INTRA-METROPOLITAN OFFICE LOCATION - 
AN EXAMINATION OF LAND AND BUILDING 
COSTS AS CRITERIA IN THE 
DECISION TO LOCATE OFFICES

by

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July, 1973
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THESIS ABSTRACT

This thesis reviews office location as a facet of urban spatial arrangements. An analytical framework is presented within which office locators may assess the suitability of alternative locations for the furtherance of office activity. Particularly, this thesis is concerned with office location criteria involved in the decision to locate offices in an intrametropolitan context. Location factors are made explicit with land and building costs subjected to extensive analysis.

Relationships are hypothesized between land values and construction costs of office premises and the location of those premises across the metropolitan region. Regression and comparative analyses are utilized to test and determine the significance of these hypotheses. All data relate to the Greater Vancouver Region.

This study concludes firstly that there is no linear relationship that adequately describes or predicts changes in assessed land values and construction costs per unit area of net rentable office floor space. Secondly, construction costs per square foot of net rentable floor space are significantly greater at central city locations as opposed to suburban locations. Thirdly, that there is an insignificant difference in assessed land values per
square foot of net rentable office floor space as between central city and suburban sites. If assessed land values are a fair indicator of relative market value of office sites then it is implied that there is an insignificant differential in market values, and subsequently the cost of land, per square foot of net rentable office floor space.
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>THESIS ABSTRACT</td>
<td>(i)</td>
</tr>
<tr>
<td>LIST OF TABLES</td>
<td>(v)</td>
</tr>
<tr>
<td>LIST OF FIGURES</td>
<td>(vi)</td>
</tr>
<tr>
<td>ACKNOWLEDGEMENTS</td>
<td>(vii)</td>
</tr>
<tr>
<td><strong>CHAPTER 1</strong></td>
<td></td>
</tr>
<tr>
<td>1.1 OBJECTIVE OF THESIS</td>
<td>1</td>
</tr>
<tr>
<td>1.2 STRUCTURE OF THESIS</td>
<td>2</td>
</tr>
<tr>
<td>1.3 MOTIVATION FOR AND SIGNIFICANCE OF THE STUDY OF OFFICE LOCATION PRACTICES</td>
<td>3</td>
</tr>
<tr>
<td>1.4 PURPOSE OF STUDYING URBAN SPATIAL ARRANGEMENTS</td>
<td>8</td>
</tr>
<tr>
<td>1.5 LITERATURE REVIEW</td>
<td>10</td>
</tr>
<tr>
<td><strong>CHAPTER 2</strong></td>
<td></td>
</tr>
<tr>
<td>2.1 APPROACH TO THE STUDY OF OFFICE LOCATION PRACTICE</td>
<td>15</td>
</tr>
<tr>
<td>2.2 BASIC POSTULATION</td>
<td>15</td>
</tr>
<tr>
<td>2.3 DEFINITIONS</td>
<td>16</td>
</tr>
<tr>
<td>2.4 STATEMENT AND DISCOURSE ON OFFICE LOCATION RATIONALE</td>
<td>19</td>
</tr>
<tr>
<td>2.5 DELINEATION OF LOCATION VARIABLES FOR FURTHER ANALYSIS</td>
<td>25</td>
</tr>
<tr>
<td>2.6 SUB-HYPOTHESES</td>
<td>28</td>
</tr>
<tr>
<td><strong>CHAPTER 3</strong></td>
<td></td>
</tr>
<tr>
<td>3.1 RESEARCH METHODOLOGY</td>
<td>44</td>
</tr>
<tr>
<td>3.2 DATA MANIPULATION</td>
<td>52</td>
</tr>
</tbody>
</table>
**LIST OF TABLES**

<table>
<thead>
<tr>
<th>TABLE I</th>
<th>TABLE SHOWING INTERTRADE WAGE DIFFERENTIALS IN THE CONSTRUCTION INDUSTRY FOR THE VANCOUVER REGION FOR THE YEARS 1963 AND 1971</th>
<th>32</th>
</tr>
</thead>
<tbody>
<tr>
<td>TABLE II</td>
<td>TABLE SHOWING BUILDING HEIGHTS AND NET RENTABLE SQUARE FOOTAGE OF OFFICES BY LOCATION</td>
<td>36</td>
</tr>
<tr>
<td>TABLE III</td>
<td>TABLE SHOWING COMPOSITION OF SAMPLE BY LOCATION</td>
<td>45</td>
</tr>
<tr>
<td>TABLE IV</td>
<td>COMPARATIVE CONSTRUCTION COST STATISTICS FOR SUBURBAN AND CENTRAL CITY OFFICE LOCATIONS</td>
<td>56</td>
</tr>
<tr>
<td>TABLE V</td>
<td>COMPARATIVE ASSESSED LAND VALUE STATISTICS FOR SUBURBAN AND CENTRAL CITY OFFICE LOCATIONS</td>
<td>57</td>
</tr>
<tr>
<td>TABLE VI</td>
<td>CONSTRUCTION COSTS BY METHOD OF CONSTRUCTION AND STOREY HEIGHT FOR THE GREATER VANCOUVER REGION</td>
<td>63</td>
</tr>
</tbody>
</table>
LIST OF FIGURES

FIGURE 1. SCHEMATIC OF THESIS STRUCTURE.......................... 2

FIGURE 2. GRAPH SHOWING LOG OF FLOOR SPACE RATIO REGRESSED AGAINST DISTANCE FOR OFFICES ACROSS THE GREATER VANCOUVER REGION............................................. 41

FIGURE 3. GRAPH SHOWING COMMERCIAL LAND VALUES - DOWNTOWN VANCOUVER............................................. 49

FIGURE 4. GRAPH SHOWING UNIT CONSTRUCTION COSTS REGRESSED AGAINST DISTANCE FROM THE URBAN CENTRE............................................. 54

FIGURE 5. GRAPH SHOWING UNIT ASSESSED LAND VALUES REGRESSED AGAINST DISTANCE FROM THE URBAN CENTRE............................................. 55

FIGURE 6. GRAPH SHOWING FREQUENCY DISTRIBUTION OF CONSTRUCTION COSTS PER SQUARE FOOT OF NET RENTABLE FLOOR SPACE............................................. 58

FIGURE 7. GRAPH SHOWING FREQUENCY DISTRIBUTION OF ASSESSED LAND VALUES PER SQUARE FOOT OF NET RENTABLE FLOOR SPACE............................................. 59
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CHAPTER 1

1.1 OBJECTIVE OF THESIS:

A primary objective of this thesis is to present an analytical framework within which the locators of offices may assess the desirability and suitability of alternative locations for office activity. The paper delineates those factors which influence the decision to locate offices in an intra-metropolitan context. It is a further objective to test the significance of certain criteria perceived to be contained in the decision to locate offices. Data for the Greater Vancouver Region is presented to test hypotheses related to selected location variables.

In addition to the above primary objectives it is anticipated that this thesis will provide an improved understanding of the decision process involved in the location of offices together with an appreciation of the significance of office activity as a user of urban land. Further it is hoped that a better understanding of the urban structure results together with an appreciation of those factors that may or may not induce the dispersal of office activity within a metropolitan area.
1.2 STRUCTURE OF THESIS

The following schematic indicates the structure of this thesis.

FIGURE 1 - SCHEMATIC OF THESIS STRUCTURE
1.3 MOTIVATION FOR AND SIGNIFICANCE OF
THE STUDY OF OFFICE LOCATION PRACTICES:

It is evident, when studying urban spatial arrangements, that office activity has been seriously neglected as a user of urban land. Other land uses within the metropolitan area have received partial, if still inadequate, treatment through analysis and the propagation of theories that seek to explain and presumably guide the location of those activities. Industrial location has been subjected to analysis dating from Weber (1). Similarly, retail activity has been studied from the precise geometry of Lösch (2) and Christaller (3) through to Huff (4). The third branch of the economic trinity involved in the production of goods and services, offices, has yet to be seriously explored.

It is suggested that the dearth of literature dealing with office location may be attributed to the inability of 'theorists' to submit to less sophisticated tools of analysis in providing an approach to office location practices. The inability to utilize complex mathematical and economic tools to understand this land use and subsequently to misunderstand the importance of the area as a facet of urban spatial arrangements, is no doubt a reflection of the complex nature of office activity. Office use is not readily capable of being linked to costs of factor inputs, production processes and factor outputs.
The nature of work undertaken in offices defies such neat classification. It is extremely difficult to impute dollar values and subsequent 'sophisticated' formulations to the quality of decisions and ideas that emanate from office activity. The suitability of such inputs as ideas, innovations and decisions are measured, at the best, by the continued existence and survival of the individual firm. Further it is difficult to gauge the difference in quality of such processes at alternative locations.

In addition to the desire to see this area of study advanced for academic satisfaction there is the further desire to appreciate the effect of office activity upon the physical urban environment. Although office activity does not, in itself, occupy a large proportion of the total available urban land surface, the ancillary problems associated with the provision of that space are extensive, with implications for many other aspects of urban existence.

The problems associated with the centralizing of economic activity in urban areas are particularly important. It is contended that time should be taken to consider the desirability of agglomerating office users within central areas of cities and to assess the suitability of alternative solutions to the location of office activity within the metropolitan area. Until the present time, an attitude of 'laissez faire' appears to have been the aphorism employed by those agencies vested with power of directing office
location. A lack of understanding of the locational characteristics of individual office users has probably tended to reinforce this attitude. The decisions of those employed in the actual location of offices are often no better. Although locators may consider themselves adept in deciding the location of individual office buildings they appear totally inept at understanding and appreciating the consequences of their decisions elsewhere upon the urban system.

The current approach to central city problems reflects no more than delayed reactions to underlying economic factors involved in the creation of urban areas. As long as the reactions are after the proverbial horse has bolted there will be a magnification and compounding of problems associated with central city areas. In 'solving' current problems of the urban core, society is inducing further problems, while at the same time obliterating any remaining options available, that would allow long term solutions for the advancement of our urbanized society.

In order to reduce the abstractions of the problems involved in locating offices at the centre of cities, it is necessary to punctuate this discussion with examples of the types of problems encountered. Two basic types of problems, associated with concentrating economic activity at the centre of cities, are identified: those problems of an economic order
and those of a socio-political nature.

Economic problems centre firstly upon the public treasury and secondly upon that group of society employed in central areas. In support of centralized activity, after acknowledging its existence and growth, society is constantly engaged in forays into the public fisc to provide improved access to those central areas, to provide infrastructure and to maintain it. For that group of persons employed in the downtown area there is the economic cost of commuting from place of domicile, typically the suburbs, to place of employment. Although some individuals may derive a psychic income from sitting in their cars on six lane freeways, it is suggested that the majority would prefer a reduced working day.

Those problems of a socio-political nature revolve around environmental problems of pollution and the decay associated with intense activity within central city cores. Property taxes derived from intense commercial activity in central city cores are a political stumbling block: municipalities enjoy the revenues obtained from commercial activity to subsidize the residential tax burden.

In addition to those known consequences of locating economic activity, notably offices, at the centre of cities, there are the unknown, yet appreciable consequences of the effect of such locations on the spatial arrangement of other
land users. One is particularly concerned with residential, retail and perhaps recreational users. If urban areas experience growth in office activity, that growth implies increased employment. Employees in turn require accommodation.

