TRANSPORTATION ALTERNATIVES FOR A
VIABLE DOWNTOWN DETROIT

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Acknowledgment

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Foreword

The subject and the title of this paper were not given at the outset but gradually approached through an extended selection process. The paper reflects the writer's intention to get a general insight into the transportation problems of U.S. cities while working on it. At the same time it should be of some use to the locally interested people and agencies.

Within this frame two sets of problems related to the transportation sector seemed to be worth dealing with. The first was the extremely bad everyday mobility of those who are not able to operate a car, the poor, the old people, the children, and the disabled. The second circled around the phenomenon of the declining central city and more specifically the central business district (CBD) or the downtown. It can be asked to what extent the transportation system contributes to this decline and what the role of different systems for a revitalization could be. While both problems offered enough generality and the first had even to be considered the more pertinent, the second was chosen for its greater relevance for European cities.

The whole paper is based on the premise that a revitalization of the downtown Detroit is generally accepted and supported. Of course this is not true, and many groups would object to such a goal partly because their interests are opposed and partly because they give priority to other goals. Furthermore, the problem of revitalization of the downtown is linked to the controversy on centralization versus decentralization of the urban activities which is itself very complex and was therefore consciously excluded. Thus a certain image of the city was adopted avoiding a fundamental analysis about what people think of their future city or more generally about the desired life style and the nature and pattern of human settlements. Such a restriction was necessary for reasons for time.
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Introduction
(includes description of the term "viable downtown")

"Downtown" and "Central Business District" (shortly "CBD") were usually used as synonyms in this paper. The second term, however, should be considered as a more specific one, implying a certain notion of the city structure which is typical for most American cities and - perhaps less accentuated - some European cities of today. It means a city center which is almost exclusively devoted to a single activity, namely the business sector. The efforts towards more viable city centers, however, no longer go in the direction of such an extreme spatial separation of urban activities. The term "Central Business District" seems therefore to be rather inadequate for the kind of city which forms the background for this paper.

The "downtown" or "CBD" was geographically defined as the area bounded by the Lodge, Fisher, and Chrysler Freeway, and the Detroit River. But the two terms were not always used in this fixed sense. They could also have an abstract meaning signifying the activity center of the city which was of course supposed to be at the same location but without fixed boundaries.

As the title expresses, the viability of downtown serves as a set of evaluation criteria for discussing different transportation systems. However, this framework was not strictly applied. First, the term "viability" would itself need a study in order to be defined and cleared up. Moreover, such a study should be made by a team including experts thoroughly familiar with the social and political situation of the city. Second, the evaluation procedure offers basically too many theoretical problems to be dealt with in this report. In two previous papers1,2 the author got to the pessimistic conclusion that cost-benefit analyses, at least at the present stage, are not capable of really giving complete and adequate information for decisions on urban transportation facilities. Therefore a certain notion of "viability" was arbitrarily adopted which serves more as a general background than a strict set of criteria for the purpose of this paper.

The CBD Study with its several sub-studies3 was taken as a useful basis for describing the "viability" of downtown. Some additions were made out of other sources and personal perceptions. The following citations out of another international fellow's paper may give a general impression of what "viability" in this context here means4:

1) Urs Ritschard, "Some Methods of Cost-Benefit Analysis" (in German), ORL-Institut, Zurich, October, 1970.
2) Urs Ritschard, "The Air Pollution by the Traffic" (in German), ORL-Institut, Zurich, August, 1971.
"By humanization I suggest an emphasis on increased livability, above all in the collective spheres of life. Livability reflects a state of mind. The environment, particularly the urban environment, is increasingly man-made and therefore definitely mirrors the collective state of mind of the people."

"The city (of Detroit) shows its wealth in individual homes. It is a characteristic of Detroit, however, that it shows little manifest wealth of a collective nature, in its cultural facilities and public institutions. The center of the city is singularly provincial in proportion to the metropolitan population."

"If it contains the highest level of functions in a regional hierarchy, one might expect a far greater diversity of activities and experiences in downtown Detroit, during day or nighttime, week-days or week-ends, particularly in view of the fact that, unlike Los Angeles, the freeway network seems to accentuate the centrality of Detroit's original lay-out."

No attempt is made here to describe the social and economic factors influencing the "viability". Instead of it a set of desirable features of downtown Detroit is presented in purely physical terms. The following postulates shall roughly give a definition of the "viability of downtown":

1. **More people in the streets!** The streets of downtown give a deserted impression at many times of the week. Relatively few pedestrians can be seen, especially during office hours, at night, and on weekends. The size of the buildings in downtown and the consciousness of being in a city of 1.5 million people and in a metropolitan area of 4.2 million people let us expect much more people in the downtown streets. This situation increases anxiety to many people using downtown and, to some degree, it may really impair the safety from crime of people walking around in downtown. A CBD sub-study\(^5\) states:

   "There is concentration of pedestrian volume along Woodward and the central core, and dramatic decrease of pedestrian volume outside this core. Any area past Washington Blvd. and Broadway is comparatively deserted and pedestrians will probably feel isolated and have a certain amount of anxiety about using this area."

The concern for a more viable downtown therefore demands that changes in the transportation system rather should enhance pedestrian movements than put barriers to them.

2. **Bigger size of downtown!** This is a very controversial postulate as was already pointed out in the foreword. According to the CBD Study it is assumed here that a bigger downtown having a bigger share of the region's activity makes sense. Each kind of the major activities is shortly discussed separately below:

---

Offices:

A comparison with other cities shows that Detroit ranks low in the CBD office space per capita of the metropolitan area's population:

Table 1: Central Business District Office Space Per Capita of the Metropolitan Area's Population in Selected Cities

<table>
<thead>
<tr>
<th>City</th>
<th>Square Feet CBD Office Space Per Capita</th>
</tr>
</thead>
<tbody>
<tr>
<td>New York</td>
<td>16.00</td>
</tr>
<tr>
<td>Boston</td>
<td>7.70</td>
</tr>
<tr>
<td>Denver</td>
<td>7.70</td>
</tr>
<tr>
<td>Chicago</td>
<td>7.50</td>
</tr>
<tr>
<td>Cincinnati</td>
<td>7.30</td>
</tr>
<tr>
<td>Seattle</td>
<td>5.40</td>
</tr>
<tr>
<td>St. Louis</td>
<td>5.30</td>
</tr>
<tr>
<td>Washington, D.C.</td>
<td>5.10</td>
</tr>
<tr>
<td>Minneapolis</td>
<td>5.00</td>
</tr>
<tr>
<td>Buffalo</td>
<td>3.50</td>
</tr>
<tr>
<td>Detroit</td>
<td>3.03</td>
</tr>
</tbody>
</table>

The fact that Detroit as having the third biggest of the listed metropolitan areas in terms of population ranks eleventh clearly shows the insignificance of the present downtown. However the amount of office space isn't the only index of the viability of a city district. It can even be a minor one what is shown by the fact that an extreme accumulation of office space can have reverse effects on the viability. This is presently recognized in several European cities where efforts are made to limit the growth of office activities in favor of residential, recreation, entertainment, and retail activities. On the other hand people working in offices always help maintain some daytime activity in the surrounding area. They can give rise to restaurants being built. They may also stay for shopping after work or entertainment after work, thereby enhancing the nighttime activity. In addition, an important CBD attracts businessmen from other cities or countries who again contribute to the viability in many ways.

The Detroit CBD, in spite of its relatively small size, still represents the area with the highest amount of office space in the region, as the comparison with the second largest business center, the Northland area, shows:

Table 2: Comparison of office space between the Detroit CBD and the Northland area

<table>
<thead>
<tr>
<th></th>
<th>Detroit CBD</th>
<th>Northland area</th>
<th>Northland area</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>net sq. ft.</td>
<td>gross sq. ft.</td>
<td>estimated net sq. ft.</td>
</tr>
<tr>
<td>in existence 1968</td>
<td>12,040,865&lt;sup&gt;9&lt;/sup&gt;</td>
<td>5,642,308&lt;sup&gt;10&lt;/sup&gt;</td>
<td>3,660,000</td>
</tr>
<tr>
<td>built since 1960</td>
<td>over 1.2 million&lt;sup&gt;11&lt;/sup&gt;</td>
<td>4,846,361&lt;sup&gt;10&lt;/sup&gt;</td>
<td>3,145,000</td>
</tr>
</tbody>
</table>

Housing:

Existing housing in downtown Detroit is spare and usually of poor quality. It is mainly located in the fringe areas of the CBD. The highest concentration is north of Adams Street.

Table 3: Existing housing in the Detroit CBD<sup>12</sup>

<table>
<thead>
<tr>
<th>Structure Type</th>
<th>Rooms or Dwelling Units</th>
<th>Estimated Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single Family</td>
<td>21</td>
<td>67</td>
</tr>
<tr>
<td>Multi-Family</td>
<td>2,918</td>
<td>4,282</td>
</tr>
<tr>
<td>Institutional Quarters&lt;sup&gt;*&lt;/sup&gt;</td>
<td>10</td>
<td>1,628</td>
</tr>
<tr>
<td>Misc. Residential Structures</td>
<td>1,811</td>
<td>2,477</td>
</tr>
<tr>
<td>Total</td>
<td>4,760</td>
<td>8,454</td>
</tr>
</tbody>
</table>

* e.g. jails, nursing homes

These figures are nearly negligible. It is generally agreed upon that a viable downtown needs a much higher amount of housing in all quality categories. The 24-hour presence of the residents and the whole set of services provided for these people contribute to the activity level beyond the office hours. This in turn could increase safety and reduce anxiety which constitutes a prerequisite for having more people going to downtown for other than work purposes.

New housing in the CBD and the adjacent areas could be possible without disruption of the existing residential areas. It might be interesting here to know the number of new dwelling units planned in the proposed development by Henry Ford at the riverfront which is 1,000.

