COMMUNITY CONSEQUENCES

OF RAPID TRANSIT

by

Larry Herbert

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We accept this thesis as conforming to the
required standard

THE UNIVERSITY OF BRITISH COLUMBIA

May 1969
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Department of Community and Regional Planning

The University of British Columbia
Vancouver 8, Canada

Date May 1, 1969
If we think of the city as one building, one unit, . . . ONE, then we can conceive the interlock each piece must exert upon the next. Within a 'form' there is an inner tension which binds and sticks until all that contributes to its creation unites to polish and present the entity in a fashion capable of resisting forces which would disrupt. If the form is living, its sap or blood travels with precision to all corners of the entity; -- nature has planned this.

In quest then of nature, man has built entities and designated himself 'animate blood'. But over time the organism has changed: not just growth, but evolution, and is today calling upon man, its animate blood, to meet the new age with an evolved, important life system: -- can man plan this . . .
Hypothesis:

With the introduction of rapid transit, the structure of the city will change. Understanding the nature of this change can permit planners to use rapid transit as a tool or aid in the implementation of the city's plan.
ABSTRACT

The hypothesis: Urban development will be stimulated by introducing rapid transit into a city's structure. Therefore, rapid transit can be used by planners as a tool to control and implement predetermined development of varying natures within the city.

Chapter 1 discusses the role which transportation in general can play in changing the city. It is examined as a changing technology, as a cause of centralization and decentralization, and as a theory explaining urban structure.

Chapter 2 begins by discussing theory of rapid transit planning after which three case studies are presented -- Chicago, Cleveland, and Toronto. Each of these cities has been chosen to illustrate different rapid transit planning approaches. Chicago represents a system oriented to the central city; Cleveland represents a system oriented to the suburbs; and Toronto represents a new system oriented to the central city but expanding into suburban areas.

Chapter 3 applies the theory and case study information to Vancouver. Three theoretical rapid transit stations are proposed. Nanaimo-Hastings represents the impact rapid transit has upon a neighborhood of older homes adjacent to a high-quality commercial shopping strip. Main-Hastings/Pender (Chinatown-Strathcona) represents the relationship of rapid transit to the edge of the core area and to urban renewal. Georgia-Granville represents the integration of rapid transit in the core. In each case the effects upon adjacent land use are postulated.
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Chapter 1

Introduction
The city is rarely constructed at once: it has a long evolutionary growth. ¹

To paraphrase, the city does not develop to service one predetermined point in time; instead, it is subject to the same processes of change which influence and affect man and all he does.

The phrase 'community consequences' is perhaps an oversimplification of this notion -- its purpose is to limit some of this immense change to a more tangible concept, one whose dimensions are visible and whose horizons are conceivably within one's grasp.

It is the purpose of this thesis to discuss and illustrate rapid transit as a factor of change in a city.

**Urban decentralization**

Transit planner Michael Lash has discussed the effects which technological change in transportation has had on the city. ² First, he states, there was the horse and buggy -- distance was limited, comfort was minimal, and convenience was such that it was often easier to walk.

Then there were streetcars and people were able to travel farther in the same time -- in greater comfort, and at greater convenience. Technological advances in industry increased the need for labor -- improved transportation brought labor from greater distances. The core areas also grew because owners, clerks, salespeople and customers could now travel farther without loss of time.

Then came the automobile and areal expansion accelerated. In 1890, the streetcar era, people lived up to three miles from the core and this took 30 to 45 minutes to travel. By 1920, with the automobile, people could travel the same distance in 10 to 20 minutes, and the old 30 to 45 minute radius was pushed several miles further from the core. ³
From these facts it can be generalized that technological changes in transportation were a major cause of the North American trend to urban decentralization.

The Automotive Safety Foundation suggests that:

... the direction of urban growth is likely to follow the pattern which has evolved over the larger part of this century. That is, the bulk of urban growth will occur on the periphery of central cities, industry will continue to disperse, and the majority of residents will continue to live in single family homes. The rate of car ownership will continue to rise.4

Lash would probably not agree. He has shown that urban change came from technological change. And he has not precluded an alteration of present-day trends by future innovations. He has stated that a trend is only "a current route based upon the facts of the past". In other words, a trend today need not be a trend tomorrow.

Thus one must ask if the 20th century trend of urban decentralization is going to continue; is it natural, or is it expeditious. Changes in transportation technology improved man's mobility, but it is open to question why decentralization resulted.

The Automotive Safety Foundation, quoted above, suggests that the trend of decentralization will continue in the future. The basis of their suggestion is the projection of statistics taken from United States cities (1920 to 1968).

Canadian cities which at first appear to be almost identical to those in the United States exhibit substantial variations when examined more closely. Canadian urban differences resulted from the economic lag which developed during the depression. The depression in both countries began at the same time but it hit Canada harder and the country did not revive until the Second World War. In the United States there were three years
of relative prosperity between 1936, the end of the depression in the United States, and the economic influences of the War in 1939.

The technological advances which preceded the depression, for all intents and purposes were equally accessible to Canada and the United States. Indeed, Canada was the home of many of them: the telephone was invented in Ontario, the first electric streetlights were in Victoria, the first commercial radio was XEWA (now CKDF) in Montreal, Canadian experimental television dates from 1932, etc. Thus the technology was available, but because of economics, it was not able to become as widespread.

The result of the lag is reflected in our present urban structure. Canadian cities do not sprawl as do their U. S. counterparts. Because we have not been able to purchase as many automobiles and spend as much money accommodating them, we have had to accept greater concentration. This is illustrated in the figures of the Automotive Safety Foundation which lists the population densities of the largest U. S. and Canadian cities. (See Table I-1) An examination of the table shows that the population density of the Canadian example cities is higher than those in the United States examples.

If the number of high-rise apartments is considered as a measure of acceptance of high population densities, Canadian cities continue to show a higher acceptance of density than do their U. S. counterparts.

To illustrate this, Vancouver and Calgary may be compared respectively with Seattle and Salt Lake City.

Vancouver is one of Canada's most affluent cities; but high-rise development is extensive throughout the central city (see Table I-2). These apartments provide housing for all income groups and many provide
TABLE I-1  Population densities in five large United States and Canadian cities

<table>
<thead>
<tr>
<th>City</th>
<th>Central city population density (per square mile)</th>
<th>Central city plus suburbs population density (per square mile)</th>
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<tbody>
<tr>
<td>1. Montreal</td>
<td>26 400</td>
<td>9 300</td>
</tr>
<tr>
<td>2. New York City</td>
<td>24 697</td>
<td>7 462</td>
</tr>
<tr>
<td>3. Toronto</td>
<td>20 580</td>
<td>8 200</td>
</tr>
<tr>
<td>4. Chicago</td>
<td>15 836</td>
<td>6 209</td>
</tr>
<tr>
<td>5. Philadelphia</td>
<td>15 743</td>
<td>6 092</td>
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### TABLE I-2: High-rises built per year:

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<th>Year</th>
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<th>Calgary</th>
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<tbody>
<tr>
<td>1960</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>1961</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>1962</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>1963</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>1964</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>1965</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>1966</td>
<td>2</td>
<td>8</td>
</tr>
<tr>
<td>1967</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>1968</td>
<td>-</td>
<td>6</td>
</tr>
<tr>
<td>Total</td>
<td>8</td>
<td>21</td>
</tr>
</tbody>
</table>

A breakdown by years is not available for Vancouver, by central city neighborhoods:

- West End and core: 121
- Kerrisdale: 15
- South Granville: 10
- Kitsilano: 7
- Oakridge: 4
- 10th and Blanca: 2
- Fairview: 2
- Mt. Pleasant: 1

Total: 162

High-rise is defined as 10-storeys, the number is arbitrary.

Sources:

- **Calgary**: Letter, Building Inspection Division, City Hall, February 21, 1969
- **Salt Lake**: Letter, City Planning and Zoning Commission, City and County Building, February 19, 1969
- **Vancouver**: Personal count
recreation facilities which would be luxuries in private homes.

Seattle is among the most affluent U. S. cities; it ranks second after Los Angeles in percent of families earning $10,000.00 annually; it ranks first in the U. S. (47.8%) in percent of white-collar workers; and it ranks third in per capita automobile ownership. But Seattle has only a meager selection of high-rise apartment buildings, most of which date from the 1950's, and are adjacent to the core on the east. During the 1960's only one notable high-rise was built outside the city's core -- this structure is on the shore of Lake Washington. Residents adjacent to it, however, have convinced the city government to prohibit further high-rise development. Thus Seattle has not accepted high population density as has its Canadian neighbor, Vancouver.

Calgary, the second Canadian example, has experienced a boom in high-rise construction in the past five years -- see Table I-2, and today there is over $20,000,000.00 worth of high-rise apartments either planned or under construction. Salt Lake City is comparable in size and age to Calgary but it has yet to begin significant high-rise development (see Table I-2). Instead, Salt Lake City is building freeways and spreading north and south toward Ogden and Provo; the city will eventually form a metropolis of single family homes, seventy miles in length.

Looking at still smaller Canadian cities, one finds high-rise development -- 10 storeys or higher, in such cities as Victoria, Regina, Prince George, and even Nanaimo. It would be difficult to find equivalent projects in similar U. S. cities. Thus Canadian cities, because of economic conditions, have been forced to experiment with centralized living at high densities. U. S. cities because of better economic conditions have not been forced to experiment in this way.
Because Central cities built in the last century or in the first half of this one were not constructed to provide places in which to relax or places where children can play does not mean that central cities cannot be constructed or reconstructed with these things in mind.

Man is continually innovating — he is experimenting with new housing forms which will meet his needs and not require him to move out of the city to do so. One has only to cite Moishe Safdie's Habitat in Montreal or Corbusier's Unité in Marseilles to illustrate high density housing innovations.

Speaking of the U. S. experience, Lash states:

There has been a considerable amount of comment in the popular literature. . . suggesting a massive disillusionment with suburban living and a growing trend toward apartment living in the city.  

Questions asked by Lash in 1963-64 in Minneapolis indicate a preference for suburban living but he points out that his questions only reflect current opinion. If 'central city' image could be divorced from 'slum', 'crime', 'dirt' and 'noise', then the answers would probably not have been as heavily weighted to suburban living.

Lash has looked at several aspects of core-area decline. Of eleven cities he studied, only one showed a percent increase in retail sales between 1958 and 1963. San Francisco rose by 3%. The next closest was Washington, D. C., which showed a decrease of 1%. Other figures include Minneapolis-St. Paul at -15%, Cleveland at -20% and San Diego at -38%.

It is interesting to note that of the cities studied, only San Francisco and Washington are well known for having attractive core areas. Thus the nature of the central city as a place in which to be is another factor affecting decentralization.
A transportation theory of urban growth

The changing nature of the city is explained as a 'communication theory of urban growth' by Richard Meier. He holds that those functions requiring the greatest amount of communication locate in a city's core. Those functions requiring lesser amounts of communication locate concentrically outward from the core. The term 'communication', however, can be expanded to refer not only to telephones, computer centers, and other electronic media, but to all aspects of man's need to be in contact with others. By covering all that is implied by the word 'contact', Meier's theory can be extended beyond the electronic media to encompass person-to-person communication. Then, in turn, the notion of 'communication' is expanded to include transportation since transportation brings people into contact.

If we apply Meier's redefined concept to urban structure, we can state that the core functions of a city will be those requiring the greatest amount of transportation; those requiring lesser amounts will locate concentrically from the core.

A planner's role is to understand how and why the pieces of urban structure fit and affect each other. He must guide urban development so that it is complimentary to the ideal natural order. Transportation planner Henry Fagin refers to an "evolving urban environment" which the planner must understand in order to evaluate proposals. This is necessary because each alternative can result in different consequences with ramifications beyond the actual facility.

Transportation is an urban function and its introduction into a city has consequences; it is a key part of the natural order, but it requires careful planning.
The layout and details of the transportation system ... affects the changing patterns both of urban development and of interaction among the many establishments that constitute the urban region.\textsuperscript{14}

Urban transportation planning must be conducted concurrent with, and cannot be separated from land use planning. The land use pattern determines the amount and spatial distribution of travel to be accommodated by the transportation system; and in turn, the transportation system is one of the most important determinates of the land use pattern.\textsuperscript{15}

Fagin and transportation engineer K. W. Bauer use slightly different terminology but both agree that transportation acts to change urban form and must, therefore, be planned. Fagin's approach is somewhat more technical in that he speaks of the design of the system, but he infers that design interacts with the established urban region. Bauer, on the other hand, goes directly into the relationship between land use and transportation. He does not permit one to proceed without the other — he uses the word "concurrent."

From these two points of view one can see a dichotomy in transportation planning. This dichotomy is discussed by J. D. Carroll in his paper, "New Ways to See Land Use and Transportation".\textsuperscript{16} At the beginning of the industrial revolution, Carroll states that cities were fixed physical environments, but by the mid-1800's the increasing focus of transportation had converted them to "dynamic social and political environments". Much of modern city planning grew out of the search for answers to the problems recognized during the 19th Century.

As a result, some planners have used transportation plans to act as the catalyst for change in a region. Carroll says it is "less likely that transportation facilities will lead rather than follow land settlement"; instead, new land use will make new transportation facilities necessary.
This is one side of the dialogue, the side which sees a time differential between settlement and transportation.

The other side sees no time differential. On this, Carroll says, "... future transportation planning must have an agreed upon regional land-use development plan and policy as a prime input".¹⁷

But the planning process cannot be restricted to future urban districts with future transportation systems. It must apply equally to existing urban areas and their transportation needs -- it must be acceptable wherever there is change even when rapid transit is the last added feature.