Solutions to the problems associated with the centralizing of office functions in urban areas are not evident. In seeking alternatives to concentrating activity in central areas, to alleviate the problems outlined above, two approaches are delineated.

The first approach, which is conceptually feasible, involves allocating and charging social costs involved at downtown locations to the users of such locations. To induce dispersal such social costs would need to be greater than any social costs determined at alternative locations. This approach is considered impracticable until an appropriation of costs, other than by arbitration, is found to equitably reflect the individual firm's contribution to the total costs of agglomeration.

The second approach, and that pursued in this thesis, is to provide an analytical framework to enable the locator of offices to assess alternative sites for office use. The approach involves making explicit the locational criteria required by the individual locator, measuring those criteria,
in dollar terms where possible, at alternative locations and deciding on the basis of cost advantage which site to accept to locate an office project. An individual locator will define those locational attributes required of a site to sustain a specific office activity and weigh the advantages or disadvantages accordingly.

In summary, it is evident that concentration of economic activity at the downtown core of cities present problems to society. Such problems, it is submitted, have been compounded by recent 'solutions'. It is time to question the effectiveness of such solutions while at the same time suggesting alternative approaches to solving core area problems.

1.4 PURPOSE OF STUDYING URBAN SPATIAL ARRANGEMENTS:

Office use is one of several land uses that constitute urban areas. By understanding the way in which all urban land uses locate, society may exercise a degree of effective and efficient control over the spatial allocation of uses within an urban area. That such control might be required is a political decision. However, three degrees of control that may be exercised are discussed below.

Firstly, should an urban activity, for example an industry such as an abattoir, be considered an obnoxious and non-conforming user of urban space, then through an
understanding of its and other users locational requirements that obnoxious use may then be harmoniously re-located.

Secondly, by understanding the location processes, effective control may be exercised on the basis of analysis and prediction of probable future states of urban spatial arrangements. Knowing those future states would then allow the direction of energies and resources in attaining those states effectively. Should a predicted state be considered unpalatable, then society may take steps to avoid that predicted situation. For example, knowing the locational prerequisites of land users, if a transportation improvement is effected, one should be able to predict the probable future spatial demands for residences. If society could tolerate that future state then it would be able to direct resources to phasing such items as municipal financing and utilities more efficiently. If the development were considered undesirable then society would avert the undesirable state by perhaps rerouting the transportation system.

Thirdly, given an optimal spatial arrangement, again knowing the mechanics of locating specific land uses, one should be able to provide for that arrangement. This latter suggestion requires absolute control over land arrangements and would probably require totalitarian directive to ensure its success.
Substantial political arguments can be proffered for and against exercising control of urban spatial arrangements through an understanding of the location rationale of different users. However the merits and demerits of any of the above reasons for acquiring a degree of control over urban spatial configurations are beyond the scope of this thesis.

In summary, an understanding of the significance of various location criteria used in locating offices will bring about an enhanced understanding of the total spatial arrangement of urban land users and thus facilitate a degree of control over the total urban environment.

1.5 LITERATURE REVIEW:

It is important to note at this point that no major theoretical work is available on the location of offices. Scholarly work with respect to office location is sadly lacking. Reasons for such a dearth of writings on the subject were alluded to earlier. A review of the bibliography contained in Appendix (C) indicates that the vast majority of work, dealing with offices in general, has been carried out in the United Kingdom. Despite the paucity of literature on office location criteria, it is necessary to expose that which has been written and to determine the significance of that literature.
Writings of a documentary nature commenting upon the state of office location practices are to be found in popular journals such as 'Fortune' (5), 'Business Week' (6), and 'The Economist' (7). Although of limited theoretical value, such articles provide an awareness of the problems confronting the locators of offices and society in general. The continual obtrusion of such phenomena, as contained in those articles, assists in reinforcing the stimulus to theorize on the location of offices. This review need not concern itself with intricate criticism of such documentation as those commentaries do not provide academic food for thought.

Those writings that excuse attaining a rational theory of office location deserve criticism. Vernon suggests that:

"to try and account for the location of the nations office workers in any conclusive way is an exercise in acute frustration." (8)

He continues in pyrrhonic fashion:

"the chances of a rational location of offices pattern are not that good." (9)

Vernon not only excuses himself from a discussion of the complex nature of office location but also implies that the pursuit by others in determining a rational approach to the location of offices will yield little success. Only after serious and rigorous work in defining and verifying location criteria will there emerge an understanding of the office
function within metropolitan areas. With respect to this latter point the writer is in agreement with Harris. In modelling urban systems Harris has written:

"It is evident that considerable research, regarding the central office function, its future growth potential and its locational characteristics will be required before this activity can be adequately modelled and before its needs and influences can be adequately dealt with in planning activities." (10)

Harris recognizes the problem and at least suggests that extensive work be carried out on the location of offices. Meanwhile urban areas are modelled irrespective of the importance of this particular activity and without knowledge of its impact upon the total urban system. (11)

Hoover has been suggestive of the necessity of understanding urban spatial arrangements by writing:

"the first step in building a useful conceptual framework for understanding urban spatial patterns is to sort out the multifarious location factors that influence the preferences and placement of specific activities in types of decision units." (12)

Despite Vernon's pessimism in determining a rational pattern of office location, the latter together with Hoover has
attempted to describe, in an intuitive fashion, the rationale for the location of office buildings. The reader is directed to *Anatomy of a Metropolis* (13) for an extensive review of their propositions. Many of the suggestions relating to external economies, communications and journey to work are considered more fully when presenting an explicit statement of the rationale for office location in Chapter 2 of this thesis.

A significant piece of North American literature dealing with the variables involved in locating offices was written by Foley (14). The latter's work attempts to provide evidence of the criteria to be considered by firms when locating offices. The crystallization of location practices is purely descriptive in so far as Foley's study of the San Francisco Bay area only describes those factors that should be considered in the location of offices. Foley offers neither analysis nor verification of his suppositions.

Finally, the major piece of analytical work carried out, as far as this writer has been able to ascertain, is a British study commissioned by the Location of Offices Bureau (LOB) (15). The LOB study is an extensive work covering major office users located in the Greater London Conurbation Centre and up to 30 miles from Charing Cross. Although it is tenuous to impute the findings of the LOB study to other metropolitan regions, it is regarded as an important empirical
work on office location practices. With respect to location
criteria, the LOB study provides an explicit statement of
office location practices (16). The study, however, does not
attempt to determine if there is any real or factual signifi­
cance in the criteria cited.

An extensive bibliography on various facets of
office location and related topics is included as Appendix (C)
to this thesis.

In summary, this overview of the literature on
the location of offices intimates that there has been little
analysis and consequently no theory available with which an
understanding of urban spatial arrangements may be furthered.
These solitary works that have been completed, although a
step in the correct direction, need to be verified and rein­
forced.

The remainder of this thesis is devoted to an
examination of office location criteria in general, and more
specifically to land and building costs as component variables
in the decision to locate offices.
CHAPTER 2

2.1 APPROACH TO THE STUDY OF OFFICE LOCATION PRACTICE:

This section outlines the basic approach to be taken in achieving the objectives of this thesis. The approach involves the presentation of a basic hypothesis that forms a spatial framework within which an orderly and systematic examination of the problem may proceed. The postulation is formed to provide a cost/benefit situation within which a location decision may be formulated. Identified with such costs and benefits are the advantages or disadvantages that all alternative locations possess with respect to characteristics contained in the location decision. Following a general discussion on office location criteria, land and office costs, are selected for further analysis. Such analysis involves the postulation of relationships with those specific variables and their location across the metropolitan region. The hypotheses are subjected to measurement, statistical testing, interpretation and inference. By determining the significance of such relationships, one is then, ceteris paribus, capable of tentatively pronouncing the soundness of considering such criteria as elements in the decision to locate offices.

2.2 BASIC POSTULATION:

The confines of this study are found within the
bounds of the underlying basic hypothesis of this thesis which states that:

THE DESIRE TO LOCATE OFFICES IN SUBURBIA WILL ONLY OCCUR WHEN THE NET BENEFITS, TO A SPECIFIC LOCATOR, OF SUCH A LOCATION ARE GREATER THAN THE NET BENEFITS ACCRUING AT A MORE CENTRALIZED LOCATION.

2.3 DEFINITIONS:

Before proceeding with the implications of the major hypothesis of this thesis the following terms are defined to obviate difficulties of interpretation.

(a) 'offices'
are those premises used in the furtherance of office activity. Such activities, derived from the Standard Industrial Classification (SIC) code, are tabulated in Appendix (A). (1)

(b) 'suburbia'
The following discussion regarding suburbia allows for an understanding of the urban-suburban dichotomy together with a cognizance of what constitutes the continuous metropolitan region.

Suburbia is a nebulous concept and thus difficult to define precisely. Suburbia is typified in any of the behavioural, geographic or demographic respects illustrated below. Although vague and deficient, such an appreciation is considered sufficient for the purposes of this paper in
determining an understanding of suburbia.

Whyte, in determining a definition of suburbia was at a loss is writing:

"It is true the city and suburb together make up the metropolitan area. Geographically speaking the decision is difficult to make." (2)

In distinguishing the central city from the suburbs, Whyte draws the following dichotomies: heterogeneity and homogeneity, concentration and dispersal and specialization and middle range. (3)

Gans has described the suburbs as:

"...... the latest and most modern ring to the outer city, distinguished from it only by lower densities, and by the often irrelevant fact of the rings' location outside the city limits." (4)

Writh, the Chicago urban sociologist distinguishes areas of a city by:

"...... place and nature of work, income, racial and ethnic characteristics, social status, custom, habit, taste, preference and prejudice." (5)

Greer concluded that:

"...... the 'ideal type' approach to central city-suburban differences is less than adequate. It represents a dichotomy supported only at the level of government. For the most part the two halves of the metropolis represent different configurations, of the same attributes, different 'mixes of the same population types'." (6)

Chinitz, in introducing 'City and Suburb' (7),
distinguishes urban and metropolitan areas. Such distinctions may be considered synonymous with central city and suburbs. Chinitz observes that the central city,

".....implies high density spatial arrangements - a lot of people and a lot of business clustered in a small area...." (8)

Chinitz suggests that metropolitan or suburban regions are contiguous to the urban area with relatively low densities compared to the central city yet high compared with rural areas. (9)

(c) 'net benefits'
are the positive residual, in dollar terms, of benefits over costs at a given location.
This definition is to include discounted tangible and intangible, measurable and imputed costs and benefits to the locator of office premises. Social costs and benefits, although recognized, are specifically excluded from this thesis.

The hypothesis contained in section 2.2 provides the springboard from which the remainder of this thesis is derived. In essence, the hypothesis allows a spatial framework within which the merits and demerits of alternative office locations may be assessed. The costs and benefits implied in the hypothesis encompass the advantages that one site holds over another with respect to the location characteristics desired by an individual office locator. Following an exposition of those locational characteristics, this thesis
attempts to discover the significance of land and building costs as specific location variables.

2.4 STATEMENT AND DISCOURSE ON OFFICE LOCATION RATIONALE:

This section delineates those location factors considered in the decision to locate offices. The list is as complete as is possible to adjudge, but does not preclude additional criteria in the pursuit of exhaustiveness. The arguments listed are not applicable to the same extent, if at all, for each and every decision to locate offices. Individual locators will consider those essential points with respect to the peculiar nature of their location requirements.