7) includes Southfield, Lathrup, and parts of Oak Park and Detroit.
8) from two given figures (12,041,000 and 18,581,433) in CBD Study, Selected Statistics 1968-69, a transformation factor of 1.54 was derived.
10) Ibid., p. 13.
11) Ibid., p. 10.
Other Activities:

These other activities are usually a constituent element of a viable city district. As the following figures show, they are not too well represented in downtown Detroit.

Table 4: Extent of several activities in the Detroit CBD

<table>
<thead>
<tr>
<th>Establishment category representing activity</th>
<th>Employment</th>
<th>Net occupied floor area in sq. ft.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wholesale and Retail Trade, whereof:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wholesale Trade</td>
<td>17,001</td>
<td>5,201,972</td>
</tr>
<tr>
<td>Food Stores</td>
<td>(1,834)</td>
<td>(989,834)</td>
</tr>
<tr>
<td>Eating and Drinking Places</td>
<td>(2,930)</td>
<td>(590,667)</td>
</tr>
<tr>
<td>Hotels, Rooming Houses, Camps, and other</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lodging Places: 92 establishments</td>
<td>2,177</td>
<td>2,333,201</td>
</tr>
<tr>
<td>cp. data from other source14:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Major hotels: 7 with 4,341 rooms</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hotels: 2 with 130 rooms</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other transient residential:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>29 with 2,331 rooms</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>6,802 rooms</td>
<td></td>
</tr>
<tr>
<td>Motion pictures: 36 establishments</td>
<td>495</td>
<td>216,486</td>
</tr>
<tr>
<td>Amusement and Recreation Services, except motion pictures: 34 establishments</td>
<td>325</td>
<td>116,310</td>
</tr>
<tr>
<td>Medical and other Health Services: 293 establishments</td>
<td>4,215</td>
<td>764,505</td>
</tr>
<tr>
<td>Educational Services: 32 est.</td>
<td>528</td>
<td>298,538</td>
</tr>
<tr>
<td>Museums, Art Galleries, Botanical and Zoological Gardens: 3 establishments</td>
<td>3</td>
<td>2,420</td>
</tr>
<tr>
<td>Total</td>
<td>24,744</td>
<td>8,933,432</td>
</tr>
</tbody>
</table>

3. Reduce amount of vacant land and deterioration structures! The built-up area in the CBD steadily decreased since about 1940.15 Downtown was gradually adapted to the requirements of the private car, with huge amounts of land used for freeways, arterials, and parking lots. This trend was intensified and facilitated by the exodus of many firms and residents to the suburbs. The following table gives an idea of the magnitude of this decline in built-up area.


Table 5: Land use in the Detroit CBD in 1963\textsuperscript{16}

<table>
<thead>
<tr>
<th>Land Use Category</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Built-up</td>
<td>26%</td>
</tr>
<tr>
<td>Open land</td>
<td>6%</td>
</tr>
<tr>
<td>Roads (streets, alleys, freeways)</td>
<td>51%</td>
</tr>
<tr>
<td>Parking</td>
<td>17%</td>
</tr>
<tr>
<td><strong>Total 800 acres (= 1.25 sq. mi.)</strong></td>
<td>100%</td>
</tr>
</tbody>
</table>

Only about a fourth of the land was built up. In the meantime, construction took place at several locations, but still the percentage of the built-up area is very low, especially in the fringe portions of the CBD.

The open land as it appears today and the parking lots can't be considered active elements of the city. They can at best offer service functions. Parking lots and empty buildings impair the visual and functional continuity which is an important feature of a viable city. It is mainly the pedestrian with his low speed only allowing step for step visual impressions who is heavily affected by these gaps in continuity. Generally the attractiveness of the Detroit CBD for pedestrians who are constituent for a viable city is very low compared to other cities. In addition, gaps offer better opportunities for crime and decisively increase anxiety when walking around at night.

4. **Create attractive environment!** Recognizing the importance of the pedestrian for the viability of downtown, it is logical and necessary to create an attractive environment for him. Of course a good environment is desirable for most other urban activities too, but for these it is generally much easier to meet any standards than for outdoor activities. Basically the task here is to minimize undesirable impacts which are mainly of two kinds in the Detroit area: impacts from traffic, construction work and industry, and impacts from inclement weather. Outdoor activities, however, need not only protection but also a stimulant which is visual and functional variety and which was already partly mentioned in postulate 3. Whenever possible, some range of choice for the routing and the environment should be given to the pedestrian. The existence of a weather protected pedestrianway system, as an example, should not prevent people from using a "beautiful weather" route or, at least, from having access to open spaces.

One means of creating variety is to preserve many of the existing public places which are triangular, semi-circular, or multi-faceted, but also many of the unusually shaped buildings. Very valuable are the few little parks as Times Square Park, Capitol Park, Library Square, Harmony Park, and Grand Circus Park. New and larger ones should be added in areas adjacent to the CBD. Special attention has to be given to a redevelopment of the riverfront west and east from the civic center. The excellent potential for recreational and public use of these locations at the transition between an urban high density and a water zone has to be recognized and strict criteria have to be applied for

\textsuperscript{16} Ibid., p. 87.
decisions on future development. The dense street network in downtown should be preserved too. It offers to the pedestrian many possibilities of surprise and gives him a motion awareness.

Of course the same permanent efforts against the increasing air and "noise" pollution are necessary as in most other big cities.

The purpose of this paper was to compare different transportation technologies about their suitability for serving the downtown Detroit. Private care and rail transportation still represent the two main alternatives, or more adequately, elements of an urban transportation system. Unfortunately, for reasons of time, no special attention could be given to future technologies as it was originally intended and which would have been the subject of a third chapter.
CHAPTER I

HIGHLY PRIVATE CAR ORIENTED TRANSPORTATION SYSTEM

1. Description

The transportation system or alternative discussed in this chapter is based on the assumption that the transportation needs related to the Detroit CBD will further on be met to a high degree by the private car. In view of future growth of the CBD and of efforts undertaken to improve its viability measures for maintaining the good accessibility by car are searched out. The idea is to investigate the potential and limitations of such a system to satisfy the future needs of a viable downtown, with the road vehicles, private cars and buses, having essentially the same technical characteristics as today. Merely some minor innovations in technology which can be expected in the near future will be looked at here. It would have been interesting to consider in a third chapter far-reaching technological changes because perhaps one day many of the investments made for a highly private car oriented system could be used by a fully automatic personal vehicle, similar to the existing cars but more adequate for high density areas. Improvements can also be expected simply on an operational basis which involves about the same technology as today's cars. These possibilities will be discussed within this chapter.

The existing transportation system of Detroit can be considered as highly private car oriented. This is also true for the CBD related traffic which is demonstrated by the following figures:

Table 6: Passengers entering the CBD on a typical weekday from 7 a.m. to 7 p.m. in 1970\(^1^7\)

<table>
<thead>
<tr>
<th>Mode</th>
<th>Number of Passengers</th>
</tr>
</thead>
<tbody>
<tr>
<td>by private cars and taxis</td>
<td>217,860</td>
</tr>
<tr>
<td>by motor buses</td>
<td>85,201</td>
</tr>
</tbody>
</table>

The rail transportation has a very insignificant share in the total passenger volume. There are two commuter lines in operation, both leading to or near the downtown Detroit and carrying about 1,000 passengers in each direction on a typical weekday in 1971.\(^1^8\)

2. Introduction

This chapter deals with the question to what extent the future transportation needs can still be met by the private car, with respect to the requirements

\(^1^7\) Department of Streets and Traffic, "City of Detroit - Central Business District Cordon Count 1970", March 24 and 25, 1970, Table 4.

\(^1^8\) Southeastern Michigan Transportation Authority, "Report on Commuter Rail Transportation in Southeastern Michigan".
of a viable downtown. Although this chapter represents a maximum commitment to the private car, the strong restrictions to the construction of new express-ways and arterials leading from the suburbs to the downtown have to be con-
sidered. Only this way it represents a realistic development alternative for the future. The transportation study by De Leuw, Cather & Company, undertaken within the context of the Central Business District Study Detroit in July, 1970, attempts to follow this line by stating: "The existing-plus-committed freeway and arterial street system serving the Detroit CBD is believed to be approaching the maximum development that is physically desirable. There may be possibilities for improving the traffic service capabilities of existing facilities, but it would not seem appropriate to add any major facilities. This fully developed system, therefore, represents a major constraint on the growth of the CBD and the character of travel to it."\(^{19}\) In spite of these constraints incorporated into this study it can still be considered as one making a strong commitment to the private car. It doesn't specifically promote the installation of a transit system which, at least at the beginning, would probably need strong measures for disabling the private car in order to reverse present trends and to get a ridership high enough for an efficient operation of the system. It conversely attributes to the transit system the residual role of taking care for the amount of traffic which, under all circumstances, can't be handled by the private car. It seems therefore appropriate to rely in this chapter mainly on this study by De Leuw, Cather & Company which offers the advantages of being a complete transportation plan for the CBD, elaborated in cooperation with the CBD Study staff, and of being to a high degree realistic financially and politically and thus having good chances for implementation. Of course the study itself can't be called "private car oriented" with its resulting transit ridership of 42,000 peak hour trips. Because its main concern, however, is the accommodation of the private car, it can be taken as an excellent base for judging the limitations to an extended use of the private car in the downtown area.

3. The Transportation Plan of the CBD Study: DeLeuw, Cather & Company

3.1 Basic Assumptions

The following assumptions were made:

- The character of the future CBD was envisioned as a strong regional center, containing a total employment of 150,000 persons. In addition, it should provide for slightly more than 12,000 dwelling units for all income levels within its boundaries located in attractive residential areas. The


\(^{20}\) Ibid.
CBD would also have a full complement of community services to aid the adjacent neighborhoods. Finally, the number of convention and entertainment facilities would be increased which would together with the proposed CBD residential areas, generate 18-hour activity.