On this point Michael Lash states that new facilities face competition from "entrenched" transport modes. Planning a system for a new area can result in greater impact for that system since it can be planned as a scarce resource.¹⁸

Where co-ordination of land use with transportation allows community consequences to be foreseen, addition of transportation to an established area leaves the question of consequences open to a variety of land use possibilities. Thus the planner can act as a guide to ensure that land use changes in established urban areas will be complimentary to the community and to the direction of that community.

Although Carroll writes of co-ordinating new settlements and their land uses with future transportation, it is not difficult to redirect his concepts so that a co-ordination might be sought simply between new land uses and future transportation. Carroll says that transportation must have an agreed upon land use plan, and his description of the process is not inapplicable to new land use and transportation planning for old settlements.

Carroll sees the process as having three dimensions. The surface provides the length and width, and the nature of land use is the depth.
To make this apply to existing settlement, it might be suggested to go a step further by introducing the fourth dimension -- time. The interaction between land uses and transportation, whether in an existing urban area or in a new one, must continue through time. Interaction will not occur for an isolated instant; it must be viable over a long period. Although planning the interaction may be easier if both land use and transportation are to begin life simultaneously, interaction must be equally successful no matter what the age of the individual component parts.

Bauer, Fagin and Carroll all recognize that transportation can change urban structure, and they all agree that transportation should be planned to enhance land uses. The American Society of Civil Engineers has said:

people and communities are being fit into systems of design rather than developing a design which fits people and communities.\(^1\)

Carroll expresses this idea as wholesale versus retail transportation planning.\(^2\) The wholesale aspect is traditional O/D studies, traffic counts, etc. The retail aspect is people, their differences, the places they want to go, why they go where they do, and their desires for convenience and comfort. Lash considers 'today's urban transportation issues', the first being a combination and arrangement of transportation facilities to optimize the economic and social needs; and the second, to combine and arrange the transportation facilities to influence the physical growth of our urban areas in patterns which are most beneficial to society.\(^3\) Both acknowledge the basic need for planning a system so that it will function well, but both recognize the statement of the American Society of Civil Engineers by stating that the system must be planned to co-ordinate with the needs and movement patterns of the people who are to use it.
Summary

A transportation system's installation will have effects upon the community -- there will be physical changes; there will be social changes. Man built the city to house his needs but technological changes, particularly in transportation, have outpaced city planning.

Decentralization was made possible by technological changes and widespread affluence, but urban sprawl resulted from the lack of environmental planning in the central city.

Engineers and planners now recognize that transportation can be used as a catalyst for change and redevelopment of the city. In the past, attention was paid to the system's technical plan, today it is realized that the plan has a social side which is as important as the technical one. Thus proper planning of the mobility system and understanding the consequences which will result from it can permit man to live with high population densities in a manner satisfactory to all his needs.
Footnotes:


3. Loc. cit.


6. Ibid., p. 291.


17. Loc. cit.


Chapter 2

Rapid Transit Planning Theory and Three Case Studies

-- Chicago

-- Cleveland

-- Toronto
Rapid transit can be planned to interact with a city in a desired manner; but the interaction can vary from city to city. The plan can be different if the intended market is different. This chapter will examine rapid transit planning, first by presenting the ideas of several transportation engineers and transportation planners; and second, by examining three case studies where rapid transit has been used for different goals.

Transportation engineer Wilbur Smith has divided the theoretical approach to rapid transit into four parts. He calls the first "Components of the urban transportation balance". It states that it is necessary to ensure a) a co-ordinated system of terminals, and b) develop transportation centers which enhance rather than impede the efficient functioning of a city's transportation network. Thus Smith has identified the component parts as the terminals or centers of transportation, and says that their arrangement should be one which aids and encourages interface. This part of Smith's theory is born out in the findings of the Long Island Railroad where it has been found that the location of the core terminal affects the choice of transit mode if choice is available. If the location is good, the rail service will attract riders. The Long Island system is a commuter rather than a rapid transit service, but the same reasoning should apply to both. If site selection for a central rapid transit terminal is good, i.e., convenient to the greatest number of destinations for the greatest number of people, then it will, in Smith's words, "enhance the service and therefore attract riders".

The second part of his theory conceptualizes the system as "a single facility providing transfer between two or more vehicular modes", or "an entire urban core as a transportation center". Here the system acts either as a middleman, with the purpose of conveying (people) from one mode to
another mode, or the rapid transit system might operate where it can deliver its passengers directly from origin to destination without mode change. An illustration of the first alternative might be a rapid transit system which carries riders from a bus-feeder route to a core distribution system such as a taxi service.

Smith's third point states that the system must be efficient. It should a) separate conflicting modes; for example, bus rapid transit from automobile traffic; b) eliminate pedestrian congestion which might occur within the system at central points; and c) attempt to become a competitive substitute for the advantages of travel in private vehicles.

The fourth point is a definition of the major job of the core transportation system. Smith says this is the handling of rush-hour traffic and the co-ordination of rapid transit with other interconnecting transportation modes so that it facilitates comprehensive urban transportation.

He suggests that large cities may require a concentration of transportation facilities at some major point. A classic example of this is London's Victoria Station where the Circle, District and Victoria subway lines interconnect and link directly to commuter trains, to the Central Bus Line and to the Green Line Coach suburban bus routes. One central terminal collects routes so that transfers can be made from it. The disadvantage, suggested in Smith's third point, is pedestrian congestion, which can be coupled with confusion due to the multiplicity of transit routes.

Ancillary to this, Smith recommends a series of these central transfer points peripheral to the core. Not only would this reduce congestion and confusion, but these nodes could be planned as foci for development projects such as shopping centers or suburban office buildings. The attraction to the transfer node is the market potential of both the rapid transit radial
and the connecting feeder routes.

D. S. Berry states:

In metropolitan areas not now having rail-rapid transit or commuter rail service, the type of rapid transit service to be provided should depend on the density of development, the compactness of the central area, plans for urban renewal, estimated costs of construction of alternate plans and their benefits, and probable effects of the components of the plan on the community.⁴,⁵

Berry's theory of the system's design suggests a relationship between the system and the nature of each individual city. He refers to population densities in the urban area and areal compactness in the core as critical constraints for the system's plan. Since rapid transit plays an important role in the city, he accepts the view that it can be used as a catalyst for urban redevelopment, and can be made an integral part of large commercial or residential complexes, because it spurs development along its route. Rapid transit, then, might be planned to pass through a redevelopment area and in so doing, attract private capital into the renewal project.

Since every city will require an individually planned transit solution, Berry includes a theorized evaluation of alternative rapid transit modes and their respective capability-relationships to the community. The theory has been presented in tabular form in the book The Technology of Urban Transportation, of which Berry is a co-author. Two rapid transit modes are compared with the automobile, and with each other (see Table II-1).

Transportation planner Leslie Tass has listed several criteria for rapid transit planning.⁶ He begins by saying that a city should have a minimum population of 1,000,000. This might be disputed by engineering firms who have recently laid out rapid transit plans for Edmonton, Calgary, and Winnipeg -- all under 500,000 population. It could also be cited that the
### TABLE II-1  Comparison of Urban Transportation Modes

<table>
<thead>
<tr>
<th>Item of Comparison</th>
<th>Automotive Transportation</th>
<th>Rail-Rapid Transit</th>
<th>Bus-Rapid Transit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. For moving workers to and from CBD</td>
<td>Requires expensive parking or long walk at CBD</td>
<td>Excellent for workers living near lines</td>
<td>Excellent for workers living near lines</td>
</tr>
<tr>
<td>2. For workers needing to travel for business</td>
<td>Essential</td>
<td>Not satisfactory for most such travel</td>
<td>Not satisfactory for most travel</td>
</tr>
<tr>
<td>3. For movement of goods</td>
<td>Essential</td>
<td>Not satisfactory for most goods</td>
<td>Not satisfactory for most goods</td>
</tr>
<tr>
<td>4. For recreational travel</td>
<td>Essential for travel outside city</td>
<td>Not satisfactory in most cases</td>
<td>Not satisfactory in most cases</td>
</tr>
<tr>
<td>5. Coverage of area</td>
<td>Complete, with freeways and arterials</td>
<td>Inferior in low-density areas. Needs feeders</td>
<td>Good in medium-density areas-provides own feeders</td>
</tr>
<tr>
<td>6. Capacity per track or lane</td>
<td>3000 passengers per hour</td>
<td>To 40,000 passengers per hour</td>
<td>To 30,000 passengers per hour, unless limited by bus stop capacity</td>
</tr>
<tr>
<td>7. Travel time, door-to-door, non-CBD trips</td>
<td>Best for most non-CBD trips</td>
<td>Poor for most trips; requires transfers</td>
<td>Poor except for trips along lines</td>
</tr>
<tr>
<td>8. Travel time, door-to-door, CBD trips</td>
<td>Good to poor, dependent on congestion, distance to parking</td>
<td>Good, for those trips from zones near transit stations only</td>
<td>Good for trips from zones near stops; fewer transfers</td>
</tr>
<tr>
<td>9. Vehicle comfort</td>
<td>Excellent—private cars; driver cannot relax</td>
<td>Superior, with passengers able to read newspapers unless crowded</td>
<td>Poorer, with less smooth operation</td>
</tr>
<tr>
<td>10. Cost per passenger mile for an 8-mile trip</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. To CBD--</td>
<td>6-10¢</td>
<td>3¢ or more</td>
<td>3¢ or more</td>
</tr>
<tr>
<td>b. To non-CBD place</td>
<td>2-6¢</td>
<td>3¢ or more</td>
<td>3¢ or more</td>
</tr>
<tr>
<td>11. Effect on CBD development</td>
<td>Requires parking, and would be impractical as only mode in large cities</td>
<td>Permits more compact CBD Development by not requiring parking. Has high-capacity central area distribution system</td>
<td>Requires much more space than rail-rapid transit, for central area loading</td>
</tr>
</tbody>
</table>

subway system for the city of Boston was planned when that city was well below the million mark. Any arbitrary population figure should be subordinate to the nature of the specific city's population including its density and its culture; and to the nature of the specific rapid transit plan, i.e., whether it focuses on suburban commuters or central city ridership.

It is interesting to note that of the six rapid transit systems operating in North America in 1963, only New York City and Toronto were operating at capacity potentials, which indicates that the simple force of numbers is of less importance to rapid transit than urban population densities and urban structure. It was noted in Chapter 1 of this thesis that the highest densities in major North American cities are in Montreal, Toronto, and New York City. The greatest population is in New York City, Los Angeles, and Chicago. Traffic figures for the Montreal rapid transit were not considered in this reference since the system was not in operation.

Tass has set down several configuration factors important to planning rapid transit so that it will function with the community. He begins by stating that a central point should be selected as a focus from which radials can be constructed (see diagram II-1). To facilitate transportation to non-core destinations a circumferential route should be planned. It circles the central focus and connects the radials (see diagram II-2). To eliminate a congestion and confusion at the central terminal, he recommends no more than two radials meeting at any one station. If there are more than two radials directed toward the core, he recommends a skewed arrangement (see diagram II-3). This diversifies traffic over a larger area in the core. As can be seen in the diagram, transfer to the other radials is not affected
Tass diagrams:
Theoretical Subway Configurations

Diagram II-1

Diagram II-2

Diagram II-3
by the skewed design.

In summation of the three theoretical approaches to rapid transit planning: Smith is concerned with how efficiently the system can perform its tasks; Berry is concerned with the relationship of the system to the city; and Tass is concerned with the configuration of the system. Each has presented his theory separately, but common to all is the emphasis that the characteristics of rapid transit should be allowed to vary with each individual city.

It is now possible to proceed to case study examination of several rapid transit systems. To determine the nature of each, such criteria as station spacing, provision of parking along the routes, bus-feeder connections and the physical nature of the city -- i.e., the quality of nearby intersections and the surrounding types of land uses, will be taken as indicators.

Some basic theory pertaining specifically to the above criteria will be discussed before the actual case studies are presented.

W. S. Homburger discusses station spacing and says that too many station stops reduce speed; too few increase access time to the system for users thus cancelling the gains which the system seeks. If a system provides local service but is also interested in attracting commuters, it can provide "skip-stops" whereby two trains travel the same line, each stopping at alternate stations; all stopping at main stations. In Chicago, 'A' and 'B' trains operate on certain lines with 'A' trains stopping at 'A' stations and 'B' trains stopping at 'B' stations. Both stop at stations marked 'AB' which are located in areas relevant to both schedules (see Map II-3).

The BARTD system in San Francisco-Oakland has a unique method for accommodating local and commuter services. Two subways will operate beneath
Market Street in the city's core. The lower system will be the 3-County BARTD service, or the commuter line; the upper system will accommodate the five local streetcar lines which currently use Market Street.  

The city of St. Louis has compiled a table illustrating delay causes for their bus transit. The bus service shares the city streets with automobiles; therefore many of the delay categories do not apply to rapid transit. Nevertheless, one of their statistics shows that passenger stops account for 17.9% of the total trip time. Total delays account for 29.7% of the trip time.

Station spacing is of major importance to the nature of the system. In general, greater spacing distances are better for commuter oriented systems. As stated by Wilbur Smith, one of the major functions of the rapid transit system is to provide proper service to the rush hour rider --the commuter.

The range of spacing (see Table II-2) is .41 miles for Toronto's central-city oriented system to 2.3 miles in the BARTD commuter-oriented system. The nature of the systems in each of the two extreme cases is quite different, and the spacing of their stations reflects this.

