users, intended to encourage behavioural change.

Continued growth, however, has in the past few years become an undesirable aspect of urban development. It is now felt by some public authorities that it would be desirable to control and reduce the rate of growth of urban areas in Canada. Consequently, methods of alleviating congestion that do not
increase system capacity are viewed as complementary policies which can assist in the process of halting the growth of urban centres in the long run. The techniques of traffic avoidance are well-suited to this new objective, though they are primarily long-range techniques, and still in the conceptual stage. The techniques of traffic restriction, though quickly and cheaply activated, are useful primarily for strictly small-scale, local control of congestion. In effect, the problem of congestion is simply pushed outside the area of restriction. Therefore, of the methods which do not increase capacity, traffic restraint methods appear to be the most interesting at the present time.

These restraint methods are composed of both pricing controls and capacity controls; presumably both approaches would be utilized in a given situation in order to be effective. From the perspective of transportation costs discussed earlier, restraint techniques are the logical choice for reduction of congestion. Like the volume redistribution techniques, they are low-cost and quickly applied. In fact, in the case of pricing controls, some revenue can be expected. However, restraint techniques represent a discouragement directly applied to travel and particularly automobile travel. It may seem to public officials the more prudent course to pursue the incentive policies of volume redistribution mechanisms, instead of the disincentive policies of restraint mechanisms. Note that recent experimentation with transit promotion has apparently had little success in reducing motoring, suggesting that vehicle volume redistribution techniques may have little success by themselves.
2.6. Congestion Pricing Techniques: Some Comparisons

There exist a number of different methods which can be used as pricing schemes for road use. These methods can be classified as directly applied to travel under congested conditions, or indirectly applied through some interfacing object or activity which is charged for (Table 2.3.). From the viewpoint of social cost pricing no approach is likely to be able to set a price equal to marginal social cost. The direct pricing methods are at least theoretically more preferable from this viewpoint, since they respond more closely to road use.

Indirect pricing techniques which are charges upon inputs, such as fuel or tire taxes, purchase fees or annual licences, are not very promising approaches to paying for congestion costs which vary significantly throughout the road system and by time of day. Effluent-oriented mileage charges would also suffer from this criticism. Poll taxes are rejected as too inequitable, because they cannot discriminate even between modes of travel and may have undesirable effects upon employment opportunities without actually lowering traffic volumes. A differential fuel tax would function similarly to an ordinary fuel tax and its ability actually to discriminate by location is doubtful.

Of the other two indirect methods, parking charges and daily licences, the licence approach tends to be favoured in terms of its approximation of marginal social costs pricing, and resultant benefits to society. This approach has the shortcoming that vehicles making short journeys into the congested area suffer the same charge as vehicles that make
**Table 2.3: Congestion Pricing Techniques**

**CHARGING METHODS FOR USE OF ROADS**

**INDIRECT**
- RELATED TO VEHICLE OWNERSHIP
  1. ANNUAL LICENCES
  2. PURCHASE TAX
- RELATED TO VEHICLE USAGE
  3. FUEL TAX
  4. TYRE TAX
- RELATED TO AMOUNT AND PLACE OF USAGE
  5. DIFFERENTIAL FUEL TAX

**DIRECT**
- CHARGES REGISTERED OFF VEHICLES
  - POINT PRICING
    - MANUAL SCANNING
    - AUTOMATIC SCANNING
    - TOLL GATES
    - ELECTRONIC RECORDING
  - ZONE SYSTEMS
    - BOUNDARY CONTROLLED
    - TIME PULSED
      - (TIME REFERENCE IN ROAD)
    - AUTOMATIC UNIT SYSTEMS
      - SINGLE UNIT PER POINT
      - MULTIPLE UNITS PER POINT
- CHARGES REGISTERED ON VEHICLES
  - DRIVER OPERATED
  - AUTOMATIC
    - CONTINUOUS CHARGING WITHIN ZONE
    - FIXED CHARGE ON ENTRY TO ZONE
- TIME BASED
  - (CLOCKWORK OR ELECTRONIC REFERENCE IN VEHICLE)
- DISTANCE BASED
  - (MECHANICAL LINK TO ODOMETER)

**Sources:**
extended trips inside the licensed area. Parking charges are criticised because they can not control through traffic, and because they are more indirect in their impact upon other users. Some investigators have shown that the net benefits gained through pricing are less sensitive to the selection of a non-optimal price when parking charges are utilized. This factor could be a significant point in favour of parking charges, because it would not be likely that an optimal price could be estimated.

The direct methods, for the most part, are still in the experimental stage, but theoretically at least, their ability to vary charges by time-of-day, location, and in some cases, vehicle type gives them the appearance of relative precision. Of these methods the most appealing is point pricing which would use automatic devices to sense the presence of vehicles on a road segment. It would be possible to follow the route of a particular vehicle through the congested area, thereby charging according to differences in journey length and streets used.

On a practical level, direct charge systems lose some of their appeal. They tend to involve the establishment of costly, large-scale networks of electronic technology, or alternatively suffer the time costs associated with alternative manual surveillance systems. Some approaches notably those with monitors on each vehicle, represent a large political change in terms of government involvement with individual behaviour. Administration and enforcement systems for these direct charge systems may not function well. Generally, prepayment or post-payment is necessary, and involves difficulties for
colllection\textsuperscript{52}. This criticism holds for daily licence systems as well. Visibility of the pricing zone for drivers is another practical problem for direct charge systems, and the licence system.

In contrast, the parking charge idea offers several practical advantages. It is a small deviation from present practice, and consequently less likely to raise political opposition in that sense\textsuperscript{53}. It is far cheaper to implement than many of the other road price techniques. It is a system of regulation which is already familiar to road users and administrators\textsuperscript{54}. Therefore, although far from the perfect economic solution, parking charges certainly seem worth investigating in comparison to other road pricing schemes. In any case, the following considerations should be kept in mind concerning choice of pricing mechanism:

"In general, the choice of a pricing strategy depends at least to some extent, on subjective preferences and objectives of policy. This is true even within a relatively limited and static view of technologies and demand structures. Among the range of issues to be considered are development objectives, administrative questions, and welfare issues."\textsuperscript{55}
1. Adapted from Beesley and Roth (1962), p. 184.
3. Smeed (1968), pp. 34-43 generalizing from empirical evidence of the English road system
4. ibid, pp. 42, 64.
6. ibid, p. 7.
8. ibid, p. 334, intersection-by-intersection and between travel times analysis is recommended.
10. ibid, pp. 4-5.
12. The following discussion assumes that the traffic is homogenous: all vehicles the same, all drivers the same, Walters (1961), p. 677.
13. Hansen, p. 35.
19. Pratt, p. 182.
20. Accident data is compared to intersection characteristics, and occasionally traffic volume, but not congestion: Traffic Control And Roadway Elements: Their Relationship To Safety, Automobile Safety Foundation, Washington, 1968-71, Chapters 2, 4.
23. Very gross aggregate estimates can be made, but the understanding of the relationship between health and air pollution is small, Bates, pp. 76-80.
24. Effluent charges are one exception.
25. Braybrooke.
27. Heggie, p. 9. shows that the differences between marginal private cost and marginal social cost under congestion is considerably greater for automobiles as compared to buses.
30. ibid, p. 12.
34. ibid, pp. 51-54.
36. Thomson (1968) suggests that traffic management techniques may actually add to trip length in the long run, pp. 29-30.
37. The Livable Region 1976/1968, GVRD, takes a common compromise position: growth is not to be directly restricted, but decentralized and discouraged by land and transport
development techniques.

38. Owen (1970) discusses some of these techniques, pp. 88-115, 131-133.


41. Kirby, p. 3.


44. Beesley, p. 229.

45. Thomson (1967) shows net benefit from licences exceeds that of parking charges.


47. Wigan & Bamford, p. 12.

48. Kirby, p. 5.

49. Kirby, p. 4.


51. Manufacturers of these systems are hesitant to suggest their use for road pricing for this reason, Kirby, p. 5.

52. When people change jobs, and residence often, traditional collection methods tend to become complicated.

53. Burns, p. 750.


3.1. Introduction

The purpose of this chapter is to review the present state of knowledge concerning the use of the parking price increase technique and to review the relevant basic characteristics of the Vancouver situation so that some insights useful in directing the analysis of this technique can be developed for use in the following chapters. The first section of this chapter discusses programs, actual and proposed, analyses and surveys dealing with parking price increases or some aspect of demand elasticity for automobile travel. The next section reviews a number of characteristics of the primary area of congestion in Vancouver, the downtown peninsula, with emphasis upon transportation considerations. The last section of this chapter suggests a strategy of application for the parking price increase concept to be analyzed in the Vancouver situation.

3.2. A Survey Of Related Experience

The development of the concept of parking price increases into applied public policy as a means of relieving congestion has yet to be completely realized. It should be remembered that experience is limited and evidence available does not permit conclusive findings.
3.2.1. **Characteristics Of The Urban Parking Situation**

In most large cities in North America, most of the congestion and most of the parking spaces tend to be concentrated in the same area: in and around the Central Business District (CBD). Parking spaces within this area tend to serve a broad variety of users and exist under a number of different financial arrangements between user and operator. Governments often subsidize parking activities through land use bylaws and taxation policies. Due to all these considerations, there also exists a number of ways in which congestion pricing of parking facilities can be introduced. It should be recognized that congestion charges must address the large private sector in downtown parking in order to be effective.

Through traffic cannot be assessed congestion charges through the medium of parking prices. This factor is often cited to indicate the possible failure of this mechanism. As flow decreases due to the parking price increase, through traffic may increase in response to the improved roadway conditions. It has been argued that figures utilized to indicate a high proportion of through traffic for CBD's consider too small an area. Examination of a more reasonable approximations of the CBD's suggests that through traffic is a small portion of all traffic, and would not significantly undermine the impact of the price increase technique. Additionally, it is clear that each situation must be examined for its own particular characteristics, since conditions vary widely.

Peak hour travel in the urban core is generally very
congested and consequently dealing with long-term parkers, such as commuters, must be a primary concern of this tool. In this case the role of private parking stalls is even more important, since often the majority of publicly-owned stalls are short-term, on-street facilities.

3.2.2. Parking Price Increase Programs

A number of cases of parking price increases in urban centres will be examined as well as some unsuccessful proposals to implement parking charges. When possible, the discussion below will indicate the intent of the policy, the form or content of the policy, the nature of the affected area, and the impact of the policy upon parking and travel behaviour.

3.2.2.1. San Francisco

Probably the most thoroughly examined example of parking price increases through taxation is the San Francisco experience. In October, 1970 a 25% tax covering the city and county of San Francisco was imposed upon all parking, with the exception of: residential, hotel, military storage, and meter parking. This tax was instigated primarily to raise money, not to alleviate congestion, or any other part of the urban transportation problem. In July 1972, the tax was lowered to 10% due to opposition from affected individuals and business interests, and remains at that level at the present time.

In the municipal parking lots the tax was conferred entirely upon the user. The results are shown in Table 3.1. The number of automobiles parked dropped slightly each year and
the gross revenue dropped proportionately slightly more each year. When the tax was reduced, both revenue and usage increased beyond the pre-tax levels. These results suggest that parking demand is relatively inelastic and that revenues (or profits) are relatively sensitive. This seeming contradiction suggests that there has been a tendency for all types of parkers to decrease their length of stay and for a greater decrease in long-term parking relative to short-term. Rough estimates of elasticities for commuter and shopper demand gathered from garages dominated by one or the other, supports these suggestions.

Information for non-municipal facilities is rather limited. Greater elasticity appeared the further removed the lots were from the city core. It was believed that rate-cutting was widespread. It was concluded that the impact of the parking tax upon the industry was fairly severe, at least in terms of loss of immediate gross revenue.

The general qualitative impression of transportation agency officials and businessmen in the San Francisco area is that the parking tax had no noticeable effect upon congestion. It was calculated that the tax may have reduced vehicular traffic by approximately 2%. It seems reasonable that the tax would have greater effect upon peak hour traffic, and reductions were noted on the Golden Gate Bridge the first month of the tax; however, this may have been due to other changes in the transportation system.

Downtown business interests were strongly opposed to the tax, feeling that it reduced the sales volume they could have
### Table 3.1: Municipal Parking Trends In San Francisco, 1970-1973

<table>
<thead>
<tr>
<th>Fiscal Year</th>
<th>Autos Parked</th>
<th>Gross Income</th>
<th>INDEX (1969-70 = 1.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1969-1970</td>
<td>4,595,144</td>
<td>5,417,955</td>
<td>Autos Parked: 1.00</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Gross Income: 1.00</td>
</tr>
<tr>
<td>1970-1971</td>
<td>4,579,091</td>
<td>5,189,768</td>
<td>Autos Parked: 1.00</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Gross Income: .96</td>
</tr>
<tr>
<td>1971-1972</td>
<td>4,516,494</td>
<td>5,046,734</td>
<td>Autos Parked: .98</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Gross Income: .93</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Gross Income: 1.03</td>
</tr>
</tbody>
</table>
had. The investigation of this case concluded that this opposition was unfounded and rather based upon disappointments from other quarters, such as general economic conditions and suburban competition.\textsuperscript{16}

3.2.2.2. \textbf{Chicago}

In Chicago, a small tax was levied upon downtown parkers of fifteen cents per day. No appreciable reductions in auto trips occurred. The tax was imposed expressly to raise money.\textsuperscript{17}

3.2.2.3. \textbf{Toronto}

A broad program of parking policies, including taxation of users, is being considered in order to deal with congestion in downtown Toronto\textsuperscript{18}. Broadly, this plan calls for restriction upon the amount of parking to be permitted, increased fines for illegal parking activities, and increased rates in the downtown. The outcome of this proposal is not yet known.

3.2.2.4. \textbf{New York}

In 1971, it was proposed to place a $200/year charge upon parking in downtown Manhattan and a $10 fee upon auto use in the downtown area, in an effort to reduce congestion. Downtown businessmen objected strenuously to this proposal and the idea was dropped. However illegal parking fines were raised to $50; interestingly, the courts eventually ruled against these fines as too exorbitant\textsuperscript{19}. 
3.2.2.5. The Environmental Protection Agency

In 1973, a battery of transportation policies, among them parking surcharges, were proposed by this agency for use in the cities of New York, Los Angeles and Washington, D.C. so that these cities would be able to reach future air quality standards. The response in Washington to the parking surcharge proposal was extremely negative and led by business interests. The EPA proposal was a charge of fifty cents per car per day parked in the downtown in 1975, to be raised to $2.00/day by 1977. Eventually, EPA was forced to give up this plan for all cities due to negative response.