- It was considered to be unrealistic to anticipate an increase in capacity of the totality of streets crossing the CBD boundary. Therefore, no additional expressways or arterials directly connected to the CBD area were projected. This doesn't mean that future improvements in the form of increased capacity are not necessary in other sections of the expressway- or street-system only for the purpose of maintaining the projected volume of CBD related traffic.

3.2 Computation of the Relevant Traffic Data

Out of the assumptions the following figures were derived as a basis for the design of the transportation facilities:

3.2.1 Capacity of the access roads to the CBD

Table 7: Capacity of the access road to the CBD, vehicles per hour

<table>
<thead>
<tr>
<th>Access Roads</th>
<th>Good Service (Level of Service C)</th>
<th>Medium Service (Level of Service D)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Through the boundary formed by the Lodge, Fisher, and Chrysler Freeways (excl. Windsor Tunnel)</td>
<td>28,800 inbound</td>
<td>34,100 inbound or outbound</td>
</tr>
<tr>
<td>Through Windsor Tunnel</td>
<td>28,500 outbound</td>
<td>1,500</td>
</tr>
</tbody>
</table>

A capacity of 30,000 vehicles per hour was assumed to be available, in addition to a capacity of 5,600 vehicles per hour reserved for trucks, buses and vehicles arriving via the Windsor Tunnel.

3.2.2 Projection of external trips

External trips are the ones made between the outside and the CBD area. These can be grouped according to their purpose. In the case of an external trip being undertaken for several purposes, it was assigned to the main purpose and labeled a "primary trip" in the report. Single purpose trips crossing the CBD boundary all pass for "primary trips". The additional trips necessary in the multi-purpose case were called "secondary trips" and are of course internal trips, i.e. trips within the CBD boundaries.
Table 8: Estimated average weekday trip attractions to the Detroit CBD:  
(= external trips; influx; crossing the CBD boundaries)

<table>
<thead>
<tr>
<th>Type</th>
<th>Estimated daytime person trips in 1968</th>
<th>Future daytime person trips</th>
<th>Future nighttime person trips</th>
<th>Future 24-hour person trips</th>
</tr>
</thead>
<tbody>
<tr>
<td>Work</td>
<td>90,000</td>
<td>118,000</td>
<td>17,200</td>
<td>135,200</td>
</tr>
<tr>
<td>Work subsidiary</td>
<td>40,600</td>
<td>56,500</td>
<td>1,000</td>
<td>57,500</td>
</tr>
<tr>
<td>Non-work</td>
<td>75,500</td>
<td>144,700</td>
<td>80,900</td>
<td>225,600</td>
</tr>
<tr>
<td>Residential work</td>
<td>13,700</td>
<td>7,100</td>
<td>800</td>
<td>7,900</td>
</tr>
<tr>
<td>Residential non-work</td>
<td>7,100</td>
<td>14,500</td>
<td>9,700</td>
<td>24,200</td>
</tr>
<tr>
<td>TOTAL</td>
<td>219,800</td>
<td>340,800</td>
<td>109,600</td>
<td>450,400</td>
</tr>
</tbody>
</table>

Daytime and nighttime are not specifically defined, but out of the context it can be concluded that it is from 7:00 a.m. to 7:00 p.m. and 7:00 p.m. to 7:00 a.m. respectively. Work subsidiary trips are work trips out of, and back into, the CBD by employees. Residential work trips include both work trips outside the CBD by CBD residents and work trips at CBD residences by employees living outside the CBD.

Table 9: Estimated peak-hour volumes in the peak direction  
(= external person trips)

<table>
<thead>
<tr>
<th>Type</th>
<th>Morning Inbound</th>
<th>Evening Outbound</th>
</tr>
</thead>
<tbody>
<tr>
<td>Work</td>
<td>53,100</td>
<td>53,100</td>
</tr>
<tr>
<td>Work subsidiary</td>
<td>--</td>
<td>2,800</td>
</tr>
<tr>
<td>Non-work</td>
<td>21,700</td>
<td>21,700</td>
</tr>
<tr>
<td>Residential work</td>
<td>1,800</td>
<td>1,800</td>
</tr>
<tr>
<td>Residential non-work</td>
<td>700</td>
<td>1,500</td>
</tr>
<tr>
<td>TOTAL</td>
<td>77,300</td>
<td>80,900</td>
</tr>
</tbody>
</table>

3.2.3 Modal split of the external trips

The peak-hour modal split was made with respect to the capacity limits in 3.2.1.
Table 10: Modal split for morning inbound trips in the peak hour

<table>
<thead>
<tr>
<th>Type</th>
<th>Total person trips</th>
<th>%</th>
<th>Trips by transit</th>
<th>%</th>
<th>Trips by Car</th>
<th>%</th>
<th>Number of Autos*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Work</td>
<td>53,100</td>
<td>100</td>
<td>29,200</td>
<td>55</td>
<td>23,900</td>
<td>45</td>
<td>17,100</td>
</tr>
<tr>
<td>Work subsidiary</td>
<td>--</td>
<td></td>
<td>--</td>
<td>--</td>
<td>--</td>
<td></td>
<td>--</td>
</tr>
<tr>
<td>Non-work</td>
<td>21,700</td>
<td>100</td>
<td>10,400</td>
<td>48</td>
<td>11,300</td>
<td>52</td>
<td>9,400</td>
</tr>
<tr>
<td>Residential work</td>
<td>1,800</td>
<td>100</td>
<td>1,000</td>
<td>55</td>
<td>800</td>
<td>45</td>
<td>600</td>
</tr>
<tr>
<td>Residential non-work</td>
<td>700</td>
<td>100</td>
<td>340</td>
<td>48</td>
<td>360</td>
<td>52</td>
<td>300</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>77,300</td>
<td>40,940</td>
<td>36,360</td>
<td>48</td>
<td>27,400</td>
<td>52</td>
<td>27,400</td>
</tr>
</tbody>
</table>

Table 11: Modal split for evening outbound trips in the peak hour

<table>
<thead>
<tr>
<th>Type</th>
<th>Total person trips</th>
<th>%</th>
<th>Trips by transit</th>
<th>%</th>
<th>Trips by Car</th>
<th>%</th>
<th>Number of Autos*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Work</td>
<td>53,100</td>
<td>100</td>
<td>29,200</td>
<td>55</td>
<td>23,900</td>
<td>45</td>
<td>17,100</td>
</tr>
<tr>
<td>Work subsidiary</td>
<td>2,800</td>
<td>100</td>
<td>300</td>
<td>10</td>
<td>2,500</td>
<td>90</td>
<td>2,300</td>
</tr>
<tr>
<td>Non-work</td>
<td>21,700</td>
<td>100</td>
<td>10,400</td>
<td>48</td>
<td>11,300</td>
<td>52</td>
<td>9,400</td>
</tr>
<tr>
<td>Residential work</td>
<td>1,800</td>
<td>100</td>
<td>1,000</td>
<td>55</td>
<td>800</td>
<td>45</td>
<td>600</td>
</tr>
<tr>
<td>Residential non-work</td>
<td>1,500</td>
<td>100</td>
<td>700</td>
<td>48</td>
<td>800</td>
<td>52</td>
<td>600</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>80,900</td>
<td>41,600</td>
<td>39,300</td>
<td>48</td>
<td>30,000</td>
<td>52</td>
<td>30,000</td>
</tr>
</tbody>
</table>

*The following vehicle occupancy rates were used:
- Work trips 1.4 persons per vehicle
- Work subsidiary trips 1.1 persons per vehicle
- Non-work trips 1.2 persons per vehicle

The figures for the 12-hour modal split are also given here because they determine the parking demand:

Table 12: Modal split for 12-hour daytime trips

<table>
<thead>
<tr>
<th>Type</th>
<th>Trips by transit</th>
<th>%</th>
<th>Trips by Car</th>
<th>%</th>
<th>Total = 100%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Work</td>
<td>64,900</td>
<td>55</td>
<td>53,100</td>
<td>45</td>
<td>118,000</td>
</tr>
<tr>
<td>Work subsidiary</td>
<td>5,600</td>
<td>10</td>
<td>50,900</td>
<td>90</td>
<td>56,500</td>
</tr>
<tr>
<td>Non-work</td>
<td>69,500</td>
<td>48</td>
<td>75,200</td>
<td>52</td>
<td>144,700</td>
</tr>
<tr>
<td>Residential work</td>
<td>3,900</td>
<td>55</td>
<td>3,200</td>
<td>45</td>
<td>7,100</td>
</tr>
<tr>
<td>Residential non-work</td>
<td>6,900</td>
<td>48</td>
<td>7,600</td>
<td>52</td>
<td>14,500</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>150,800</td>
<td>190,000</td>
<td>340,800</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 13: Modal split for 12-hour nighttime trips

<table>
<thead>
<tr>
<th>Type</th>
<th>Trips by transit</th>
<th>%</th>
<th>Trips by car</th>
<th>%</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Work</td>
<td>5,200</td>
<td>30</td>
<td>12,000</td>
<td>70</td>
<td>17,200</td>
</tr>
<tr>
<td>Work subsidiary</td>
<td>100</td>
<td>10</td>
<td>900</td>
<td>90</td>
<td>1,000</td>
</tr>
<tr>
<td>Non-work</td>
<td>16,200</td>
<td>20</td>
<td>64,700</td>
<td>80</td>
<td>80,900</td>
</tr>
<tr>
<td>Residential work</td>
<td>200</td>
<td>30</td>
<td>600</td>
<td>70</td>
<td>800</td>
</tr>
<tr>
<td>Residential non-work</td>
<td>1,900</td>
<td>20</td>
<td>7,800</td>
<td>80</td>
<td>9,700</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>23,600</strong></td>
<td><strong>86,000</strong></td>
<td><strong>109,600</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The percentage figures show that nighttime trips were assumed to be more auto-oriented than daytime trips. For the daytime 12-hour trips the same modal split was chosen as for the peak-hour traffic, which is a rather doubtful assumption. This means that the transit system could attract the same percentage of riders in off-peak hours than in the peak hour.