Many of the factors listed below appear intuitively sound criteria for locating offices: actual consideration given to any one reason is largely unresearched. To ascertain the credibility of such factors, it would be necessary to solicit information and opinions from those persons actually involved in the location of offices. This thesis, because of time constraints has not attempted to procure such information.

(a) **Accessibility to consumer markets.**

The desire of office users to be in propinquity to a consumer market will vary with the nature of the activity executed. Those activities that solely process information, such as data processing centres, do not need to be close to
a consumer market. However those office functions that sell services to the general public, for example, banks, real estate offices, medical and dental offices, will have their location determined to a considerable extent by the availability of a consumer market sufficiently large, in dollar terms, to support the services provided by those offices. In many cases the principles involved in retail location will be applicable to offices providing services to the public (10).

(b) **Accessibility to external organizations:**

This factor is important to those functions incapable of internalizing all of the activities necessary for the existence of an organization. Financial institutions are examples whereby, because of the diversity of activity undertaken, it is unrealistic to employ experts in each and every field where their advice is required. The ability of firms to utilize specialists from related institutions ensures the success of the firm. For example a stock broker that is an expert on mining stocks may need to seek further advice on government securities.

Those institutions capable of internalizing functions necessary for continued operation will be less prone to count this factor as a significant location variable. Insurance offices requiring only processing and filing space will be able to locate their activity independently and without
regard to external organizations as their survival is not a function of close proximity to other organizations. Goddard (11) has researched inter-organizational linkages for the City of London and concluded that there are distinct inter-office type linkages.

In addition to proximity to other work organizations, a locator of offices may give consideration to proximity to non-work related activities such as dining, shopping and recreational facilities. Such a consideration would be concerned directly with employee welfare and indirectly with the ability of an organization to maintain a stable labour force.

(c) Accessibility to labour markets:

In determining the importance of this criterion in the decision to locate offices, a firm will have regard to the absolute size, educational or skill level, the stability and cost of labour required to complement its activity. Firms with different requirements will weigh the importance of these factors according to the special characteristics required by the individual firm. In addition to the above factors the availability of adequate transportation networks and methods of conveying employees to work will be considered.

(d) Inter-personal communication:

The clustering effects evidenced on Wall Street in
New York, Threadneedle Street in the City of London and Howe Street in Vancouver all reflect the desire of financial institutions to be in a position where inter-personal communication is facilitated. Such institutions will be involved in 'bush telegraph' communications whereby personal contact is essential due to the nature of the operations undertaken. Reliance upon rapid, oral, effective and often confidential information in order to obtain a competitive edge in business is the hallmark of such organizations.

Despite the ubiquitous growth and use of computers in communication networks it is suspected that such organizations, with an ear to the ground, will desire to locate where personal contact with others is facilitated.

(e) Location of parent use:

The desire for office functions to be integrated with the parent use is evidenced in such activities as downtown department store accounts. In such instances the location requirements of the parent use will determine the parasitic office's location. However it may be possible to segregate functions within a complex development. In considering such a possibility the individual organization will evaluate the inconvenience caused by divorcing the location of internal functions.
(f) **Prestige and tradition:**

Prestige may convey solidity, leadership, address, stability, wealth or eminence to the users of a particular office function. Prestige, as a factor, is an impression that the firm believes society possesses with respect to a location or firms associated with a location. Such an impression may be more apparent than real. From the LOB study (12) it is evident that many locators consider prestige as a formidable component in the office location decision. Tradition is used synonymously with prestige to impart similar confidences. Tradition or 'we have always located here' is a much cited location factor. (13)

(g) **Managerial utility:**

The decision to locate offices need not be made by reasoned thinking of other variables contained in this section. Dominant members within an organization may exert considerable influence on the location decision. Such individuals may prefer short commutes, restaurant facilities, views, golf courses and the like. The rationale for the location of offices then becomes difficult as subjective utilities are involved in the decision process.

(h) **Physical capabilities for expansion:**

In determining the suitability of this criterion
as a location factor, the locator should possess a cognizance of future growth potential within the organization. To plan for physical expansion the locator will require estimates of when and in what quantities that growth will be manifested. For those firms where additional physical capacity is little other than a pipe dream this factor will be relatively insignificant in the location decision.

(i) **Employee welfare**:

Those far sighted employers capable of adapting a well worn adage will realize that what is good for their employees is also good for the firm. A firm will concern itself with employee efficiency. Should a reduced commute improve the employees' welfare then there is every chance that it will also improve their efficiency. Firms indulging in such altruisms are likely to weight this factor more heavily in deciding an office's location than more malevolent employers.

(j) **Land costs**:

The locator of offices concerned with land costs will be interested in land costs attributable to a unit area of usable floor space and will evaluate such costs at alternative locations.
(k) **Building costs:**

In considering construction costs the locator of offices will account for the cost attributable to a unit area of usable floor space in providing an office structure at alternative locations.

The foregoing represents a comprehensive list of those variables to be considered in the location of offices. The listing provides a convenient framework whereby each of those variables may be selected in an orderly and systematic fashion and subjected to further analysis. The following section reviews the significance of two of the above factors, land and building costs, considered in the decision to locate office buildings.

2.5 **DELINEATION OF LOCATION VARIABLES FOR FURTHER ANALYSIS**

For the purposes of this thesis, land and construction costs for offices have been selected for further analysis; the reasons are threefold.

Firstly, both location criteria are capable of meaningful measurement. Secondly, both elements are readily identifiable as entities with little ambiguity. Thirdly, data are available in relatively consistent form that allows for statistical measurement and inference.
Few advantages are gained through considering variables if those variables are unjustifiable location criteria. In assessing the relevance of land and building costs as location factors, it has been necessary to determine those parties involved in the location of offices, and to decide whether or not the costs of providing land and structures, for office premises, are indeed relevant to the location decision. There are five identifiable groups concerned with office location criteria in general. Their interests will vary with respect to different location variables depending upon individual requirements.

Firstly, investors seek a return on invested equity capital in the form of current income, future capital gains or some combination of the two. In assessing the potential of an investment, commensurate with a given degree of risk, the investor will evaluate the locational characteristics of a site as they affect the final user; the lessee. The investor, as is the lessee, is concerned with a site’s existing and potential profitability and its ability to pay rent. This ability will be influenced by location factors other than land and building costs. Investors, however, are concerned with land appreciation at some later date as well as the allocation of land and improvements for tax purposes. Investors are thus interested in land and building costs as location criteria.

The second group of persons concerned with location criteria for offices are speculator developers. The office developers function is to provide physical office space in
the correct quality and quantity, at the correct place and at the correct time such that the created value is greater than the project cost. In maximizing the return on equity funds, the developer attempts to maximize the positive spread between value and cost. Value is partially determined by the locational attributes that a site possesses with regard to the final user. In maximizing the spread between value and cost, ceteris paribus, the developer attempts to minimize costs. As the major portion of development costs are accounted for by land and building costs, the developer is concerned about such costs at alternative locations. He thus treats land and building costs as location criteria.

The third identifiable group are owner occupier developers. This group has regard to location criteria as they affect the individual firm's requirements. Land and building costs, in the case of this group, are treated as accounting identities in the firm's operations as are subsequent operating expenses based upon original capital expenditures e.g. property taxes. Initial capital costs for land and buildings are thus considered by this group of office locators. Differentials between alternative sites should be evaluated. It is suspected that owner occupiers are less concerned, with land and construction costs, than speculative developers as such costs are a relatively small consideration when taken in the context of the firms overall operation.
The fourth category of individuals concerned with office location criteria are the final users or lessees. They have no regard for the initial capital costs of providing an office building. The lessees' prime consideration is the ability to pay rent, given a certain degree of profitability, which is determined by locational attributes other than the costs of providing land and structures to be used for offices.

Finally, the fifth body involved or required to be knowledgeable of location factors are municipal planning authorities. The interest that this group should display involves a comprehension of all location variables as they impinge upon the activities of the four groups described above. Their function is to reconcile the requirements of investors, developers, owner occupier developers and final users, with the interests of society at large.

From the above discussion and analysis it is evident that land and building costs are justifiable criteria to be examined as far as investors, developers and owner occupier developers are concerned.

2.6 SUB HYPOTHESES

This section presents hypotheses related to land and building costs as component variables in the decision to locate offices together with the rationale for such propositions.
(A) **Building costs**

For the purpose of this thesis building costs are defined as:-

those estimated costs, identified on building permits, lodged with municipal building permit offices, as 'total costs to completion'.

N.B. Unit construction costs derived from building permits are strongly comparable to reliable estimates of actual costs given by industry - see Table (VI).

It is hypothesized that:-

(i) **OFFICE BUILDING COSTS PER SQUARE FOOT OF NET RENTABLE OFFICE FLOOR SPACE ARE INVARIANT ACROSS THE URBAN REGION**

The above hypothesis (i) further implies that since unit costs are invariant across the urban region that there is no difference in unit construction costs as between central and suburban locations. The latter locations are exclusive sub sets comprising the total set of all office locations.

It is thus hypothesized that:-

(ii) **THERE IS NO SIGNIFICANT DIFFERENCE IN COSTS OF CONSTRUCTION PER SQUARE FOOT OF NET RENTABLE OFFICE FLOOR SPACE AS BETWEEN CENTRAL CITY AND SUBURBAN LOCATIONS**

The rationale for the above hypotheses is that construction costs are presumed to be a function of labour costs, material costs, technological forms and scale economies. Other factors that were considered to have a possible affect upon construction costs included the use of union or non-union labour and logistical problems involved in supplying and operating congested and restricted sites. Financing cost
differentials are a further possible variable. With respect to the type of labour involved in the construction of offices, any differentials between union and non union wage rates are difficult to determine. Local authorities appeared unable to discern discrepancies due to this factor when contemplating submitted estimated project costs. With respect to possible differentials due to logistic difficulties in supplying restricted sites it was found, on consultation with industry, that although recognizing a possible cost differential, it was difficult to factor out of total project cost. Higher costs of supplying materials and providing additional work e.g. street closures, were applicable to large scale projects. In such cases any additional costs were minimized by effective work phasing and planning. Although possible additional costs pertain to large scale projects, when allocated on a square foot of rentable floor space, such costs would be minimal. With respect to financing costs it is difficult to generalize. Specific operations and operators will experience different advantages or disadvantages in the securing of finance to carry through an office project.

In reviewing the arguments of the construction cost function, it can be seen that the function contains cost elements of labour and materials together with 'non-cost' elements of technological form and scale economies, that affect the total project cost. The following analysis is intended to determine the effect of the above four elements upon the costs attributable to a square foot of usable office floor space.
(1) Labour costs

Labour costs, within a metropolitan region, are likely to be homogeneous for a given input of labour required to produce a given unit of office space. Trade union practices will equalize labour rates within a given metropolitan region particularly where information is relatively perfect and is disseminated effectively. The hourly rates of an electrician will be the same in North Vancouver as they are in Burnaby. The location of a specific office project will thus have no bearing on labour rates charged to produce a unit area of net rentable floor space. Anomalies arise where different mixes of labour inputs are required. In assuming strict comparability between buildings this does not present problems. In reality it is difficult to discover buildings identical in all respects. A review of labour rates for craftsmen involved in the construction industry, Table (1), indicates only marginal intertrade wage differentials.