3.2.2.6. Conclusions

There are a number of observations which can be made from even the scanty data available here. First of all, no parking price increase scheme directed at reducing automobile travel has been successfully implemented. Any scheme to tax downtown parkers meets stiff resistance from the business community. Evidence from the San Francisco case suggests that commuters are more responsive to parking charges than shoppers.

One explanation of the impotency of previous parking taxation programs can be based upon the above observations. As long as these schemes apply to all downtown parkers indiscriminantly, they will arouse the opposition of a very strong urban pressure group: downtown businessmen. This situation will result in the rejection of the scheme, or the watering down of the increase in parking prices until it is ineffective. It also seems likely that since most of the
implementing bodies had little interest in reducing congestion by discouraging motorists they may not have taken all the steps necessary to ensure that the parking tax would have had such an effect. In fact, in the interests of revenue, fewer motorists discouraged means higher taxes collected depending upon the shape of the demand curve.

3.2.3. Surveys Of Consumer Response

There are two pieces of information concerning consumer response to parking price increases it would be desirable to obtain: how many travellers will discontinue parking at what increase (what is the elasticity of demand); and what will their alternate action be. There have been a number of investigations which attempt to provide answers to the above questions either through analyses of changes in the transport system, or through the results of attitudinal surveys.

The elasticity of demand is often represented as a quantitative measure which indicates the change in demand for a one per cent change in price. The determination of the elasticity of demand for urban transportation is neither a simple nor conclusive exercise. There are both short-term and long-term elasticities; for example, an individual who owns a car may make a different short-term response to improved public transit than he will in the long term once it becomes necessary to purchase another car. A distinction should be made between demand for accessibility and demand for the particular transportation activity. Transportation is not a static or homogeneous activity: it varies with time, place, destination,
price, mode or route. Recognizing all these considerations it is not surprising that a range of elasticities are found for automobile travel. The results of previous investigations concerning the demand elasticity of automobiles are presented in Table 3.2. Where possible, the description of the study indicates whether the data is derived from attitudinal surveys, or some change in the transportation system. Many of these estimates are cross-elasticities between automobiles and some other mode specifically. Surveys dealing directly with response to parking price increases are discussed in more detail below.

The earliest investigation of parking price increases found was conducted in Liverpool, England in 1963. Questionnaires were left on cars parked in the central area of Liverpool. Information concerning journey purpose, and parking use was collected. Respondents were asked to indicate their future parking behaviour under an hourly price increase for parking. There were four ranges of price increase possible; each questionnaire offered only one price increase, so that there were four sub-samples in the survey. Demand elasticities were calculated for various trip purposes, and are shown in Table 3.3. These estimates must be tempered with some qualifications. No data was collected concerning alternative action that the 'priced-off' parker would take. Response to the survey was low (22%), although this result was attributed to the method of distribution, not the subject matter. The author estimated that there was considerable frustrated demand for parking at that time. Finally, this survey was initiated from a viewpoint.
<table>
<thead>
<tr>
<th>STUDY</th>
<th>DESCRIPTION</th>
<th>ELASTICITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moses and Williamson</td>
<td>-calculated % of commuters who would divert to other modes, based upon travel time and trip cost</td>
<td>0.3</td>
</tr>
<tr>
<td></td>
<td>-data came from survey of commuters in Cook County in the Chicago area</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-long-run elasticity permitting capital improvement, change of job or residence</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-would be less for short-run</td>
<td></td>
</tr>
<tr>
<td>M.E. Beesley</td>
<td>-London, 1965</td>
<td>3.3</td>
</tr>
<tr>
<td></td>
<td>-long-run elasticity</td>
<td></td>
</tr>
<tr>
<td>G.R. Brown 1971</td>
<td>-cross-elasticity between car and bus, based upon the question: what is the minimum quality of service you would desire if you were to use normal bus service?</td>
<td>0.5</td>
</tr>
<tr>
<td></td>
<td>-data came from 1967 survey of rush hour travellers using Lion's Gate Bridge</td>
<td></td>
</tr>
<tr>
<td>Charles Rivers Associates</td>
<td>-Boston, 1968</td>
<td>0.495</td>
</tr>
<tr>
<td>Wilbur Smith Associates 1968</td>
<td>-using data from surveys of commuter habits in a number of large cities, a highly generalized cross-elasticity was developed between cars and transit -the cost differences in terms of time and trip price between the existing car and transit commuters was used to develop the diversion curve</td>
<td>0.5-1.0 depending upon value travel time</td>
</tr>
<tr>
<td>R.L. Pratt 1970</td>
<td>-using data from Washington (1965), D.C. commuter surveys, and Twin Cities (1969) survey, a diversion curve is calculated for those commuters considered to have free choice of mode -this yields a cross-elasticity between car and transit, based upon price of trip, travel time</td>
<td>0.82</td>
</tr>
</tbody>
</table>
concerned primarily with the satisfaction of parking demand, not its restriction.

A more recent study of parking price increases was conducted at Oxford, England in 1969\textsuperscript{25}. This study was directed at commuters travelling to work at the University of Oxford, and achieved a very high response rate (85\%). Though a range of income groups were surveyed, it must be recognized that the universe of this survey is a distinct sub-group of society, with perhaps unique attitudes with respect to the subject matter. The survey specifically sought reaction to increased parking prices, both in terms of demand elasticities and alternative behaviour patterns. Respondents were asked what their response would be to two levels of parking price increase; the results are shown in Tables 3.4 and 3.5. The expected regressive distributional effects of this parking charge are observable in the data shown.

There is one more survey from England which is worth mentioning, that carried out in London during 1966 by J.M. Thomson\textsuperscript{26}. The survey collected information concerning behavioural response should parking become unavailable in central London (Table 3.6). Work trip parkers made the most dramatic shift to other modes, while shopping trips appeared most likely to be abandoned. Conceivably, these reactions are closely related to that which would occur under some form of parking charge. The credibility of the results is strengthened by the high response rate (67\%).

In Washington, D.C. there exists a wide range of employee parking policies throughout the government-dominated local
### Table 3.3: Elasticity Of Demand For Parking Space: Liverpool

<table>
<thead>
<tr>
<th>Price Change</th>
<th>To Or From Work</th>
<th>Shopping</th>
<th>Other Purposes</th>
<th>All Parkers</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 to 3d</td>
<td>0.095</td>
<td>0.087</td>
<td>0.075</td>
<td>0.074</td>
</tr>
<tr>
<td>3d to 6d</td>
<td>0.414</td>
<td>0.081</td>
<td>0.081</td>
<td>0.259</td>
</tr>
<tr>
<td>6d to u/-</td>
<td>0.333</td>
<td>0.870</td>
<td>0.525</td>
<td>0.357</td>
</tr>
<tr>
<td>0 to 1/-</td>
<td>0.332</td>
<td>0.391</td>
<td>0.272</td>
<td>0.273</td>
</tr>
</tbody>
</table>

Source: Roth, (1965), p.49.

### Table 3.4: Response To Parking Charges (Car Drivers)

<table>
<thead>
<tr>
<th></th>
<th>Park</th>
<th>Further Out</th>
<th>Abandon Car</th>
<th>Other Answer</th>
<th>No Answer</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pay</td>
<td>291</td>
<td>-</td>
<td>-</td>
<td>6</td>
<td>(0.3)</td>
<td>(14.8)</td>
</tr>
<tr>
<td></td>
<td>(14.5)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Park</td>
<td>139</td>
<td>343</td>
<td>-</td>
<td>2</td>
<td>(0.1)</td>
<td>(24.1)</td>
</tr>
<tr>
<td>Further Out</td>
<td>(6.9)</td>
<td>(17.1)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Abandon Car</td>
<td>121</td>
<td>29</td>
<td>415</td>
<td>4</td>
<td>(0.2)</td>
<td>(28.4)</td>
</tr>
<tr>
<td></td>
<td>(6.0)</td>
<td>(1.5)</td>
<td>(20.7)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other Answer</td>
<td>23</td>
<td>3</td>
<td>2</td>
<td>290</td>
<td>1</td>
<td>(15.9)</td>
</tr>
<tr>
<td></td>
<td>(1.2)</td>
<td>(0.2)</td>
<td>(0.1)</td>
<td>(14.5)</td>
<td>(0.1)</td>
<td></td>
</tr>
<tr>
<td>No Answer</td>
<td>96</td>
<td>54</td>
<td>61</td>
<td>8</td>
<td>118</td>
<td>(16.8)</td>
</tr>
<tr>
<td></td>
<td>(4.8)</td>
<td>(2.7)</td>
<td>(3.0)</td>
<td>(0.4)</td>
<td>(5.9)</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>670</td>
<td>429</td>
<td>478</td>
<td>298</td>
<td>131</td>
<td>2,006</td>
</tr>
<tr>
<td></td>
<td>(33.4)</td>
<td>(21.4)</td>
<td>(23.8)</td>
<td>(14.9)</td>
<td>(6.5)</td>
<td>(100.0)</td>
</tr>
</tbody>
</table>

Source: Heggie, p.22.
### Table 3.5: Elasticity Of Demand For Parking For Different Incomes

<table>
<thead>
<tr>
<th>Assumption 1</th>
<th>Prices (d. per day)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0-30</td>
</tr>
<tr>
<td>Price Range</td>
<td></td>
</tr>
<tr>
<td>Average Price</td>
<td>15</td>
</tr>
<tr>
<td>Income</td>
<td></td>
</tr>
<tr>
<td>Under 900</td>
<td>0.75</td>
</tr>
<tr>
<td>900-1350</td>
<td>0.66</td>
</tr>
<tr>
<td>1350-2400</td>
<td>0.51</td>
</tr>
<tr>
<td>2400-4200</td>
<td>0.30</td>
</tr>
<tr>
<td>Over 4200</td>
<td>0.17</td>
</tr>
<tr>
<td>Unknown</td>
<td>0.55</td>
</tr>
<tr>
<td>Total</td>
<td>0.50</td>
</tr>
</tbody>
</table>

N.B. It is assumed by these calculations that only those who stated they would pay the charge will do so.

Source: adapted from Heggie, p. 24.

### Table 3.6: Reaction To Restraint And Journey Purpose (%)

<table>
<thead>
<tr>
<th>Journey Purpose</th>
<th>Would Use Public Transport</th>
<th>Would Use Taxi</th>
<th>Would Use Walk</th>
<th>Would Not Make Essential Bicycle Journey</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal Work</td>
<td>72</td>
<td>8</td>
<td>7</td>
<td>10</td>
<td>100</td>
</tr>
<tr>
<td>Employer’s Business</td>
<td>51</td>
<td>21</td>
<td>4</td>
<td>17</td>
<td>100</td>
</tr>
<tr>
<td>Personal Business</td>
<td>57</td>
<td>20</td>
<td>4</td>
<td>15</td>
<td>100</td>
</tr>
<tr>
<td>Shopping</td>
<td>59</td>
<td>14</td>
<td>7</td>
<td>19</td>
<td>100</td>
</tr>
<tr>
<td>Meal, Visiting Friends</td>
<td>58</td>
<td>20</td>
<td>5</td>
<td>15</td>
<td>100</td>
</tr>
<tr>
<td>Entertainment</td>
<td>62</td>
<td>21</td>
<td>2</td>
<td>14</td>
<td>100</td>
</tr>
<tr>
<td>Return Home</td>
<td>50</td>
<td>21</td>
<td>14</td>
<td>6</td>
<td>9</td>
</tr>
<tr>
<td>More Than One Purpose</td>
<td>64</td>
<td>18</td>
<td>5</td>
<td>11</td>
<td>2</td>
</tr>
<tr>
<td>All Purposes</td>
<td>62</td>
<td>16</td>
<td>5</td>
<td>13</td>
<td>4</td>
</tr>
</tbody>
</table>

Source: Thomson, p. 46.
economy. Utilizing work trip survey data which indicated whether or not parking was free, and with the aid of a mode-split model, and parking price estimates, changes in travel behaviour based upon parking price increases were projected\(^7\). (Table 3.7.) Using an average current charge of $2.00/day, this data yields an elasticity estimate of \(-.41\) for auto driver trips and a cross-elasticity of \(.38\) for bus passenger trips.

There have been other analyses of this particular idea made in articles or studies concerned primarily with a much broader subject area. One such study is that conducted by Quarmby concerning travel mode for the journey to work\(^8\). This study develops a statistical model of modal choice based upon travel time, costs, economic status of the traveller and trip purpose, used predictively in combination with a number of urban transportation policy changes. Beginning with a 69%-31% split between the automobile and public transit, two increments of parking charge increases were made. The model indicates that for increase in price of \(1/20\), \(3/20\) of an English pound, mode split would change to 57%-43% or 41%-59%. These predictions were based upon 1966 incomes and prices.

Finally, there is one survey that has been carried out in the Vancouver area that has had some concern with parking charges. In 1966, N.D. Lea & Associates conducted a survey of morning rush hour patrons of the Lion's Gate Bridge. In 1972, a brief report was issued which analyzed some of the results of this survey\(^9\). In that report it is stated that the survey results show that parking prices would have to increase from an average of $0.55 to $1.00 in order to produce the 50% shift to
Table 3.7: Projected Changes In Travel Behaviour Resulting From A Parking Tax In Washington, D.C.

Percentage Change In
Increase In
Average Parking Cost | Auto Driver Trips | Transit Trips
--- | --- | ---
$.25 | -4 | +3
.50 | -8 | +6
.75 | -12 | +10
1.00 | -15 | +13
1.50 | -20 | +20
2.00 | -23 | +26
2.50 | -26 | +33
3.00 | -29 | +38
3.50 | -31 | +42
4.00 | -34 | +47
4.50 | -36 | +51
5.00 | -37 | +55

bus transit. This data is sufficient to calculate a price elasticity of approximately 0.6. Though this survey undoubtedly has the most relevance for the current study, its results must be qualified by the narrow focus of the survey, and the events of half a decade.