But the averages say nothing about the extremes within the various systems. In Edmonton's planned system, for example, the range is 1800' between core stations, to 1-mile distances between stations on the branch suburban lines. In Cleveland the range is from .67 miles to 2.55 miles with shorter spacing in the suburbs. In Montreal, distances vary from 1.472' between downtown St. Laurent and Berri de Montigny stations, to 11,036' between Berri de Montigny and Ile Ste. Helene station at Expo '67. The basis of planning in the Montreal system is population density along the route, and anticipated system use.
Table II-2  Average Station Spacing on Several North American Rapid Transit Systems

<table>
<thead>
<tr>
<th>City</th>
<th>Average Station Spacing in Miles</th>
<th>Sources (footnotes)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Operating or under construction</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>San Francisco (BARTD)</td>
<td>2.3</td>
<td>13</td>
</tr>
<tr>
<td>Cleveland</td>
<td>1.1</td>
<td>14</td>
</tr>
<tr>
<td>Chicago (Eisenhower Expressway)</td>
<td>.7</td>
<td>15</td>
</tr>
<tr>
<td>Montreal</td>
<td>.48</td>
<td>16</td>
</tr>
<tr>
<td>Toronto</td>
<td>.41</td>
<td>17</td>
</tr>
<tr>
<td><strong>Planned</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Atlanta</td>
<td>1.8</td>
<td>18</td>
</tr>
<tr>
<td>Los Angeles</td>
<td>1.0</td>
<td>19</td>
</tr>
<tr>
<td>Edmonton</td>
<td>.95</td>
<td>20</td>
</tr>
</tbody>
</table>
Station stops, then, are located where there is a need according to the philosophy of each individual system rather than by any optimal spacing distance.

Another of the indicators of a system's nature is its policy of provision of parking along the route. The Tri-State Transportation Commission Studies (New York, New Jersey, and Connecticut) have found that the installation of a parking garage at a suburban station (1½ miles from the core) increased passenger service by 123%. At another station similar results occurred when the service (frequency and bus-feeder connections) was improved and provision for parking was made -- 14,000 new trips per month were added.24

The planned Calgary rapid transit system calls for parking facilities to be constructed at the ends of the radial lines. In this manner commuters could approach the system at a distance remote from any possible core congestion by taking feeded-bus services or by driving to the radial terminals and transferring to the rapid transit for the trip into the city's core.25

In Chicago, $100,000.00 has just been requisitioned for a study of park-and-ride facilities. Current Chicago rapid transit construction is linked with median strips in existing expressways. The purpose of this study is to learn the possibilities of locating parking areas within expressway cloverleaves, or of decking expressways for parking purposes at rapid transit stations. The goal is that of reducing the number of cars now travelling the crowded expressways to the Loop.26 It has been noted by the Chicago Transit Authority that 56% of all rapid transit trips in Chicago are linked with bus-feeder services.

The Cleveland system, which will be studied more closely in the case
example section of this chapter, is very strictly oriented toward suburban commuter ridership and has provided park-and-ride facilities at almost half of the system's seventeen stations.\textsuperscript{27} It is estimated that as much as 55\% of the ridership at some stations is park-and-ride.\textsuperscript{28} The system provides a total of 5,218 free stalls and 77 metered stalls; there are kiss-and-ride facilities at six stations; and 58 bus-feeder routes link into the rapid transit system.\textsuperscript{29}

Three cities have been chosen to illustrate rapid transit planning in North America. Two, Chicago and Cleveland, will be examined as minor cases; a third, Toronto, will be taken as the major illustration. Each system has been chosen because of distinct qualities.

\textbf{Chicago} represents the old guard with its famous Loop elevated, and with its system oriented to the core built at a time when most people were oriented to one center. It also represents the giant metropolis with its population of 7,000,000. But today, when people are oriented to many centers, Chicago represents innovation in rapid transit as the Chicago Transit Authority has expanded its market to include service to centers outside the Loop. Thus Chicago embodies both old and new approaches to planning rapid transit; it represents the streetcar era before the automobile, and it represents the commuter era of the United States today.

\textbf{Cleveland} represents much of the contemporary thought in rapid transit planning. It is in the forefront of planning systems which are geared to catch commuters from low-density suburbs. It is new, dating from 1955, and although its major goal has been to reduce the number of automobiles travelling into the core, recent revision of the system is broadening the market-orientation to service non-core centers and to provide a localized distributor service of rapid transit to the core.
Toronto represents a new system of rapid transit oriented to the central city, but now expanding into the suburban commuter shed. In this way, Toronto's system combines the philosophy of Chicago's non-median rapid transit and Cleveland's commuter-oriented system. The system, however, exhibits several features which are noteworthy in themselves. Among the most significant is the influence the rapid transit system has had upon the community. Toronto's rapid transit is famous in the literature for having repaid its capital costs through increased tax revenues along the routes. It is significant, too, because it is Canadian and the evolution of cities in Canada, although similar to the pattern in the United States, is not identical.

CHICAGO

The city of Chicago is one which has experienced fast growth and expansion -- it has been described as having grown from a "log cabin to a metropolis of 1,000,000"; and it did this in the 60 years between 1830 and 1890. Over the next 40 years, this population tripled.  

The rapid transit system in Chicago, in particular the Loop elevated system, has been a factor of this growth and provides an excellent historical example of the interaction which this form of urban transportation can have in a community. Its influential role extends a decade prior to its opening:

Not merely the lines that were actually considered, but visionary lines that were projected by promoters but never built had a great influence on the speculative real estate market of 1889 - 1890.  

(See Map II-1)

The period of the 1890's, economically, was one of extreme depression,
Downtown Chicago Elevated and Buildings Built -- 1889-1910

MAP II-1

CHICAGO CORE:
- UNION ELEVATED "LOOP"
- Buildings 1889-1895
- Buildings 1896-1910

Legend:
- 1000' = 1 Mile
Key to Buildings: Map II-1

1889 - 1895 -- the period of speculation:

<table>
<thead>
<tr>
<th>Building</th>
<th>Year built</th>
<th>Height in storeys</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tacoma Building</td>
<td>1889</td>
<td>13</td>
<td>A</td>
</tr>
<tr>
<td>Auditorium Theater</td>
<td>1889</td>
<td>19</td>
<td>A</td>
</tr>
<tr>
<td>Reliance Building</td>
<td>1890</td>
<td>17</td>
<td>A</td>
</tr>
<tr>
<td>Champlain Building</td>
<td>1890</td>
<td>n.a.</td>
<td>A</td>
</tr>
<tr>
<td>Monon Building</td>
<td>1890</td>
<td>13</td>
<td>A</td>
</tr>
<tr>
<td>A. H. Andrews Building</td>
<td>1890</td>
<td>7</td>
<td>A</td>
</tr>
<tr>
<td>Rand McNally Building</td>
<td>1890</td>
<td>10</td>
<td>A</td>
</tr>
<tr>
<td>Leiter Building (Sears)</td>
<td>1891</td>
<td>8</td>
<td>A</td>
</tr>
<tr>
<td>Monadnock Building</td>
<td>1891</td>
<td>18</td>
<td>AC</td>
</tr>
<tr>
<td>Ashland Block</td>
<td>1891</td>
<td>10</td>
<td>A</td>
</tr>
<tr>
<td>Columbus Memorial Building</td>
<td>1891</td>
<td>n.a.</td>
<td>A</td>
</tr>
<tr>
<td>Unity Building</td>
<td>1891</td>
<td>n.a.</td>
<td>A</td>
</tr>
<tr>
<td>Andrews Building</td>
<td>1891</td>
<td>7</td>
<td>A</td>
</tr>
<tr>
<td>Fair Store</td>
<td>1892</td>
<td>11</td>
<td>A</td>
</tr>
<tr>
<td>Women's W.C.T.U.</td>
<td>1892</td>
<td>13</td>
<td>A</td>
</tr>
<tr>
<td>Northern Hotel</td>
<td>1892</td>
<td>16</td>
<td>A</td>
</tr>
<tr>
<td>Schiller Building (Theater)</td>
<td>1892</td>
<td>17</td>
<td>AB</td>
</tr>
<tr>
<td>Yondorf Building</td>
<td>1892</td>
<td>10</td>
<td>B</td>
</tr>
<tr>
<td>Masonic Temple</td>
<td>1892</td>
<td>19</td>
<td>C</td>
</tr>
<tr>
<td>Manhattan Building</td>
<td>1893</td>
<td>16</td>
<td>ABC</td>
</tr>
<tr>
<td>Old Colony Building</td>
<td>1893</td>
<td>n.a.</td>
<td>C</td>
</tr>
<tr>
<td>Ellsworth Building</td>
<td>1893</td>
<td>n.a.</td>
<td>C</td>
</tr>
<tr>
<td>Hartford Building</td>
<td>1894</td>
<td>n.a.</td>
<td>C</td>
</tr>
<tr>
<td>Stock Exchange Building</td>
<td>1894</td>
<td>13</td>
<td>A</td>
</tr>
<tr>
<td>Chemical Bank</td>
<td>1894</td>
<td>9</td>
<td>C</td>
</tr>
<tr>
<td>Marquette Building</td>
<td>1895</td>
<td>17</td>
<td>A</td>
</tr>
<tr>
<td>Studebaker Building</td>
<td>1895</td>
<td>10</td>
<td>A</td>
</tr>
</tbody>
</table>

1896 - 1910 -- the period of construction and the decade following the opening of the Loop:

<table>
<thead>
<tr>
<th>Building</th>
<th>Year built</th>
<th>Height in storeys</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fisher Building</td>
<td>1896</td>
<td>18</td>
<td>AB</td>
</tr>
<tr>
<td>Gage Building</td>
<td>1898</td>
<td>12</td>
<td>AB</td>
</tr>
<tr>
<td>Cable Building</td>
<td>1899</td>
<td>10</td>
<td>AB</td>
</tr>
<tr>
<td>Carson Pirie Scott Store</td>
<td>1899</td>
<td>12</td>
<td>AB</td>
</tr>
<tr>
<td>McClurg Building</td>
<td>1900</td>
<td>7</td>
<td>AB</td>
</tr>
<tr>
<td>Mandel Brothers Building</td>
<td>1904</td>
<td>11</td>
<td>A</td>
</tr>
<tr>
<td>Chapin and Gore Building</td>
<td>1904</td>
<td>8</td>
<td>AB</td>
</tr>
<tr>
<td>Hunter Building</td>
<td>1908</td>
<td>12</td>
<td>AB</td>
</tr>
<tr>
<td>Brooks Building</td>
<td>1910</td>
<td>12</td>
<td>A</td>
</tr>
</tbody>
</table>

Sources:


C. Homer Hoyt, *One Hundred Years of Land Values in Chicago*, University of Chicago Press, Chicago, 1933.
but the construction of the elevated lines, including the Loop, caused the downward trend on State Street, the major commercial street of downtown Chicago, to reverse itself and even reach record high land values. Other downtown streets were also able to withstand the depression by "firmly maintaining" their land values.\textsuperscript{32}

The benefits were not restricted to the core:

The 'Alley Elevated' (1890) road was being constructed between State and Wabash with the result that the value of State Street frontage from 22nd to 63rd Streets increased several hundred percent in a few months.\textsuperscript{33}

The Loop elevated is looked upon as having given many corporations incentive to locate in Chicago. It permitted downtown buildings to group together and thus create the type of core area which was attractive to large business enterprises.\textsuperscript{34} Over twenty-five buildings of between 12 and 16 floors were constructed between 1889 and 1894. "Tear down that old rat trap and erect a 16-storey building" was the slogan of 1889.\textsuperscript{35}

The speculation and development of land central to the projected elevated routes anchored the core firmly and created a focal district easily accessible to the people of the entire urban area.

State Street department stores were just attaining their first exuberant expansion, . . . as the elevated lines brought people downtown. . . . The Chicago Loop had become the place where the people in the Metropolitan Area congregated for the purpose of making most retail purchases, except foodstuffs, for transacting financial business, and for entertainment.\textsuperscript{36}

(Note: Map II-2 indicates the ease of access from department stores to the elevated. Walking distances to a station is seldom more than 1 block, or 320 to 400').\textsuperscript{37}

On October 12, 1897, the Union Loop was opened. The benefit was so pronounced to the property lying within the Loop that 'The Loop' became a synonym for the high
value zone of the Central Business District of Chicago, while property owners outside the golden circle cursed the Loop as a Chinese Wall that stopped the natural expansion of the Central Business District area.\(^{38}\)

The configuration of the elevated lines coming from the South Side, the West Side, and the North Side were linked together by the Union Loop in the core; from then on the core was known as 'The Loop'.\(^{39}\)

Outside the core, the areas experiencing construction in the early 1900's were also located in close proximity to elevated lines. These areas were residential in nature, attracting the higher income people who were moving from the core to escape factories, warehouses, new immigrants, and crime.\(^{40}\)

(This) was the era when the two-apartment building was gaining rapid popularity and when rows and rows of such structures were being erected.\(^{41}\)

The period following the opening of the elevated line, 1900 - 1916, was not as active as the period of speculation which had preceded it. Annual building volumes continued to increase, and land values increased, but "there was no wild excitement and no widespread public participation in the real estate market".\(^{42}\)

Demand for core development was sufficient to cause the civic government to lift the height restrictions of the 1880's (130') to 260' in 1900.\(^{43}\) Almost two dozen buildings of 12 to 19 storeys were planned for construction in the Loop in the early 1900's.\(^{44}\)

(The height limitation was removed in 1923 to permit skyscrapers above 22 storeys to be built in the Loop. About twenty were built, ranging in height from 35 to 46 storeys -- 560'. Notable in this group was the Merchandise Mart (1930), built on the air rights over the railroad tracks -- it was the world's largest building at the time.\(^{45}\)
Two of Chicago's rapid transit lines, Lake Street and the Eisenhower Expressway, will now be compared as examples of rapid transit planning in that city.