(2) Material costs

The dollar cost of providing building materials for a unit area of rentable office floor space is likely to be invariant across a metropolitan region. Suppliers, although differentiating costs as between intermetropolitan locations are likely to develop flat rate charges for intrametropolitan locations.
TABLE I

TABLE SHOWING INTERTRADE WAGE DIFFERENTIALS IN THE CONSTRUCTION INDUSTRY FOR THE VANCOUVER REGION

<table>
<thead>
<tr>
<th>OCCUPATION</th>
<th>YEAR 1963</th>
<th>1971</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bricklayer</td>
<td>3.17</td>
<td>5.18</td>
</tr>
<tr>
<td>Carpenter</td>
<td>3.14</td>
<td>5.86</td>
</tr>
<tr>
<td>Cement Finisher</td>
<td>3.04</td>
<td>5.25</td>
</tr>
<tr>
<td>Electrician</td>
<td>3.53</td>
<td>6.55</td>
</tr>
<tr>
<td>Labourer</td>
<td>2.37</td>
<td>4.54</td>
</tr>
<tr>
<td>Lather</td>
<td>3.00</td>
<td>6.01</td>
</tr>
<tr>
<td>Painter</td>
<td>2.96</td>
<td>5.52</td>
</tr>
<tr>
<td>Plasterer</td>
<td>3.15</td>
<td>5.95</td>
</tr>
<tr>
<td>Plumber</td>
<td>3.39</td>
<td>6.40</td>
</tr>
<tr>
<td>Reinforcing Rodman</td>
<td>2.96</td>
<td>6.15</td>
</tr>
<tr>
<td>Structural Steelworker</td>
<td>3.37</td>
<td>6.15</td>
</tr>
<tr>
<td>Sheetmetal Worker</td>
<td>3.17</td>
<td>6.25</td>
</tr>
</tbody>
</table>

(3) **Technological forms and scale economies**

Technological form involves the use of an appropriate technology to cope with different construction projects. With respect to offices, the technology involved may involve anything from the elementary wood frame techniques for low rise buildings to highly complex reinforced concrete techniques necessary to ensure the structural feasibility of high rise tower blocks. In addition to the superstructure of a building different buildings require varying degrees of complex infrastructure. A three storey block uses relatively simple methods of servicing when compared to larger scale projects e.g. use of elevators, water pumps.

Scale economies exist where there is a reduction in cost of a marginal unit increase in the amount of office space provided. Economies of scale will be derived from more efficient use of labour and machinery and bulk orders that secure special rates. In general larger scale projects will reap the benefit of such economies.

With respect to the two non-cost elements of technological forms employed and scale economies, concern is with project scale. The size of a project may be viewed in terms of building height or square footage of office floor space. The latter two aspects of project scale may be combined to achieve any of the following four situations:
(a) low rise and large square footage
(b) low rise and small square footage
(c) high rise and large square footage
(d) high rise and small square footage

The implications of the four situations above give rise to the link between the technology employed and scale economies, together with the relative affects upon the total project cost. Those links together with the relative effect on cost (+ or -) are as follows:

(a) simple form (-) and economies of scale (-)
(b) simple form (-) and diseconomies of scale (+)
(c) advanced form (+) and economies of scale (-)
(d) advanced form (+) and diseconomies of scale (+)

From the foregoing analysis it is evident, given constant labour and material costs that the most advantageous form of office project, from a construction cost point of view, is low rise and large square footage while the most disadvantageous forms are high rise and low square footage e.g. space needle. A further observation is that the relative unit cost advantage/disadvantage of low rise and small square footage (b) over high rise and large square footage (c) depends upon the relative offsetting effects on total project cost of technological form and economies of scale.

In reality the most advantageous project cost
combination is not in evidence in the Greater Vancouver Region. Similarly the most disadvantageous combination is not evidenced. From Table (II) it can be seen that the compromise situations of (b) and (c) are the types of office project undertaken. The interesting characteristic being that central city locations, on average, employ high rise and large square footage relative to the low rise and small square footage offices found at suburban locations.

In conclusion the most advantageous cost combination for office structures is not evidenced in the central city because accessibility desired by a large number of central locators limits the ground area available; low rise, large square footage consumes accessibility. The most advantageous cost combination is not in evidence in the suburbs as office use is small scale and local market orientated. The most disadvantageous cost combination is illogical and thus not observed. The compromise situations represent, firstly, central city areas with high rise and large square footage as accessibility to the centre is the overriding factor for large numbers with large space requirements; ground area is severely restricted. Secondly suburban areas utilize low rise, small square footage as the market threshold limits the office function and its space requirements.

(B) **Land Costs**

This thesis, in determining a measure of land costs,
TABLE II
GREATER VANCOUVER REGION - 1971
TABLE SHOWING BUILDING HEIGHTS AND
NET RENTABLE SQUARE FOOTAGE (NRSF) BY LOCATION

<table>
<thead>
<tr>
<th>BUILDING HEIGHTS</th>
<th>CENTRAL</th>
<th></th>
<th>#</th>
<th>%</th>
<th></th>
<th>#</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 3</td>
<td>6</td>
<td>16.6</td>
<td>32</td>
<td>94</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 - 5</td>
<td>5</td>
<td>13.9</td>
<td>1</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 - 10</td>
<td>9</td>
<td>25.0</td>
<td>1</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11 - 15</td>
<td>6</td>
<td>16.6</td>
<td>-</td>
<td>-</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>16 - 20</td>
<td>2</td>
<td>5.6</td>
<td>-</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21 - 25</td>
<td>2</td>
<td>5.6</td>
<td>-</td>
<td>-</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>26 - 30</td>
<td>5</td>
<td>13.9</td>
<td>-</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>31 +</td>
<td>1</td>
<td>2.8</td>
<td>-</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>36</td>
<td>100.</td>
<td>34</td>
<td>100</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>NRSF</th>
<th>CENTRAL</th>
<th></th>
<th>#</th>
<th>%</th>
<th></th>
<th>#</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 5000</td>
<td>-</td>
<td>-</td>
<td>6</td>
<td>18.2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5001 - 10,000</td>
<td>-</td>
<td>-</td>
<td>14</td>
<td>42.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10001 - 15,000</td>
<td>1</td>
<td>2.9</td>
<td>8</td>
<td>24.2</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>15001 - 20,000</td>
<td>1</td>
<td>2.9</td>
<td>4</td>
<td>12.1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20001 - 40,000</td>
<td>7</td>
<td>20.0</td>
<td>1</td>
<td>3.0</td>
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<td></td>
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<tr>
<td>40001 - 60,000</td>
<td>4</td>
<td>11.4</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>60001 - 80,000</td>
<td>6</td>
<td>17.1</td>
<td>-</td>
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<td>-</td>
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<tr>
<td>100001 -150,000</td>
<td>3</td>
<td>8.6</td>
<td>-</td>
<td></td>
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<tr>
<td>150001 -200,000</td>
<td>1</td>
<td>2.9</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>200,000 +</td>
<td>8</td>
<td>22.8</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>35</td>
<td>100.</td>
<td>33</td>
<td>100</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source - Research Data
utilizes assessed land values for property tax purposes. The rationale for such an approach is discussed in section 3.1 when dealing with research methodology. Although not entirely satisfactory such a measure is a reasonably good proxy of relative market values of office sites. - see Appendix (B)

To facilitate the analysis of land costs it is necessary to isolate those factors that determine the value of land, and consequently the price paid, for office sites. The analysis assumes that the locator of offices is working under a competitive market.

Those forces that affect the market value of office sites, may be termed market (economic) and non-market (social) forces. The combination of both forces sets market value. Market forces are those of the inter-action of demand and supply operating through the price mechanism. Non market forces, or social forces, such as zoning are exogenously determined by planning authorities.

To analyse the relative effects of both forces upon the value of office sites and hence the cost of land attributable to a unit area of net rentable floor space, it is useful to split the analysis into two parts: firstly, to examine the effects of market forces in the absence of non market forces and secondly to examine the combined effects of both forces.
(1) Effect on price in the absence of zoning.

In the absence of artificial constraints the interaction of demand and supply, operating through the price mechanism will determine the value of sites for office use. Classical analysis suggests that accessibility to the centre of an urban area is the criterion for a high degree of competition between different users, and that the use capable of sustaining the highest profit will effectively compete the more accessible and central site away from the less profitable use.

On the demand side of the equation, those users desiring a central location will compete with each other such that the more efficient in terms of profitability will bid the site away from the less profitable use. This process will continue such that all but the most efficient user desiring central accessibility will be removed from the most accessible location. The effect on site costs is such that as one moves away from the centre unit site costs decrease.

On the supply side of the equation there is a fixed supply of central and highly accessible sites. As one moves from the centre there is an increasing supply of substitutable sites. The relative effect upon the unit site cost is thus to depress unit site costs the further one moves from the central and more accessible site.
The interaction of demand and supply works such that as one moves away from the centre of an urban area there is an increasing supply of available office sites with a decreasing demand for those sites as office users occupy the more accessible sites before the less accessible sites.

However, all office functions do not thrive on central urban accessibility. Other location criteria such as proximity to local markets may be an overriding location factor. In such cases it is difficult and misleading to apply, per se, the classical notion of accessibility to an urban centre. As far as offices are concerned, accessibility to locational attributes necessary to support the particular office function is a more meaningful approach when determining site costs for office users. Just as there are physical limitations to highly geographically central locations so there are institutional limitations on less central, yet nonetheless desirable, locations as far as some office users are concerned. The same competitive forces are observed but the rationale is not accessibility to an urban centre but accessibility to other location factors.

(2) Effect on price due to market and non market forces.

From the above it was seen that the market or competitive forces operating through the price mechanism ensured that, as one moved away from an accessible centre
there is a reduction in unit site costs. In reality market forces are artificially constrained by institutional intervention. (14) Zoning determines both the permitted use of site together with intensity of use. With respect to the former, zoning ensures that office sites only occur at pockets across an urban region. With respect to intensity of use, the more intensely a given site area is developed the lower will be the costs of land attributable to a unit area of net rentable floor space, although unit site costs will be relatively greater. From Figure (2) it can be seen that as one moves away from the centre of an urban area intensity of use decreases. The sample used in this thesis indicates that such a decrease approximates an exponential decay function. The effect being that sites are used less efficiently the further one moves from the centre with a resultant increase, ceteris paribus, in the cost of land attributable to a unit area of usable office floor space.

The combined interaction of pure market forces with institutional constraints, as they affect the cost of land per unit area of net rentable floor space, are seen to be offsetting effects. Competition ensures that land prices decrease as one moves from the centre of an accessible area while zoning ensures that sites are used less efficiently the further one moves from the centre with a resultant increase in unit costs.
FIGURE 2.

Graph showing log floor space ratio regressed against distance for offices across the Greater Vancouver region.

- Constant $A = 1.568$
- Coefficient $B = -0.0004418$
- $F$ Ratio = 139.8
- $F$ Probability = 0.000
- Std. Error (A) = 0.125
- Std. Error (B) = 0.000003736
- Std. Error (Y) = 0.6531
- Coeff. of Det. ($R^2$) = 0.69
- $t$ Statistic = 11.85
In reality the market is imperfect with office users competing for sites with knowledge of zoning constraints. The bidding process described earlier operates within the institutional limitation.