3.2.4. Implications For Parking Price Increase Policies

It appears from the literature that the elasticity of automobile demand with respect to parking price increases elsewhere in North America and Britain is not very high. An elasticity of around -0.3 or -0.4 for work trips appears consistent with the information available. The Vancouver data may be distorted, since the study area is the most congested entranceway to the downtown area during rush hour. Clearly, parking price increases ought not to be considered as a stand-alone policy for the relief of congestion in our urban centres. It is clear that a number of undesirable avoidance activities would occur should a parking price increase program be implemented: illegal parking, employer reimbursements, chauffered work trips. Since no application of parking price increases has been implemented which has been specifically directed at reducing automobile trips or reducing congestion then it may be that better results could be expected when such an objective is truly sought.

The results of elasticities compared by trip purpose at first appear somewhat confusing: the San Francisco case indicates that commuter demand is more elastic, while the Liverpool results indicate that shopping trips have more elastic
demand. This apparent contradiction may be explained as follows: work trip parkers have a higher cross-elasticity to other modes, while shoppers have a higher elasticity to discontinue the trip entirely. This viewpoint is supported by the evidence of the Thomson study.

Political opposition to increased parking prices appears to be a highly significant factor in determining success. This opposition is led by downtown business interests, who do not want charges applied to shoppers. For this reason, and because of the concentration of congestion in the peak hours, it may be desirable to investigate the potential of parking charges applied selectively to commuter parking. However, the problem of subsidized or free parking for employees will have to be overcome.

3.3. The Vancouver Context

The advantages and disadvantages of the parking price increase mechanism, and its method of implementation, must be examined within the specific context of the Vancouver situation. A review of some of the characteristics of the urban centre of Vancouver follows.

3.3.1. Congestion

Due to the resources that would have to be given to the task of measurement of congestion in Vancouver (see 2.3.) this particular analysis will not be carried out. It is commonly accepted that the more congested traffic situations exist predominantly in the peak hours and in the downtown peninsula.
and also along the major routes into the city centre. This condition is illustrated in Figure 3.1. The charts show volume of flow into the downtown for the Granville St. and Burrard St. bridges for the years 1960 and 1973. The base period volumes have increased by 40-50% while the morning peak hour volumes have only been able to increase by 10%. It appears that peak hour flow restricted from volume increase due to road capacity has spread in time from one hour to two in an effort to accommodate the increase in demand. Certainly travellers experience some congestion at these points during the rush hours. Some further suggestion of the extent of congestion within the downtown is shown by the problems created for traffic flow by recent construction projects.

3.3.2. Land Use

Basic land use patterns in and nearby the downtown peninsula are shown in Figure 3.2. It is important to remember that the downtown area is contained almost entirely on a peninsula which is accessible from three quarters of the compass only by a few bridges. Land use can be divided into two basic zones: the West End residential area; the business district. Of course, neither area is entirely homogeneous in use, and throughout the downtown there exist a number of special areas; for example: the Granville Mall, Chinatown, St. Paul's hospital, False Creek. Accordingly, the parking price increase scheme will probably have to adapt not only to major land use divisions, but to some of these local deviations within a single zone. It should be noted that the business district extends
PeAK HOUR AND BASE ROAD TRAFFIC VOLUMES

Figure 3.1.

<table>
<thead>
<tr>
<th>Hour</th>
<th>7:00-8:00</th>
<th>8:00-9:00</th>
<th>9:00-10:00</th>
<th>10:00-11:00</th>
<th>11:00-12:00</th>
<th>12:00-1:00</th>
<th>1:00-2:00</th>
<th>2:00-3:00</th>
<th>3:00-4:00</th>
</tr>
</thead>
<tbody>
<tr>
<td>1973</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1980</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Bridge: Everyone Bridge

Northbound:

- 1973
- 1980
beyond the downtown boundaries defined by City Hall: the peninsula, excluding Stanley Park, and including all east to Main St. Particularly, considerable commercial activity centres on Broadway to the south, and past Main to the east.

3.3.3. Transportation Patterns

At the present time, there are three major methods of transportation available in downtown Vancouver: by foot, by car or by bus. A small portion of travellers utilize the park 'n' ride system which combines the car and bus modes. People also travel by taxi, motorcycle or bicycle. Attention here will concentrate upon motor vehicle traffic, and primarily upon private vehicles.

The pattern of morning peak hour flows into the downtown area is shown in Figure 3.3. Within the downtown area, traffic is regulated on many streets by a number of traffic management measures: reversible lanes on Georgia St.; one-way north-south streets east of Burrard; 'no turn' restrictions on Burrard, Hastings, Pender and Georgia Streets during certain hours. It is possible that the limits of effectiveness of these measures may have been reached in the downtown. In the West End residential area, traffic barricades exist to discourage through traffic except on the main streets.

3.3.4. Parking Opportunities

There currently exists a very broad range of parking opportunities in the downtown peninsula. There are different types of parking facilities in terms of: physical
character; costs to the user; restriction on use; enforcement of restrictions; techniques of operation. As well quantity and type of demand for parking and quantity and type of supply vary from area to area within the downtown.

The distribution of total parking supply among the categories of facilities is an important factor to consider in the development of a parking price increase system. Data from an inventory of existing facilities conducted in 1971 demonstrates several interesting characteristics of the Vancouver parking supply. Approximately 13% of all parking stalls were short-term, on-street facilities. Combining this figure with more recent estimates of Downtown Parking Commission public, off-street, short-term stalls, then about 17% of all stalls could be said to be aimed exclusively at short-term parkers. Conversely, it should also be noted that many commercial outlets tend to favour all-day parkers in their pricing schemes. Furthermore, about 23% of the off-street stalls were at that time free or restricted in use; this percentage may have grown over the intervening period due to the pace of office tower construction.

Enforcement of downtown parking regulations is minimal. Currently there are five policemen who attempt to enforce parking regulations throughout the City while not occupied with more important duties. A recent survey of illegal parking in the downtown indicates that about 40% of all curb space in the central business district experiences about 30% per day illegal use.
3.3.5. **Problems Associated With Congestion**

As was discussed in Chapter Two (see 2.4.2. and 2.4.3.), it is difficult to describe in quantitative terms the effects of congestion since in many cases data is very poor or there is uncertainty concerning the relationship with congestion. The available information is summarized below.

### 3.3.5.1. Air Pollution

The air pollution problem in British Columbia at the present time can be categorized as emergent: that is, isolated and short-lived serious situations have occurred, but as yet no recurrent major problems exist. In the Vancouver area, gaseous contaminants present the major threat:

> "The level of gaseous contaminants at which minor adverse effects occur has now been reached. These effects will become more serious and pronounced in the future, unless corrective action is taken."\(^4^3\)

Transportation is the primary source for emissions of these gaseous pollutants: "transportation... produces 84% of the carbon monoxide, 87% of the hydrocarbons, and 70% of the oxides of nitrogen."\(^4^4\). Special concern has been raised over the potential problem of severe smog.\(^4^5\) Hydrocarbons and oxides of nitrogen react in the presence of sunlight to form oxides and other oxidants. Levels of these pollutants are sufficient in the Vancouver area for this process to begin.

### 3.3.5.2. Noise Pollution

A recent survey of GVRD residents indicated that traffic noise is considered the most significant source of this type of pollution in Vancouver.\(^4^6\) A one-shot survey of traffic noise
from curbside was conducted around the block of Robson, Granville, Georgia, and Seymour streets in 1972. Taken during the hours from one p.m. to six p.m. the noise level hovered fairly consistently between about 78 DBA and 88 DBA.

3.3.6. **Political And Administrative Involvement**

Information concerning the powers, policies and behaviour of the various involved entities will be discussed during the analysis in Chapter Five. At this time, it is necessary only to recognize that various governmental bodies and political pressure groups do have a role in the success and failure of planning policies in Vancouver.

3.3.7. **Future Downtown Development**

Development in the downtown in the immediate future appears to be characterized by strong growth in terms of residential population, employment and office development. A study published last year offers an 'extremely conservative' estimate of 142,000-145,000 total employment downtown by 1980. If roughly the same division of volume between commuting modes resulted, then it is extremely doubtful that the roadway system could handle these volumes in the same length rush hour.

The outlook for public transit is one of continual pressure upon the capacity of the system. Demand for bus and streetcar vehicles has increased considerably in North America, while supply is limited. Bus transit is expected to be the only transit until at least 1980. If necessary, extra capacity could be added to the system if special needs arose.
Another aspect of the growth potential of the downtown area is outward expansion. As land values continue to rise, growth in the CBD activities may shift outside the peninsula. Parking facilities may duplicate this pattern, as well as changing form and prices within the peninsula. Unfortunately, understanding of the forces operating to cause these changes is very poor.

Another difficult to predict, but important, influence is the effect of the state of the economy upon lifestyles and patterns of growth in Vancouver. At the present time growth in our national economy is slowing considerably and gasoline costs continue to rise. It may be that the above forecast of growth is incorrect under these conditions.

3.4. Commuter Parking Price Increases For Vancouver

Some specific features of the Vancouver situation suggest that a parking price increase program may be useful here. Congestion is concentrated primarily in the downtown and along the major access routes to the urban centre. Therefore it seems reasonable to direct restraint programs toward downtown users. Due to the isolated physical nature of the downtown peninsula, most motorists park in a fairly small and compact area. Through traffic in the downtown is fairly low and need not be considered an adverse factor. Consequently a well-defined area exists in which to apply a parking price increase program. There is some interest in this idea at a governmental level as well.

There are also a number of reasons for choosing to focus upon commuters who park downtown:

1. This group can be identified with the largest
concentration of congestion costs: the peak hours

2. Applying economic disincentives to commuter trips (provided there is alternative transport) is least likely to disturb the current functioning of the downtown. Parking price increases can be easily discontinued, or modified. Actual application to a small, relatively 'safe' sector of the market permits the exploration of the strengths and weaknesses of this idea in practice, without restricting the field of further action.

3. A particularly attractive side benefit of parking price increases applied to downtown commuters is the necessary growth of the public transit system. The increased capacity will be available for other use during the rest of the day.

4. Opposition to parking price increases pursued in this manner should be at a minimum. The public should not become overly concerned provided alternative modes can absorb 'priced-off' commuters. Tourists and shoppers should be relatively unaffected and therefore downtown businesses should be less likely to oppose such a program.

Consequently this study will focus its analysis upon a program of parking price increases to be directed primarily at downtown commuters. It will be assumed that the increases will be applied solely within the downtown peninsula, bounded on the east by Main St., since this is an obvious and clear boundary encompassing almost the entirety of downtown parking.
1. Kulash (1212-1), pp. 3-5.
2. ibid, p. 5.
3. ibid, p. 9.
4. Heggie, pp. 16-17 and Kulash (1), pp. 9-18 who argues that about 15-30% is through traffic.
8. ibid, pp. 12.
10. ibid, pp. 16-17.
11. ibid, pp. 18-21.
12. ibid, p. 23.
15. ibid, pp. 26-28.
16. ibid, pp. 31-36.
17. From a letter received from the City of Chicago, August, 1974.
19. This information summarized from the New York Times, March 5, 6, 10, 1971.
23. Some of the elasticity estimates are available only from secondary sources.
31. ibid, p. 47.
32. Kulash (9) also suggests this, p. 41.
34. Turn Down Traffic Volume, p. 9, since downtown has also grown rapidly it can be presumed that rush hour traffic volumes would approach similar magnitude increases as base hours.
35. Province, March 18, 1974, p. 25 referring to Granville Mall construction.
37. 1971 Downtown Parking Inventory Study, Engineering Department, City of Vancouver.
38. Parking Engineer, City of Vancouver.
43. Lynch, p. 90.
44. *ibid*, p. 1.
47. *The Vancouver Soundscape*, World Soundscape, Simon Fraser University.
49. Interview, Ian Graham, Bureau Of Transit, June, 1974.
50. Interview, Parking Engineer, City Of Vancouver, July, 1974.
51. *Province* June 14, 1975, p. 1, GNP Drops 1.45 % In Last Quarter.
CHAPTER FOUR: PARKING PRICE INCREASES IN VANCOUVER: TECHNICAL PERFORMANCE

4.1. Introduction

This chapter presents the analysis of the technical performance of a parking price increase system directed at downtown commuters in Vancouver. The first section of this chapter describes a questionnaire survey conducted in order to assess the behavioural response of downtown commuters to a number of different parking price increases. The next section considers the variety of possible effects that a parking price increase system might initiate in Vancouver. Concentrating primarily upon the downtown area, consideration is given to: physical effects upon the transportation system and land use; economic effects; environmental effects. The concluding sections deal with the practical considerations that can be identified as important to the successful implementation of this policy.

4.2. The Parking Price Increase Survey

In the summer of 1974, a questionnaire survey was given to commuters working in the downtown area of Vancouver. This survey was designed to uncover the work travel behaviour of commuters and their attitudes and hypothetical behaviour towards a series of parking price increases. In the following sections, the methodology utilized by the survey, and the results obtained will be discussed.
4.2.1. **Survey Design**

The primary objectives of this survey were to sample downtown automobile commuters in order to determine at what level of price increase they would discontinue parking and what alternative course of action would then be taken. Knowledge concerning the socio-economic characteristics and travel behaviour of all types of downtown commuters was considered to be useful secondary data to acquire for examination of automobile commuter's expectations concerning bus transit. The design was to allow generalization of the responses to a large a portion of the commuter universe as possible.

A large range of possibilities exist for information collection through attitude surveys. In order to understand the strengths and weaknesses of the results obtained it will be useful to describe the methodology utilized and the reasons for its choice.

4.2.1.1. **Type Of Survey**

A questionnaire survey was decided upon primarily because the resources of the study precluded anything else. Although questionnaire surveys may be more subject to misinterpretation of questions by respondents and may suffer from lower response rates they are far less expensive and consume less manpower than interview surveys. Furthermore the results of questionnaire surveys are standardized and therefore more totally comparable. Since the information sought by this survey requires only simple responses it was felt that standardization would not unduly limit subjects responses.
4.2.1.2. The Choice Of Population Universe

Although the survey was aimed primarily at downtown automobile commuters, there were a number of different ways in which the population universe could be drawn:

1. All downtown employees, or some subgroup.
2. All downtown parkers or some subgroup.
3. All those persons travelling into the downtown during the morning rush, or some subgroup.
4. All regional residents who work downtown, or some subgroup.