### 3.2.4 Parking demand

The computation of the parking demand was related to the 12-hour traffic volumes. It was made separately for the daytime and the nighttime demand with the distinction of long-term and short-term parking. The residential parking was directly related to the projected dwelling units.

- Long-term parking was defined as one lasting about 9 hours on the average and being connected to the trip purpose "work". No additional supply was considered necessary for work subsidiary trips because persons making such trips left from a CBD parking space and returned to it. The initial work trip was already accounted for in each instance.

- Short-term parking was defined as one lasting about 3 hours on the average and being connected to the trip purpose "non-work".

- The computation of the number of residential parking spaces accounted for both the residential work trips and the residential non-work trips.

The long-term and short-term parking space demand was estimated by multiplying the 12-hour car volumes by a factor representing the portion of these volumes in the area at the moment of peak accumulation.

Out of surveys in the CBD of Detroit (for long-term parking) and of other cities (for short-term parking) the following factors were chosen accounting for a reserve of an additional 15% of parking spaces for flexibility in handling seasonal peaks and other special situations:
<table>
<thead>
<tr>
<th></th>
<th>Long-term</th>
<th>Short-term</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daytime</td>
<td>0.85</td>
<td>0.25</td>
</tr>
<tr>
<td>Nighttime</td>
<td>0.85</td>
<td>0.90</td>
</tr>
</tbody>
</table>

For the residential parking, a rate of 1.25 spaces per dwelling unit was used.

The results of the parking demand computation are represented by the following figures:

Table 14: 12-hour car volumes and derived parking demand

<table>
<thead>
<tr>
<th></th>
<th>DAYTIME</th>
<th>NIGHTTIME</th>
</tr>
</thead>
<tbody>
<tr>
<td>12-hour car volume for work trips</td>
<td>38,000(^\text{21})</td>
<td>8,600(^\text{21})</td>
</tr>
<tr>
<td>12-hour car volume for non-work trips</td>
<td>62,700(^\text{22})</td>
<td>29,200(^\text{22})</td>
</tr>
<tr>
<td>long-term parking spaces</td>
<td>32,300</td>
<td>7,300</td>
</tr>
<tr>
<td>short-term parking spaces</td>
<td>15,700</td>
<td>26,300</td>
</tr>
<tr>
<td>TOTAL PARKING SPACES</td>
<td>48,000</td>
<td>33,600</td>
</tr>
</tbody>
</table>

Residential Parking Spaces
(in addition) 15,000

Special parking demand: The parking demand for the proposed stadium was estimated separately. It amounts to an additional 5,000 spaces which was deemed sufficient to accommodate weekday stadium crowds of 17,500. Together with 6,500 excess spaces from the daytime parking supply crowds of 40,250 could be accommodated on weekday evenings.

3.2.5 Projection of internatl trips

"Internal" in this context means "within the CBD boundaries". The bulk of the internal trips are secondary trips\(^\text{24}\) amounting to 828,000 one-way daytime trips. The relatively small number of primary trips\(^\text{24}\) is attributed to the CBD residents. Daily there are 15,600 one-way work trips and 72,000 one-way non-work trips.

---

21) Occupancy rate = 1.4 persons per vehicle.
22) Occupancy rate = 1.2 persons per vehicle.
23) Occupancy rate: range of 2.0 to 2.5 persons per vehicle for various purposes.
24) cf. 3.2.2.
The secondary trips have peaks occurring during the morning and evening rush hours and the lunch period. The period from noon to 1:00 p.m. experienced the heaviest of these peaks with the volume during that period representing about 20% of total 12-hour daytime secondary movements.

3.2.6 Movement of goods

21,500 truck deliveries were projected to be made daily in the CBD, requiring 870 spaces.

3.3 Proposals for Constructive and Operational Improvements or Adaptations

3.3.1 Streets

The main features of the system are:

- Separation to a high degree of the vehicular and the pedestrian traffic;

- Creation of a few super-blocks, mainly in the core area (i.e. within the collector-distribution loop; see below), with only minor vehicular traffic in their inside on local access and service streets;

- Creation of a collector-distributor loop with adjacent parking structures;

- Creation of a penetrator into the main shopping area with adjacent parking structures;

- Elimination of on-street parking on most streets (as a logical consequence of the above devices);

- Provision of a portion of the interior street system (i.e. within the collector-distributor loop) to the exclusive use of buses, taxis and local service vehicles.

Collector-distributor loop: (cf. Fig. 1)

This loop would be formed by the one-way couplets of Larned and Congress Streets, First Street and Cass Avenue, and Columbia and Elizabeth Streets and a proposed Brush-Beaubien Blvd. Parking facilities to serve the core and adjacent areas are proposed to be built along this loop in order that parking space could be found within acceptable walking distances of ultimate destinations.

The principal role of this loop would be to expedite movement of autos from freeway ramps and arterial streets to parking facilities.
Shopping penetrator: (cf. Fig. 1)

This one-way couplet formed by Clifford-John R Streets and Grand River Avenue would serve the downtown shopping district with direct access to and from the freeways via Bagley Avenue on the west and Madison Street on the east as well as via Grand River Avenue.

Other major streets: (cf. Fig. 1)

- Michigan Avenue - Monroe Street - Gratiot Avenue thoroughfare. Its function would be to create flexibility by allowing circulation across the core and to give access to three existing parking structures as well as to parking facilities committed for development in the "Kern Block" and between Cadillac Square and Monroe Street. Between 1,400 vph and 1,700 vph were projected to use it during the evening peak hour of a typical weekday. However this route would not be intended as a through arterial, traffic control would intentionally favor pedestrians and buses.

- Jefferson Avenue.

- Third Street Boulevard. It would serve parking facilities on the western edge of the CBD as well as the proposed stadium.

- Extension of Woodbridge Street for improving the access to the Detroit-Windsor Tunnel.

- Lafayette Boulevard extended westwards to the proposed Brush-Beaubien Blvd. Still further to the west, it would penetrate the area of major parking facilities.

- Cass Avenue and Clifford Street would form a one-way couplet north of Columbia Streets.

- Second Street would be developed as a minor two-way arterial.

3.3.2 Parking

Residential parking demand was assumed to be met within each development. Daytime non-residential parking demand was distributed and resulted in an average walking distance of 860 feet. This means that a vacant parking space could normally be found within an average of two blocks of each person's destination.

The stadium parking would have to provide for 5,000 spaces being necessary for daytime events.

Nighttime non-residential parking demand could easily be met by the daytime supply.
Special attention was given to the short-term parking in the major retail and business core bounded by Washington Blvd - Detroit River - Randolph - Broadway - Grand Circus Park. Out of the total CBD short-term demand of 15,700 this area needs a portion of 7,756 spaces. The attributed supply consisted of 9,110 spaces thus showing even some excess for long-term employee parking.

One of the maps being part of the report by DeLeuw, Cather & Company shows a number of existing and committed parking structure spaces of 16,040 (cf. Fig. 2). To meet the demand of 48,000 non-residential spaces an additional 32,000 spaces would be needed in the case that on-street parking and open parking lots were completely eliminated. Together with the needed 15,000 residential parking spaces and the 5,000 spaces for the stadium this number mounts to 52,000. A comparison with the existing spaces in both parking structures and parking lots results in an additional need of only 8,000 non-residential spaces, compared with the 32,000 mentioned before.

A recent study25 investigated the potential of the area along the collector-distributor loop and the shopping penetration for future parking structure construction. Considering the restrictions set by the existence of still viable buildings, called "anchors" (= structurally sound buildings of medium to large size which are expected to be still functioning in 1990), he arrived at a possible amount of 26,175 spaces (cf. Fig. 3). Should this maximum program be implemented, there would only be a number of about 5,800 spaces needed to be constructed in the rest of the CBD area, in addition to the residential parking and the 5,000 spaces for the stadium.

The future parking structures were not supposed to exceed a maximum height of three levels, including the ground level. Higher parking structures, however, would be permissible, as an exception, to meet the requirements of high-rise apartments. The plan further assumed that parking facilities would be built as part of multiple use developments with housing and/or commercial space above. Part of the top deck and outside portions of lower decks of some parking facilities would be used for pedestrian malls and weather-protected walkways.

3.3.3 Transit

Due to the fact that about 42,000 trips in the evening peak hour can't be accommodated by the private car, some kind of rapid transit system was considered to be necessary. It was supposed that only with high-speed transportation on separate right of way this high number of riders could really be attracted and thus the sketched plan for vehicular movement be made workable. The assumption of a maximum of 500 surface buses competing with private cars for space on the surface street system called also for such a rapid transit system. Since in 1968 the 17,000 peak hour transit riders could be accommodated by about 500 bus trips, the 2.5 times higher demand of 42,000 outbound trips would - for a similar level of service - probably require some 800 bus trips. The type of the rapid transit system wasn't specified, but it was felt that the system would probably operate in subway in the CBD.

25) Ken Malkowski, City of Detroit Mayor's Committee for Community Renewal (report to be published).
In addition to the introduction of rapid transit it was considered necessary to improve the bus service both in the short- and long-range by devoting a portion of the interior street system (i.e. within the collector-distributor loop) to the exclusive use of buses, taxis and local service vehicles. This proposal includes a loop formed by the west side of Washington Blvd. north of Michigan Avenue, the whole width of Washington Blvd. south of Michigan Avenue, Fort Street, the south side of Cadillac Square, Randolph Street, Broadway, Witherell, and Park Street as one element and Woodward Avenue between Adams and Congress Streets as the other. Woodward Avenue would carry about 100 buses in each direction during the peak hour. The loop would handle the remaining volume of up to 400 buses per hour. Two extreme kinds of operation would be possible on this loop:

- All buses coming from outside of the CBD circle the loop before leaving the CBD again;

- All buses coming from outside of the CBD turn back at the loop. Passengers would have to transfer to loop buses.