The selected lines parallel each other running from the Loop on the east to the suburban communities of Oak Park, River Forest, and Forest Park on the west (see Map II-3).

The Lake Street line represents the elevated era of rapid transit planning dating from the beginning of this century. (Only parts of the line are elevated, the remainder is surface.) Examination of the map shows that its service is aimed at capturing the local residential market and transporting it to the Loop. (It should be noted that much of the area through which the Lake Street line runs is an area of continuous "row house" development built around the turn of the century.)

Until 1962, the Lake Street line operated as a surface route beyond the vicinity of the Loop. In 1962 the outer 2½ miles of the line were relocated onto an elevated structure on the right-of-way of the Chicago and North Western railroad. Map II-3 indicates the changed stops in red squares.46

Station stops have two readily evident characteristics; they are spaced at ½-mile distances, and they lie at intersections of major north-south crosstown streets, many of which had feeder electric streetcar lines when the line opened.47 Today, bus-feeder connections can be made at each of these north-south crosstown streets.

Exceptions to the ½-mile spacing: (west to east)

Cicero Avenue to Pulaski Road -- 1-mile. The residential district to the north of Lake Street is interrupted by a large expanse of rail yards; Kostner Avenue, the north-south crosstown street at the ½-mile location is
Map II-2
Lake Street and Eisenhower Expressway Rapid Transit Routes -- Chicago
Source: Chicago Transit Authority
Chicago Transit Map, 1959
interrupted for ½-mile northward by the rail yards. Both of these factors reduce potential ridership between Cicero Avenue and Pulaski Road.

Pulaski Road to Homan Avenue -- 3/4-mile. Garfield Park occupies much of the area on both sides of Lake Street, thus reducing ridership potential for the rapid transit line. The stop at Homan Avenue, however, is central to a residential zone on the northwest and on the east. Although Homan Street is not major as are the other north-south streets shown on Map II-3, it is the only north-south street between Pulaski Road and Kedzie Avenue which travels uninterrupted crosstown. (It runs from North Avenue to Cermak Road, a distance of 4 miles without interruption.) There is no cross-town route at the ½-mile point between Pulaski Road and Kedzie Avenue.

Homan Street to Kedzie Avenue -- ½-mile. This is the first major north-south crosstown street since Pulaski Road, a distance of 1 mile. Although only ¼-mile from the stop at Homan Street, the stop at Kedzie Avenue, by nature of the crosstown artery, has greater potential to attract riders from a greater distance. High-density residential development surrounds the intersection on all sides, also raising ridership potentials.

California Avenue to Ashland Avenue -- 1½-miles. The north side of Lake Street along this segment of the line is zoned industrial and does not therefore, contribute riders to the Loop-oriented transit line. South of Lake Street many of the parallel east-west streets are major traffic arteries into the Loop, and are a hindrance to pedestrians walking to the line. The traffic lights at the major streets and the heavy traffic also act as further barriers to line access.

Ashland Avenue to Halstead -- 1-mile. The ½-mile spacing is prevented for reasons similar to those mentioned under the California-Ashland segment of the Lake Street line. There is, in addition, no crosstown street at the
A third feature of the Lake Street line is the policy of skip-stop trains where train 'A' stops at 'A'-marked stations; train 'B' stops at 'B'-marked stations, and both trains stop at 'AB'-marked stations.

Along the Lake Street line all trains stop at all stations ('AB') between the terminal in River Forest and Homan Street -- a distance of just over 5 miles. From Kedzie Avenue to Canal Street (the Loop), the trains stop at alternate stations thus speeding service over the final 3½ miles before the Chicago River. The nature of land use in this final 3½ miles has been discussed in the explanation of station spacing exceptions. This fact of land use plus the orientation of the line, the movement of central city residential dwellers to the Loop, further explains the skip-stop policy -- stations are skipped in areas less relevant to the nature of the system's plan.

The Eisenhower Expressway line represents the city's rapid transit planning in the 1950's. Policy has been broadened from transportation to the Loop, to transportation to a variety of points of activity, such as universities, shopping centers, and cultural complexes.

The pattern of station spacing remains similar to that of the Lake Street line with stops every ½-mile except where land use reduces rider potentials. Stops are co-ordinated even more firmly with major north-south crosstown arteries, all of which have bus service to the rapid transit stations.

The innovation of this line is the use of the median strip in an expressway. The Eisenhower Expressway pioneered this approach to right-of-way for rapid transit when it was opened in 1958. The use of an express-
way median acts as a constraint upon the positioning of stations because north-south streets are permitted to cross the expressway's right-of-way only once every \( \frac{1}{2} \)-mile.

Exceptions to the \( \frac{1}{2} \)-mile spacing: (west to east)

Central Avenue to Cicero Avenue -- 1-mile. The reasoning behind the missed stop is similar to that used to explain the \( \frac{1}{2} \)-mile station spacing exceptions of the Lake Street line -- south of the Expressway, residential development has been interrupted by rail yards thus reducing potential ridership.

Pulaski Road to Kedzie Avenue -- 1-mile. Garfield Park interrupts residential development over part of the distance north of the Expressway, but more important, there is no major north-south street intersection at the \( \frac{1}{2} \)-mile point. Homan Street, which acts as a substitute stop on the Lake Street line, is not a major arterial and does not, therefore, constitute justification for a substitute stop on the Eisenhower Expressway line.

Unlike the Lake Street line, the Eisenhower route maintains a near \( \frac{1}{2} \)-mile station spacing between California Avenue and the Loop. (The spacing is not precisely \( \frac{1}{2} \)-mile through this segment due to the diagonal Ogden Avenue, and the irregular spacing of some of the major north-south crosstown arteries.) Maintenance of station spacing through the area is in line with the policy of providing rapid transit to a variety of activity points. The Eisenhower line has stations within walking distance (1000') of the University of Illinois Research and Educational Hospital, the University of Illinois Chicago Campus, and the Federal Post Office.

In the Loop, the Eisenhower Expressway rapid transit turns north at Dearborn and travels through the area in subway.
Expanding upon present rapid transit planning policy in Chicago -- it is aimed at reinforcing the vitality of the core through the extension of rapid transit into the suburbs; by creating all-weather distribution; and by reducing the volume of automobile traffic in the core. A request for $100,000.00 to study park-and-ride facilities for Chicago has been cited earlier in this thesis.

The policy of using expressway medians for rapid transit is to be continued. Notable in the expansion is the north-south Dan Ryan Expressway rapid transit line which will carry riders from 95th Street to the Loop, 4 miles farther than the old elevated line which turned east and west at 63rd Street. Rapid transit is also planned for the median of the J. F. Kennedy Expressway.\(^5\)

In the Loop, a new subway to replace the elevated Union Loop is being planned. In addition to this, a distributor route is planned to serve the near West and near North Sides after cutting through the Loop.\(^5\)

The following statement appeared in the February 1969 issue of the IRT Newsletter, pp. 10-11, with reference to the above Loop expansion.

In Chicago, the Tribune reported that the mere planning of two new downtown subway systems 'has stirred action in the real estate community' even though the new systems are not yet under construction and may be years away from completion. The Chicago activity prompted by the subway ranges from plans to construct new buildings to purchases of downtown properties as long-range investment.\(^5\)

It can only be said that the impact rapid transit has on Chicago has not altered in the 80 years since the first elevated rapid transit was planned.

Station spacing in the newest of Chicago's expressway median rapid transit lines (the Dan Ryan Expressway route), is increasing from that city's traditional ½-mile distances to 1-mile. The new approach is geared to attract more riders away from freeways to rapid transit. This policy change
is still new to Chicago; therefore, the study will shift to Cleveland where commuter-oriented rapid transit is the rule of design.

CLEVELAND

The Cleveland rapid transit system is fairly new, dating from 1955; but when it was planned Cleveland was strongly subjected to the effects of decentralization. The Cleveland situation was described by the Cleveland City Planning Commission in a report entitled Downtown Cleveland, 1975:

It must be noted that the spatial growth of a metropolitan area such as Cleveland, coupled with the increase in automobile ownership and usage, creates a situation in which professional and business enterprises of moderate size (20 - 100,000 sq. ft. of office space) find it more advantageous to take space in outlying areas. . . .

To emphasize the effects decentralization has had on the core, the Planning Commission points out that no office buildings of over 100,000 sq. ft. have been constructed in the downtown since 1930, and that no new hotels had been built since 1929. Although the Commission adds that the core area is almost completely built-up, it states that much of what exists dates from the late 1800's and is in commercial/semi-industrial uses. Many of these structures are in the area of Public Square, in the center of the core, and in a potential amenity area which could support much higher land uses. In addition to this part of the core, there are "two extensive areas (in the northeast section of the downtown) . . . of very old and low-rated buildings devoted to mixed and marginal . . . use."  

Thus decentralization in Cleveland appears to be so strong as to have discouraged investment of private capital in major core-area projects for three decades. The only concentration of new office space is being built east of the Inner Belt Freeway, an area which had been considered out-
side the downtown's edge.\textsuperscript{57}

Another result of Cleveland's decentralization has been the loss of tax benefits.

Downtown Cleveland represents 22 percent of the total assessed valuation of the City. . . . To the extent that the value of Downtown declines through neglect and obsolescence, taxes are likely to increase on all other properties in the City of Cleveland.\textsuperscript{58}

These statements were issued in 1959, four years after the opening of the Cleveland Transit System's rail-rapid transit service. It does not appear, then, that core changes have resulted from this rapid transit operation. Since the stimulation of core development is usually characteristic of rapid transit, an examination of the system is of particular interest.

First, the basic planning goals:

For over 50 years Cleveland has been confronted with the problems of transportation services to meet the requirements of the growing metropolitan area. These have centered around the recognized need to provide convenient and inexpensive transportation to the central business district.\textsuperscript{59}

The County-wide goal in respect to transportation is to move people from their homes to their places of business and other destinations with a maximum of speed, economy and convenience.\textsuperscript{60}

Rapid transit was approved by the voters in the fall of 1949;\textsuperscript{61} operation of the first CTS route began on March 15, 1955, when the route between Windermere Station and Union Terminal was opened. On August 14, 1955, the western route between Union Terminal and 117th Street and Madison Avenue was opened.\textsuperscript{62} (see Map II-4)

The orientation of the system is described by \textit{Metropolitan} magazine as:

\ldots a high-speed mass hauler between downtown
Cleveland and various collection and distribution stations to the east and west. At all of these stations convenient transfer is provided with surface lines.63

The rapid transit system (1955) contained 14 stations averaging over 1-mile in spacing.64 All central stations spacing is over 1-mile, some as much as 1½-miles. Suburban station spacing averages 8/10 of a mile. (With the western extension to Hopkins International Airport, opened November, 1968, the number of stations rose to 17, and the range of station spacing became .67 miles to 2.55 miles.)65 (See Map II-4) 7 of the 14 stations have special off-street bus terminals. With the extension to the airport, 57 bus lines of the CTS plus 1 from the North Olmstead Municipal Bus Line fed into the rapid transit service.66 (The airport extension was designed using the same goals as stated above. Included in the service area of the airport extension are the Ford Motor Company's Plant, the Chrysler Tank Plant, and the Lewis Flight Laboratory of N.A.S.A. 67)

Examples of the concentration of bus-feeder service can be illustrated by the West 25th Street and Joraine Avenue station where 14 bus lines hook into the rapid transit service. On the east side, the University-Cedar Road station has 10 bus-feeder connections.68

Provisions for automobile feeders include 5,295 free parking stalls plus 77 metered stalls spread over 7 suburban stations. Provision is also made for kiss-and-ride at 6 stations.69

The intended plan of the system is to locate stations beyond congested points, and in so doing, attract patronage. Stations positioned beyond the zone of congestion create easier access for riders since they are not forced to drive through heavy traffic in order to reach the rapid transit service. As mentioned, station spacing, in keeping with the plan,
Map II-4

Cleveland and Shaker Heights
Rapid Transit
decreases with distance from the core. This is the opposite of rapid transit systems in other cities where station spacing decreases as it travels into the high-density areas close to and in the core.

The intention is to bring riders from low-density suburbs to the core: the west side rapid serves ten suburban communities which have an average population density of 1,378 per square mile.70

The design capacity of the Cleveland Transit System (hereafter referred to as C.T.S.) trains is 32,000 riders per hour.71 In 1967-68, approximately 60,000 people rode the rapid transit system on an average weekday. On nights when stores remain open late, this number would rise to 66,000. Peak loads were experienced during Christmas and Easter when 80,000 riders used the service.72 Rush hour periods on average weekdays accommodate 10,000 riders or 20,000 of the daily 60,000 total.73

The consulting engineers, Prager-Cutting-De Leuw, conducted an origin/destination survey of the rapid transit system in 1955. (They covered the east side line of the CTS and the Shaker Heights rapid transit system. The west side line of the CTS was not in operation at the time of their study.)

(See Table II-3)

(See Map II-5)

The areas which generate the greatest ridership are also areas of high-density, being zones of multiple family dwellings. Lower density zones generate lower ridership totals74 (see Map II-5). It should be noted that the rapid transit line itself follows railroad rights-of-way and in so doing passes through industrially zoned areas; the residential neighborhoods are only adjacent. Access to stations, therefore, most often requires a mode split. This is not a problem to CTS since the planned
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*c* — service with CTS only

*s* — service with Shaker Heights only
Origin of Rapid Transit Riders to the Core (East Side) -- Cleveland
service is geared to passenger arrival by automobile or bus. In some cases pedestrian bridges have been built to cross the tracks and link apartments to stations. The Shaker Heights line departs from railroad right-of-way to use the median strips of Shaker Heights and Van Aken Boulevards. Stations are accessible on foot and 1/4-mile spacing acts well to attract local traffic destined for the core. (The Shaker Heights survey zone 'AI' showed the highest individual contribution to ridership in the O/D survey.) Ridership decreases with distance from the line and with changes in the density.