It should be noted that each approach, if carried out successfully, would offer different advantages in terms of information obtained. The fourth possibility was quickly eliminated because no sampling frame is available which identifies an individual with both his place of work and his place of residence. The third population, that of downtown rush-hour travellers, would provide extra information about through traffic levels. However, the practical difficulties of this approach are extreme. Teams of workers would have to interfere with traffic at the intersections which approach the downtown. Aside from the resources required, this activity would incur a safety problem and probably obstruct rush-hour traffic.\(^2\)

Utilizing downtown parkers as the sampling universe is common practice for this type of survey. This would require obtaining permission to enter a number of private parking facilities, and would also require a team of workers. Furthermore, on-street and lane parking would likely be
underrepresented in the results because of the difficulties of distribution. Consequently, downtown employees as a whole were chosen as the population universe. Sampling this universe was very easily and cheaply done by distributing mailback questionnaires to their employers for re-distribution among their workers. A sampling frame for downtown businesses does exist in the form of City of Vancouver business licence registrations. It was felt that the implied approval or authority given by the method of distribution would result in high response rates. Within this universe, the variety of parking facility types will be represented and the characteristics and behaviour of non-automobile commuters available. With the hoped for high response rate a relatively small distribution would yield the necessary automobile commuter returns.

4.2.1.3. The Survey Samples

It should be noted to begin with that a random sample of downtown businesses returning questionnaires from all their employees is not necessarily a random sample of downtown commuters. The analysis of these results may not be as reliably generalizable to the population universe of downtown commuters as a perfectly random sample. However, no one method of sampling is 'best' for every situation and survey, and in the opinion of this author the sample chosen is satisfactory.

There were actually three separate subsamples utilized in this survey. All samples consist of randomly selected business firms: a sample of all downtown businesses which have employment
of one hundred persons or less (excluding hotels, taxi firms, government offices contractors and rent-a-car firms); all downtown businesses which have employment of over one hundred persons in the same office (excluding hotels, contractors, and merchandizers); a sample taken from a limited number of employees of a randomly chosen large merchandizer (employment over one hundred persons). This procedure was carried out for the following reasons:

1. The only list available which approaches an acceptable frame of most downtown businesses is the City of Vancouver's Business Licence File (BLF). Unfortunately, it suffers from a number of shortcomings. Duplications exist in the sense that restaurants and law firms often have several licences. Inadequacy exists in that contractors, hotels, taxis, rent-a-car firms and government offices are excluded from this list*. The listing is incomplete especially in one vital aspect: the number of employees for each licence is generally unknown. The list is somewhat out-of-date and inaccurate.

2. It was not possible to obtain a random sample of firms with probability weighted according to employment from the BLF. It seemed likely that large firms, and large firms with specialized functions, would be underrepresented in the results should a simple random selection be taken from this list.

3. In downtown Vancouver, four large merchandizing firms represent approximately 4,800 employees (nearly
.5% of present downtown employment). These firms are a key component of the downtown character and should not be ignored, yet each one is too large to sample entirely.

Ideally, sample size should be calculated from the standard error involved in this random sample\(^5\). Preknowledge of the magnitude of sampling error would be difficult to obtain in this case. Often an arbitrary target figure, such as 500 units, is utilized for large samples\(^6\). For this study it was estimated that a supply of approximately 3000 questionnaires would be sufficient to obtain 500 responses from each major sub-universe. Due to the impossibility of knowing how exactly how many employees a firm would have, sample size goals were roughly set for the subsamples; between 600-700 questionnaires were distributed to the small and large firms and the remainder to be utilized by the merchandizer.

4.2.1.4. Possible Sources Of Bias

It is difficult in the case of this survey to determine what biases may exist in the results. There are two reasons for this situation: the paucity of data concerning transportation flows and employee characteristics in downtown Vancouver; the unique structure of the survey sample, which undermines the value of comparisons against available separate data sources. Some recognition of the possible areas for bias should be made nevertheless.

Originally, it was intended to use the questionnaire identifying numbers to indicate exactly which questionnaires
were given to which firm. It would then have been possible to compare response rates among firm types and to do follow-ups on those firms whose employee's responses exhibited some peculiarity. Unfortunately due to a mix-up in the printing of the questionnaires it became subsequently infeasible to do this.

Another possible source of bias is through non-response. As was mentioned earlier, there are a number of employment sub-categories which have been excluded from the survey samples. Those exclusions which could be expected to travel during the rush hour are not seen as likely to have significant differences in response.

One non-response bias that could exist involves income distribution. It is conceivable that the higher levels of management in a number of the firms may have felt that they were too busy to fill out the questionnaire. If income correlates with attitude toward parking price increases, as seems likely, then this type of bias could be important. This is difficult to assess due to lack of information for comparison purposes.

Another possible source of bias from non-response is the mode split of respondents; it may be that automobile commuters sampled declined to respond rather than to indicate their disapproval on the form. Table 4.1 indicates the mode split for all three subsample results, plus a composite mode split for the population universe. Also shown are the mode split figures given by cordon counts in 1973. By arbitrarily assuming a 10% through traffic figure for automobile travellers for all entrances but the Lion's Gate Bridge, and also assuming some
Table 4.1. Mode Split Percentages For All Subsamples

<table>
<thead>
<tr>
<th>Mode</th>
<th>Firms</th>
<th>Firms</th>
<th>Firms</th>
<th>Split</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Car</td>
<td>46</td>
<td>43</td>
<td>30</td>
<td>45</td>
<td>57</td>
</tr>
<tr>
<td>Bus</td>
<td>47</td>
<td>50</td>
<td>68</td>
<td>49</td>
<td>38</td>
</tr>
<tr>
<td>Other</td>
<td>7</td>
<td>7</td>
<td>2</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>
600 persons would enter the downtown by automobile on non-work trips between 7 A.M. and 9 A.M. then the mode split percentages given by the cordon are purposely low so that it can be shown that it is safe to assume that the survey mode split is not significantly different from reality.

4.2.2. Survey Analysis

This section of the report will summarize the relevant data gathered by the questionnaire survey in terms of the three subsamples and also generalizations to the population universe from which they were drawn. It should be noted that the response rate for this survey was quite high; the aggregate response rate was 51.9% or 1450 returned out of 2793 delivered. The larger the usable sample the less the true sampling error will be; therefore to some extent, the better the results.

4.2.2.1. Subsample Analysis

Some useful observations can be made from an examination of the distribution of characteristics and attitudes that are shown in the simple tabulation of the responses in the questionnaire returns. To begin with, there exists some differences in the response rate of each subsample (Table 4.2.). It is possible that small firms and their employees felt less of an obligation to respond to the questionnaire, which may explain the lower response rate in the subsample.

Noting the mode split for the three subsamples (Table 4.3.), it may be instead that the slightly higher proportion of automobile commuters was a factor in the lower response from
### Table 4.2: Response Rate By Subsample

<table>
<thead>
<tr>
<th>Subsample</th>
<th>Response Rate(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small Firms</td>
<td>45.0% (536/1190)</td>
</tr>
<tr>
<td>Large Firms</td>
<td>57.1% (799/1400)</td>
</tr>
<tr>
<td>Large Merchandizers</td>
<td>56.7% (115/203)</td>
</tr>
</tbody>
</table>

### Table 4.3: Mode Split By Subsample

<table>
<thead>
<tr>
<th>Mode</th>
<th>% Of Response</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Small_F.</td>
</tr>
<tr>
<td>Car</td>
<td>46.1</td>
</tr>
<tr>
<td>Bus</td>
<td>47.4</td>
</tr>
<tr>
<td>Walk, Bicylce or motorcycle</td>
<td>6.0</td>
</tr>
<tr>
<td>Taxi</td>
<td>0.2</td>
</tr>
<tr>
<td>Other</td>
<td>0.4</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
</tr>
</tbody>
</table>

### Table 4.4: Payment For Parking By Subsample

<table>
<thead>
<tr>
<th>Type</th>
<th>% Of Response</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Small_F.</td>
</tr>
<tr>
<td>On-street</td>
<td>4.5</td>
</tr>
<tr>
<td>Stall Controlled By Place Of Work</td>
<td>46.5</td>
</tr>
<tr>
<td>Commercial Stall</td>
<td>40.5</td>
</tr>
<tr>
<td>Stall Associated With A Residence</td>
<td>2.0</td>
</tr>
<tr>
<td>Unorganized Space</td>
<td>1.2</td>
</tr>
<tr>
<td>Not Parked Downtown</td>
<td>0.8</td>
</tr>
<tr>
<td>Don't Know</td>
<td>0.4</td>
</tr>
<tr>
<td>Other</td>
<td>0.4</td>
</tr>
<tr>
<td>No Response</td>
<td>3.6</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
</tr>
</tbody>
</table>
small firms. In the discussion of bias, it was suggested that for the survey as a whole, the mode split appears fairly similar to that of the population universe. The differences between samples seem understandable. A number of reasons exist why a small firm may have a higher proportion of automobile commuters and also why they may be more resistant to the questionnaire: ease of parking on the lot of a small building; necessity due to work function; likelihood of the site being a greater distance from transit routes. In the case of large merchandizing firms, many employees are female and therefore perhaps less likely to have access to an automobile. Also, few spaces are held by the company for employees, but rather encouraged for customers.

Turning to present parking behaviour, it is interesting to note the generally high proportion of parkers who do not pay anything themselves for the privilege (Table 4.4). This factor is quite strong in the case of employees of small firms. Cross-tabulation with the types of facilities used (Table 4.5.) indicates that 84.7% of all automobile commuters in small firms which park at work-related facilities do not pay anything for parking. This statistic reinforces the intuitive conclusion that parking price increases may be more difficult to administer in the case of small firms. In general, it is clear that the vast majority of parkers presently utilize space already controlled in some way, either by their place of work or some parking enterprise.

The duration of parking activity carried out on a workday also varies from subsample to subsample (Table 4.6.). The lower proportion of small firm employees parking for a full day (over


### Table 4.5: Parking Facility Utilization By Subsample

<table>
<thead>
<tr>
<th>Payment</th>
<th>% Of Response</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Small P.</td>
</tr>
<tr>
<td>Daily</td>
<td>12.5</td>
</tr>
<tr>
<td>Monthly</td>
<td>29.6</td>
</tr>
<tr>
<td>Free</td>
<td>52.2</td>
</tr>
<tr>
<td>No Response</td>
<td>5.7</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
</tr>
</tbody>
</table>

### Table 4.6: Duration Of Parking By Subsample

<table>
<thead>
<tr>
<th>Number Of Hours</th>
<th>% Of Response</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Small P.</td>
</tr>
<tr>
<td>1 hour or less</td>
<td>4.5</td>
</tr>
<tr>
<td>over 1 to 2</td>
<td>2.0</td>
</tr>
<tr>
<td>over 2 to 3</td>
<td>4.5</td>
</tr>
<tr>
<td>over 3 to 4</td>
<td>10.5</td>
</tr>
<tr>
<td>over 4 to 5</td>
<td>4.0</td>
</tr>
<tr>
<td>over 5 to 6</td>
<td>11.3</td>
</tr>
<tr>
<td>over 6 to 7</td>
<td>8.1</td>
</tr>
<tr>
<td>over 7 to 8</td>
<td>31.6</td>
</tr>
<tr>
<td>over 8 to 9</td>
<td>15.8</td>
</tr>
<tr>
<td>over 9 to 10</td>
<td>3.6</td>
</tr>
<tr>
<td>over 10 to 11</td>
<td>0.8</td>
</tr>
<tr>
<td>No Response</td>
<td>3.2</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
</tr>
</tbody>
</table>
7 hours) also suggest that control of these parkers may be difficult. Still, the majority of all commuters park for a full day.

Turning to that part of the questionnaire concerned with the attitudes of automobile commuters it was first attempted to establish what proportion of commuters felt that use of their automobile for work trips was essential and for what reason. Table 4.7. indicates the proportion of parkers who feel the car is essential and Table 4.8. indicates the reasons given. Clearly a large percentage of all subsamples feel their automobile is necessary for the work journey. It is interesting to note that commuter vehicles may make a significant contribution to off-peak congestion, judging by the popularity of travel during work hours.