From the above analysis it is possible to suggest three alternative situations that might occur with respect to land costs attributable to a square foot of net rentable floor space. Firstly that such costs are invariant across the metropolitan region; secondly that costs decrease the further one moves away from the centre of an urban area or thirdly that costs increase with distance.

Competition for office sites is not between all office users for all sites but between some users for some locations; central accessibility is not the dominant location variable for all office functions. There is no reason to suppose that a suburban office function is less profitable in terms of space efficiency than a central office function.

For the purpose of this thesis it is thus hypothesized that:

(iii) **THE COST OF LAND PER SQUARE FOOT OF NET RENTABLE OFFICE FLOOR SPACE IS INVARIANT ACROSS THE METROPOLITAN REGION.**

The above hypothesis (iii) implies, that since unit costs of land per net rentable square foot are invariant across the
urban region, that there is no difference between suburban and central city unit costs. Again the central city and suburbia are exclusive subsets constituting the total set of all office locations. It is thus further hypothesized that:

(iv) THE COST OF LAND PER SQUARE FOOT OF NET RENTABLE OFFICE FLOOR SPACE IS INVARIANT AS BETWEEN CENTRAL AND SUBURBAN LOCATIONS.
CHAPTER 3

3.1 RESEARCH METHODOLOGY

From those hypotheses it was necessary to construct a sample of office buildings, determine a point in the urban region from which those offices were spatially related, collect land and building cost data on individual office projects and ensure that such data were comparable for statistical measurement.

(i) Sample Identification

This thesis reviews only principal non-government office buildings constructed in the City of Vancouver and the municipalities of Burnaby, New Westminster, Coquitlam, North Vancouver City, and North Vancouver District. Major office buildings in Delta, Richmond and Surrey were not in evidence. Government buildings were excluded on the grounds that criteria other than economic probably determined their locations. The principal source consulted, in deriving a sample of office buildings, was found in 'Real Estate Trends in Metropolitan Vancouver 1971' (VRET) (1) supplemented with information obtained from discussions with municipal authorities. The sample obtained is not a complete sample of all office space in the Greater Vancouver Region (GVR) but from Table III it can be
### TABLE III

<table>
<thead>
<tr>
<th>AREA</th>
<th>(1) (SQ. FT)</th>
<th>(2) (SQ. FT)</th>
<th>(3) (SQ. FT)</th>
<th>(4) (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CITY OF VANCOUVER</td>
<td>12,587,000</td>
<td>4,605,000</td>
<td>36.7</td>
<td></td>
</tr>
<tr>
<td>DOWNTOWN PENINSULA</td>
<td>9,625,000</td>
<td>4,096,000</td>
<td>42.5</td>
<td></td>
</tr>
<tr>
<td>SUBURBS</td>
<td>712,000</td>
<td>320,869</td>
<td>45.8</td>
<td></td>
</tr>
</tbody>
</table>

**SOURCE:** 'Office Space Survey, 1971' - Real Estate Board of Greater Vancouver 1971 and thesis data.
seen to represent 42.5% of the downtown peninsula space, 36.7% of the City of Vancouver space and 45% of suburban office space, the total sample represents approximately 36.4% of all non-government office space in the Greater Vancouver Regional District. Much of the remaining office space is contained in small units in multi-purpose developments. Complex developments were excluded where apportioning of unit costs would have been grossly inadequate. Unfortunately such complex developments often included large scale office projects. The information obtained from VRET was scrutinized by cross checking municipal records to determine anomalous reporting.

The sample includes a total of 71 office buildings across the GVR of which 36 are classified central locations and 35 are classified suburban locations. All office sites classified as central are within the City of Vancouver; all others are defined as suburban sites. Higher place office functions such as those located along Broadway have been included in the central sample. The sample used to test unit building costs includes 34 buildings at central locations and 32 at suburban locations. The sample used to consider land assessment data comprises 32 and 27 sites respectively. Discrepancies between sample sizes are due to missing data.

(ii) Research process

Originally it was intended to obtain building cost
data from municipal building permit offices and land cost data from land registry files. The former proved satisfactory while the latter proved highly unsatisfactory. In tracing and searching land registry deeds of the subject sites, to ascertain the price paid for a site immediately prior to development, it was evident that reported sales prices, where obtainable, were anomalous. In the absence of access to confidential land registry certificates it was impossible to verify the accuracy of reported figures. Property exchanges, non arms length transactions and lot consolidations all compounded the difficulty of obtaining data that might be considered acceptable for this thesis.

Unable to obtain reliable data indicative of market value from land registry files, it was decided to use current assessed land values for property tax purposes when considering land costs per square foot of net rentable floor space. Such a measure, although not indicative of true market value is considered acceptable as representative of relative market values across the metropolitan region. The limitations of such data will be discussed below.

VRET provided information necessary to test the hypotheses concerning building costs. Such data included civic addresses, net rentable square footage, year of project completion and storey height. Additional information was abstracted from municipal building permits. That data included
permit application data, gross building area, total estimated project costs to completion and site areas. Building permits were located by civic address from files lodged in municipal offices.

To satisfy the hypotheses concerning land costs per square foot of net rentable floor space, assessment files lodged with municipal assessment offices were searched using the civic addresses from VRET to determine the roll numbers of subject properties. From the roll numbers, assessed land values for property tax purposes were determined. Checks on past assessment rolls were carried out to discover if there had been radical permitted changes in use that might distort assessed values after a project's inception. Conversions by an appropriate factor were made to eliminate discrepancies due to single and dual roll reporting methods employed by different municipalities.

The location of office sites sampled were plotted on a scale map and measured from a predetermined central point; the junction of Georgia and Granville Streets on the downtown peninsula. Figure (3) illustrates that Vancouver's highest land values for offices are found at this location reflecting high competition for the highly central and accessible location. All distances are straight line distances with obvious topographical barriers accounted for. Time distance contours were considered as an alternative method of measurement but the fine grain information
FIGURE 3

GRAPH SHOWING COMMERCIAL LAND VALUES - DOWNTOWN VANCOUVER

$/SQ.FT. OF SITE

YEAR


Source: 'Office Space Survey 1971', Real Estate Board of Greater Vancouver 1971
required was unobtainable from the coarse grain data available.

Data with respect to construction costs and land values were subjected to two processes to make it comparable, and manageable, in dealing with the above sub hypotheses.

Firstly all data was transformed into a comparable unit measurement of area. That unit area was determined as a net rentable square foot of office floor space. Where VRET did not supply such information, gross building areas were reduced by 10% to arrive at the net figure. The reduction is arbitrary, but municipal officials agreed that such a reduction accounts for the major variance between gross and net floor space. Rentable square footage is a good measure for two reasons. Firstly all other cost information such as taxes, maintenance and rents are based on rentable square footage. Secondly, it is meaningful to use when comparing alternative locations. Land costs are typically measured in terms of unit site area which is meaningless when comparing alternative sites with different institutional constraints.

Secondly all construction cost data was transformed to common 1971 dollars using the Dominion Bureau of Statistics’ (DBS) composite non residential construction cost index (2). All land data is in current 1973 assessed values. The two types of data are not capable of aggregation.
(iii) **Limitations of data**

(a) **Building Costs:**

With respect to building costs there are three limitations that must be noted. Firstly, estimated construction costs are subject to municipal taxes. The greater the reported figure the greater are the taxes payable. However taxes as a proportion of total project cost are likely to be marginally insignificant when dealing with office projects. Diligent municipal officials are likely to recognize any misreporting of project costs. Secondly reported figures are estimates and not actual costs. Estimates on a single project may differ significantly between any two estimators. Thirdly, when comparing costs between municipalities it is difficult to account for differences in municipal standards which may or may not significantly affect project costs.

(b) **Assessed land values:**

In looking at the cost of land to a locator of offices this thesis has attempted to ascertain the market value of sites cleared of buildings and available for development as offices. It is assumed that market value is the price that would be paid, necessary to secure a site and thus a development cost. As noted earlier, actual acquisition costs were unobtainable in any meaningful form. Assessed land values for property
tax purposes were considered a reasonably good measure of relative market values. Assessed values, however, exhibit the following disadvantages. Firstly, the dollar allocation of value between land and buildings is arbitrary. It is difficult to split total value of a site between land and improvements. Secondly assessment procedures are likely to be inconsistent, not only between municipalities but also within a single municipality over time. The disadvantages of using assessed land values are considered important but are an improvement over the anomalous reporting found in land registry files. Assessment data is advantageous from the points of view that it is conveniently defined on plans and records, that such records are continuously updated and that any major change in permitted use is quickly identified through changes in assessed value.

3.2 DATA ANALYSIS

(i) Statistical testing

Tests were constructed to satisfy the requirements of sub hypotheses contained in section 2.6. With respect to both assessed land values and construction costs the purpose of such tests were twofold; firstly, through regression analysis, to determine whether or not such values and costs could be expressed as linear functions of distance from the urban centre and secondly, through comparative analysis, to
determine any significant differences between suburban and central unit costs and values.

Scatter diagrams were constructed to determine whether or not regression techniques would prove a suitable tool of analysis. It was evident that no linear relationship existed for either dependant variable as a function of distance from the urban centre. To substantiate the observations, regression analyses were performed on the data. The resultant statistics are shown in Figures (4) and (5).

Comparative statistical analyses were performed to determine whether or not there were any significant differences between central and suburban average construction costs and central and suburban average assessed land values per square foot of net rentable floor space. The resultant statistics are tabulated in tables (IV) and (V). Frequency polygons for construction costs and assessed land values per square foot of net rentable floor space are shown in Figures (6) and (7).