Although the rapid transit systems have had little or no effect on Cleveland's core, this is not true for the suburban parts of the community where there is greater interaction with the service.

In addition to moving people efficiently, rapid transit has a beneficial and stabilizing effect on nearby land values. The permanence of rail-rapid transit attracts commercial and residential construction, as has been proven in Shaker Heights. . . .

In Shaker Heights, $30,000,000.00 in new development has been invested along the rapid transit line.

Since . . . 1955, over 30 . . . commercial and apartment buildings have been constructed (along the CTS rapid transit line) or are in the planning stages. These buildings are valued at $169,000,000.00.

Air rights over one station recently sold for $1,500,000.00 for the construction of two high-rise apartment buildings.

This investment is significant in view of the fact that the 14.92 miles of rapid transit (excluding the extension to Hopkins International Airport), most of which is either surface or open cut, cost only $38,900,000.00.

This, then, is the relationship which rapid transit in Cleveland
has with the community. But, as noted, the core area of the city is suffering from decentralization. The City Planning Commission and the Board of Trade Commissioners have decided that a catalyst for growth in the central area can be a new approach to rapid transit.

Considering the need for core revitalization, the consultant engineers conducting a feasibility study for new rapid transit in Cleveland quote Robert Moses of the Triborough Bridge and Tunnel Authority of New York City (1953):

A fair analysis of such impact . . . on adjacent, nearby and related property values shows that they usher in rapid development of vacant, undeveloped and unproductive outlying sections, face lifting of older and decaying neighborhoods, and incentive to private speculative enterprise, By a sound program of public works, millions of dollars are added to tax rolls, and private property becomes income-producing instead of lying fallow.82

Thus the City has accepted the fact that public investment in rapid transit can stimulate private capital for core area rehabilitation and redevelopment. The problem, then, is how rapid transit should be used to accomplish the goal. The engineers, Praeger-Cutting-De Leuw, state:

The concentrated business and commercial area of downtown Cleveland occupies an area of only 1 square mile. There are essentially no stations in the last three miles of the trip and none of the intermediate heavily populated residential or business areas is served.

Greater Cleveland's rapid transit service is comparable to the suburban railroad commuter services in other large cities. These tap outlying residential communities and discharge passengers in a main central terminal from which passengers reach their city destinations by subways, other mass transit facilities, taxicabs or walking.83

The solution:

The construction of a downtown subway in Cleveland as an extension of the present Rapid will permit the passenger bound for the downtown business, shopping, or
amusement area to travel to within a short walking distance of his destination. \textsuperscript{84}

The single rapid transit terminal at the west end of the Downtown linear core is a disadvantage to the functioning of the core as a whole because of the length of walk to 'primary destinations' at the middle and east end of the area. Additional terminals in the core would improve access and thereby encourage new development as well as maintain present property values. \textsuperscript{85}

The existing single station in the Terminal Building imposes long walking distances on many people. . . . The resulting inconvenience has adversely affected the patronage of the present rail transit services. \textsuperscript{86}

These statements indicate a departure from the older commuter orientation of rapid transit planning in Cleveland. Until this time the service's goal had been simply the delivery of suburban residents to the core. It is now realized that the system, to maximize potential, must be able to deliver riders to specific destinations as well as to the general destination -- the core.

After considering several alternative solutions, the engineers decided on a circular distributor route with stations located in the core at Huron Road and East 9th Street, East 13th Street and Euclid Avenue, at Superior Avenue between East 6th and East 9th Streets, and for passengers arriving on the west side line, a fourth station at Public Square (see Maps II-6 and II-7).

Station spacing is 1500 to 2100 feet, and running time between Union Terminal and the farthest point on the distributor is 5 minutes. The new line will ring 77\% of the downtown working population within 800 feet of a rail rapid transit station. \textsuperscript{87} (At present, only 21\% of the downtown working population is within the 800 foot distance of rapid transit. \textsuperscript{88})

The estimated daily traffic (1955) which this core distributor could
Map II-6
Downtown Cleveland Rapid Transit Distributor

Source: E.H. Prager, et.al.
Cleveland Subway, 1955
Map II-7
Station locations, daytime working population and 800' radii -- Downtown Cleveland
Source: E.H. Prager, et al., Cleveland Subway, 1955, p. 18
be expected to attract is 121,800; 65,700 of these would specifically use the distributor route.\textsuperscript{89}

The scope of the plan is broadened to cover the following points:

-- stabilization and enhancement of property values

-- space for expansion; that is, to establish a basis for a plan of areal expansion in the core for shopping and office activities. The engineers state:

The location of the recommended subway is such as to expand the area from the traditional one street -- Euclid Avenue, pattern and to distribute new growth over a wider expanse of downtown Cleveland. Most offices are within approximately two blocks of Euclid Avenue. The normal growth of this office space, now almost fully occupied, as well as the retail stores and commercial services would spread in all directions from the present location of concentrated land use.\textsuperscript{90} (See Map II-8)

-- relief of street traffic; the ability of downtown Cleveland to cope with traffic using standard methods is nearing capacity. The provision of a subsurface core distributor will relieve present congested conditions and at the same time cope with increased numbers of people travelling to the core.\textsuperscript{91}

A reduction . . . of approximately 2,400 automobiles per day coming into the downtown may be expected. This figure represents 6,700 trips diverted from automobiles . . . (plus) 700 bus trips entering and leaving the Central Business District each day will be eliminated.\textsuperscript{92}

-- regularity of operation; the nature of the subway system would remove transit from the weather, a major hazard of Cleveland's winter.

The remaining points include time savings, increased comfort, better service to people working in the core, better service to people shopping in the core, local transportation in the downtown, improved safety, and service to the Mall, a prestige segment of downtown containing the Public Library, the Auditorium, and the Federal Building.\textsuperscript{93}
Map II-8
Areas Subject to Intensifies Land Use, Downtown Cleveland
Source: E.H. Frager, et. al. Cleveland Subway, 1955, p.52
In this manner, rapid transit plus "... specific encouragement of downtown construction ... of needed office buildings, retail establishments, hotels, and other structures ..."\textsuperscript{94} will bring development to the core, which until the advent of the distributor subway plan, had been restricted to locations along the suburban rapid transit route.

It is interesting to note that Chicago has progressed from central city-core focused rapid transit to rapid transit aimed at attracting suburban commuters; Cleveland progressed from commuter-oriented rapid transit to a service providing core area distribution.

\textbf{TORONTO}

The first proposal for rapid transit in Toronto was in 1910-11 when a firm of consultants and engineers prepared plans and specifications for a subway to run from the downtown area to the intersection of St. Clair and Yonge Streets, just over three miles. This proposal was defeated by the voters.\textsuperscript{95}

This defeat did not prevent another engineering firm from proposing another subway plan in the next year -- 1912; it met the same fate as its predecessor. In 1915, Toronto's mayor appointed a committee to study radial urban railways and rapid transit. The study recommended electric radial railway lines.\textsuperscript{96}

The next proposal for rapid transit came in 1942 from the Toronto Transit Commission. (Hereafter referred to as either TTC or the Commission.) Two routes were recommended: a) a north-south subway in the vicinity of Yonge Street from Front Street to St. Clair Avenue, and b) an east-west line beneath Queen Street from Trinity Park to Broadview Avenue (see Map II-9). Involvement in the War, however, made implementation of the plan
One way Streets
Municipal Parking Lots
Places of Interest
1. Adelaide Street Postal Station K-19
3. Art Gallery of Toronto K-18
4. Banting Institute J-18
5. Bus Depot K-19
6. Canadian Customs L-19
7. Central Y.M.C.A. J-19
8. City Hall K-19
9. Conservatory of Music J-18
10. Grace Hospital J-18
11. Hart House J-18
12. Holy Trinity Church K-19
13. Hospital for Sick Children K-18
14a John Street Pumping Station L-18
15. Juvenile Family Court Building K-20
16. Loew's Theatre K-19
16a MacKenzie House K-19
17. Maple Leaf Gardens, Limited J-19
18. Medical Arts Building H-18
19. Metropolitan Courthouse K-18
20. Mount Sinai Hospital K-18
21. O'Keefe Centre L-19
22. Osgoode Hall K-18
23. Parliament Buildings J-1
24. Police Headquarters L-19
25a Provincial Archives and Sigmund Samuel Canadian Gallery J-18
26. Registry Office K-19
27. Royal Ontario Museum J-18
28. St. Michael's College J-19
29. St. Michael's Hospital K-19
30. Toronto General Hospital J-
31. Toronto Harbour Commission L-19
32. Toronto Public Library J-18
33. Union Station L-19
34. Uptown Theatre J-19
35. Varsity Stadium J-18
36. Victoria College J-18
impractical.

Growth in Toronto kept the idea of a subway alive. The TTC realized that adequate speeds on several important streetcar lines would soon be difficult to maintain. Anticipating the need, the Commission hired a staff to make subway plans in 1943; in 1944, consultants were hired and by 1945, plans and estimates of a definite route were presented to the electors of Toronto.97

The plan envisaged the construction of two rapid transit routes. The first was the Yonge line, to run from Union Station under Front Street and then north under or paralleling Yonge Street through the heart of downtown Toronto to Eglinton Avenue. The second was a Queen line, an east-west route to run beneath Queen Street from Trinity Park in the west to Broadview Avenue in the east.98 (See Map II-9)

The result of the referendum was 79,935 for, 8,630 against. On September 8, 1949, work began on the Yonge route, "the most urgently needed of the two routes".99 (Except for the extension from St. Clair to Eglinton, this proposal is the same as the Commission's 1942 recommendation.)

The Commission's statistics showed that the Yonge Street streetcar line was carrying 12,000 passengers per hour in the peak periods. The line was operating at capacity and the busiest in the city.100

The primary design objectives of the TTC's plan include:

1. The subway would go where the need was greatest despite the obviously high cost of building a line through the heart of the downtown area.

2. The line would be designed to handle a heavy volume of traffic -- at least three times greater than the capacity of the heaviest surface streetcar line -- with speed and safety. ... a (design) capacity of 40,000 passengers an hour in one direction. ...

3. It would be built to facilitate fast and convenient interchange of passengers between the subway and the
connecting surface transit routes.\textsuperscript{101}

The Yonge Street line opened March 30, 1954, "... (it) was the first subway built in North America since the beginning of World War II. ... It is a high capacity conventional rail system fully co-ordinated specifically to speed passengers to and from the city's busy downtown core area."\textsuperscript{102}

In 1956, it was found that approximately 10,000 automobiles per day were left at home as a result of the Yonge Street subway.\textsuperscript{103} In the 3rd Annual Report of the Toronto Transit Commission -- 1957, it was estimated that the system's capacity (40,000 passengers per hour) would be reached in five years.\textsuperscript{104}

The present (1956-57) Yonge Street subway is ... operating at 75\% of its capacity and the growth of passenger traffic is such that within five years the subway may be overloaded. It is imperative, therefore, that another north-south line be constructed to relieve it, and University Avenue is the most convenient location for such a line, having regard to the established business district.\textsuperscript{105}

In 1957, the Metropolitan Toronto Planning Board restated the planning policy for the city's rapid transit:

- The subway should carry as many passengers as possible, as far as possible, on the most direct route, and with the greatest saving in time. In particular, it should serve as efficiently as possible the central business district.\textsuperscript{106}

Among the original design objectives of rapid transit had been the provision of relief on traffic congested streets. Yonge Street, as noted, had 12,000 passengers per peak hour patronizing its streetcars. In 1954, Bloor Street was experiencing 9,000 passengers per peak hour and increasing. In addition to acknowledging the pending overload on the existing Yonge Street subway, it was realized that an east-west service would have to be provided.
In the original plan, the second recommended subway had been proposed for Queen Street. In the interim, growth and development in the central area shifted north so that Bloor Street had become the most important east-west artery. The Bloor Street streetcar line "... was operating a maximum capacity and because of severe congestion ... it was impossible to maintain satisfactory transit service."\(^{107}\)

In 1958, a compromise system was worked out, one which like the Queen Street proposal would serve downtown, and at the same time reduce congestion on Bloor Street streetcars and on the Yonge Street subway. The new route placed a subway below Bloor-Danforth Streets from Keele Street on the west to Woodbine Avenue on the east. From St. George Station, just west of Yonge Street on the Bloor line, a line was to be constructed to run north-south below University Street parallel to the Yonge Street subway.\(^{108}\) (See Maps II-10 and II-11)

This 'T'-shaped route was constructed in two stages: the University line was first, construction began November 16, 1959, it opened February 28, 1963. Since opening, 30,000 additional daily riders travel to the core by subway.\(^{109}\) The second, the Bloor-Danforth line, began on February 5, 1962, and opened February 26, 1966.\(^{110}\)

The Bloor-Danforth-University and Yonge subway lines form the basis of Toronto's rapid transit system. Together they total 14.98 miles:

- Bloor-Danforth 8 miles
- Yonge 4.6 miles
- University 2.38 miles.\(^{111}\)

Of this, 13.08 miles is in subway (either cut and cover or tunnel), 1.9 miles is in either open cut or bridge.
Map II-10
The Yonge, Bloor, Danforth and University Subways -- Toronto

Source: Toronto Transit Commission
Map II-11
Downtown Toronto Subway System

Key to Stations:

6 Bloor-Yonge
7 Wellesley
8 College
9 Dundas
10 Queen
11 King
12 Union
13 St. Andrews at King
14 Uss.onde at Queen
15 St. Patrick at Dundas
16 Queen's Park at College
17 Museum at Bloor
18 St. George
19 Bay
Map II-11
The Downtown Toronto Subway System
Source: Toronto Transit Commission
Bloor-Danforth  
7.5 miles  subway  
.5 miles  bridges  

Yonge  
3.2 miles  subway  
1.4 miles  open cut  

University  
2.38 miles  subway.\textsuperscript{112}

The Bloor-Danforth and Yonge extensions are not considered in these statistics.