Some confusion and uncertainty on the part of respondents is indicated by their response to questions concerning the hypothetical parking price increases. Respondents were asked to indicate at what level of increase in parking price they would discontinue parking downtown. It was stressed that respondents assume they themselves would pay the increase. The results are presented in Table 4.9. Once again there are noticeable differences between subsamples. The patterns of pricing-off will be examined in more detail when generalizing to the population universe. However, it is worth noting the discrepancies between the response to the question concerning the essential need for the car and the response to this question. The sum of the 'no response' and 'willing to pay more than $2.00' categories falls far short of the percentage of
Table 4.7.: Attitude Toward Automobile As Work Trip Vehicle By Subsample

<table>
<thead>
<tr>
<th>Response</th>
<th>Small F.</th>
<th>Large F.</th>
<th>Merchand.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes, Car Is Essential</td>
<td>69.6</td>
<td>53.6</td>
<td>57.1</td>
</tr>
<tr>
<td>No, Car Is Not Essential</td>
<td>29.6</td>
<td>44.2</td>
<td>34.3</td>
</tr>
<tr>
<td>No Response</td>
<td>0.2</td>
<td>2.3</td>
<td>8.6</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

Table 4.8.: Prime Reason Why Car Is Essential By Subsample

<table>
<thead>
<tr>
<th>Reason</th>
<th>Small F.</th>
<th>Large F.</th>
<th>Merchand.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Need Vehicle For Day Trip</td>
<td>44.2</td>
<td>31.3</td>
<td>55.0</td>
</tr>
<tr>
<td>Transporting Objects</td>
<td>3.5</td>
<td>1.1</td>
<td>-</td>
</tr>
<tr>
<td>Often Stay Late/ Irregular Hours</td>
<td>14.5</td>
<td>11.1</td>
<td>5.0</td>
</tr>
<tr>
<td>Only Acceptable Means Of Travel</td>
<td>20.9</td>
<td>37.2</td>
<td>40.0</td>
</tr>
<tr>
<td>Other</td>
<td>0.6</td>
<td>2.1</td>
<td>-</td>
</tr>
<tr>
<td>No Response</td>
<td>16.3</td>
<td>17.0</td>
<td>5.0</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>
Table 4.9.: Response To Parking Price Increases By Subsample

<table>
<thead>
<tr>
<th>Daily Increase (Monthly Increase)</th>
<th>Small F.</th>
<th>Large F.</th>
<th>Merhand.</th>
</tr>
</thead>
<tbody>
<tr>
<td>$ .10 more ($2.00 more)</td>
<td>9.7</td>
<td>8.0</td>
<td>11.4</td>
</tr>
<tr>
<td>$ .20 more ($4.00 more)</td>
<td>5.3</td>
<td>6.3</td>
<td>11.4</td>
</tr>
<tr>
<td>$ .30 more ($6.00 more)</td>
<td>5.7</td>
<td>6.3</td>
<td>20.0</td>
</tr>
<tr>
<td>$ .40 more ($8.00 more)</td>
<td>1.6</td>
<td>4.6</td>
<td>5.7</td>
</tr>
<tr>
<td>$ .50 more ($10.00 more)</td>
<td>17.8</td>
<td>23.6</td>
<td>22.9</td>
</tr>
<tr>
<td>$ .60 more ($12.00 more)</td>
<td>0.8</td>
<td>2.6</td>
<td>5.7</td>
</tr>
<tr>
<td>$ .70 more ($14.00 more)</td>
<td>0.4</td>
<td>4.0</td>
<td>2.9</td>
</tr>
<tr>
<td>$ .80 more ($16.00 more)</td>
<td>2.0</td>
<td>1.7</td>
<td>-</td>
</tr>
<tr>
<td>$ .90 more ($18.00 more)</td>
<td>-</td>
<td>0.3</td>
<td>-</td>
</tr>
<tr>
<td>$1.00 more ($20.00 more)</td>
<td>15.8</td>
<td>16.5</td>
<td>8.6</td>
</tr>
<tr>
<td>$1.10 more ($22.00 more)</td>
<td>1.2</td>
<td>1.4</td>
<td>-</td>
</tr>
<tr>
<td>$1.20 more ($24.00 more)</td>
<td>0.4</td>
<td>0.3</td>
<td>2.9</td>
</tr>
<tr>
<td>$1.30 more ($26.00 more)</td>
<td>1.2</td>
<td>0.3</td>
<td>-</td>
</tr>
<tr>
<td>$1.40 more ($28.00 more)</td>
<td>0.4</td>
<td>0.3</td>
<td>-</td>
</tr>
<tr>
<td>$1.50 more ($30.00 more)</td>
<td>5.7</td>
<td>1.1</td>
<td>-</td>
</tr>
<tr>
<td>$1.60 more ($32.00 more)</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>$1.70 more ($34.00 more)</td>
<td>0.4</td>
<td>0.3</td>
<td>-</td>
</tr>
<tr>
<td>$1.80 more ($36.00 more)</td>
<td>-</td>
<td>0.6</td>
<td>-</td>
</tr>
<tr>
<td>$1.90 more ($38.00 more)</td>
<td>-</td>
<td>0.3</td>
<td>-</td>
</tr>
<tr>
<td>$2.00 more ($40.00 more)</td>
<td>2.8</td>
<td>2.3</td>
<td>2.9</td>
</tr>
</tbody>
</table>

Willing to pay increase greater than $2.00 more daily (or $40.00 more monthly):

<table>
<thead>
<tr>
<th></th>
<th>Small F.</th>
<th>Large F.</th>
<th>Merhand.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Willing to pay</td>
<td>17.0</td>
<td>7.1</td>
<td>-</td>
</tr>
<tr>
<td>No Response</td>
<td>12.1</td>
<td>12.3</td>
<td>5.7</td>
</tr>
</tbody>
</table>

Total

100      100         100
commuters in each subsample who indicated they felt the car to be essential for work trips. This contradiction may indicate that a large number of automobile commuters will resent the parking price increase program, although they may actually be discouraged from driving by it. It could be that respondents deliberately responded at a lower level of increase than they would discontinue in reality; for the most part, it is felt that this type of response is unlikely.

In conjunction with the question concerning parking price increases, respondents were asked what alternative action they would take once they discontinued parking. The results are shown in Table 4.10. Unfortunately, it seems likely that a significant degree of uncertainty and unreliability is inherent in the response to this question. This viewpoint is borne out by the relatively high proportion of non-response for this question with the exception of the large merchandizing firm sample. It is difficult to interpret the distribution of percentage response to the given alternatives. It seems likely that many automobile commuters lack experience with most alternatives or are uncertain of the particular circumstances that might exist under the parking price increase program. For instance, many commuters appear to believe that they would park elsewhere; perhaps it was not clear that the entire downtown would be within the increase zone. Also auto commuters were asked how often they used the bus system (Table 4.11.). Another cause of uncertainty for the results of the alternative behaviour question is the realization that two alternative actions were not offered in prepared format: re-location of the
Table 4.10: Alternative Action After Discontinuing Parking By Subsample

<table>
<thead>
<tr>
<th>Alternative</th>
<th>Small F.</th>
<th>Large F.</th>
<th>Merchand.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Park Farther Away</td>
<td>10.9</td>
<td>17.7</td>
<td>25.7</td>
</tr>
<tr>
<td>Join A Car Pool</td>
<td>4.0</td>
<td>13.4</td>
<td>11.4</td>
</tr>
<tr>
<td>Use Public Transit</td>
<td>39.3</td>
<td>40.5</td>
<td>57.1</td>
</tr>
<tr>
<td>Walk, Bicycle Or Motorcycle</td>
<td>4.5</td>
<td>2.3</td>
<td>-</td>
</tr>
<tr>
<td>Take A Taxi</td>
<td>4.0</td>
<td>0.9</td>
<td>-</td>
</tr>
<tr>
<td>Other</td>
<td>11.7</td>
<td>6.8</td>
<td>-</td>
</tr>
<tr>
<td>No Response</td>
<td>25.5</td>
<td>18.5</td>
<td>5.7</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

Table 4.11: Bus System Use For Work Trips By Automobile Commuters By Subsample

<table>
<thead>
<tr>
<th>Usage</th>
<th>Small F.</th>
<th>Large F.</th>
<th>Merchand.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Never</td>
<td>49.4</td>
<td>44.7</td>
<td>40.0</td>
</tr>
<tr>
<td>Very Seldom</td>
<td>38.5</td>
<td>37.9</td>
<td>40.0</td>
</tr>
<tr>
<td>Once A Week</td>
<td>4.0</td>
<td>6.3</td>
<td>5.7</td>
</tr>
<tr>
<td>Frequently</td>
<td>7.3</td>
<td>7.7</td>
<td>14.3</td>
</tr>
<tr>
<td>No Response</td>
<td>0.8</td>
<td>3.4</td>
<td>-</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>
firm, in the case of self-employment; delivery of commuters downtown in automobiles which do not remain in the downtown area. A small number of respondents, included in the category 'Other', wrote in these alternatives. Due to these considerations, it seems prudent to say only that bus transit and parking farther away are the alternatives that commuters wish most to pursue.

Automobile commuters were further asked if increased parking prices would be a significant factor in any future job selection decision (Table 4.12.). The response indicates this possibility is not generally a serious one, but also illustrates once again the differences in attitude between subsamples.

Finally, a number of questions were directed toward bus users, in order to obtain travel characteristics and attitudes for purposes of comparison to the hypothetical needs of automobile commuters should they utilize a bus system. Unfortunately, automobile commuters responded poorly to this section of the questionnaire. It was decided not to use most of this sequence of questions. One of the questions is useful because it indicates that parking restriction and congestion are factors which can cause changes in travel behaviour. Respondents were asked to indicate the prime reasons why they had switched to bus use for work trips if they formerly drove (Table 4.13.). A high percentage of commuters indicated that they had switched. The more popular reasons were: reduced costs, congestion, and the difficulties of finding parking. It may be that those users who switched over because of congestion would switch back under improved conditions.
Table 4.12: Importance of Parking Price Increases In Future Job Selection By Subsample

<table>
<thead>
<tr>
<th>Importance</th>
<th>Small F.</th>
<th>Large F.</th>
<th>Merchand.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Couldn't Consider It A Factor</td>
<td>48.2</td>
<td>61.0</td>
<td>48.6</td>
</tr>
<tr>
<td>Could Be A Minor Factor</td>
<td>18.2</td>
<td>11.7</td>
<td>22.9</td>
</tr>
<tr>
<td>Could Be A Major Factor</td>
<td>15.4</td>
<td>9.7</td>
<td>14.3</td>
</tr>
<tr>
<td>Don't Know</td>
<td>8.5</td>
<td>8.0</td>
<td>11.4</td>
</tr>
<tr>
<td>No Response</td>
<td>9.7</td>
<td>9.7</td>
<td>2.9</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

Table 4.13: Reason For Switching To Bus By Subsample

<table>
<thead>
<tr>
<th>Reason</th>
<th>Small F.</th>
<th>Large F.</th>
<th>Merchand.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduce Costs</td>
<td>28.2</td>
<td>27.8</td>
<td>13.6</td>
</tr>
<tr>
<td>Save Time</td>
<td>2.9</td>
<td>4.3</td>
<td>-</td>
</tr>
<tr>
<td>Avoid Congestion</td>
<td>15.5</td>
<td>21.6</td>
<td>36.4</td>
</tr>
<tr>
<td>Car Pre-empted</td>
<td>9.7</td>
<td>11.1</td>
<td>9.1</td>
</tr>
<tr>
<td>Parking Too Difficult</td>
<td>17.5</td>
<td>17.3</td>
<td>27.3</td>
</tr>
<tr>
<td>Change Of Residential Location</td>
<td>6.8</td>
<td>3.1</td>
<td>-</td>
</tr>
<tr>
<td>Change Of Work Location</td>
<td>1.9</td>
<td>1.9</td>
<td>4.5</td>
</tr>
<tr>
<td>Improved Bus Service</td>
<td>8.7</td>
<td>7.4</td>
<td>-</td>
</tr>
<tr>
<td>Other</td>
<td>1.9</td>
<td>1.2</td>
<td>4.5</td>
</tr>
<tr>
<td>Multiple Response</td>
<td>6.8</td>
<td>4.3</td>
<td>4.5</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

| % Of Bus Commuters Who Switched  | 40.6     | 40.3     | 28.2      |
4.2.2.2. Different Commuter Groups

From the information presented in the previous section, it is clear that differences in reaction to the parking price increase scheme are likely to occur in different subgroups of downtown commuters. Broadly speaking, commuters who work in small firms displayed parking behaviour which appears more difficult to control, as well as demonstrating a somewhat stronger feeling of attachment to the automobile. The employees of large merchandizing firms already exhibit stronger involvement with public transit and appear to respond more quickly to parking price increases. The lesson to be drawn from these differences is that, to be successful, the administration of a parking price increase scheme will have to recognize and deal with a mixture of behaviour patterns.

4.2.2.3. Generalization Of Survey Results

The population universe of the survey is a large subset of the entire downtown workforce (about 80%), and has been estimated by utilizing the downtown employee estimates provided by the City of Vancouver\textsuperscript{11}. With the help of these guideline total employment figures for each subsample, the survey results can be generalized to a majority of the workforce. These calculations will provide a rough estimate of the reductions in the number of vehicles that would travel downtown during the morning rush and what the alternative behaviour of auto commuters might be, assuming successful implementation. It will also be assumed that the same parking price increase will be paid by all.
Figure 4.1. Response to Parking Price Increase

Subsample of Small Firms

Legend

- Curve Interpolated from Major Price Increases
- Curve Following All Responses
- Envelope Containing Probable Range of Actual Response
Figure 4.2. Response to Parking Price Increase

Subsample of Large Firms

Legend

- Curve Interpolated from Major Price Increases
- Curve Following All Responses
- Envelope Containing Probable Range of Actual Response
Figure 4.3

Response to Parking Price Increases, Subsample of Large Merchandizers

Legend

Interpolated Curve
The results of the parking price increase question for all three subsamples are displayed in graph form in Figures 4.1., 4.2., and 4.3. Three curves are shown for each subsample, except the large merchandizers, where there wasn't enough data points. The light broken curve shows the interpolated 'priced-off' function for a very few, widely spaced increases in price that tended to receive large percentages of the overall response. It can be argued that this curve most closely reflects reality because respondents reduced the choices to three or four large increments in order to simplify their choice and their real-life behaviour would follow this curve, but with narrower increments. Alternatively, the unbroken light curve utilizes all data points in its construction. It can be argued that these curves most closely reflect reality because most people will not change their present behaviour without a fairly large shove. The few who are responsive to small changes reflect in these results along with the majority. Since these speculations are somewhat uncertain, it seems reasonable to include the heavy broken curve to provide an envelope wherein the commuter's response may conceivably lie. It is interesting to note that the curve utilizing all data points does concur with the suggestion made in Chapter Three that small price increases could be expected to have little effect.

This same information is presented in Table 4.14. in numerical form, for the price increase of $.50 per day only. Utilizing the population universe estimates, a figure for total number of auto commuters discontinuing parking is arrived at.
Table 4.14.: Estimates Of The Number Of Discontinuing Parkers At An Increase In Parking Price Of $.50 Daily

<table>
<thead>
<tr>
<th>Subsample</th>
<th>Total Population</th>
<th>% Automobile Commuters</th>
<th>Discontinuing Parking (%)</th>
<th>Number Diverted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small Firms</td>
<td>65,000</td>
<td>46.1</td>
<td>28-40</td>
<td>8390-11986</td>
</tr>
<tr>
<td>Large Firms</td>
<td>13,500</td>
<td>43.9</td>
<td>32-48</td>
<td>187-02845</td>
</tr>
<tr>
<td>Merchandizers</td>
<td>4,800</td>
<td>28.5</td>
<td>55-71z</td>
<td>752-00971</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>11039</strong></td>
<td><strong>115802</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. Adjusted to remove non-peak travellers.
2. Assumed, taking maximum envelope width from graphs for other subsamples.