(ii) Statistical significance and interpretation

Figures (4) and (5) indicate that distance from the urban centre does very little to explain variations in the dependant variables at points across the metropolitan region. It is concluded that assessed land values and construction costs per square foot of net rentable floor space cannot be
FIGURE 4

GRAPH SHOWING UNIT CONSTRUCTION COSTS REGRESSED AGAINST DISTANCE FROM THE URBAN CENTRE

CONSTANT A 27.04
COEFFICIENT B 0.0002312
F RATIO (B) 13.98
F PROBABILITY (B) 0.0005
STD ERROR (A) 1.97
STD ERROR (B) 0.0000618
STD ERROR (Y) 10.56
COEFF. OF DETERM. ($R^2$) 0.184

$t$ STATISTIC 3.73

DISTANCE (FEET)
FIGURE 5

GRAPH SHOWING UNIT ASSESSED LAND VALUES
REGRESSED AGAINST DISTANCE FROM THE
URBAN CENTRE

CONSTANT A  5.9
COEFFICIENT B  0.0000314
F RATIO (B)  5.18
F PROBABILITY (B)  0.025
STD ERROR (A)  0.437
STD ERROR (B)  0.0000138
STD ERROR (Y)  2.275
COEFF. OF DETERM. ($R^2$)  0.08

$t$ STATISTIC  2.277
TABLE IV

CONSTRUCTION COSTS

<table>
<thead>
<tr>
<th>All Locations</th>
<th>Central</th>
<th>Suburban</th>
</tr>
</thead>
<tbody>
<tr>
<td>$/SQ. FT. NRFS (1971 Dollars)</td>
<td>21.5</td>
<td>26.5</td>
</tr>
<tr>
<td>Mean Construction Cost</td>
<td>11.6</td>
<td>10.4</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Ho: $u_c - u_s = 0$

Ha: $u_c > u_s$

$n_c = 33$
$n_s = 31$

$n_c + n_s - 2 = 62$

Critical ratio: 1.29

Calculated 't' score: 4.86

Conclusion - reject the null hypothesis that there is no significant difference in the mean construction costs between central and suburban locations at 0.01% level of significance.
### TABLE V

**ASSESSED LAND VALUES (ALV)**

<table>
<thead>
<tr>
<th></th>
<th>All Locations</th>
<th>Central $/SQ. FT. NRFS (1973)</th>
<th>Suburban Dollars</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean ALV</td>
<td>5.1</td>
<td>5.5</td>
<td>4.8</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>2.3</td>
<td>2.5</td>
<td>2.1</td>
</tr>
</tbody>
</table>

**Ho:** $u_c - u_s = 0  
**Ha:** $u_c - u_s \neq 0$

- $n_c = 32$
- $n_s = 27$
- $n_c + n_s - 2 = 57$

<table>
<thead>
<tr>
<th>Critical ratio</th>
<th>Calculated 't' score</th>
</tr>
</thead>
<tbody>
<tr>
<td>fort 0.10, 57</td>
<td>1.6</td>
</tr>
<tr>
<td>fort 0.01, 57</td>
<td>2.6</td>
</tr>
</tbody>
</table>

Conclusion - cannot reject the null hypothesis that there is no significant difference between central and suburban ALV's at 0.10% level of significance.
FIGURE 6

GRAPH SHOWING FREQUENCY DISTRIBUTION OF CONSTRUCTION COSTS PER SQ. FT. OF NRFS FOR:

(a) Central locations

(b) Suburban locations

(c) All locations

No. of Observations

$/SQ.FT. NRFS

Source - Research Data
FIGURE 7

Graph showing frequency distribution of assessed land values per sq. ft. of NRFS

(a) Central locations
(b) Suburban locations
(c) All locations

Source - Research Data
expressed as a linear function of distance from the urban centre in any meaningful fashion.

From table (IV), with respect to differences in mean unit construction costs, it can be inferred from sample data that the hypothesis that there is no significant difference between central and suburban mean construction costs be rejected at the 0.01 percent level of significance i.e. there is a significant difference in central and suburban mean costs per square foot of net rentable floor space. With respect to mean assessed land values per square foot of net rentable floor space, Table (V) indicates that the hypothesis that there is no difference in such values between central and suburban locations cannot be rejected at the 0.10 percent level of significance i.e. there is an insignificant differential between central and suburban mean assessed land values per square foot of NRFS.

3.3 TENTATIVE CONCLUSIONS

From the foregoing analysis the following major points emerge:-

(1) that between central and suburban locations there is a significant difference in the average construction cost per square foot of net rentable office floor space; central costs are significantly higher than suburban costs.
(2) that between central and suburban locations there is an insignificant difference in the mean assessed land values per square foot of net rentable office floor space.

(3) that distance from the urban centre is an inappropriate variable with which to describe and predict changes in unit construction costs at points across the metropolitan region; and

(4) that distance from the urban centre is not an appropriate variable with which to describe and predict changes in assessed land values per square foot of net rentable office floor space at points across the metropolitan region.

Relating the four main findings of this thesis back through the sub-hypotheses of section 2.6, the following represent probable causes of the above observations.

With respect to the statement that there are significant differences between suburban and central mean unit construction costs, it was noted earlier, when deriving a rationale for sub hypothesis (ii), that construction costs were a function of labour costs, material costs, technological forms and economies of scale. It was suggested that technological form and scale economies were offsetting effects upon the costs of construction. It was further noted that advanced technological forms were applied to high rise buildings manifested at central locations. Advanced technological forms increase unit construction costs relative to lesser forms of
construction technology - see table (VI). It is thus concluded that the higher central unit construction costs are caused by more advanced construction techniques to build high rise buildings evidenced at central locations. In order to accommodate large numbers of office users seeking the attributes of highly central and accessible sites high rise structures are used to surmount the consumption of a limited supply of such sites. It is further implied that cost economies of scale, derived from large scale central projects are insufficient to offset additional costs necessitated by advanced construction forms required to carry out high rise, large scale central projects.

With respect to insignificant differences between central and suburban mean assessed land values per square foot of net rentable floor space, it was noted, when deriving a rationale for sub hypothesis (iv), that competition for all office sites was not between all office users but competition for some sites by some users. There is no reason to believe that central office users, seeking central accessibility for survival are more or less efficient or profitable in terms of unit floor area than suburban office users desiring locational attributes other than central accessibility. As there are a limited number of highly centralized and accessible sites so there are a limited number of suburban sites with other locational features desired by some locators.
<table>
<thead>
<tr>
<th>METHOD OF CONSTRUCTION</th>
<th>STOREY HEIGHT</th>
<th>1967 $</th>
<th>1970 $</th>
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</thead>
<tbody>
<tr>
<td>WOOD FRAME</td>
<td>1-2</td>
<td>12.50-15.00</td>
<td>15.00-18.00</td>
</tr>
<tr>
<td></td>
<td>1-8</td>
<td>16.00-23.00</td>
<td>22.00-27.00</td>
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<tr>
<td></td>
<td>9-20</td>
<td>18.00-25.00</td>
<td>27.00-30.00</td>
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<tr>
<td></td>
<td>21+</td>
<td>22.00-32.00</td>
<td>27.00-35.00</td>
</tr>
</tbody>
</table>

With respect to the expression of construction costs and assessed land values per square foot of net rentable floor space as linear functions of distance from the urban centre, zoning ensures that office development only occurs at pockets across the urban surface thus distorting any possible function that might otherwise exist. Distance from the centre does not explain changes in unit construction costs and assessed land values per square foot of net rentable floor space for offices at points across the metropolitan region.

Figure (1) illustrates that land and building costs were two location variables abstracted from the total set of office location criteria. The locator of offices when reviewing land and construction costs, would on the basis of this thesis, conclude that:-

(1) with respect to construction costs, that there are significant cost advantages in providing a unit area of office floor space at suburban locations as opposed to central locations; and

(2) that there is no significant cost benefit to be gained, on the basis of assessed land values per square foot of net rentable floor space, from locating at either central or suburban locations.

With respect to (2), if assessed land values fairly reflect relative market values, then the conclusion that there is no significant difference in assessed land values can
readily be applied to market values. If the price paid for an office site, and consequently the developers cost, is market value, the locator would conclude that there is an insignificant difference in the cost of land per square foot of net rentable floor space for offices between central and suburban locations.

3.4 AREAS FOR FURTHER RESEARCH

The subject of office location requires to be researched in its entirety. As a follow up to this thesis a number of specific areas require refinement. Construction cost data is based upon estimated project costs. A more realistic approach would be to obtain final audited cost accounts. Assessed land values have serious drawbacks. Although an improvement on the anomalous, non classified land registry data, it is considered nothing more than the better of two evils. Alternative methods of determining actual market value must be found if improved conclusions are to be drawn regarding site costs to a locator of offices.

This thesis focused on, and analysed two specific location criteria contained in the total set of location variables. Before other criteria are evaluated it is deemed necessary to obtain a statement of opinion and practice from those parties actually involved in the location decision. Such a statement might be obtained by soliciting information
through questionnaires and interviews. The LOB study would prove of valuable assistance in this regard.

Further suggested areas of work include the determination of the location of specific types of office use. In addition to location by type of office activity it would prove useful to determine the locational requirements of such types.
In relating the general conclusions to this thesis's objectives it is stated that:

(a) an analytical framework for the understanding of office location decisions has been established.
(b) the various criteria perceived to be contained in the location decision have been made explicit.
(c) two locational criteria were analysed and their significance determined; and
(d) although the study does not detail the significance of office use as a user of urban space, it does point to areas where office use is of vital interest.

The specific conclusions of this thesis are documented in the previous section. The significance of those findings may, in itself, be considered meagre; total analysis of all location criteria, hopefully in a more refined fashion, may assist in understanding the office location decision. It is felt that time spent in analysing and understanding the cause of urban dilemmas is more important than attempting to juggle the effects.

As a derivative of the above discussion, this section places the conclusions of this thesis in the context of earlier findings concerned with office location criteria and attempts
to recommend policy guidelines.

As alluded to several times, research with respect to the office location decision is virtually non existent; work on the significance of various criteria involved in locating offices is non existent. The need to develop research in this area, in order to formulate a policy guiding tool, will be sharply focused on when presenting policy recommendations. That work carried out on offices consists mainly of studies documenting post location decisions. In this respect most research appears positive in outlook. A more normative approach to research is required if the location of offices is to be understood in any one of the areas that office activity impinges upon.

The specific conclusions of this thesis concerning land costs neither confirm nor conflict with earlier findings; similar approaches are not discernible. Classical analysis with respect to unit site costs bears no relationship with the approach taken in this thesis. At the outset of this study two distinctions were recognized. Firstly, that this thesis focused on a specific land use as opposed to several uses. Secondly, to satisfy the major objective of this thesis, a meaningful comparative method of measurement was mandatory; unit site costs do not adequately account for institutional limitations at alternative sites in any meaningful fashion.
The specific findings, with respect to building costs, besides confirming, in a logical manner, that high rise forms of construction are significantly more expensive than low rise forms, determines that suburban costs of construction are cheaper than central city costs. The interesting characteristic being, not that one form of construction is cheaper than another, but that high rise forms predominantly occur at central city locations, while low rise forms occur at suburban locations.

In arriving at a set of policy guidelines based upon this thesis, care is taken not to impart a grand scheme of specific recommendations; it is felt that the isolated conclusions of this study do not warrant such confidences. However, some tentative proposals are given that are a result of immersion in the subject of office location. Policy guidelines are immediately required for those persons researching office location. It is suggested that until an adequate comprehension is gained of the processes involved in the office location decision, it is difficult to follow through policy recommendations in other areas.

Efforts should be made to determine the locational requirements of different users and to develop methods of comparing locational attributes at alternative sites. The thrust of such enquiry should be twofold. Firstly, defining the locational requirements of different users through soliciting
information from industry, and secondly, to develop feasible methods of measuring the significance of locational attributes for different users at different sites.

In developing a comprehension of office location criteria involved in the location decision, benefits accrue to both public and private interests. The benefit derived from understanding office use, and utilizing that understanding as a policy guiding tool, would assist in the reconciliation of public and private interest through the elimination of possible misunderstandings of respective requirements. The use of a mutually acceptable standard of locational requirements would circumvent such differences. In the public sector, the efficient and effective phasing of resources and energies would be facilitated. Planning of physical and financial resources fall within the ambit of this discussion. If a full comprehension is gained of the forces involved in the location decision, then that knowledge, coupled with an understanding of other land uses, may be applied in determining land use allocation, transportation and infrastructure policies; office use impinges significantly on such areas. The planning of more efficient and effective financial policies, such as capital investment and revenue producing schemes, stems directly from attaining a more efficient and effective use of physical resources. In the private sector, a degree of uncertainty is removed from both the development and investment functions.
Private enterprise, in the absence of hit and miss (intuitive) methods or policies, would function more efficiently.