Average station spacing is under $\frac{1}{2}$-mile indicating that this system, like the one discussed in the Chicago case study, is geared to serve the local central city's market carrying it to the core district (see Map II-9).

Exceptions to the spacing average occur when gaps in urban residential continuity occur. Example 1: St. Clair to Davisville stations on the Yonge line -- 3/4 miles. Much of the each side of Yonge is taken by the Mt. Pleasant Cemetery; the west side south of Davisville is broken by the Canadian National Railway.

Example 2: Lansdowne to Dundas West stations on the Bloor line -- 5/8 miles. South and north of Bloor residential continuity is interrupted by industrial land.

Of the 36 stations of the three subway lines, all except four (Christie, Chester, and Donlands on Bloor-Danforth, and Rosedale on Yonge) have bus feeder service. (See Map II-10) Bus concourses and loading ramps are provided at several stations. The 3rd design objective, as already noted, is to provide good transfer between surface and subsurface transit. In the 1956 report of the TTC, the importance of transit to Toronto is assessed in the following quote:

A comparison of the use of transit in Toronto and
other comparable cities on this continent indicates that the per capita riding habit in Toronto is the highest, and that in general, Canadian cities have suffered less reduction in passengers than comparable cities in the United States.\textsuperscript{113}

The role of park and ride is not yet a major feature of the Toronto system. A survey at Eglinton station indicated only 13\% of the riders previously took their automobiles to the core.\textsuperscript{114} The figure compares with 55\% in the Cleveland case.

Other urban features adjacent the subway routes:

-- density of buildings: the schematic diagram -- Map II-12, shows that site coverage in the immediate vicinity of the subway stations is, for the most part high -- over 50\% coverage. 22 of the 36 stations have at least half of the surrounding area in 50-75\% site coverage. Only 3 stations have 10-15\% site coverage over half or more of the adjacent site.

It should be noted that the site coverage in non-core areas drops significantly \( \frac{1}{2} \) to 1 block from the main thoroughfare. Back from the high coverage strips along Danforth Avenue, site coverage drops to 10-15\%. A similar situation occurs north of Bloor on Yonge Street where coverage drops to 10-25\%. With the western Bloor stations, site coverage drops to 26-50\% beyond the strip developments of the main streets.

-- land use: similar to site coverage, commercial strips run the lengths of Bloor, Danforth, and Yonge Streets. South of Bloor and Yonge, both the Yonge and University subway lines run through the city's core. Land use here is commercial/institutional both adjacent to and back from the lines. In the suburban stretches (non-core), land use changes to residential back from the main street. There is only one significant industrially zoned area on the non-core segments, at the Dundas West station.
-- street widths: adjacent intersections are most frequently 66' in width (see Map II-14). Bloor Street and Danforth Avenues have 86' widths, Yonge is 66' wide south of Glen Elm Avenue (just north of St. Clair Avenue). North of Glen Elm, Yonge widens to 86'. The prestige University Avenue is boulevarded and 100' wide, but with the exception of College Street (86') at Queen's Park Station, all other core area streets crossing the subway lines are 66' wide.

In the non-core stretches of the rapid transit system, street widths exceed 66' only at Woodbine Avenue, Keele Street, and Eglinton Avenue (86'); St. Clair Avenue is 100' feet at its intersection with Yonge.

The Toronto experience is cited throughout rapid transit literature as an example illustrating the effects which modern rapid transit planning can have on the city.

In its 1955 report, the Toronto Transit Commission acknowledged that the Yonge Street subway had become an important factor stimulating the construction of commercial buildings along and near its route, in particular in the vicinity of main stations.\textsuperscript{115}

In the next year's report the Commission announced that it had decided to relocate its planned new head office from St. Clair station to Davisville station. The St. Clair site and air rights over the station had been sold for commercial development.\textsuperscript{116}

The 1957 report claimed that land values on intersecting streets adjacent the subway had risen from three to twelve times since the beginning of subway construction eight years earlier. The Commission reported that "there is no question that the construction of a rapid transit line contributes
MAP II-12
Land Coverage Along
Toronto Subway Lines

76-100%  51-75%  26-50%  10-25%

Source: Density of Buildings - Toronto (1957)
E.M.O. Map Series 407-M-3
Ottawa
Map II-14
Road Right-of-Way Widths
Toronto

Source: Metropolitan Plan for the Metropolitan Toronto Planning Area, Metropolitan Toronto Planning Board, 1966
greatly to the benefit of all sections of the community and not only to those who travel on it."\(^{117}\)

In an address to the Joint Meeting of the Cleveland Real Estate Board and the Cleveland Chamber of Commerce in 1966, G. W. Heenan, past president of the Toronto Real Estate Board said that the $67,000,000.00 investment (the capital cost of the Yonge Street subway) had "... ignited a $10,000,000,000.00 development explosion along the route from Front and York Streets to its northern terminal, Eglinton Avenue."\(^{118}\)

In 1959, the TTC conducted a study to examine and compare changes in property value of land within the 'subway sphere of influence' against value changes of land beyond the sphere of influence.

Toronto is subdivided into 40 wards for taxation purposes; 14 of these wards are adjacent the Yonge Street line. Assessment in the City of Toronto increased from $1,346,000,000.00 in 1950 to $1,788,000,000.00 in 1959, an increase of $442,000,000.00. Property adjacent the Yonge Street subway increased from $530,000,000.00 to $770,000,000.00, an increase of $240,000,000.00 or more than half the total assessed increase in the City. In 1962, assessments in areas adjacent to the subway had increased by 58% over the preceding decade; a 25% growth rate would have been considered normal.\(^{119}\) In the core, the increase had been 45%; north of College Street, the increase in the tax wards rose to 107%.\(^{120}\)

The City's assessment department calculates that the additional growth contributes $5,000,000.00 annually to tax rolls, enough to pay the subway's annual amortization costs.\(^{121,122}\)

Between 1959 and 1963, development within walking distance of the Yonge line accounted for approximately 2/3 of all development in the City.
This covers 90% of all office construction and 48.5% of all high-rise apartment construction.\textsuperscript{123}

The effects on construction are not limited to the Yonge line. Property adjacent the Bloor-Danforth line was valued at $250,000,000.00 before the subway route was announced. By opening date in 1966 the value had doubled.\textsuperscript{124} Heenan predicts that the Bloor-Danforth line will generate $2,000,000,000.00 in office and apartment construction by 1976.\textsuperscript{125}

Anticipating this the Commission purchased right-of-way properties larger than necessary so that private developers might be more easily attracted to build along the line.

Illustrations of the form of development which can occur adjacent to or in conjunction with rapid transit include:

-- Eglinton station - a 17-storey office tower and a shopping concourse built over the subway station. A 2-level parking garage in the system's adjacent yards area has been built for 450 cars.\textsuperscript{126}

-- Davisville station - four 16-storey and several other high-rise apartment buildings have been built near the station.\textsuperscript{127}

-- Old Mill station on the Bloor extension has a 23-storey apartment tower built on excess land purchased from the TTC.\textsuperscript{128}

-- In the core area several projects have been planned including the $250,000,000.00 Eatons Center (cancelled). Projects carried through include the Toronto-Dominion Center ($125,000,000.00) and the $14,000,000.00 Robert Simpson Building.\textsuperscript{129}

In 1967 a $70,000,000.00 transportation terminal was proposed for Front Street to replace Union Station. It was to feature connections to long distance and commuter trains, an airport limousine service, a
helicopter service, freeway access and, of course, rapid transit connections to the Yonge and University lines. Three office towers, a hotel and a covered stadium were also included in the project. In 1969 this project was incorporated into Metro Center, a billion dollar, 190 acre project over the CNR and CPR waterfront yards. Added to the features mentioned are a broadcasting-communications tower, railway offices, and a convention-trade center. Metro Center will form the southern portion of a projected north-south pedestrian mall running between Nathan Philips Square and the waterfront.

On February 2, 1969, a second development costing $250,000,000.00 was announced for the waterfront to be coordinated with Metro Center. It will include office buildings and 10,000 apartment units.

The last two of these developments will anchor the downtown core of Toronto to the waterfront bolstering the existing core development south of College Street. A major criticism of Toronto's rapid transit system was stated by transit planner Leslie Tass who said the intersection of the Bloor-Danforth line with the Yonge line had had the effect of shifting the focus of core development northward to the intersection of Bloor and Yonge.

He pointed out that east-west rapid transit riders are forced to transfer in order to get to the core resulting in development at the transfer point instead of in the core.

He states that ridership is lost due to the non-diagonal core oriented route. His estimate (1961) is that 16,000 trips per day are lost to private automobiles because of this fact. He further explains that development along the non-diagonal will be slower than if the route had been directed at the core. Heenan stated that the Bloor line would create $2 billion
worth of development; the Yonge line which runs directly to the core, stimulated $10 billion in development. Thus Heenan supports Tass' theory.

A number of neighborhoods in Toronto have held meetings of local residents and ratepayers to devise district plans. General analysis is first carried out by the City of Toronto Planning Board which publishes a draft plan that can be discussed by local groups.

One such neighborhood district is Yorkville (see Map II-15). All three subway lines converge in this district which combines the 'excitement of downtown and quiet residential streets.' The planning goal for the area is to institute change by replacing the old but not destroying the best of the old.

The General Plan on page 13 of the Plan for Yorkville, clearly indicates that high density development -- both commercial and residential, is to be kept in areas close to the subway lines. Commercial services and offices having a metro-wide market are kept on main streets. Local commercial services are permitted on main streets but further from the subway stations. Apartment development is located behind the commercial strips close to subways.

On page 22 of the Plan, areas designated for redevelopment are shown. In most cases they are either immediately adjacent to subway stations or close by. The plan, published in 1968, then, encourages the continuance of the trend toward development in connection with rapid transit which became established naturally with the opening of the rapid transit route in 1954.

With the Bloor-Danforth subway line nearing completion, the TTC commenced construction on two extensions to that route: on the west, 3.49 miles into the Borough of Etobicoke, and on the east, 2.77 miles into the Borough of Scarborough. This added 6.26 miles to the 14.98 existing miles
Map II-15
The Yorkville Neighborhood
Toronto
Source: City of Toronto Planning Board, Plan for Yorkville, 1968, p.1
for a total of 2124 (see Map II-16). The design objectives remained the same as those which governed preceding subway construction.\textsuperscript{135}

Construction began simultaneously on both, March 1, 1965 and both opened to the public on May 11, 1968.\textsuperscript{136}

Station spacing policy remained similar to that practiced on other parts of the line. Longer distances between outlying stations are due to reduced urban densities and breaks in residential continuity caused by parks, cemeteries and river valleys. The objective of these extensions was to attract automobile commuters to rapid transit. To do this, the system has installed large-scale park-and-ride facilities at outlying stations.

On the west extension of the Bloor line, the Islington station has over 1,000 parking stalls. On the east extension of the Danforth line, two stations have park-and-ride facilities. Victoria Park station has 260 stalls, Warden station at the eastern terminus has 1,000 stalls.

Kiss-and-ride entrances are provided at Warden and Islington stations.

Continuing the general design objective of the rapid transit system -- good transfer between surface and subsurface transit, bus-feeder connections have been provided at each of the nine new stations. At the Main Street station a covered streetcar loop has been included.\textsuperscript{137}

Continuing to expand the city's rapid transit system the next planned route is a 4-mile extension of the Yonge Street line to Sheppard Avenue in the Borough of North York. Scheduled opening is 1972, the new extension will raise Toronto's rapid transit system to 25-miles.\textsuperscript{138} (See Map II-17) As throughout the rest of the system the Yonge extension will have bus-feeder services. Other details of the route are not available at this time.
SUBWAY STATION INDEX

AND ADJACENT STREET NUMBERS

1. EGLINTON 2000
2. DAVISVILLE 1900
3. ST. CLAIR 1461
4. SUMMERHILL 1189
5. ROSEDALE 1009
6. BLOOR-YONGE 720-1
7. WELLESLEY 951
8. COLLEGE 448
9. DUNDAS 909
10. QUEEN 571
11. KING 10
12. UNION 21-44
13. ST. ANDREW 140
14. OSSOHOE 129
15. PATRICK 441
16. QUEEN'S PARK 1
17. MUSEUM 99
18. ST. GEORGE 923
19. SPADINA 403
20. BATHURST 100
21. CHRISTIE 270
22. OSSOHOE 463
23. DUFFERIN 1195
24. LANSDOWNE 1099
25. DUNDAS WEST 1203
26. KEELE 1739
27. HIGH PARK 1074
28. RUNNYMEDE 2218
29. JANE 2440
30. OLD MILL 2676
31. ROYAL YORK 3012
32. ISLINGTON 2206
33. BAY 64
34. SHERBOURNE 420
35. CASTLE FRANK 687
36. BROADVIEW 40
37. CHESTER 270
38. PEAR 440
39. DONLANDS 900
40. GREENWOOD 1377
41. COXWELL 1368
42. WOODBINE 2074
43. MAIN 1300
44. VICTORIA PARK 3042
45. WARDEN 3219
(Aat St. Clair)
A model of the proposed Lawrence Station on the extension of the Yonge route. Note that the buses will loop underground on a level above the track platform.