Table 4.15.: Estimates Of Alternative Behaviour At Parking Price Increase Of $.50 Daily

<table>
<thead>
<tr>
<th>Reaction</th>
<th>% Of Response</th>
<th># Of Parkers</th>
<th>% Of Parkers Diverted</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>S.F.</td>
<td>L.F.</td>
<td>Mer.</td>
</tr>
<tr>
<td>Park Beyond Zone</td>
<td>11.1</td>
<td>18.1</td>
<td>29.2</td>
</tr>
<tr>
<td>Join Car Pool</td>
<td>4.0</td>
<td>16.4</td>
<td>8.3</td>
</tr>
<tr>
<td>Public Transit</td>
<td>54.5</td>
<td>49.1</td>
<td>62.5</td>
</tr>
<tr>
<td>Walk Or Cycle</td>
<td>7.1</td>
<td>2.9</td>
<td>-</td>
</tr>
<tr>
<td>Use Taxi</td>
<td>3.0</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Other</td>
<td>10.1</td>
<td>7.6</td>
<td>-</td>
</tr>
<tr>
<td>No Response</td>
<td>10.1</td>
<td>5.8</td>
<td>-</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>11028</strong></td>
<td><strong>157892</strong></td>
<td></td>
</tr>
</tbody>
</table>

1. Rounded off
2. Not exact with Table 4.14. due to rounding error loss.
utilizing mode split figures from cordon count information\textsuperscript{12} it appears that between 24\% to 34\% of the present automobile travellers entering the downtown during the morning rush would be discouraged from parking.

The new behaviour that would accompany this reaction is presented in Table 4.15. Clearly the vast majority of diverted commuters would desire to use the public transit system. If those who intend to park further away also utilize the transit system for some stage of the journey, then expansion will probably be necessary. Utilizing the mode split data once more, it appears that the transit system would experience an increase in demand between 19\% and 27\%. Finally, the percentage of automobile rush hour traffic removed by the \$50 increase is calculated. Making the generous assumption that the respondents in categories 'Other', 'No Response' and 'Park Farther Away' could not actually ease congestion in any way, there still remains a reduction between 16\% and 22\% of rush hour automobile person-trips. This figure must be viewed with caution, however, due to the uncertainties involved in utilizing the questionnaire results for estimates.

4.3. Impact Of Parking Price Increases

While it will be possible to enumerate the likely effects of a successfully implemented parking price increase program, it is far more difficult to measure with any degree of reliability the depth of impact of each effect. In a few cases, sufficient complementary information may be available so that with the aid of the survey results some estimate can be made. Such estimates
must be accepted with reservation for two reasons: the basic uncertainty inherent in the survey; the additional uncertainty involved in attempting to predict at least twice removed reactions to a hypothetical program in a complex system.

4.3.1. Parking Activity

Immediately following the introduction of the parking price increase there will be a reduction in the number of all day parkers. This will undoubtedly result in a loss of profits for the parking industry. As was the case in San Francisco, the variety of characteristics of parking facilities will precipitate different impacts upon individual facilities. Under local conditions a number of different reactions may occur: reduction of prices to commuters to absorb a share of the price increase while maintaining customers; use of additional inducements to attract all day parkers such as a free car wash; orientation of the parking facility toward short-term parkers; removal of the property from the parking market into some other activity. In the long run, if downtown growth continues, other demand for parking should recoup the immediate loss.

It is very difficult to estimate the magnitude of the loss in profits that would occur under a specific level of price increase. One reason is that the magnitude of the possible reactions of lot operators cannot be easily predicted. Knowledge of the economics of the parking industry available to this study is limited; in any case, it is not axiomatic that operators would pursue the profit-optimizing course of action. Many of the major commercial lots use a price structure that is
preferential to all day parkers. It has been suggested that the convenience of operation, and savings on non-earning entry and exit time encourages this type of policy. Also, the hourly rates of these major lots are somewhat what higher than the Downtown Parking Commission lots which attempt to cater to short-term users. Consequently, it would appear that large reductions in profits would be sustained by this sector of the industry unless some policy changes are made\textsuperscript{13}. Lot owners need not choose to cater to short-term parking; they can sell their land or take other action.

Even more unclear is the likely impact of the drop in demand upon non-commercial parking spaces. It may be that some of these facilities will seek to rent out the extra spaces, but this is pure speculation.

4.3.2. \textit{Downtown Commuter Travel Patterns}

One of the strongest impacts of parking price increases will be upon downtown automobile commuters. The magnitude of this impact has been discussed in section 4.2.2.3.; in this section consideration will be given to the character of this impact and possible secondary effects.

Clearly fewer cars will utilize the major transportation routes leading to the downtown during rush hours. Bus availability during the entire day should increase, particularly on these same routes. The park 'n' ride system, bikeways, and taxi licencing may show some expansion due to the introduction of this program.

A number of undesirable effects may develop. Parking
activity upon the fringes of the downtown, particularly along Broadway, may increase dramatically. A similar pattern may occur in smaller form at further distances from the central area. These activities would contribute to local congestion. Some natural limit upon this type of activity exists in the small extra capacity of rush hour buses as they near the downtown. Some commuters will undoubtedly adopt drive-in-drop-off-drive-out travel patterns. The physical isolation of the downtown area, plus the distribution of jobs and homes in the region suggests that this type of activity will be at a minimum.14

4.3.3. Congestion

The difficulties of measuring congestion (commented upon in Chapter Two) and the difficulties of predicting the reaction of a complex system suggest that it would be unwise to attempt to estimate quantitatively the reduction in congestion which could be expected under a specific parking price increase program. The City of Vancouver Engineering Dept. has proposed that a reduction in traffic volumes of approximately 10% into the downtown area would "virtually eliminate congestion on many major corridors"15. According to the results of the calculations for a $0.50 parking charge such reductions in volumes are well within the grasp of this policy.

In the longer term, however, assuming that downtown employment continues to grow, a system of parking price increases will gradually have a weaker impact upon congestion as demand for travel rises. It is possible though, that this
policy could be used in conjunction with other planning programs, to restrain the volume of automobiles entering downtown to a specific level, even under conditions of employment growth.

4.3.4. Other Aspects Of The Transportation Problem

Evidence indicating the impact that reduced congestion might have upon some interrelated aspects of the urban transportation problem as it stands in Vancouver is rather scarce. The uncertainty inherent in our understanding of the relationship between congestion and accidents precludes any projections for that aspect. As well, it appears that the relationship between noise and traffic volumes is such that significant improvement would not be felt until volumes throughout downtown decreased to at least 500 v.p.h.\textsuperscript{16}. In the case of land values and uses, uncertainties in prediction once again make it hazardous to predict changes caused by the parking price increase program (see section 4.3.6).

Due to the information available in a recent study of the air pollution problem in the Vancouver area,\textsuperscript{17} it is possible to make a rough estimate of the impact of parking price increases on this problem. Utilizing the motor vehicle emission estimates for Vancouver made available by Environment Canada and the results of the survey, it was possible to calculate an estimate of the reduction in yearly vehicle miles travelled by automobiles and the corresponding impact upon emission (a function of both miles travelled and speed) for a parking price
Table 4.16: Reduction In Motor Vehicle Emissions In Vancouver With A Parking Price Increase Of $.50 Daily

<table>
<thead>
<tr>
<th>Emission Factors (gms/mile)</th>
<th>Carbon</th>
<th>Hydro-</th>
<th>Oxides Of</th>
<th>Monoxide Carbons</th>
<th>Nitrogen</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emission Factors</td>
<td>87.86</td>
<td>8.08</td>
<td>4.06</td>
<td>2.65 (evap)</td>
<td>10.73</td>
</tr>
</tbody>
</table>

% Of Change Estimated

Due To Speed Change

- .45%  - .31%  + .09%

Under Reduced Congestion

Reduction In Automobile

1.1%  1.1%  1.1%

Vehicle Miles Travelled

Total Reduction In Percentage

1.03%  .97%  .66%
increase of $0.50 daily (Table 4.16.). The impact upon emissions is quite small, about one percent overall, and is not likely to increase in percentage in the future. Even a small decrease in emissions is desirable especially since technologically-induced reductions seem to be a fading promise.18

In order to obtain some idea of the number of new buses in use that would seriously reduce the effect of the automobile emissions reduction, the NOX yearly emissions for buses was used to calculate that approximately 124 new full-time service buses (an increase of 37%) would be necessary. This is a maximum estimate because the base emission rate for NOX of automobiles is the lowest of the gaseous contaminants, while it is the highest for buses. It seems unlikely that such an increase in buses would be necessary.

4.3.5. Non-Downtown Commuter Travel Patterns

The easing of congestion in the peak hours may encourage others to make more through trips crossing the downtown area. Assuming that most peak hour potential trips are made by commuters, then in view of the distribution of homes and jobs in the region, it seems likely that the only significant opportunity for this activity is available to those who live in North or West Vancouver. Since the Lion's Gate Bridge, with only three lanes, is likely to remain a bottleneck despite the parking tax, this type of behaviour should be minimal.

Increases in the availability and attractiveness of short-term parking may lead to increases in transient travel in both the peak and off-peak hours in the downtown. On the other hand,
daytime, off-peak trips by downtown commuters will decrease. The aggregate impact of these effects is likely to be quite small.

4.3.6. Downtown Business And Development

The implementation of parking price increases upon commuters may have a slight overall beneficial effect upon commercial enterprise in the downtown area. The increase of supply of short-term parking stalls and public transit availability during the day can only help to bring shoppers downtown. Non-merchandizing businesses may suffer some adverse impact where parking privileges are a fringe benefit or where they choose to attempt to share the burden of the increase with their employees.

Introduction of this policy may hasten the development of some downtown properties, as parking lot owners change to a possibly less closely controlled and more remunerative activity. It may be that this program could exert a slight slowing effect upon the growth of certain downtown activities if businesses interpret parking price increases as an additional cost of locating in the downtown. Likely the parking industry will exhibit this behaviour and perhaps cause in turn changes in the functional character of downtown buildings.

Clearly the peripheral areas outside the downtown will develop according to factors other than the parking price increase program. Yet this policy may add some impetus to growth there.
4.4. Operational Considerations

However, the advantages and disadvantages of a system of successfully implemented parking price increase may appear some thought must be given to the powers, the administrative work, and enforcement activity that must be developed into a package which will ensure the success of the policy. It should be recognized that what may seem desirable or necessary from an operational point of view may seem undesirable or unacceptable at a political level. Since there are many considerations of this type for a new policy such as this one, no attempt will be made here to provide a blueprint for implementation, but merely to consider the implications of this policy in practical terms.

4.4.1. Choice Of Approach

It is possible that parking price increases could be applied through either the place of work or the place of parking. The former method offers some advantages, but it appears prone to failure for two reasons: the complexity of the enforcement system that would be necessary to ensure that commuters did not avoid the charge entirely; the remoteness of this type of operation from the normal powers and activities of local governments. Applying the increase through the place of parking appears to avoid these difficulties, even though the administration in this case would have to be more diversified.

4.4.2. Choice Of Parking Price Increase Mechanism

There are basically four options to choose from: a tax can be set upon the parking stall owner; a surcharge can be levied
upon the individual parker; a sales-type tax can be levied upon the commodity; the rate structure for parking activities can be regulated directly by government, and the increase included in the price. These alternatives will be discussed in terms of their capacity to reach the range of target individuals with the most complete share of the original increase. The problems of enforcement, legality and administration with these alternatives will be discussed in the next two following sections.

The tax upon the parking lot owner would presumably be calculated upon the basis of the number of all day stalls. In the case of commercial operations, this method will likely result in some of the tax being passed on to short-term users, and possibly some absorbed by the operator himself. This dissipation of the increase is undesirable, especially since a strategy of avoiding short-term parkers has been suggested. Non-commercial operations may also absorb some of the increase, especially employee parking operations. Employers would certainly view this application as a tax upon locating downtown.

The sales-type tax approach is not very well suited to a strategy of charging only a sub-group of parkers. It is slightly more attractive than an owner tax for commercial stalls, since the user would bear the increase initially. Once again the owner could dissipate this effect by changing his price structure so that the commuter would not feel the entire increase.

The surcharge applied to the activity of parking downtown may be useful particularly in the non-commercial facilities. Applied directly to the individual, there is some hope that he
may absorb the whole increase; still, some compensation could be arranged by employers or through income tax deductions. This approach permits some variations in application to commercial facilities; the surcharge could be placed upon those who stay a certain length of time or arrive at a certain time of the day. This use might encourage considerable undesirable avoidance behaviour.

The most promising method of applying the parking price increase program to commercial operations would be control over the rate structure. In this way the parking commuter would certainly face the entire increase. This control could be extended to non-commercial operations. It seems likely that this mechanism would encourage the parking industry to oppose this policy.

4.4.3. Range Of Application

It is important to reach a large a portion of the target group as possible in order to maximize the decongesting effect of a particular price increase. The parking price increase program should be applied utilizing methods that fit well the range of facilities and also the individual nature of each facility. In this section, some of the problems this objective presents will be briefly discussed.

Two aspects of commercial stalls present some problems. Many lots permit a mixture of user types, which requires that the charge mechanism be sufficiently flexible to discriminate between users, while maintaining simple enforcement and administration procedures. Many lots do not maintain a human
operator, which prevents the utilization of the operator as the discriminating device. Enforcement is likely to be more difficult on these lots as well the regulation of the price structure in the case of commercial lots overcomes the problem of discrimination.

Non-commercial stalls, primarily employer-provided, present another problem. Some stalls on these lots will be used by salesmen, executives, delivery vehicles and others who may be considered essential by the company. Either all users of these lots will have to pay the surcharge or some system of exemptions will have to be arranged with each firm.

Another problem are stalls where no transaction currently takes place. The difficulty here is that no mechanism exists to which the public charge can be attached to. Either a government collection mechanism will have to be established on-site, or a billing system set up.

Some types of parking facility, while not currently significant in terms of commuter use, could become places of relief from the parking price increase program: on-street stalls, school lots, church lots, residential spaces, laneway spaces, and courtesy spaces. Some methods of dealing with these types of parking facility can easily be suggested. Laneway spaces could be surveyed and identified and then dealt with in the same manner as off-street commercial and non-commercial facilities. On-street stalls are already experiencing a high rate of illegal use; it may be desirable to restrict their hours of use so that they are unavailable during the morning rush hour the rest of these residual spaces seem relatively less likely to abuse;
perhaps some surveys could be taken over time to monitor them.