The following discussion is designed to provide an argument for using the present study of office location as a policy tool in the solution of urban problems. The discussion incorporates a number of subjective philosophies that were the original food for thought in pursuing the subject of office location.

With the scarce physical, financial and human resources available to society, it was a basic subjective philosophy that such resources be used effectively and efficiently. As central city land is fixed in supply it seems logical to use that which exists in the most efficient manner. Advocates of the economic order, arguing through the price mechanism, would suggest that such land is being used efficiently. The economic system is not a panacea for urban problems; it merely provides a convenient, contemporary tool with which to try and explain some facets of urban existence. Other aspects, such as congestion, pollution, welfare, crime and poverty are not so easily delimited with the application of economic theory i.e. they are not priced in the market; their importance tends to be subjugated to the existing economic order of things.

In following the economic argument, adversaries of such a demi-god would posit the fact that such theory should
not only account for the economic efficiency of the individual firm but for the total economic efficiency of the entire urban system as well. With respect to offices, the inclusion of factors, other than the allocation of space, that contribute to the functioning of offices, remain unaccounted for. The external by-products of office use, such as congestion, pollution and excess expenditure of human and physical resources in travelling to work are identifiable, partially accountable for yet not included in the total concept of economic efficiency to the individual firm; why?. Such externalities are not priced in the market place and are thus incapable, other than in an arbitrary fashion, of being apportioned to individual users. It is suspected that such by-products, if attributed to the individual firm, would lead to a spatial redistribution of office users. In maximizing efficiency, and presumably profits, the individual firm, in the event, would attempt to minimize the inefficient elements such as those described above. The common denominator of all such elements is intensity and excess agglomeration of use; currently at the central core. To minimize the effects of the inefficient factors, the logical starting point would be the elimination of the cause of inefficiency; central intensity and excess agglomeration of office use. For the express purpose of brevity, precision and relevance this discussion is now constrained to apply specifically to the conclusions of this study.
A method which determines total urban economic efficiency through the inclusion of externalities is absent. To achieve the same objective of eliminating inefficient urban phenomena it is necessary, through the current 'modus operandi' of locating offices, to concentrate upon the simple economic argument to the individual firm. To attain the objective it needs to be shown that the firm is capable of locating more efficiently at one site as opposed to another. On the basis of this thesis, firms, that could operate independently of a central location, would operate more efficiently at suburban locations: financial resources would not be devoted to providing relatively more expensive accommodation. In locating at the centre, besides operating inefficiently, albeit effectively, such firms contribute to inefficiency in the total urban system through compounding central agglomeration and intensification of use.

Types of policy that may be developed to eliminate inefficiencies in the urban system are classified passive, restrictive and active. Passive policies allow for the perpetuation of the status quo. In the light of current experience such policies do nothing to eliminate inefficient elements in the urban system. Restrictive policies, such as those adopted in the city of London, are by far the easiest to implement; the consequences of the London office experience were not so easily foreseeable. Active policies, using incentives or disincentives,
appear appealing in relieving the cause of inefficient urban elements. The problem with such a policy being that the onus for curing inefficiencies, created by individual firms, vest solely with society at large.

A realistic policy method would involve the combination of restrictions and incentives or disincentives as applied to office use. For such a policy to be operative, the economic location argument to the individual firm must be understood for two basic reasons. With respect to restrictions it is necessary to evaluate an individual firm's need to be at a central location; to restrict all users would eliminate the possibility of locating functions which are solely dependant upon urban centrality. With respect to incentives a similar decision rule is required such that any incentives offered to lure users away from the urban core are sufficiently strong to defeat the individual firm's economic argument. Types of restrictions, incentives or disincentives are details that must be politically and practically feasible. Research into the economic argument of locating offices, as far as the individual firm is concerned, appears to be the datum from which any rational policy, designed to eliminate inefficient elements in the urban system may proceed.
FOOTNOTES

CHAPTER 1


16. op. cit., p.6.
CHAPTER 2

1. For fuller exposition on the derivation of offices to be included in definition see D.L. Takahashi, CBD Office Location Patterns: A Vancouver Case Study (unpublished M.A. Thesis), University of British Columbia 1972. p. 118.


3. Loc. cit.


7. Benjamin Chinitz, City and Suburb: The Economics of Metropolitan Growth, (Englewood Cliffs: Prentice Hall 1964)

8. Ibid., p. 3.


10. see Brian J. Berry, Geography of Market Centers and Retail Distribution, (Englewood Cliffs: Prentice Hall 1967)


12. Loc. cit.


14. note that other factors such as topographical or geological constraints will also affect the location of offices.
CHAPTER 3


BIBLIOGRAPHY


Location of Offices Bureau, A Survey of Factors Governing the Location of Offices in the London Area, 1964.


APPENDIX A

S.I.C. Code

AGRICULTURE, FORESTRY & FISHERIES
Major Group 01.—Agriculture Production

*011 Field Crops
*013 Livestock

Major Group 07.—Agricultural Services & Hunting & Trapping
*071 Agricultural Services, Except Animal Husbandry and Horticultural Services
*073 Horticultural Services

Major Group 08.—Forestry
*085 Forestry Services
*086 Gathering of Forest Products, Not Elsewhere Classified
*089 Miscellaneous Forestry Services

Major Group 09.—Fisheries
*098 Fish Hatcheries, Farms & Preserves

MINING
Major Group 10.—Metal Mining
*101 Iron Ores
*102 Copper Ores
*104 Gold and Silver Ores
*106 Ferroalloy Ores, Except Vanadium
*108 Metal Mining Services
*109 Miscellaneous Metal Ores

Major Group 13.—Crude Petroleum and Natural Gas
*131 Crude Petroleum and Natural Gas
*138 Oil and Gas Field Services

Major Group 14.—Mining and Quarrying of Non-Metallic Minerals, Except Fuels
*141 Dimension Stone
*142 Crushed & Broken Stone, Including Riprap
*148 Non-Metallic Minerals (except Fuel) Services
*149 Miscellaneous Non-Metallic Minerals, Except Fuels

CONTRACT CONSTRUCTION
Major Group 15.—Building Construction—General Contractors
*151 General Building Contractors
S.I.C. Code (cont'd)

Major Group 16--Construction Other Than Building Construction--
  General Contractors
  *162 Heavy Construction, Except Highway & Street Construction

Major Group 17.--Construction - Special Trade Contractors
  *171 Plumbing, Heating, and Air Conditioning
  *173 Electrical Work

MANUFACTURING
Major Group 20.--Food & Kindred Products
  *204 Grain Mill Products
  *208 Beverages
  *209 Miscellaneous Food Preparations and Kindred Products

Major Group 22.--Textile Mill Products
  *225 Knitting Mills
  *229 Miscellaneous Textile Goods

Major Group 23.--Apparel & Other Finished Products Made from
  Fabrics & Similar Finished Materials
  *231 Men's, Youths' & Boys' Suits, Coats, and Overcoats
  *233 Women's, Misses', and Juniors' Outerwear
  *238 Miscellaneous Apparel and Accessories
  *239 Miscellaneous Fabricated Textile Products

Major Group 24.--Lumber & Wood Products, Except Furniture
  *241 Logging Camps and Logging Contractors
  *242 Sawmills and Planing Mills
  *249 Miscellaneous Wood Products

Major Group 25.--Furniture and Fixtures
  252 Office Furniture
  254 Partitions, Shelving, Lockers, and Office & Store Fixtures
  259 Miscellaneous Furniture and Fixtures

Major Group 26.--Paper & Allied Products
  *262 Paper Mills, Except Building Paper Mills
  *264 Converted Paper & Paperboard Products, Except Containers and Boxes

Major Group 27.--Printing, Publishing, and Allied Industries
  *271 Newspapers: Publishing, Publishing and Printing
  273 Books
  *274 Miscellaneous Publishing
  *275 Commercial Printing
  276 Manifold Business Forms
  278 Blankbooks, Loose Leaf Binders, and Bookbinding & Related Work
  *279 Service Industries for the Printing Trade
S.I.C. Code (cont'd.)

**Major Group 28.--Chemicals and Allied Products**

- 289 Miscellaneous Chemical Products

**Major Group 29.--Petroleum Refining and Related Industries**

- 291 Petroleum Refining

**Major Group 31.--Leather and Leather Products**

- 314 Footwear, Except Rubber

**Major Group 33.--Primary Metal Industries**

- 331 Slag Furnaces, Steel Works, and Rolling and Finishing Mills

**Major Group 34.--Fabricated Metal Products, Except Ordnance, Machinery & Transportation Equipment**

- 347 Coating, Engraving, and Allied Services

**Major Group 36.--Electrical Machinery, Equipment, and Supplies**

| 364 Electric Lighting and Wiring Equipment |
| 366 Communication Equipment |
| 369 Miscellaneous Electrical Machinery, Equipment, and Supplies |

**Major Group 38.--Professional, Scientific, and Controlling Instruments: Photographic & Optical Goods, Watches & Clocks**

- 381 Engineering, Laboratory, & Scientific & Research Instruments & Associated Equipment
- 384 Surgical, Medical, and Dental Instruments and Supplies
- 387 Watches, Clocks, Clockwork Operated Devices, and Parts

**Major Group 39.--Miscellaneous Manufacturing Industries**

| *391 Jewelry, Silverware, and Plated Ware |
| *395 Pens, Pencils, and Other Office and Artists' Materials |
| *396 Costume Jewelry, Costume Novelties, Buttons, and Miscellaneous Notions, Except Precious Metal |
| *399 Miscellaneous Manufacturing Industries |

**TRANSPORTATION, COMMUNICATIONS, ELECTRIC, GAS AND SANITARY SERVICES**

**Major Group 40.--Railroad Transportation**

| *401 Railroads |
| *404 Railways Express Service |

**Major Group 42.--Motor Freight Transportation and Warehousing**

| 421 Trucking, Local and Long Distance |
| 422 Public Warehousing |
S.I.C. Code (cont'd.)

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<td>*446 Services Incidental to Water Transportation</td>
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<td>458 Fixed Facilities and Services Related to Air Transportation</td>
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WHOLESALE & RETAIL TRADE

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<td>*506 Electrical Goods</td>
<td></td>
</tr>
<tr>
<td>*507 Hardware, and Plumbing &amp; Heating Equipment &amp; Supplies</td>
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</tr>
<tr>
<td>*508 Machinery, Equipment, and Supplies</td>
<td></td>
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<tr>
<td>*509 Miscellaneous Wholesalers</td>
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<table>
<thead>
<tr>
<th>Major Group 52. -- Retail Trade -- Building Materials, Hardware, &amp; Farm Equipment Dealers</th>
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<tbody>
<tr>
<td>522 Plumbing, Heating &amp; Air Conditioning Equipment Dealers</td>
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<tr>
<td>523 Paint, Glass, and Wallpaper Stores</td>
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<td>524 Electrical Supply Stores</td>
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<tr>
<td>525 Hardware and Farm Equipment</td>
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S.I.C. Code (cont'd.)