The map to the right shows the detail of the route of the Yonge Subway extension to Sheppard Avenue as well as the locations of the new stations. Tunneling for the construction of the right-of-way will begin in September 1968 and it is expected that the extension will be opened in 1972.

The proposed Sheppard Station includes 2 speed ramps or travelling sidewalks, 240 feet long to carry passengers between the mezzanine level and the bus concourse west of Yonge Street.
In 1968, a planning report on rapid transit recommended to Metro Council that a decision should be made by 1972 stating which of two new subway routes should be built -- Queen Street or Spadina Avenue. In the interim, it recommended that provisions be made to accommodate rapid transit on the median strip of the Spadina Expressway.\(^{139}\)

On December 2, 1968, a new Official Plan of the City of Toronto was presented to City Council by the City of Toronto Planning Board.\(^{140}\) On December 4, 1968, it received unanimous approval. It is the first new plan since 1949 and it emphasizes the role of rapid transit in the central city and in the metropolitan region.

(The plan is not yet official, needing approval of the Minister of Municipal Affairs of Ontario.)

The relevant sections of the new City Plan to this thesis are as follows:

**The City's Relation to the Region**

1.1 The heart of the City is the functional center of the Toronto region. . . . It is the policy of Council that, in the mutual interest of the City and the region, this situation shall continue as the region grows in extent and population.

1.2 It is therefore the policy of Council to exercise its influence to encourage the location in the Central Area of the City . . . the development of the transportation system to provide convenient, rapid access to the Central Area from all parts of the region by high-speed long-distance mass transit, and the planning of the region to channel development to selected points on the mass transit system.

**The Structure and Quality of the City**

1.3 (a) It is the objective of Council that various parts of the City are provided with an efficient and convenient public transportation service, and adequate municipal services.
1.4 (a) The policy of Council is to provide for the location of concentrations of medium and high density commercial development and of high density residential development in the Central Area and in areas which have or will have ready access to the Central Area by rapid transit and main roads. Council's policy in this regard will be shown by the designation of areas for such high and medium density concentrations on the Generalized City Plan Map at such locations.

(e) Development of the rapid transit system will be encouraged to serve the concentrations referred to in Section 1.4 (a). The development of subsidiary transit service will be encouraged for other areas.

(f) The linkage of the rapid transit system with the regional system of expressways and long distance mass transit by means of facilities, including parking areas or structures, designed to permit easy transfer from one system to another, will be encouraged.

High Density Residence Areas

2.9 (a) Any future designation of land as a high density residence area on the Generalized City Plan Map will be in conformity with the policies of Section 1.4 (a), and in making any such designation Council will have regard for the following:-

   ii. proximity to rapid transit stations and main roads

Transportation

7.1 Council will encourage integration of transportation and development in the region to provide for development to be focused at locations served by high-speed mass transit service to the Central Area, and so as to avoid reliance on transportation by the private automobile.

7.2 Council will encourage the regional mass transit and expressway systems to be developed to focus on the Central Area.

Rapid Transit

7.3 (a) Council will support construction in the following order of new rapid transit lines:-

   i. in the vicinity of Queen Street from a point at or west of Roncesvalles Avenue to a point at or east of Greenwood Avenue and the Greenwood sub-
way yards with the construction of the central section of this route to proceed at the earliest possible time.

ii. in the vicinity of Bathurst Street or on Spadina from Queen Street or Bloor Street respectively northerly to a point beyond the City's northerly boundary.

iii. extension of the system to serve the Canadian National Exhibition and Toronto Islands.

**Expressways**

7.5 It is the policy of Council that expressways be constructed within the City only to the extent and in locations required to provide adequate service for commercial and industrial traffic and for those people for whom the use of the automobile is essential.

7.8 It is the policy of Council that there be no construction of a Crosstown Expressway.

**Terminal Facilities**

7.17 Council will support and encourage the provision of the following terminal facilities:-

i. for bus, rail, road and air passengers in a new transportation center in the vicinity of Union Station.

On May 23, 1967, the Government of Ontario initiated a commuter transit system called 'GO-Transit' to connect the cities of Hamilton and Pickering to Toronto (see Map II-19).

The design objective was to provide an alternative method of travel to Toronto for commuters who live beyond the boundaries of Metropolitan Toronto. 'GO-Transit' is interurban rather than urban, and it is only an alternative to expressway transportation rather than rapid transit.

Thus 'GO-Transit' is not to be a consideration of the Toronto rapid transit case study in this thesis.
Map II-19
The Toronto Commuter Shed in Its Region
Footnotes:


2. Loc. cit.


9. Chicago Transity Authority, Public Information Department, Chicago Transit Map, 1959.


30. Homer Hoyt, One Hundred Years of Land Values In Chicago, 1933, p. 196-198.
31. Ibid., p. 148.
32. Ibid., p. 183-184.
33. Ibid., p. 171.
60. *Loc. cit.*
63. *Loc. cit.*
77. Loc. cit.
84. Loc. cit.
98. *Loc. cit.*
111. *Loc. cit.*


Chapter 3

An Application of Rapid Transit to Vancouver
The purpose of Chapter 3 is to demonstrate the effect rapid transit will have upon Vancouver based on the theories presented in Chapter 1 and comparison with the case studies of Chapter 2.

The question of decentralization:

In Chapter 1, it was pointed out that the effects of technology — in particular the technology of transportation — have influenced the structure of North American cities over the past century. One result of increased mobility has been that man has sought freedom from overcrowding and pollution in the central city by moving to the suburbs. Nevertheless, innovations in housing such as the Unite in Marseilles and Habitat in Montreal have tried to create living conditions that are adaptable to all of man's needs and wishes, and still retain high density living.

In Chapter 3, rapid transit is seen as a technological change in urban transportation yet to come to Vancouver. It should be understood that the integration of rapid transit with residential land uses is open to the widest possible range of innovation and experimentation. The author will suggest three possible locations for integrated developments in a rapid transit plan for Vancouver.

The transportation theory of urban growth:

Richard Meier's theory has been expanded in Chapter 1 to include transportation. The basic point remains that those land uses which employ transportation services most will locate closest to the core. Land uses requiring decreasing transportation service will locate concentrically outward from the core.

For the purposes of Chapter 3, the word 'core' includes that area in the city where maximum accessibility to transportation facilities exists.
Thus, in Vancouver, the 'transportation-core' need not be restricted to the Burrard Peninsula but is free to be located at any point of interface along the urban transportation system — in this thesis, a rapid transit system.

Apart from Meier, the other sources quoted in Chapter 1 all refer to the manner in which transportation causes or can cause change to occur. J. D. Carroll saw it as a three dimensional manner to which the author or this thesis added the fourth dimension — time. The alternatives were transportation as a catalyst for urban development in new settlements (Fagin), or concurrent planning of new transportation and land uses (Bauer). No matter which alternative is selected, transportation was seen to be a facility which must be viable over a long time period. Whether for existing urban structure or for new settlements, land use and transportation should be co-ordinated to enhance each other in the present and in the future.

Applying the theories discussed above, Chapter 3 considers concurrent planning of a transit system and land uses in the city of Vancouver. Some of the changes which introduction of rapid transit has produced in Chicago, Cleveland and Toronto will be related to representative station sites in Vancouver.

In 1968 a study by N. D. Lea and Associates entitled *Transportation Systems for the City of Vancouver, An Appraisal* proposed a rapid transit corridor for Pender Street running roughly from Denman Street in the West End to the Pacific National Exhibition grounds (see Map III-1).

Two of their recommended rapid transit stations were located approximately at Nanaimo and Hastings and at Main and Pender/Hastings. (The Study is not explicit on any location details.)

Each of these stations has been selected for examination as they
LEGEND MAP III-1

- FREEWAY CORRIDORS
- POSSIBLE FUTURE FREEWAY CORRIDORS
- TRANSIT CORRIDORS
- POSSIBLE FUTURE TRANSIT CORRIDORS

Source: N.D. Lea and Associates, Transportation Systems for the City of Vancouver, Map 8010-108
represent different urban qualities and characteristics; and a third station having no connection with the N. D. Lea Study has been postulated for Granville and Georgia to illustrate the effects of rapid transit in the city core.

**NANAIMO-HASTINGS**

1. Present description:
   - commercial strip development extends east-west on both sides of Hastings Street;
   - ½-block north and south of Hastings at the lanes between Franklin and Hastings and between Pender and Hastings land use changes to single family dwellings. No commercial development exists on Nanaimo Street.

2. Reasons for selection:

   This site is chosen to illustrate the impact of rapid transit on a neighborhood of older homes adjacent to a high-quality commercial shopping strip. Theoretically, Nanaimo-Hastings can represent any number of locations in any urban area where single family residential development surrounds the commercial shopping area strung along a main traffic artery.

3. Similar sites in the case studies:

   Several stations in Toronto's Yonge Street line north of Bloor exhibit characteristics similar to those at Nanaimo and Hastings. Prior to the opening of the subway commercial uses extended as a strip along Yonge Street and along several of the main cross streets. Behind the commercial zone, land use was residential, consisting largely of older single-family dwellings. With the opening of the subway land values at intersections and on adjacent properties rose sharply. The T.T.C. Report of 1957 shows that intersection values rose from three to twelve times; and in the ten years
preceding 1962, property north of College Street was reassessed upward by 107%. (See p. 63 and 66, Ch. 2)

At Eglinton Station a 17-storey office tower and a shopping concourse were built in the air rights over the subway station with the result that the surrounding commercial district was strengthened as a business node. Rising values on residential property resulted in the replacement of single-family homes with high-rise apartments.\(^1\),\(^2\) Similarly, at Davisville Station several high-rise apartments were built on land adjacent to the rapid transit yards and shops.\(^3\) With increased demand for property close to the subway the T.T.C. found it profitable to sell its land at St. Clair station to private commercial interests and relocate its planned new headquarters to the Davisville site (see p. 63, ch. 2).

The number and nature of land use changes adjacent to the subway led the T.T.C. to state that the benefits which can result from rapid transit are not restricted to its riders but are spread over all sections of the community.

This type of land use change was not just limited to areas permitting a commercial and residential mix. At Castle Frank Station on the Bloor line several high-rise apartments have been constructed close to the subway\(^4\) and at Old Mill station a 23-storey apartment building has been constructed in the air rights.\(^5\)

In the 1968 neighborhood plan for Yorkville a major feature has been to plan high-density development of both commercial and residential natures close to the subway lines. The new *Official Plan of the City of Toronto* (1968) also recognizes the relationship between high-density development and rapid transit by basing its planning upon the notion that all medium and high-
density residential development should have ready access to the Central Area through rapid transit.

Development similar to that described above is restricted to Toronto. In Cleveland, apartments have been constructed at suburban stations east and west of the core area. At 98th and Detroit Streets station, apartments were built on land which had previously been unused. At Windermere Station high-rise offices and apartments were built in the air rights.6

Historically the Chicago case showed that residents who moved away from the city's core to escape the construction of factories and warehouses and to avoid the influx of immigrants located in new high-density areas which had good access to rapid transit. Although people moved from the core they retained their desire to have good access to the core. (See p. 33, ch. 2)

The changes can be summarized as follows. Both commercial and residentially zoned properties experience an increase in value. Single family residential lots immediately adjacent to the transportation facility experience pressure to change to multiple-family use. The extent of the pressure to change is highest for land where there is an adjacent commercial zone, as at Eglinton, but change will also occur where no commercial zone is present, as at Old Mill Station.

Intensification of land use occurs in commercial areas with the addition of multi-storeyed office/retail structures. Areal expansion does not occur because the area remains governed by walking distances from the transportation facility. The changes in land uses noted in the case studies all occurred 'adjacent' to the stations -- seldom more than two blocks or a 5-10 minute walking distance.

Applying Meier's theory, land uses do appear to group in a concentric
manner according to their inherent demand for service from the rapid transit facility. Commercial uses have the highest demand and are located on top of or immediately adjacent to the transportation facility. High-density housing locates next, and low-density housing, in turn, locates at the periphery of the area serviced by the transportation facility.

4. The theoretical site -- Hastings-Nanaimo: (See Map III-2)

A radius of 1,250 feet has been drawn from the center of the rapid transit station to act as a rough indicator of normal maximum walking distance. The radius is 1000 feet plus half the station length of 250. In Toronto, all rapid transit stations have been planned to be 500 feet in length.

The 1,000 foot radius drawn on Maps III-2 and III-3 is a result of caution.

As a general axiom, a transit system is considered to serve an area of up to one-half mile from its stops -- based on acceptable walking distance.7

Despite the half mile radius which Homburger suggests, the case studies indicate that development associated with rapid transit is most often immediately adjacent. Because this varies with the individual station it is difficult to define. Thus a more conservative estimate of impact area is used in this thesis. 1,000 feet was chosen as a round and conservative figure with which to work.

Within this radius the single-family dwelling area will experience pressure to change to a multiple-family dwelling zone. Beyond the radius, or along appropriate breaking lines, such as streets or lanes at or near the 1,000 foot radius, pressure will not be great enough to effect a change from single to multiple-family land uses.

Commercial development on Hastings presently includes several
speciality stores, restaurants, a junior department store and a theatre. Although commercial development already extends well beyond the 1,000 foot radius on Hastings Street, intensification resulting from the rapid transit installation will occur as close to the station as possible. Blocks 53 to 56 and 42-43 will experience the greatest benefit. In addition to proximity to the rapid transit, the most important existing development is located here.

Block 55: - section 'A' is seen as a bus-feeder terminal adjacent to the station. Commercial development is shown to be expanded over the remainder of the south half of Block 55 due to the adjacent bus-feeder facility and the subway station. Bus-feeder and park-and-ride potential at this location is high due to connection with the N. D. Lea proposed freeway interchange of Nanaimo Street and the Great Northern Cut freeway corridor. (See Map III-1) Blocks 76 and 75 are shown as multiple family areas but it is possible that high-density residential structures could be constructed over the park-and-ride facility.