No proposal with regard to these kinds of operation was made. A combination of the two schemes could be the best solution.

3.3.4 Internal movement system

Pedestrian Circulation:

The creation of super-blocks favors the pedestrian within their boundaries. In addition, the general principle of reducing conflicts between pedestrian and vehicular traffic was applied throughout the entire CBD wherever possible. Four types of facilities were proposed:

- A continuous deck level system: it would be developed in conjunction with the parking structures built along the collector-distributor loop and the shopping penetrator. These walkways would be 15 to 25 feet above the ground, according to the levels of existing buildings. Portions of the parking levels adjacent to the walkways should be used for retail shops, thus giving more variety and life to this deck level system. It would encircle the entire core area, penetrate through the retail core, extend to the Detroit River frontage, and radiate to outlying activity centers.

- A major pedestrianway system: Most pedestrianways within the core area would belong to this system which would extend usually on the present grade level but which would be separated from the vehicular traffic. To some degree devices for protection from inclement weather should be provided.

- Local access streets with existing cross sections or with additional space for pedestrian service: This is the traditional sidewalk system. With vehicular traffic decreasing in some core area streets these sidewalks could at some locations be enlarged.
Underground concourses developed in conjunction with rapid transit subways: Proposals for this system couldn't be made yet because they have to be linked completely to projects for rapid transit subways. Such courses are very successful in Canada where especially Montreal has made much progress towards an extended system of underground pedestrianways. They link the major buildings and are bordered on both sides by shops and restaurants.

Assignments of internal trips to this combined pedestrianway system indicated that peak hour volumes ranging from 5,000 to 15,000 persons per hour might occur along the different kinds of pedestrianways.

**Mechanical System:**

For longer trips within the CBD some kind of a mechanical system other than automobiles or taxis would be desirable, at least in the long-range. Such systems which are usually categorized as "people movers" are presently under development or even proposed. On a small scale, mainly in parks and at expositions, first operational experiences were made. None of these innovations, however, were tested in an urban environment yet. In the interim, reliance will have to be placed on traditional systems with taking into consideration a possible changeover in the future. Four routings were proposed for internal, non-pedestrian movements of people with assigned volumes ranging from 1,000 to 5,000 persons per hour. The core area facilities would experience traffic at the upper end of that range.

- Woodward Avenue "spine": Service could be given by external buses in peak hours. Off-peak needs could be met by Mini-Loop 1 as at present. A future Woodward Avenue subway might also add to service on this route.

- Public transportation loop around the core: It is the same which was already proposed for the external buses (see 3.3.3). Here again service could be offered by both the external buses and mini-buses.

- Larger loop to the west of the CBD: As connector between satellite activity and residential centers and the office and business core.

- Larger loop to the east of the CBD: These two larger loops would constitute modifications of the present Mini-Loop 2.

The operational requirements for this internal (CBD) transportation system were stated as following:

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average speed</td>
<td>10 mph</td>
</tr>
<tr>
<td>(15 mph for a future &quot;people mover&quot;)</td>
<td></td>
</tr>
<tr>
<td>Headways during peak periods</td>
<td>1 to 2 minutes</td>
</tr>
</tbody>
</table>
3.4 Cost of Implementation

Only sparse information was available on the cost of the implementation of the described transportation plan. Therefore, what follows isn't a broad presentation and discussion of these costs but, as a matter of completeness, a mentioning of the obtained information.

1) Collector-Distributor Loop:

Implementation cost of the Brush-Beaubien Boulevard  $6 Million

Implementation cost for the connection and channelization of the First Street - Cass Avenue and Columbia Street - Elizabeth Street one-way couples in the vicinity of Grand River Avenue $0.3 Million

Total implementation cost for collector-distributor loop: $6.3 Million

2) Development of parking structures along the collector-distributor loop and the shopping penetrator:

The study by Ken Malkowski mentioned before aims at an estimate of the total implementation cost, including the acquisition cost of the land and the existing buildings, the demolition cost of these buildings, and the construction cost. Of course, still viable buildings, so-called "anchors", and their sites were exempted from development. With the assumption of three level parking structures he arrived at an aggregated number of 26,175 spaces. The total cost for their implementation came out to be $138.3 million.

4. Discussion of the Transportation Plan by DeLeuw, Cather & Company

4.1 Potential for Implementation

The plan was described and discussed here under the heading of a private car oriented system. It must be repeated at this place that the plan does not absolutely represent but only gives the base for such a system, through its main concern with the private car. The fact that 42,000 peak hour trips, or more than 50%, have to be made by transit shows that there is a fairly good balance between the modes. Because of this high number of transit riders the assumption was even made that some kind of rapid transit system with a subway portion at least in the CBD area would be in existence. The

26) Information from Thomas Walters, CBD Study Coordinator.

27) Ken Malkowski, City of Detroit. Mayor's Committee for Community Renewal (report to be published).
assumption of this subway section, however, seems to be less stringent than the one about the number of transit riders (i.e. modal split). The same level of ridership could perhaps be handled by some 800 peak-hour surface bus trips, compared with about 500 or less with the existence of the subway rapid transit. This would require modifications of the described plan in three alternative directions:

- The street capacity would have to be increased in order to carry the 300 additional peak-hour buses. Rapid transit service by a portion of the 800 buses (on exclusive or limited access lanes) would even require a substantial increase of street space. And yet it is questionable if such an only-bus system can really attract the high number of riders projected. It could be much more probable that the third alternative way would come true.

- In the case that no increased street capacity can be offered the private-car traffic has to be slightly reduced in order to make possible the circulation of the additional 300 peak-hour buses. This in turn means an increase of transit riders and therefore a number of bus trips higher than 800.

- With the transit system failing to attract the assigned ridership and with no supply of additional street capacity the vehicular traffic will sooner or later --with a CBD developing towards the stated goal of increased employment-- meet an unbearable level of congestion and a lack of parking opportunities. This in consequence means a threat to the policies of CBD development. As stated before, this case could be the most probable.

These short explanations on the possible solutions for the transit system already show the heavy constraints which exist for maintaining the auto-orientation of the motor-city, Detroit, at least for its central part, the CBD. It must be understood that all such statements are only valid within the frame of the stated goals of developing the future CBD towards a strong regional center and of creating a high quality of the environment. If we ask, with these goals in mind, what can be done more for accommodating the private car, it suddenly becomes clear that the plan nearly offers the maximum commitment to the private car. This becomes perhaps still more clear when we compare the plan with a hypothetical approach favoring to a maximum, for some period of time, the establishment of rapid transit as it is happening in a few European cities right now. Instead of assigning to rapid transit a mere supplementary, casual role, it could be made to the backbone of the whole transportation system by asking what problems it would solve and how its operation could be made efficient. This approach is not so inadequate as it might appear at first sight. It has to be considered that most rapid transit systems involve economies of scale which don't allow unlimited incremental changes. According to the kind of rapid transit system finally proposed, quite different measures could be tolerated or necessary for the private car than the ones proposed by the plan.
Coming back to the question of the implementation chances of the plan, it is important to notice that constraints for further construction in the transportation field were clearly recognized. The proposed system doesn't involve the construction of huge, controversial facilities. The only major public investment for the street traffic would be the Brush-Beaubien Boulevard. All the other changes are rather spot-like realignments or changes of the street-profile. The plan has much more the character of improving the efficiency of the vehicular traffic than of increasing the volumes and capacity which, strictly speaking, of course cannot be separated completely from each other. But it seems that there is not too much controversy about the proposals. Given the fact that there is only rapid transit development to the extent that it becomes necessary-- even with the improvements for the private car -- it can be assumed that the potential for implementation of this plan is much better than any other basically different from this one. At this place it must be mentioned again, however, that there could be controversy about much more basic questions, namely about the role of the future CBD at all. But this report is not concerned with these fundamental issues, having a specified growth of the CBD and an improvement of its environment as premises. The implementation of the plan by DeLeuw, Cather & Company will probably much less face problems of public decision than the ones of creating a suitable climate for inducing private investments to participate. This concerns mainly the high number of multi-use structures containing the proposed parking facilities along the collector-distributor loop and the shopping penetrator. The same is true for some of the extended pedestrian-ways. To say more about the chances for implementation of either of the systems described in this report would need a much deeper analysis of the local power structure and of the goals and behavior patterns of the different population groups interested or related in some way to the CBD.

4.2 Influence on Development Goals

As was already pointed out in the Introduction to this report, the setting of planning goals for the future CBD would require a careful analysis, involving such important items as the value and behavior patterns of all kinds of population groups as well as the relevant economical and political mechanisms. For several reasons such a broad view couldn't be adopted here. Therefore, this report is not explicitly concerned with important problems as poverty, unemployment, crime, public finance, which are dominant in the Detroit scene. It simply states some goals on land use and the urban environment which certainly could be considered instrumental goals for fulfilling these other, more human related goals. In which way they do this, however, is not quite clear at this moment. Nevertheless, the chosen goals here which can be summarized under the heading "viable downtown" have some sense in giving the frame for this report. They are premises for all statements or conclusions in this report. This implies that nothing can be argued beyond this frame. Moreover, it can be assumed that a number of persons can identify themselves directly with the one or the other land use and environmental plan regardless of its ascertained impact on these other fields.
In order to prevent any misunderstanding it must be repeated that the author is not fixed to the opinion that transportation investments represent somehow a switch leading future development for sure in one or the other direction. There are many other, perhaps more important, factors which are responsible for certain processes and future development happening in a desired way. The best transportation system serving the CBD is not of great help for the viability if, for certain reasons, private and public investors are not interested in developing the CBD or if there is a lack of attracting activities in this area and people are therefore not making use of it. On the other hand it cannot be denied that there exist at least strong relationships between the transportation system and the physical pattern of a city.