Major Group 53.--Retail Trade--General Merchandise
531 Department Stores
532 Mail Order Houses
533 Variety Stores
539 Miscellaneous Retail Stores

Major Group 54.--Retail Trade--Food Stores
541 Grocery Stores
542 Meat and Fish (Sea Food) Markets
543 Fruit Stores and Vegetable Markets
544 Candy, Nut, and Confectionery Stores
546 Retail Bakeries
549 Miscellaneous Food Stores

Major Group 55.--Automotive Dealers & Gasoline Service Stations
551 Motor Vehicle Dealers (New and Used Cars)
554 Gasoline Service Stations
559 Miscellaneous Aircraft, Marine, & Automotive Dealers

Major Group 56.--Retail Trade--Apparel & Accessory Stores
561 Men's and Boys' Clothing & Furnishings Stores
562 Women's Ready-to-Wear Stores
563 Women's Accessory and Specialty Stores
564 Children's and Infants' Wear Stores
566 Shoe Stores
567 Custom Tailors
568 Furriers and Fur Shops
569 Miscellaneous Apparel & Accessory Stores

Major Group 57.--Retail Trade--Furniture, Home Furnishings, and Equipment Stores
571 Furniture, Home Furnishings, and Equipment Stores, except Appliances
572 Household Appliance Stores
573 Radio, Television, and Music Stores

Major Group 58.--Retail Trade--Eating and Drinking Places
581 Eating and Drinking Places

Major Group 59.--Retail Trade--Miscellaneous Retail Stores
591 Drug Stores and Proprietary Stores
592 Liquor Stores
593 Antique Stores and Second-Hand Stores
594 Book and Stationery Stores
595 Sporting Goods Stores and Bicycle Shops
597 Jewelry Stores
599 Retail Stores, Not Elsewhere Classified
S.I.C. Code (cont'd.)

FINANCE, INSURANCE & REAL ESTATE

Major Group 60.--Banking
*602 Commercial and Stock Saving Banks
*605 Establishments Performing Functions Closely Related To Banking
*609 Banks, All Kinds and Establishments Performing Functions Closely Related to Banking

Major Group 61.--Credit Agencies Other Than Banks
*611 Rediscount & Financing Institutions for Credit Agencies Other than Banks
*614 Personal Credit Institutions
*615 Business Credit Institutions
*616 Loan Correspondents and Brokers
*619 Mortgage Companies, Agents and Brokers

Major Group 62.--Security & Commodity Brokers, Dealers, Exchanges & Services
*621 Security Brokers, Dealers & Flotation Companies
*622 Commodity Contracts Broker's & Dealers
*623 Security and Commodity Exchanges
*624
*628 Services Allied with the Exchange of Securities or Commodities
*629 Security and Commodity Brokers, Dealers and Exchanges

Major Group 63.--Insurance Carriers
*631 Life Insurance
*632 Accident and Health Insurance
*636 Title Insurance

Major Group 64.--Insurance Agents, Brokers and Service
*641 Insurance Agents, Brokers and Service
*649 Insurance Companies, Agents, Brokers and Services Including Adjusters

Major Group 65.--Real Estate
*651 Real Estate Operators (Except Developers) and Lessors
*653 Agents, Brokers and Developers
*655 Subdividers and Developers
*659 Real Estate Agents, Broker Managers, Title Abstractor's Sub Dividers, Developers and Operative Builders

Major Group 66.--Combinations of Real Estate, Insurance, Loans, Law Offices
*661 Combinations of Real Estate, Insurance, Loans, Law Offices
S.I.C. Code (cont'd.)

Major Group 67.—Holding and Other Investment Companies
*671 Holding Companies
*672 Investment Companies
*679 Miscellaneous Investing Institutions

SERVICES
Major Group 70.—Hotels, Rooming Houses, Camps, and Other Lodging Places
  701 Hotels, Tourist Courts and Motels

Major Group 72.—Personal Services
  721 Laundries, Laundry Services & Cleaning and Dyeing Plants
  722 Photographic Studios, Including Commercial Photography
  723 Beauty Shops
  724 Barber Shops
  725 Shoe Repair Shops, Shoe Shine Parlors, & Hat Cleaning Shops
  729 Miscellaneous Personal Services

Major Group 73.—Miscellaneous Business Services
*731 Advertising
*732 Consumer Credit Reporting Agencies, Mercantile Reporting Plants
*733 Duplicating, Addressing, Blueprinting, Photocopying, Mailing, Mailing List & Stenographic Services
*734 Services to Dwellings and Other Buildings
*735 News Syndicates
*736 Private Employment Agencies
*739 Business Services, Not Elsewhere Classified

Major Group 75.—Automobile Repair, Automobile Services and Garages
  751 Automobile Rentals, without Drivers
  752 Automobile Parking
  753 Automobile Repair Shops

Major Group 76.—Miscellaneous Repair Services
  762 Electrical Repair Shops
  763 Watch, Clock and Jewelry Repair
  769 Miscellaneous Repair Shoes and Related Services

Major Group 78.—Motion Pictures
  781 Motion Picture Production & Distribution

Major Group 79.—Amusement & Recreation Services, Except Motion Pictures
  791 Dance Halls, Studios and Schools
  792 Theatrical Producers (except Motion Pictures), Bands, Orchestrans and Entertainers
S.I.C. Code (cont'd.)

793 Bowling Alleys & Billiard & Pool Establishments
794 Sports Promoters & Commercial Operators & Miscellaneous Amusement & Recreation Services

Major Group 80.—Medical & Other Health Services
*801 Offices of Physicians and Surgeons
*802 Offices of Dentists and Dental Surgeons
*803 Offices of Osteopathic Physicians
*804 Offices of Chiropractors
*807 Medical and Dental Laboratories
*809 Health & Allied Services, not Elsewhere Classified

Major Group 81—Legal Services
*811 Legal Services

Major Group 82.—Educational Services
823 Libraries & Information Centers
824 Correspondence Schools & Vocational Schools
829 Schools & Educational Services, Not Elsewhere Classified

Major Group 84.—Museums, Art Galleries, Botanical & Zoological Gardens
841 Museums and Art Galleries

Major Group 86.—Nonprofit Membership Organizations
861 Business Associations
*862 Professional Membership Organizations
*863 Labour Unions & Similar Labour Organizations
864 Civic, Social and Fraternal Associations
865 Political Organizations
866 Religious Organizations
867 Charitable Organizations
869 Nonprofit Membership Organizations, Not Elsewhere Classified

Major Group 89.—Miscellaneous Services
*891 Engineering and Architectural Services
*893 Accounting, Auditing and Bookkeeping Services

VACANT
*991 Commercial Office
992 Commercial Retail
993 Commercial Wholesale
994 Industrial
996 Residential
999 Vacant Land

OTHER
990 Non-Classifiable Establishment

* Denotes included in definition of office activities utilized in this study.
Appendix B

Reliability check on the use of assessed land values (ALV) as an indicator of relative market value of land for office premises

Two methods are considered suitable:-

(1) Actual sales data

(2) Residual valuation of land through income capitalization.

In the absence of (1), income capitalization is utilized to check the reliability of ALV as a measure of relative market value.

Method:

Residual value of land = (Income, capitalization rate) - (construction cost)

<table>
<thead>
<tr>
<th>Given:</th>
<th>Location</th>
</tr>
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<tbody>
<tr>
<td>Rent level/sq.ft.(1)</td>
<td>Central $6.00</td>
</tr>
<tr>
<td># sq.ft.</td>
<td>1000</td>
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<tr>
<td>Annual income (gross)</td>
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<tr>
<td>Construction cost/sq.ft.(2)</td>
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<tr>
<td></td>
<td>Suburban $5.00</td>
</tr>
<tr>
<td></td>
<td>1000</td>
</tr>
<tr>
<td></td>
<td>$5000</td>
</tr>
<tr>
<td></td>
<td>$16.3</td>
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</table>

Assumption:

(1) operating expenses for central and suburban offices are similar (3)

Schedule (I), given below is based upon a hypothetical example using construction costs and rental levels considered appropriate
for central and suburban office buildings at mid 1971.

The schedule is constructed to avoid illustrating central and suburban residual land values through the use of arbitrary yields. The schedule makes use of a range of income capitalization factors to obviate this situation. It is difficult to specify a yield that reflects average investor requirements. The objectives and situations of investors may vary radically. Current yields versus future capital gains coupled, as in 1971, with tax ramifications compound the difficulty in determining suitable capitalization rates.

Schedule (I) indicates, assuming a 1% spread in yields between central and suburban locations, that for yields between 10% - 15%, land residuals are consistently different by approximately 10% as between central and suburban locations. Comparative residuals outside of the above range are inconsistently different by more than 10%.

For the purpose of this thesis assessed land values may only be considered good measures of relative market values for office sites if the required capitalization rate is between 10-15%. Such a range is not inconsistent with rates applied in capitalizing income derived from office activity.

(1) - rental levels are those found in 'Office Space Survey 1971'
(2) - construction costs are those derived from this study.
Such costs are strongly comparable to Concose Services reporting in 'Real Estate Trends in Metropolitan Vancouver 1971'.

(3) - Real Estate trends in Metropolitan Vancouver 1971, illustrates such expenses for high rise offices. In the absence of low rise information, and it is suspected that such expenses are lower, the use of gross income is suitable when determining relative residual values.
<table>
<thead>
<tr>
<th>(1) % yield required</th>
<th>(2) capitalization factor</th>
<th>(3) Market - Construction</th>
<th>(4) Residual</th>
<th>(5)</th>
<th>(6) Market - Construction</th>
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<td>73,500</td>
<td>83,500</td>
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<td>67200</td>
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<td>11.1</td>
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<td>55,500</td>
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<td>13200</td>
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## APPENDIX C

### OFFICES: A BIBLIOGRAPHY

**CONTENTS**

<table>
<thead>
<tr>
<th>Topic</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abbreviations used</td>
<td>91</td>
</tr>
<tr>
<td>General</td>
<td>92</td>
</tr>
<tr>
<td>Law Relating To Offices</td>
<td>93</td>
</tr>
<tr>
<td>Employment in Offices</td>
<td>94</td>
</tr>
<tr>
<td>Office buildings, layout and organisation</td>
<td>96</td>
</tr>
<tr>
<td>Communications and technology</td>
<td>98</td>
</tr>
<tr>
<td>Office development</td>
<td>100</td>
</tr>
<tr>
<td>Office location</td>
<td>102</td>
</tr>
<tr>
<td>Decentralisation</td>
<td>107</td>
</tr>
<tr>
<td>Office planning policies</td>
<td>112</td>
</tr>
<tr>
<td>Transport and the journey to work</td>
<td>116</td>
</tr>
<tr>
<td>Office location in the United States and Canada</td>
<td>118</td>
</tr>
<tr>
<td>Office location in other countries</td>
<td>121</td>
</tr>
<tr>
<td>Miscellaneous Journal &amp; Periodical Articles</td>
<td>124</td>
</tr>
<tr>
<td>Abbreviation</td>
<td>Description</td>
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<td>-------------</td>
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<td>C.S.G., J.U.P.R.</td>
<td>Communications Study Group, Joint Unit for Planning Research.</td>
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<tr>
<td>J.T.P.I.</td>
<td>Journal of the Town Planning Institute</td>
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<tr>
<td>O.A.P.</td>
<td>Official Architecture and Planning (now called Built Environment)</td>
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<td>T.C.P.</td>
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<td>T.C.P.A.</td>
<td>Town and Country Planning Association</td>
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