MAIN-HASTINGS/PENDER (Chinatown-Strathcona)

1. Present description:

Being at the edge of the core area, most of the land surrounding the proposed station is presently in commercial use. Blocks 72, 73, 86, 87, and 88 have been razed for urban renewal; however construction has begun on only one and it is not definite that the planned renewal project will be carried through.

The Chinatown segment of the area's commercial development (south of Hastings Street) is well patronized as a local shopping district by the area's ethnic population and also acts as a major tourist attraction bringing people to shop, seek entertainment, and otherwise enjoy the unique
atmosphere. Several plans have been 'talked about' to further strengthen Chinatown but as yet none have seen action.

The commercial area on and north of Hastings Street between Carral and Main Streets is known as Skid Row. Its stores and hotels are shabby and rundown. Police records show the area to be the center for narcotics trafficking, hard-core alcoholism and felonies in Vancouver.

Prior to World War II, the area northeast of Hastings and Main was the center of a large Japanese population and exhibited characteristics similar to Chinatown. In recent years this has begun to reappear with the opening of Japanese restaurants and speciality stores.

2. Reasons for selection:

This site is chosen to illustrate the relationship of rapid transit to the edge of a core area and to urban renewal. In theory, Chinatown-Strathcona can represent the periphery of a core in any city where land uses have depreciated. Another important point is that Chinatown-Strathcona is unique to Vancouver because of its ethnic characteristics and history. Although it is difficult to find an exact parallel example in another city, the theoretical significance is that the periphery of many core areas contain neighborhoods of unique ethnic characteristics and historical importance.

3. Similar sites in the case studies:

Prior to the opening of the Yonge Street subway, as at Chinatown-Strathcona, the residential development north of the Bloor and Yonge intersection was running down so that various forms of urban redevelopment were under consideration. While in Chinatown-Strathcona the ethnic history is dominated by one group, in Toronto several immigrant groups have lived in the area before blending into the general society. Nevertheless, the fact
of ethnic influences have resulted in the evolution of a unique atmosphere in the district.

With the opening of the Yonge Street line, the value of property increased due to improved accessibility. Private redevelopment followed so that the area once slated for urban renewal became one of boutiques, stores, coffeehouses, and clubs. The advent of rapid transit has meant that this once economically marginal area experienced a 'shot in the arm'. Although the differences between Chinatown-Strathcona and Yorkville are vast, both represent distinct amenity districts to their respective cities.

The effect of the subway on commercial development has been extensive. New department stores were built and specialty stores were opened so that today the intersection rivals Yonge Street south of College as a core shopping street.

The effect of rapid transit in this situation has turned an area of marginal businesses and depreciating residential streets into one of thriving businesses and rising property values. Private capital has redeveloped the area because of the improved market potential; no public urban renewal has been necessary. As stated in Chapter 2, p. 67, the period from 1959 to 1963 saw 90% of all office buildings and 48.5% of all high-rise apartments built within walking distance of the subway.

The Toronto example just cited illustrates rapid transit as a rehabilitative measure for one district of a city. Similarly, in the Chicago case study it was found that rapid transit was able to stimulate commercial growth in the core during a period of general economic depression. Growth on State Street actually reached record high levels; and other downtown streets 'firmly maintained' their values. (See p. 31, Ch. 2)
In the Cleveland case study, engineers planning a core distributor system argued that public investment in rapid transit would stimulate private capital for rehabilitation and redevelopment. They based their arguments on the findings of New York City's Triborough Bridge and Tunnel Authority. (See p. 48, Ch. 2)

It can be expected, then, that depreciating peripheral areas will be revitalized when rapid transit is introduced. Increased accessibility will attract private enterprise, and if a neighborhood plan is drawn and made attractive to private investors, public money may not be necessary for redevelopment.

Thus rapid transit becomes the catalyst for change. In the case of Toronto, new land use plans followed the rapid transit installation rather than running concurrent with it. Once the effects of the transportation facility became known, the City of Toronto Planning Board encouraged neighborhoods such as Yorkville to develop local plans so that future land uses would be co-ordinated with the transportation service. The lag in obtaining concurrent planning of transportation and land use has not been detrimental in this case. Since Toronto's rapid transit was the first new system in several years, the effect of rapid transit could not have been a certainty in the planning stage. The ramifications of the system, however, now provide a basis upon which planners can work when planning future transportation systems and land use patterns.

4. The theoretical site - Chinatown-Strathcona: (See Map III-3)

Land which is presently commercial will experience intensified use due to improved accessibility. As a result of this the nature of commercial activity will change.
Official Vancouver Block Numbers

- Commercial
- Multiple Family Dwellings
- Parks
- Shopping Street

Map III-3
Chinatown-Strathcona
Rapid Transit Station Site

- Rapid Transit Station
- Bus Feeder Site
On Pender Street the provision of alternative transportation will make it possible to close the street between Carroll and Dunlevy (except for cross-traffic at Main and Gore), creating a shopping street similar to those found in European and Asiatic cities. (In Toronto the addition of rapid transit has stirred residents of Yorkville to press for the closure of amenity streets behind the main Bloor and Yonge arteries, so that pedestrian traffic would be made more attractive.)

The loss of automobile traffic for at least daytime and evening hours would be compensated by the activity of people, more than can reach the area at present. Vehicular access can remain open in the lanes.

Improved accessibility will cause property values on Hastings Street to rise. Present marginal businesses in the area will find their location has improved. Other businesses on the street will yield to the pressure of increased traffic and will be replaced by establishments having a wider appeal.

Increased accessibility will not only improve the commercial position of the area, but will also attract private capital to develop residentially zoned land. Public urban renewal now slated for several blocks will find private capital sources willing to participate in the redevelopment of the area. It is also likely that some degree of the paint-up, clean-up phenomenon which occurred among private homeowners in Yorkville will be repeated in Chinatown-Strathcona.

To enhance the central position of the subway station, lines have been drawn to it from blocks 86-89, 72, and to the Main and Hastings intersection. This approach is used in London, e.g. Picadilly Circus, to expand the catchment of a single subway station.
GEORGIA-GRANVILLE

1. Present description:

Being the heart of the city's core, the entire area is developed commercially. Major development has existed at this location for over 40 years.

2. Reasons for selection:

This site is chosen to indicate how rapid transit can be integrated into a major commercial area.

On April 25, 1966 an office-hotel-department store complex was announced for blocks 42-52, later named Pacific Center. Included in the plan is an underground shopping complex which will tie the buildings of Pacific Center together and link them with adjacent commercial structures external to the project itself. Such an underground complex can easily lend itself to integration with a subsurface rapid transit facility.

The theoretical transit station at Granville and Georgia differs from those at Hastings-Nanaimo and Chinatown-Strathcona in that it shows the intersection of two lines. Being the heart of the core it is reasonable to presume that if and when a rapid transit system is built, two lines will cross at this point.

3. Similar sites in the case studies:

The most significant parallel which can be drawn is Chicago's Loop. The effect of planning and installing a rapid transit system touched off a period of speculation and development in the core (see p. 31, Ch. 2). Rapid transit attracted major companies to the city, first, because it was possible to build large structures in an area of good accessibility; and second, because good accessibility made it possible to group large buildings
in proximity to each other. Each company gained prestige from its location in such groupings. The effect of rapid transit was so great that Chicago's core took the name 'the Loop', derived from the configuration of the rapid transit system.

Although this development occurred 80 years ago, the effect of rapid transit in Chicago is still strong. Recent announcements of new core circulation systems have stirred interest in new office and commercial complexes (see p. 39, Ch. 2).

In Toronto, the effect is similar. New office, hotel and apartment complexes worth over a billion dollars have been announced (see p. 68, Ch. 2) which will revitalize and firmly anchor the core to its traditional location and check the present drift northward toward Bloor Street. The design of these complexes place commercial and residential uses in a high density mix which will add thousands of people to the total of those who now live and work in the core, and project descriptions state that the increased traffic is to be handled by rapid transit.

Meier's theory of urban structure is strongly supported by the events which followed the installation of rapid transit in Chicago and Toronto. The systems caused renewed interest in the core which was followed by construction of major office buildings, high-density apartment towers and commercial expansion. The inherent nature of the commercial-office function is that it requires good communication and transportation services. The high-density apartment projects, because of numbers, also require such services. Thus the statement that these functions will locate as close as possible to the facilities is proven true.

If it is asked whether these new projects would have occurred without
rapid transit one can point to the example of Cleveland. That city's rapid transit is oriented to the suburbs; contact with the core is minimal, restricted to one station -- Union Terminal -- at the western edge of the core. In Cleveland's core there has been no period of speculative development preceding the rapid transit system. Similarly the opening of the service did not stir investors to build (see p. 40, Ch. 2). In Cleveland, new projects have chosen to locate outside the core. New office buildings have been built east of the Inner Belt Freeway beyond congestion, where accessibility is better. In suburban locations office and apartment structures have been built adjacent to rapid transit stations where interaction between the people who use the buildings and the rapid transit system is good. Thus it is possible to conclude that the projects planned and built in these cities would not have been planned or built without rapid transit.

4. The theoretical site - Granville and Georgia: (see Map III-4)

Established business adjacent this station such as Hudson's Bay Department store, Theater Row, the Court House, and the hotels will see increased patronage through direct subsurface linkage with new projects such as Pacific Center and British Columbia Center (see Map III-4).

As in Toronto, the planned core area projects will add great numbers of people to those who presently use the downtown. Underground shopping complexes will permit pedestrian traffic to flow throughout the area with a minimum of conflict and congestion but the key to the area's success is its accessibility. Present street capabilities will not be able to handle the increased traffic and there is no way in which the existing mass transit service can attract significantly greater patronage and avoid further
Map III-4
Granville-Georgia
Rapid Transit Station Site
Map III-4 -- Number Key:

1. Cave Theater Restaurant
2. Georgia Hotel
3. Pacific Center
4. Hudson's Bay Department Store
5. Vancouver Hotel
6. Main Branch Public Library
7. Court House Square
8. Strand Theater
9. British Columbia Center
10. Theater Row
conflict with automobiles on downtown streets. As shown in the plans for projects in other cities the solution is rapid transit. Installation of a mass rapid transporation system having a private right-of-way access to the core is the only way in which the numbers of people expected can be transported to and from the area.
Footnotes:


CONCLUSIONS

The variety of approaches to rapid transit planning -- planning for the central city, planning for the commuter or planning for any combination of the two have the common characteristic of stirring change through the urban areas they touch.

It was demonstrated in the Chicago case study that the simple act of planning for rapid transit at an unspecified future date was sufficient to trigger wide speculation and development in the core -- 'The Loop'. This happened 80 years ago yet recent planning of new rapid transit in Chicago is having the same effect as it did in the last century.

In Cleveland where the system was designed for greater interaction in the suburbs than in the core the result has been heavy capital investment in the suburbs and not in the core.

Chicago and Cleveland designed different systems to serve different markets; to solve different problems. Today, each city is planning the system of the other so that the final rapid transit service will serve the urban area comprehensively. Chicago is planning rapid transit in expressway medians to capture the suburban markets; Cleveland is planning a core distribution to bring the advantages of rapid transit to that part of the city.

In Toronto the system's plan demonstrates that service to the total city rather than to any specific market group can be a successful approach. Toronto's inner lines cater to the inner city; the extensions which now reach into the suburbs cater to that market.

On the neighborhood scale rapid transit is no less important. The three projected Vancouver station stops each show that the mode can be used to strengthen and enhance advantageous characteristics of local areas.
In the Nanaimo-Hastings case, the commercial strip is seen to be given a solid local market base through increased residential densities in the neighboring blocks.

In Chinatown-Strathcona, rapid transit is not only a stimulator of commercial rehabilitation, but also a catalyst which encourages a mix of public and private capital for redevelopment of an important atmosphere-amenity piece of the urban area. It is also seen as a method by which the human scale can be reintroduced to parts of the city which have lost this quality through improperly mixing pedestrian and vehicular traffic where they should be separated.

In the Georgia-Granville example, rapid transit acts to create physical linkages between groups of buildings. It also acts to carry great numbers of people to the core area and in so doing supports and strengthens the economics of features such as Theater Row and Hotel Row, as well as strengthening the market position of specialty stores which could not survive in suburban locations.

Proper use of rapid transit can turn it into a tool for planning, one which can be manipulated to bring about the implementation of the city plan. Where there is access there is development. The nature of the access will reflect in the nature of development which follows.

The scope of this thesis was, of necessity, limited. Some areas for further study which arise out of this paper are suggested below:

1. A logical extension of this thesis would be the development of a rapid transit system for Vancouver based on the criteria used to evaluate the case study systems. Prior to the development of the Vancouver system several more case studies, especially older systems such as in New York City and
Boston, should be examined to provide a greater understanding of community consequences of rapid transit over a long time period.

2. A series of histograms showing details of land use changes, building development permits, and property values would be of great value as an aid to analysis of the effects rapid transit has on the community. At present this information is either not collected or is scattered through numerous files at respective city halls. Assembling the data would involve not only hours of paper work, but also cutting the red tape which restricts public access to the files because other unrelated information is stored on the same papers.

3. An environmental study of pedestrian traffic routes would be an aid to understanding the role walking distances play in the overall transportation network. The study should include traffic counts and an inventory of the transportation routes available at given locations -- from paths to covered malls.

4. Central place might be applied to a study of urban sub-centers so that the inter-relationships between each and with the central core can be analysed. Understanding the central place pattern of a city can be an aid to planning a transportation system which will enhance the natural urban structure.
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