A prediction of the development impacts of the CBD transportation study needs a specification of the transit system. Two possible solutions were vaguely mentioned: a rapid transit system with the CBD portion in subway or an extended bus system. The first one was considered as being more adequate. But for this first version no typical development impacts can be predicted. They would be somewhere between the ones of the second, more highway oriented version and the ones of a transportation plan with maximum commitment to rail rapid transit. Therefore we restrict ourselves in this chapter on the second version and describe roughly what potential for development a transportation system exclusively based on the private car and buses might have.

As the CBD transportation study has shown, the proposed system could accommodate a CBD employment of 150,000 and a residential population in 12,000 dwelling units. These figures represent probably the maximum which can be achieved with a mixture of private cars and buses. Even to reach this level would be difficult, for simply technical reasons, as was shown in 4.1. Presumably the growth of the CBD would never go to this point. As the attraction of the CBD is rather low and decentralization is in an advanced stage in the Detroit region, no serious congestion would ever be accepted. Many choices are open to locate new business activities outside the CBD. This makes it hard to believe that the projected growth level could be reached with a transportation system consisting of cars and buses only and which would sooner or later reach a state of critical congestion.

Perhaps completely reverse could be the influence on residential development. Given a good living environment and no sudden decline in the economic activity of the CBD, the growing deterioration in traffic conditions could attract more people to CBD residences than would be the case with an efficient, wide-spread rapid transit system. The influence of the transportation system on the location of housing is, however, a very delicate question which can't be answered generally. Very rarely can transportation be considered as the main dominating factor for housing location.

Of greater importance is the fact that office space and housing are two competing land-use categories in the urban scene. Offices, usually able to pay higher rents, could easily push residential housing out of the CBD in the case of lacking both space and regulations against this mechanism. This is one of the important issues of rail rapid transit which usually induces accelerated growth of business activity in the central part of a city.
as soon as this latter one is privileged in terms of accessibility. With a
common belief that residents are constitutive for the viability of an area,
as described in the Introduction, it can be stated here that the discussed
transportation system has some advantages on behalf of this issue over an
enforced rail rapid transit system. However, this does not mean that this
problem linked to rail rapid transit could not be solved.

4.3 Impact on the Environment

The present street system of the CBD is open to vehicular traffic
throughout the whole area. The pedestrianways consist with only a few ex-
ceptions of the sidewalks along these streets. This traditional system
which experienced surprisingly less changes than in most other cities offers
a maximum of conflicting situations between the two modes of traffic. With
increasing volumes and speeds of the vehicular traffic, the pedestrians are
exposed to excessive levels of smoke and noise emissions and of psychological
stress. Mainly at crosswalks but also, to a lesser extent, along the whole
length of the sidewalks, innumerable hazardous situations occur.

Out of this detrimental situation the concept of super-blocks was
developed. The vehicular traffic uses only a portion of the original street
system. The few streets still left in use, as a compensation, are usually
improved for carrying more volume of cars. The areas between these streets,
called super-blocks, contain a number of streets which are henceforth either
closed to all vehicular traffic or restricted to special traffic purposes as
public transportation, service vehicles, and taxis. This kind of traffic is,
be definition, limited in volume and it therefore doesn't affect seriously
the pedestrians. It enjoys itself, for the same reason, the privilege of
not being troubled with congestion problems in these areas.

Such a system of super-blocks was proposed for the core area (i.e.
within the collector-distributor loop) by the CBD transportation study. The
two largest of these super-blocks contain an area of about 30 acres each.
Together with proposed devices for weather protection this innovation brings
a substantial improvement for the pedestrians. The final result mainly
depends on the quality of the landscaping and architectural design and of the
willingness of the city and the landowners to make their contributions. The
proposed shopping penetrator constitutes the potential for a revitalization
of the retail business. The construction of three-level parking structures
should offer even shorter average walking distances than in the existing
suburban shopping centers. It seems that also for shoppers a very attractive
environment could be created on the grounds of the proposed transportation
system.

The small-scale advantage of giving relief to the pedestrian by a
super-block system has to be balanced with a disadvantage occuring on the
larger scale. The remaining streets open to the general traffic change their
character into arteries carrying high-volume and continuous-like traffic.
Without sidewalks and pedestrians these streets can't be compared with the
arterials of today, as for instance present Woodward Avenue. Although
different from expressways in scale, they could be much the same as these in
their effects. They would become barriers of communications. As a whole network of such streets has to be laid over the CBD, there is a real danger that the area is cut into more or less isolated portions and that the well-functioning of the downtown could be impaired. The main components of this network would be the collector-distributor loop, the shopping penetrator, the Michigan Avenue-Monroe Street-Gratiot Avenue thoroughfare, Bagley and Madison Streets, and the Third Street Boulevard. It is difficult to predict whether this isolating effect will really happen and to what extent. The same, it can't be said for sure that an adequate design of the proposed deck-level system for pedestrians (see 3.3.4) can effectively reduce the disadvantages of the new arterials. Reports on experiences made in Minneapolis with a deck-level system, however, are rather optimistic. This city has started with building a network of "skyways". These are mid-block pedestrian crossings that connect the second stories of office buildings and retail stores across downtown streets. Seven skyways now join buildings in 10 blocks in the downtown core area, and four more will be opened this year. So far, all the skyways have been privately financed. An 80-foot span costs about $200,000 not including interior remodeling of these glass-enclosed, weather-protected facilities. 17,000 people use the existing parts each weekday. By 1985, 64 skyways are expected which will link 54 square blocks, an area which corresponds in size about to the future Detroit CBD core area bounded by the proposed collector-distributor loop. In case of failure of such a skyway system in the downtown Detroit, no limitations should exist, in principle, to a more intensive use of the air-rights with a partial covering of the high-volume traffic streets. So it should always be possible to eliminate the barrier-effect of the proposed high-volume traffic street network although under some circumstances the need for ventilation would result in high cost solutions.

The problem of overall air-pollution in the downtown of Detroit seems not to be as urgent as in many other cities of the United States. The major pollutant is particulate matter which primarily originates from stationary sources as factories and power plants and only to a lesser extent from vehicular traffic. The relatively low level of air-pollution is due mainly to the unstable climate with the frequent and strong winds. To some degree, the small size of the high-density portion of downtown may be the reason too. It seems, therefore, that no restraints to an increase of private car traffic to the projected level exist from the standpoint of maintaining air-quality. The shift to more concentrated traffic along a few streets, however, demands special consideration of the air-pollution at these places.

4.4 General Concluding Remarks

The CBD study transportation plan brings improvements for both pedestrians and private vehicles. While no additional capacity was assumed on the external street-system, i.e. expressways and arterials leading to and from the CBD all opportunities for improving the accommodation of private cars were taken within a number of constraints set by adverse interests. Projected or wanted growth can, however, only happen if an efficient transit system will supplement the private car. In the remainder of the chapter special measures for reducing this need of transit shall shortly be discussed.

28) Article in the Wall Street Journal, March 23, 1972, "Rising Above Congested City Traffic".
Where transit is necessary it shall involve buses instead of rail vehicles. The next chapter will go in the opposite direction. It could be that a successful operation of a rapid transit system requires a more aggressive approach than the one made in the described study. The assigned ridership of 42,000 peak-hour trips seems to be too low for any rail system.

5. Methods of Improving the Efficiency of the Private Car Use

5.1 Introduction

Street capacities and parking facilities were related to each other in the transportation plan by DeLeuw, Cather & Company. This includes the street capacities of both the external (expressways and arterials giving access to the CBD from other parts of the city or the region) and the internal (within the CBD) street system. Therefore, any solution based on increased capacity has to face at the same time both elements, streets and parking.

5.2 Additional Street Capacity

It is difficult to make, at this point in time, any projection about future expressway construction near the CBD. Unknown future involvement of citizens in this issue and possible changes in transportation policy could have a major influence on what finally will be implemented. It is interesting to note that the CBD study transportation plan assumes that no additional sections of freeways or arterials will be connected directly to the CBD and that existing limitations in capacity will be determining for the future. So even the expected extension of the Fisher Freeway to the east doesn't seem to come into existence. This extension would have needed, in order to bring increased service to the CBD, either additional lanes on sections of the existing Chrysler or Fisher Freeways together with improved exit opportunities or new connecting streets between the CBD and a major exit located east of the existing Fisher Freeway section. Both alternatives represent heavy impacts on the border area of the CBD. Special care has to be given right to these border areas because abrupt changes in the physical quality and an interruption of the communication between the core and the fringe areas would give the CBD the character of a small island within an ugly and dangerous surrounding and which would represent a major threat to the viability of downtown Detroit.

A nearly as hopeless attempt seems to be the increase of capacity through new or on existing arterials. East Jefferson Avenue, Gratiot Avenue, Woodward Avenue, Grand River Avenue, Michigan Avenue, and West Fort Street could offer more thoroughfare capacity without enlarging the street width but with the unrealistic means of eliminating most intersections by simply cutting the cross-roads. Some of them would have to be connected again by an underpass or a bridge. This would completely change the character of these arterials, and of the adjacent land. No access would be given any

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29) cf. 2.
more to all the retail and other activities now bordering these arterials. Wide residential areas along these arterials would lose their local activity centers.

The internal street system of the CBD doesn't allow any increase of capacity at all. The proposed system by the CBD study transportation plan can be considered as an efficient solution for the handling of the vehicular traffic in accordance with some consideration of opposed interests. A few doubts on the environmental impacts of the proposed system mentioned earlier (see 4.3) and other requirements of a viable city center show the impossibility of an enlargement of this element of the system. Thus, any increase on the external street system couldn't be paralleled by a corresponding one on the internal system. Consequently, adequate parking for the additional traffic would be needed at the border of, or immediately beyond, the CBD. This in turn would require an efficient internal movement system.