4.4.4. General Areas Of Operational Concern.

There are a number of these considerations which apply to many types of facilities and situations. The significance of these problems is that each choice which can be pursued requires different applications of manpower and discrimination, and consequently, differing levels of government involvement. Some actions should be taken because they are important to the success of the policy in reducing congestion. The more important considerations will be briefly enumerated here.

Only in the case of choosing an owner taxation mechanism of commercial lots would it not be necessary for the City of Vancouver to seek an amendment of their Charter. The other mechanisms require amendment and there is no guarantee that the province will grant it, although refusal has seldom occurred. The charge mechanisms can be ordered according to the width of their divergence from the present powers of the City: the sales-type tax is the most extreme; the surcharge; the regulation of rate structure; owner taxation on all stalls\(^{19}\).

According to city officials, the administration of parking price increases to individual parkers or to the facility owner would involve approximately the same workload if the City had to carry out the collection operation entirely\(^{20}\). Regulation of the rate structure and the variety of the other administrative tasks required by the range of parking facilities existent suggests that this program represents an administrative challenge to local government.
Enforcement will likely be the largest continuing cost of the parking price increase program. It will also require the development of some ingenious methods for enforcing in new situations.

Some of the other general operational problems to be overcome are as follows: adaptation of the policy to special local areas; control of 'black market' residential space parking; knowledge of the impact of the program upon parking outside the control zone; control of parking facilities designed and introduced subsequent to the establishment of parking price increases. These problems will occur once the program has been established for a while and are therefore the concern of the administration.
1. Burton & Cherry, pp. 38-41 summarize the pros and cons of these two approaches.
2. Phone interview, Traffic Engineer, City of Vancouver, August, 1974.
4. The exclusion of hotels, although a significant segment of downtown employment is not a serious drawback. Hotel employees tend to arrive and leave at unusual hours, and are not usually present in rush hour traffic.
7. The printer promised sequenced prepared questionnaires and could not deliver.
8. W.D. Lea figures used (42% for autos, 10% for buses).
10. Making the assumption (generously) that those who do not respond indicate their disapproval.
12. The same cordon count shown in Figure 3.3. Presumably the difference between total downtown workforce and the cordon count is made up of absentees and non-rush hour commuters. Since the cordon count total and the population universe are approximately equal, no adjustments were made.
13. It is certainly possible to make price policy changes that would bring in a similar revenue per day, providing there is sufficient demand for short-term parking. Example: 45/hr., $2.50 maximum, 30 spaces, all commuters = 8 hrs., gross revenue = $75.00; change to 30/hr., no max, all short-term = 7 hrs. use, gross revenue $63.00.
14. It seems unlikely that most families would have a member who has the time to play chauffeur every day, or that a home-job-job route first in then out of the downtown is readily available. For home-work distribution, see Living Close To Work.
17. Lynch et al., An Analysis Of Air Pollution In The Lower Mainland.
20. Interview, Permits & Licences Dept., City of Vancouver, August 1974.
CHAPTER FIVE: ASSESSMENT OF THE USEFULNESS OF PARKING PRICE INCREASES AS PUBLIC POLICY FOR VANCOUVER

5.1. Introduction

In this chapter, the analyses conducted by this study concerning the parking price increase mechanism will be summarized and a number of observations made about the usefulness of this mechanism as public policy for Vancouver. The first section summarizes the analysis of technical performance carried out in Chapter Four. The second section presents the information gathered concerning the political and administrative entities involved, and attempts to suggest, with the help of the literature review from Chapter One, what response these entities might have to the introduction of this policy and what role they would play in its initiation. The next section briefly considers the costs of administering such a program. Income distributional effects of the parking price increase policy are considered in the fourth section, and the overall assessment follows.

5.2. Technical Performance

The results of the analysis conducted in Chapter Four will be summarized in this section. To begin with, the general observation can be made that a parking price increase scheme which is successfully implemented appears to be capable of reducing the volume of downtown automobile commuters by a significant percentage while minimizing the undesirable side
effects. The exact level of price increase which will bring about a certain percentage reduction is a less certainly predictable factor. The survey results can be utilized to provide a rough estimate of this relationship; however, caution should be exercised in relying upon this estimate. Confusion and uncertainties revealed by the respondents while indicating what alternative behaviour they would pursue after discontinuing parking suggests that the survey diversion curve should be regarded as the upper limit of achievable results.

A few other significant observations can be extracted from the analysis of the survey data. The majority of downtown automobile commuters presently patronize private, commercial and non-commercial parking facilities. Many do not pay for the privilege of parking downtown. These considerations are important in the choice of type of price increase mechanism and range of facilities to be included in the target of the policy. A majority of diverted automobile commuters indicated that bus transit would be their choice of alternative travel mode. Additionally, the shape of the diversion curve suggests that a small incremental price increase will not necessarily stimulate the expected diversions that would be indicated by interpolation across the points of a number of large price increments. Therefore, it may be wasteful and unrewarding to change parking prices only in small increments. This policy does appear to arouse the dislike of a number of automobile commuters, as indicated by non-response and comments on the questionnaires. Finally, it was clear from the responses to a number of questions that within the universe of downtown automobile
commuters travel and parking behaviour and attitudes vary to some degree. This heterogeneity can be observed by comparing commuters classed according to firm size.

Implementation of a parking price increase program in Vancouver can be expected to have a number of effects upon the urban environment, though most of them are of relatively small magnitude. The strongest impacts would occur in parking activity and rush hour travel. The parking industry can be expected to suffer some immediate loss of profits, though it appears that many operations could rectify this loss by seeking the short-term parking market. Outside the downtown, some small increases in parking activity can be expected. Rush hour traffic volumes should be reduced by between 16% and 23% in the downtown and on the major entrance routes. Assuming successful implementation and complementary action from other government agencies involved in provision of transportation services then public transit, taxis and other modes of travel should experience a beneficial growth impetus due to the parking price increase program. Rush hour travellers should experience time savings, improved comfort and convenience and gas savings. The benefits of these expansions of alternative mode systems should be available to off-peak users as well. This program should bring about a small improvement in air pollution levels. Most other impacts are very small and uncertain: a slight slowing influence may be given to growth within the downtown, while having the reverse effect on the fringe; some rush hour drop-off trips, and increased through trips may occur.

The key observation gained from the analysis of the
technical performance of a parking price increase policy is a realization of what is necessary for successful implementation and operation of such a program. In order to discriminate clearly between parkers to locate the bulk of the target population of commuters two charge mechanisms appear preferable: rate regulation of commercial operations; surcharge applied to private, non-commercial 'employee-oriented' parking. Application must adapt to the local conditions and characteristics of the individual facility. The policy must be developed to guard against a variety of undesirable behaviour patterns, such as illegal on-street parking, with a flexible and varied enforcement and administration system. The choice certainly exists for an implementing agency to mount a far less ambitious program than that suggested here, with likely far less successful results.

5.3. Political And Administrative Behaviour

In this section, the recognized political and administrative groups will be identified and their powers, policies and past actions relevant to this research discussed. As far as possible on the basis of the thin data available and the understanding gained from the public policy analysis literature, the probable response of these groups toward the introduction of parking price increases in Vancouver will be discussed.
5.3.1. **The City of Vancouver**

The City of Vancouver holds primary responsibility for planning and control of roadways and parking within the City boundaries. With respect to the downtown area this position is not as comprehensive as it may seem at first glance: the Lion's Gate Bridge is a provincial responsibility. The City can attempt to regulate the use of downtown roads through a large variety of policies: intensive use of traffic management techniques; land use and development policies; policies directed at downtown users, such as staggered hours, or pedestrian walkways. At the present time, the City has adopted a downtown transportation policy which emphasizes the role of public transit and seeks to discourage the increase of automobile traffic\(^1\). Toward this end, new developments are being encouraged to limit parking spaces to a maximum number which is related to a lower percentage of total square footage than previous standards\(^2\). The Granville Mall was also justified to some extent by reference to this policy. As well, City Council has a clear policy of encouraging rapid transit and particularly a subway line in the downtown\(^3\). At the same time, the City supposedly supports a policy of controlling growth in the downtown area\(^4\).

While it appears that the results of a parking price increase program would be in line with the policies of Council, no policy exists which directly encourages economic disincentives applied to automobile users. In fact, it may be more accurate to interpret this silence as demonstrating some lack of interest in such a proposal\(^5\). Nevertheless, some
attempt can be made to suggest what might be the response of Council to this proposal. The TEAM-dominated present council has strong connections with downtown business interests; it seems reasonable to expect that these interests can easily bring their needs and feelings to the attention of Council downtown development has received strong support from TEAM in the recent past, so that it seems reasonable to suggest that should a parking price increase scheme appear likely to seriously threaten downtown businesses, or the desired growth of the downtown, then it is likely to receive some opposition from Council. Otherwise, evidence indicating support or opposition for other reasons is lacking.

Within the City bureaucracy, there are three departments which have some concern with respect to traffic control through parking price increases. The Planning Dept. is presently involved in preparing plans for the future development of the downtown area. The Engineering Dept. has traditionally had responsibility for the control of road and parking development and use. They are presently working upon a federally-funded project designed to reduce rush hour traffic volumes through computerized car pooling and encouragement of staggered hours. The Finance Dept., while not usually directly involved in this kind of problem, has shown initiative with respect to the parking price increase idea, due perhaps to its revenue-producing character.

Predicting the departmental response to this policy is not really possible since their reaction involves a multitude of factors: personal values, departmental goals, budgetary
considerations, for example. Only limited evidence is available, but it can be used to suggest the possible position each department might hold. The Planning department and the Finance department would probably support such a policy to some degree, although it is far from a major concern in either area. The Engineering department has indicated some opposition to this proposal. Individually, this dislike may have some source in professional bias against coercive measures of this sort; just as planning support may arise from the reverse bias. Little evidence exists on this point to determine the cause. As a department, it can be suggested that territorial struggle is responsible for Engineering department opposition. Overall, then, administrative initiative to pursue this idea seems to be lacking.

Finally, it should be remembered that in order to affect the non-commercial downtown parking supply the City must obtain provincial approval of a Charter amendment. Unfortunately, no data is available which indicates what position provincial decision-makers may take. Certainly the strength of City desire to obtain this amendment will be a factor in the outcome of a decision. Also, conflict between City and provincial authorities over rapid transit development may hinder advancement of this relatively minor issue.

5.3.2. The Greater Vancouver Regional District (GVRD)

This regional government is responsible for a number of activities within the region, one of them being non-vehicular air pollution control. Another concern is the continued
development and administration of the 'Official Regional Plan'. The GVRD has established for itself a major objective to "manage growth and change so as to maintain or enhance the livability of the Region". Involvement with this objective has led to the development of planning policies in a broad number of areas, including transportation.

The policy for the future development of regional transportation is threefold: to manage growth so that transportation needs, especially automobile, are minimized; to make use of the present transportation system capacity through restraint techniques; to expand system capacity by development of public transit facilities, especially light rapid transit. It is interesting to note that the GVRD Planning Dept. is in favour of raising parking prices in the downtown and limiting the growth of parking generally.

At the present time, the GVRD does not have any authority for the development and control of the regional transportation system, though this situation may change in the near future. Presumably, this agency has some influence in transportation decisions, but the extent of this influence is not known.

5.3.3. The Bureau Of Transit

Responsibility for policies and planning of the GVR transit system currently resides with the Bureau of Transit an agency established by the provincial government. Current policy statements indicate the following development of transit for the region, in chronological order: more buses to increase current system capacity immediately; augmentation of this system with
street-car type systems in the near future; light rapid transit in the third stage; rapid rail transit in the fourth stage. Recent expansions of the bus system have been directed at suburban areas; however, promises have been made that downtown service will be expanded.

Since the Bureau has developed independently its own plan for the expansion of transit in the Lower Mainland, it is unclear to what extent parking price increases would be incompatible or compatible with these plans. Bureau contacts have indicated that the necessary bus system expansion would be possible, but municipal authorities have no power to commit the Bureau to such a program.

5.3.4. Pressure Groups

Downtown business interests already exert political pressure on a number of issues and through a number of organizations in the Vancouver situation. Aside from the parking industry, it does not seem likely that this group will have serious objections to a commuter-oriented parking price increase program. This is not to suggest that business interests would support such a policy.

Undoubtedly, many automobile commuters will have strong negative reactions to this proposal. Commuters have not traditionally been a group which has organized to apply political pressure for the collective good. Organizations do exist which promote the automobile and they may speak out against such a policy, but that is not the same thing as organized commuters. It may be that commuters represent one of
those potential groups that cannot organize in this way, as suggested in Chapter One. The parking price increase program appears to be the only reason to organize and no non-collective good appears present to attract commuters to join an organization. In fact, the average downtown commuter probably wishes that his fellows would give up commuting, to leave the road free for him. The possibility of organization developing is not entirely non-existent. Leadership by the downtown businesses could stimulate this development.

There exists one other possibility for political pressure: environmental groups and citizen organizations. The Scientific Pollution and Environmental Control Society (SPEC) presents an example of this type of group. They have already taken an interest in air and noise pollution as it relates to motor vehicles\(^\text{19}\). They do attempt to operate as a pressure group on these issues,\(^\text{20}\) and could conceivably be interested in the parking price increase idea.

5.3.5. **Type Of Policy Mechanism**

In Chapter One, section 1.2.6., some observations were presented from the literature concerning the reaction of public decision-makers over the years to the alternative types of policy available for their use. A system of parking price increases can be classified as a policy of behavioural fix and the observations concerning the response to this type of policy appear to be repeated in this case: lack of institutional support; uncertainty of effects; encouragement of bureaucratic territorial struggle.
Although Council apparently recognizes the congestion problem,\textsuperscript{21} it clearly prefers the technological fix of rapid transit over the behavioural alternatives. The analysis conducted by this study indicates that many uncertainties exist for such a policy. Three different government groups, the City, the Bureau of Transit, and the province, must co-operate in the use of their powers to implement this program, and within the City administration there is already disagreement. It is not intended to suggest that this situation exists solely because parking price increases are a behavioural fix, but this characteristic is a contributing element.