5.3 Additional Parking Facilities

It is extremely difficult to estimate what amount of parking structures can be tolerated without very adverse impacts on the viability of the CBD. Out of the impossibility of enlarging the internal street system additional parking structures would have to be located in the border area anyway. Most of the existing parking structures obviously affect viability in a very unfavorable way with their monotonous, unbroken street-fronts30 and a lack of activities like shops, restaurants, offices, etc. on their street level. Usually and fortunately this effect isn't alarming, because adjacent activity places compensate. This compensating effect can happen as long as the parking structures are scattered throughout the CBD. What the influence on the viability will be once many of these structures are concentrated along the collector-distributor loop and the shopping penetrator or once a higher number of them are located within the CBD, can't yet be predicted. All the new parking garages are supposed to be developed in multi-use buildings containing retail and/or office space. Presumably many of the adverse effects can be eliminated this way. Experience with the first series of new parking structures will give a better base for answering these questions.

5.4 Traffic Control

It must be clearly noted that traffic control isn't a means of increasing capacity. It just helps to make best use of the given capacity by improving operating conditions of a street system. Given the fact that congestion rapidly lowers vehicular flow and that congestion is typical for peak hours, an adequate traffic control is basic for the functioning of every-day vehicular traffic. With regard to the CBD it may be interesting to mention the traffic control on expressways. Breakdowns on expressways with queues of standing vehicles are fairly common in peak hours, that means right at the moment when the highest flow of vehicles should occur. Through the device

30) Although many of them may have a good architectural design, they neglect the pedestrian's small-scale perception.
of ramp control with stop-and-go signals on the entrance ramps only the volume of cars is accepted on the expressway which allows operation under full capacity. Successful experiments were conducted in Detroit (John Lodge Freeway), Chicago, Houston, and Los Angeles.31 A permanent system of this kind can be expected in Detroit in the near future.32

5.5 Devices for Reduced Headways

The capacity on expressways and arterials could be increased if the headway between vehicles were reduced. Still today, the headways between cars stringently increase with higher speeds which is the reason for the surprising fact that maximum flow occurs at medium speeds, around 30 to 50 miles per hour according to the highway quality, and not at high speeds. Once it becomes feasible to reduce the headways or to make them independent of speed, this rule doesn't apply any longer. The capacity could be raised to any level, within certain limits, simply by fixing adequately a higher minimum speed.

Different technical solutions with more or less perfection can be found.33 The ones available in the near future will still operate on a relatively low level of performance. They basically consist of communication and sensing equipment which would be added to each car. So the only difference would be the replacement of the human eye by a device providing exact information about the headway. The driver still has to slow down or accelerate and steer the vehicle. This, of course, does not yet allow a reduction of the headway to practically zero.

An advanced technology will permit a completely automatic guidance of the vehicle which only will allow the substantial increases in capacity mentioned above. But this kind of innovation won't be available in the near future, and it will, in addition, take a certain amount of time to have it in common use so as to give relief to congestion problems in high density traffic corridors.

5.6 Better Auto Occupancy

The CBD transportation study assumed the following future auto occupancy rates:

- for work trips 1.4
- for work subsidiary trips 1.1
- for non-work trips 1.2


For the 39,300 peak-hour (evening outbound) trips made by car, the average auto occupancy rate is 1.31. With exclusion of the work subsidiary trips, this figure is 1.33. It might be interesting to know what increase in the auto occupancy rate would be necessary in order to accommodate the increased number of trips without additional public transportation service. With the existing service (1968 figures) 17,000 peak-hour trips are accommodated by about 500 bus trips.

<table>
<thead>
<tr>
<th>Description</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total peak hour (evening outbound) person trips</td>
<td>80,900</td>
</tr>
<tr>
<td>Trips by transit with 1968 level of service</td>
<td>-17,000</td>
</tr>
<tr>
<td>Work subsidiary trips</td>
<td>-2,500</td>
</tr>
<tr>
<td><strong>Trips with potential for higher auto occupancy</strong></td>
<td>61,400</td>
</tr>
</tbody>
</table>

Of the 30,000 cars allowed in the peak hour, 2,300 are related to the 2,500 work subsidiary trips with a fixed auto occupancy rate of 1.1. Thus, the 61,400 trips have to share in the remaining 27,700 cars which results in an average auto occupancy rate of 2.22.

So, the future travel needs can be accommodated by the private car without any additional public transportation service if the average auto occupancy is raised from 1.33 to 2.22 which means an increase of 67 percent. This still allows the work subsidiary trips to maintain their low rate of 1.1 persons per vehicle. The achievement of such an increase could be very difficult. It would mean that many drivers have to make one or more stops on their way from home to the working place and vice versa to pick up and drop additional passengers. It demands a strong discipline in keeping the time-schedule and does not allow much freedom to participants for changing the private program. It needs, therefore, some incentives which might outweigh these disadvantages. The recently installed ECO-Parking system at the Wayne State University campus in Detroit gives an example of such an incentive where cars carrying more than one person are given preferential parking treatment. The scarce number of parking spaces is in the first priority attributed to such cars. The system is made workable by means of a computerized car pool information system which matches drivers and riders. The arrangements are made on a permanent, that means, not on a day-to-day basis. An increase from 1.4 students to 1.5 students per vehicle is expected. It can be assumed that such a system would probably be easier to handle for the downtown area than for the Wayne State Campus with the exception, however, that the willingness of the people affected could be less because of their better financial status.

5.7 Dial-a-Ride

This concept includes a series of different operational procedures and technical devices with the purpose of providing relatively cheap door-to-door transportation service, quickly available at any time in response to a telephone call. It does this by means of a dynamically routed and scheduled transportation system. Its typical fields of application are the replacing

of conventional bus service in small and medium sized cities or the serving as a feeder for rapid transit lines in larger cities or the serving of major trip generators such as airports and shopping centers. Its role for serving the downtown of Detroit could probably only be a supplementary one. It could be used as a feeder system to rapid transit, collecting commuters for downtown in the residential areas and carrying them to the nearest station. Perhaps it could also be used as an internal movement system within the downtown area. As an exclusive transportation system besides the private car it could certainly alleviate congestion and parking problems because it means a move towards a higher vehicle occupancy. However, other systems seem to be more adequate for this purpose.

5.8 Exclusive Bus Lanes

The introduction of exclusive bus lanes can be considered as an alternative to rail rapid transit although there exist important differences in the operational and technical characteristics. In comparison to rail rapid transit, it represents usually a low-cost, low-risk, and politically feasible solution. On usually congested segments of the expressway system, a lane is reserved for the exclusive use of buses. It is assumed that the substantial loss in capacity is more than compensated by the buses each carrying a high number of passengers. Of course, this is only true with a high density of buses. The demonstration effect of the fast going buses on the individual car drivers stuck in a traffic jam in their remaining lanes might help increase the bus ridership and so lead to some balance in the use of the two kinds of lanes.

Exclusive bus lanes were introduced among others on the Shirley Mem. Highway between Washington, D.C. and the Virginia suburbs, and on 3½ miles of expressway including the Lincoln Tunnel between New Jersey and Manhattan. In the latter case, 35,000 passengers are carried in 850 buses to Manhattan in two hours between 7:30 and 9:30 a.m.

Special attention has to be paid to the separating of the lane from the others and to avoiding conflicting situations at exits. The first problem is sometimes solved by selecting a lane adjacent to a reverse traffic flow which makes an illegal use of the lane physically impossible but which could create safety problems. The second problem exists whenever there are exits on both sides of the expressways, which is sometimes the case in Detroit as well as in the rest of the United States.37

35) it is assumed here that existing lanes can be used.

36) in the sense of financial risk.

37) Some more information can be found in: Southeastern Michigan Transportation Authority, "Rapid Transit Performance and Costs", January 1971, prepared by Louis T. Klauder and Associates.
CHAPTER II

RAIL ORIENTED TRANSPORTATION SYSTEM

1. Revitalization of the Railroads for Use as Commuter Lines

1.1 The Southeastern Michigan Transportation Authority's Report on "Commuter Rail Transportation in Southeastern Michigan"

The Detroit region has an extended railroad track system (see Figure 4), converging to the downtown area and spreading out in a radial pattern. It seems, therefore, obvious that this system should have some potential for handling the bulk of commuters. For the purpose of investigating this question, a study was undertaken by the Southeastern Michigan Transportation Authority (SEMTA) in 1971.

The conclusions are rather pessimistic towards improving or instituting commuter service on existing lines. The reasons vary for each of the six corridors being items as heavy freight traffic with a related intensive switching activity, and very poor conditions of the existing facilities requiring high costs for upgrading. The problems and conclusions for the six corridors are summarized here.

1.1.1 Airport Corridor

The railroad serving this corridor starts at the Union Depot, located in Detroit at Third and W. Fort Streets, about one-half mile to the southwest from Kennedy Square. Of interest for new passenger service is only the section ending at the Detroit Metropolitan Wayne County Airport in Romulus Township. The potential of this existing railroad for a Downtown Detroit Airport rail shuttle service was investigated. Ground access to the airport from Downtown Detroit is entirely over highways, using express buses, taxicabs, or private autos. The express bus shuttle service is operated by the Greyhound Bus Company. It starts at the Greyhound Depot, located just north of the City-County Building in Downtown Detroit, and makes a stop at the four major downtown hotels. It takes 45 minutes for the entire trip and 30 minutes from the last stop at the Hotel Pontchartrain. The frequency of service is 20 minutes in the time between 3 p.m. and 9 p.m. and 30 minutes for the rest of the day.