Another consideration for this type of policy is its legitimacy (section 6.2.3.1.). Commuters, at least some of them, apparently dislike this idea; it may be that applying this type of coercion is held to be illegitimate for municipal authorities by most Vancouver citizens. Still, disenchantment with the automobile has been consistently growing for some years now and also government involvement in regulating human behaviour on this scale so that it may also be that enough people would now accept this policy as legitimate. Uncertainty about this factor could be an element in the indecisiveness of administrators with respect to this idea.

5.3.6. The Decision-making Process

It would be desirable to predict the likelihood of City decision-makers choosing to initiate the implementation of this policy mechanism. Unfortunately, very little can be said about this matter beyond the generalizations offered in section
1.2.3.3. A system of parking price increases is certainly upon the margin of the politically feasible. It does have the advantage of being reversible and flexible, so that a change in policy direction could be easily accomplished. Though no estimation can be made of the likely decision on the basis of these general guidelines, it can be pointed out that, for a decision to implement a successful application of this idea to be made requires the acceptance by the decision-makers of the need for strong commitment.

5.4. Costs Of Administration

Administration of a successful parking price increase program will involve a number of different costs. Due to the uncertainties involved, it will not be possible to estimate the magnitudes of these costs, except in a very general way. Basically, there will be three different areas of costs: preparation costs, including implementation; costs of collecting the charge; enforcement costs. Depending upon policy decisions, it may also be that some transfer payments will be made from the revenue generated to those who may suffer unduly through the redistribution of income. This possibility need not be considered a true administrative cost of the program.

A number of different expenses could be expected to occur in the preparation of a parking price increase system for operation. Some physical equipment, such as signs, fences and decals, may be necessary. The bulk of preparation costs would likely be the man-hours necessary to assemble the administrative structure, operational procedures, and trained personnel
necessary to carry out the parking price increase program. Conceivably, a certain amount of funds would have to be given to publicity. This stage of the project would represent a significant contribution in manpower, commitment and funds on the part of the sponsor government.

The day-to-day administrative costs of collecting the public charge appears to represent a small expenditure. Aside from the possibility of on-site collectors which may be necessary for non-commercial facilities without transactions, managing this program should not involve very much manpower.

Enforcement costs will probably be the largest continual expense of this program. It will be necessary to patrol a variety of types of parking facilities fairly regularly. Since five patrolmen are apparently inadequate to the present task, it seems likely that even more would be necessary for this program.

Once the parking price increase scheme begins to operate, however, the administration can defray these costs by transfer of some of the revenue produced. It appears that administrative costs, including preparation costs, may be a small portion of the annual revenue. As an illustration of the potential magnitude of revenue the results of the attitudinal survey have been utilized to produce some estimates. Using the population figures for the survey samples and a person per car standard of 1.57, it can be calculated that approximately 37,000 stalls are currently used by commuters\textsuperscript{22}. At $.50 a day initial revenue would be around $370,000 a month. Once reactions set in, monthly revenue would drop to between $214,000-$226,000. Annual revenue for the first year would be approximately $2,600,000.
Since the survey results are considered to be optimistic in terms of diversions, the actual revenue may be higher.

5.5. **Income Distribution Effects**

There are many different groups which will experience some redistribution of income due to the introduction of a parking price increase program. Although it will not be possible to indicate in quantitative terms what these effects will be, some effort can be made to describe to whom they accrue and whether the change is negative or positive.

Downtown commuters will be relatively strongly affected by income redistribution effects. Looking first at automobile commuters, there are basically three subgroups: the tolled, the tolled-off, and the untolled. The untolled, if there are any, will clearly benefit in terms of driving conditions. The tolled and tolled-off, while experiencing some loss, are merely having their costs rise to meet the true costs of their trip, according to the marginal social cost viewpoint. Accepting this viewpoint means that this increase borne by auto commuters is merely the rectification of an existing inequity. Even so, it can be said that many auto drivers throughout Vancouver do not pay the increase. Although social costs of travel are perhaps lower elsewhere in Vancouver due to lower congestion some discrimination could be argued. Yet it may be that downtown workers receive other benefits from locating there, such as higher salaries, that are in part subsidized by other regional residents through the portion of their income which goes to maintain the downtown as an urban centre. Within the downtown
Table 5.1: Comparison Of Cumulative Automobile Commuter Income Distribution (All Subsamples) With That Of Those Diverted At An Increase Of $.50 Daily

<table>
<thead>
<tr>
<th>Income Level</th>
<th>All Auto</th>
<th>Diverted At $.50 Daily</th>
</tr>
</thead>
<tbody>
<tr>
<td>under $3,000</td>
<td>0.5</td>
<td>0.7</td>
</tr>
<tr>
<td>$3,000-$5,999</td>
<td>5.2</td>
<td>6.6</td>
</tr>
<tr>
<td>$6,000-$8,999</td>
<td>23.4</td>
<td>27.4</td>
</tr>
<tr>
<td>$9,000-$11,999</td>
<td>40.9</td>
<td>53.8</td>
</tr>
<tr>
<td>$12,000-$14,999</td>
<td>59.7</td>
<td>71.1</td>
</tr>
<tr>
<td>$15,000-$17,999</td>
<td>71.7</td>
<td>82.0</td>
</tr>
<tr>
<td>$18,000-$20,999</td>
<td>79.5</td>
<td>89.1</td>
</tr>
<tr>
<td>$21,000-$23,999</td>
<td>84.1</td>
<td>92.3</td>
</tr>
<tr>
<td>$24,000-$26,999</td>
<td>87.4</td>
<td>94.5</td>
</tr>
<tr>
<td>$27,000-$29,999</td>
<td>90.3</td>
<td>96.9</td>
</tr>
<tr>
<td>$30,000-$32,999</td>
<td>92.3</td>
<td>98.0</td>
</tr>
<tr>
<td>$33,000 and over</td>
<td>100.0</td>
<td>100.0</td>
</tr>
</tbody>
</table>
auto commuting group itself, the increase demonstrates some regressive effects, according to the survey results. In Table 5.1., distribution of income of the auto commuter respondents from all samples is compared to the income distribution of those who would discontinue parking at a $.50 daily charge. Respondents with lower incomes apparently would discontinue more readily than others. Overall, automobile commuters facing the charge will suffer some small loss of income; it is doubtful that a certain price rise will translate perfectly into a certain equal reduction of social costs or that the necessities of driving downtown as viewed by most commuters will always be equal or less than the social cost of the trip.

Other downtown commuters may be viewed as benefitting from this program, if it is assumed that the additional demand for their modes of travel will bring improvements equal or better than the present situation. Of course, in the short term, these people will likely suffer overcrowding and discomfort, especially in the case of the bus system. In the longer term, it does not seem unreasonable to suggest that increased capacity of the bus system will offer more accessibility to the old user either in route location, travel time, or waiting time.

Downtown businesses will also experience some income distribution effects particularly the parking industry. This sector of downtown business will experience a significant loss of income. It might be argued that this is partially due to overdevelopment of this activity in the downtown, due to the subsidized demand for downtown automobile travel. Other sectors of downtown business should receive some small benefits, or
remain unchanged at the worst. A subgroup of downtown workers, such as taxi drivers and policemen for example, should experience some benefit as a result of this program. Working conditions for these people will be improved.

Downtown users, such as shoppers, tourists and business visitors should benefit from the less congested conditions in the downtown during rush hour, and perhaps slightly so at other times. Any commodity transfer occurring during the rush hour should share the same benefits. Finally, all regional residents will receive a small benefit in terms of the slight reduction in motor vehicle emissions.

5.6. **Summary**

To begin with, it is unfortunate that the resources of this study were not equal to the investigation of other policy mechanisms, since comparison of a number of mechanisms in terms of their different advantages and disadvantages and their relative efficiency in reducing congestion would no doubt permit a more realistic assessment of the usefulness of parking price increases as public policy. Nevertheless, some assessment can be made from the information gathered here.

As far as the investigations of this study have been able to go, it appears that a program of parking price increases directed at downtown commuters is capable of reducing rush hour traffic and therefore congestion to a significant extent in downtown Vancouver. Of course, the real test of this idea would be to put it into practice. Whether or not such a program would ever actually be considered for implementation in Vancouver is a
political question. The results of this study indicate that while congestion is a recognized problem, it is apparently not considered a major one. Furthermore, this particular policy is apparently not strongly attractive to City officials, either as a solution to this problem, or on other merits. The values held by decision-makers will, of course, play a significant role in their assessment of the desirability of this policy. In the case of the parking price increase policy, it may be that achievement of congestion reduction, or revenue production, is not the key value, but rather the income distributional effects, and the type of mechanism it is. Whether or not, if initially supported by City officials, such a policy would actually become implemented or implemented in such a fashion as to be effective in reducing congestion, is another political question. Opposition from non-governmental sources should be at a minimum due to the selective use of the charge upon commuters. The cooperation of other government agencies is required in order to develop powers to reach the private, non-commercial parkers which form a large portion of the downtown automobile commuting population; to have available adequate alternative modes of travel. The initiating agency must be committed to a strong effort to deal with operational problems, that, if left unsolved, would seriously erode the ability of the program to relieve congestion while leaving a significant portion of commuters who would provide a significant revenue. The lack of concern with congestion as a problem and parking price increases as a solution, suggests that this commitment cannot simply be assumed.
In the opinion of this author, the potential adverse effects that a parking price increase program, successfully implemented, is likely to have are not serious, nor of great magnitude, except perhaps in the case of the parking industry. In the opinion of this author, the benefits to be achieved from this program outweigh these adverse effects sufficiently to suggest that such a policy mechanism would be desirable for Vancouver. Although hardly a panacea for urban congestion, this policy would certainly be useful in relieving congestion.
1. Interview, Transportation Engineer, June, 1974.
4. Gutstein, p. 146 and Vancouver Sun, March 14, 1975 suggest there are some ambiguities in how much control.
5. Council meeting to discuss a project concerning this policy demonstrated little interest, May, 1974.
8. Interview, Downtown Study Group, June, 1974, support parking controls.
10. This conflict has been in the news recently, Province, Feb. 6, 1975.
15. Interview, Ian Graham, August, 1975.
16. Ibid.
17. Vancouver Sun, August 21, 1973, Building owner's and Managers Assoc. supports parking for shoppers but not commuters.
18. Province, August 1, 1974, suggested Phillips ride the bus.
19. Air Pollution & Transportation, SPEC.
20. Province, March 6, 1975, debate over GVRD noise bylaw.
22. Standard obtained from Transportation Engineer, City of Vancouver.
CHAPTER SIX: CONCLUSIONS

6.1 Introduction

In this chapter, the conclusions drawn from the investigations discussed in this thesis will be presented. It should be noted that these conclusions are tentative, until the parking price increase technique is tried in Vancouver. Nevertheless, some understanding of this technique is necessary prior to its initial use.

6.2 Congestion Relief Through Parking Price Increases In Vancouver

It is concluded that a system of parking price increases, tailored to the local situation, could be successfully utilized to reduce traffic congestion in Vancouver. However this technique appears useful only under certain specific conditions.

In order to deal with primary high congestion conditions while at the same time establishing a manageable-sized physical area for parking price increases it seems desirable to focus solely upon the downtown area. In order to avoid potentially decisive political opposition from business interests, parking price increases should be selectively directed away from shoppers and tourists. Therefore downtown workers who commute by automobile should comprise the target population.

A comprehensive and dynamic administrative system, along with a strong enforcement system is necessary for successful use of parking price increases. Undesirable avoidance behaviours,
such as illegal parking, make the latter necessary. The variety of parking situations existent in particular employer-provided parking, make necessary the former. A system of rate regulation of commercial stalls, and a system of surcharges applied to private, non-commercial, commuter-oriented stalls will be most effective in passing price increases to automobile commuters.

Utilization of the questionnaire results indicates roughly the following quantitative conclusions: only substantial increases, with a minimum of $.50 per day could be expected to have any significant impact; at the $.50 day level, rush hour traffic volumes could be reduced as much as 16% to 23%. Furthermore, the variation of the magnitude of responses between subsamples indicates that downtown working parkers should not be treated as a homogeneous group in the application of this congestion reduction technique.

Some leakage in the application of this technique is inevitable; for instance, businessmen claiming parking prices on their income tax. However, many potential leakages can be avoided through diligent and dynamic administration.

Most importantly, the overall success of this technique will depend upon the strong commitment of the implementing agency, and the active co-operation of other involved government bodies. Many of the above-mentioned conditions of successful application rely upon the dedication of the implementing agency. Capacity increases of bus transit and amendments of the Vancouver City Charter are necessary to success, but depend upon the co-operation of other involved government authorities.
6.3. **General Applicability**

It should be possible to successfully utilize this restricted program of parking price increases in many other North American cities. Variations in the details of application, and the magnitude of the effects of the parking price increase program must be expected. For example, the physical isolation of the Vancouver downtown is a unique aspect of this situation which will aid in the control of this program. Besides a definable area in which parking price increases can be easily applied without being avoided by parking activity outside the defined area, a fairly low level of through traffic would be desirable. Governmental response will also have a great influence upon the success of this technique elsewhere.

6.4. **Further Research**

With respect to the parking price increase idea solely, only one investigation appears worth pursuing further. The economics of operating commercial parking facilities should be more closely examined to determine in detail how the drop in demand should affect profits, and what alternatives are available for the parking industry so that this effect can be eliminated as far as possible.

Referring to the comprehensive approach to analysing the problem of congestion discussed in Chapter One, it would be desirable to investigate a number of other congestion control techniques, such as car pooling for example, and also investigate the political system in more depth to ascertain more reliably what its response would be to these different
approaches to the congestion problem. In this way, it would be possible to assess the relative advantages and disadvantages of different courses of action.

6.5. The Desirability Of Parking Price Increases As Public Policy For Congestion Relief

Only by utilizing a set of priority-ordered values can the effects of parking price increase policy be weighed and balanced such that a determination of its desirability as public policy for Vancouver can be made. This thesis has attempted to set out the various effects of this technique, and estimate their magnitude, so that this process can be knowledgeably conducted. An effort has been made to foresee the problems that would be encountered in implementing this policy, and subject to further study of commercial parking operations, this technique could now be tried if there is sufficient political dedication to congestion relief.
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