The existing railroad passes about one mile north of the airport's passenger terminals. The most part of the line is owned by the Norfolk and Western Railway (N&W). However, near Union Depot two other properties are involved: the Chesapeake and Ohio Railway (C&O) and the Union Belt of Detroit. The latter one is jointly controlled and owned by the C&O, N&W, and Penn Central. Two parallel main running tracks are in use at present over the entire route under review. Several obstacles exist today for the operation of any attractive passenger service, not to mention the almost unavoidable interference with railroad freight traffic and thus the unwillingness of the railroad companies to allow a high frequency passenger service.
Five alternative plans with increasingly better passenger service and new construction volume were developed. Only plan No. 5 represents an adequate passenger service comparable or superior to the existing one by bus.

The level of service was fixed at three trains per hour in each direction between downtown Detroit (Kennedy Square) and the airport for 18 hours a day. Consequently there is a train leaving every 20 minutes from each of the terminals. In the remaining six night hours one train an hour in each direction was assumed. The travel time is 27 minutes with a maximum degree of reliability. Plan No. 1 with minimum new investments would require 39 minutes on the trip between the airport and the Union Depot station. Delays would happen very frequently.

Costs of an attractive airport rail shuttle service (Plan No. 5):

**Capital costs:** $138.5 million

These costs include:

- New direct rail link between the railroad line and the airport passenger terminals.

- Improvements to the tracks, including the rebuilding of the 3,300 feet long viaduct over W. Jefferson Avenue between Cabacier Street and Vermont Street which today allows a speed of only 6 mph.

- Extension of the railroad from the Union Depot to Kennedy Square.

- Bypass under Delray Junction and the River Rouge drawbridge. This most expensive portion of the plan gives the necessary reliability for an airport passenger service. Delray Junction is the busiest railroad facility in the Southeastern Michigan region with an average of 114 trains per day crossing it in 1968/69. Airport trains, without this bypass, would interfere with the north-south trains of Penn Central. The long freight trains (many over 100 cars long) with the limited speed of 20 mph at this spot, together with the inherent high degree of schedule uncertainty of freight traffic make any reliable airport shuttle service impossible. The River Rouge drawbridge must open for river traffic. On a busy day there can be as many as eight openings of almost 20 minutes each.

- Purchase of rolling stock: 6 single unit Rail Diesel Cars (RDCs).

**Annual costs:**

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capital charges</td>
<td>$ 10 million</td>
</tr>
<tr>
<td>Rental charges</td>
<td>3.2 million</td>
</tr>
<tr>
<td>Usual operating and maintenance expenses</td>
<td>1.35 million</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>14.5 million</td>
</tr>
<tr>
<td>Expected annual revenue</td>
<td>3. million</td>
</tr>
</tbody>
</table>
The rental charges were based on a rate of $5.00 per train mile. The usual operating and maintenance expenses include:

- Wages for the train crew (2 man crew) $0.43 million
- Wages for the engine crew (1 man crew) 0.215 million
- Wages for the non-operating functions (managerial and administrative functions including cleaning and maintenance staff) 0.39 million
- Maintenance and operating costs (fuel, parts, supplies, and shop costs, exclusive of labor), based on a rate of 40 cents per car mile $0.31 million

**TOTAL** $1.345 million

The SEMTA report concludes that minimal changes in rail facilities between Downtown Detroit and Detroit Metropolitan Airport cannot make fast and reliable airport rail service available. On the other hand, the magnitude of expenditures required to make such service feasible is considered to be far in excess of the benefits to be gained, inasmuch as use of existing railroad facilities would only service Detroit's CBD and Airport locations. This, however, doesn't mean that no efforts should be undertaken in the future within this corridor. Quite the contrary, with passenger volumes in air travel and with highway traffic volumes increasing, high-speed airport transit services will soon become a necessity. But such a service will be feasible only within the frame and as part of a comprehensive regional transit network which accommodates and serves the needs of the airport access in conjunction with the internal regional transportation needs. Unfortunately, the question why the existing railroad doesn't satisfy the regional needs in the best way can't be answered within the scope of this paper. The negative conclusion of SEMTA, again, doesn't mean that no portions of the existing railroad could be used for a modern rapid transit facility by building it alongside of, above, or under the existing railroad rights of way.

For a better understanding of SEMTA's negative conclusions it might be interesting to compare this railroad project with the agency's Woodward line subway project. It must be noted, however, that such a comparison isn't very meaningful because the two lines serve different corridors and involve different problems and needs.
Table 15: Comparison of the Downtown-Airport rail shuttle service plan with the Woodward line subway project

<table>
<thead>
<tr>
<th></th>
<th>Downtown-Airport rail shuttle service</th>
<th>Woodward line subway Downtown-State Fairgrounds</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capital costs</td>
<td>$138.5 million</td>
<td>$315 million</td>
</tr>
<tr>
<td>Capital costs per mile</td>
<td>7.7 million</td>
<td>31.5 million</td>
</tr>
<tr>
<td>Operating costs</td>
<td>4.5 million</td>
<td>8 million</td>
</tr>
<tr>
<td>Operating costs per mile</td>
<td>0.25 million</td>
<td>0.8 million</td>
</tr>
<tr>
<td>Revenue</td>
<td>3 million</td>
<td>14 million</td>
</tr>
<tr>
<td>Revenue per mile</td>
<td>0.17 million</td>
<td>1.4 million</td>
</tr>
</tbody>
</table>

The airport line shows much better per-mile rates for the costs. On the other hand, the Woodward line can be expected to perform on a higher level of service in terms of both volume and quality, which is partly expressed by the higher per-mile revenues. Moreover, the fact has to be considered that the airport rail passenger service still has to share its tracks with a heavy freight traffic.

1.1.2 Woodward Corridor

Present commuter railroad service is provided by the Grand Trunk Western Railway (GTW) between Pontiac and Brush Street Station, east of the Civic Center in downtown Detroit. The line first goes about half a mile east of, and parallel to the Chrysler Freeway. On the height of Hamtramck, it changes to the westside of the Chrysler Freeway and goes then parallel to Woodward Avenue in an average distance of about half a mile to the east. There are three trains operated inbound during the morning peak period and three outbound during the evening peak, Monday through Friday. An additional train operates Saturday morning inbound and in the evening outbound. The trains make intermediate stops in Bloomfield Hills, Birmingham, Royal Oak, Pleasant Ridge, and Ferndale. The scheduled running time is 55 minutes for the 26 mile trip from Pontiac to downtown Detroit, 42 minutes for the 18 mile trip from Birmingham, and 34 minutes for the 13 mile trip from Royal Oak. The DSR (Department of Street Railways) provides connecting bus service to the Central Business District from Brush Street and vice versa. Trains also stop at the Chrysler plant in Highland Park and at Milwaukee Junction, about 7/8 mile from the New Center. DSR operates shuttle buses between the latter station and the New Center.

The potential of the line for increased commuter service was investigated by supposing three alternative levels of service and determining their costs and operating characteristics, and their effect upon GTW freight service, and the impact on the ridership volume.

The first level continues the current service of three daily round trips, but would add some light capital and operating improvements designed to increase patronage, while somewhat reducing operating costs.
The second level would greatly increase peak hour service and inaugurate off-peak service. 10 inbound trains would arrive in downtown between 7:20 a.m. and 9:10 a.m. In off-peak hours trains would operate every 20 minutes. In spite of this substantial improvement, the frequency is not nearly as intense as would be with a newly constructed rapid transit line. In order to achieve shorter travel times a skip-stop service could be introduced in the peak period with one train stopping at Birmingham, Royal Oak, and Milwaukee Junction and the other stopping at all other stations. The projected ridership with this improved service is approximately three times current ridership. 23 new self-propelled rail diesel cars would be required. A continuation of the Railway Company's intensive freight service would need the installation of a Centralized Traffic Control System to allow two-way running on each track, and automatic switch machines, and possibly revised switch location, to allow for a high degree of flexibility in operations.

The third level of service would include the construction of a double track grade separated railway over the 48 existing grade crossings, between Eleven Mile Road and Brush Street Station. The ridership is projected to approximately 6,600 trips in both directions and per day, of which about 1,500 inbound trips would be made in the morning peak hour.

The costs of this third level of service, which is the closest to the one offered by a newly constructed rapid transit line, but still clearly inferior, are given below:

**Capital costs:**

- Acquisition of 23 new self-propelled rail diesel cars $6.329 million
- Centralized traffic control system, automatic switch machines, revised switch location over 1. million
- Miscellaneous yard, terminal and maintenance facility improvements $1. million

Sub-Total (for service level two) $8.3 million

- Double track grade separated railway over the 48 existing grade crossings 33. million

**TOTAL** 41.3 million

**Total operating costs:** (do not include annual capital charges)

- Annual revenue $1.925 million
- Annual deficit $1.14 million
- $0.785 million
1.1.3 Michigan Avenue Corridor

Penn Central Railroad operates one commuter train daily in each direction between the Michigan Central Station and Ann Arbor with an intermediate stop at Ypsilanti. Amtrak provides rail passenger service on the same tracks by two Detroit-Chicago round trips daily. For most commuters to downtown, the Central Station is located too far away from their work places. The distance to Kennedy Square, for instance, is 1 3/4 miles. The line follows Michigan Avenue as far as Ypsilanti and then the Huron River between Ypsilanti and Ann Arbor.

The SEMTA Report assumed that a ten-year life span will cover the maximum period over which commuter service might be operated prior to the implementation of a rapid transit system in the corridor. This did not justify substantial capital improvements. The segment of the line between Ann Arbor and Detroit is a double tracked and largely grade separated right-of-way, with fairly well maintained track capable of high capacity operation along most of its length. A service level of three trains in each direction on weekdays with stops at additional stations was assumed. So capital improvements were limited to the acquisition of used rolling equipment, the construction of five new stations, and track improvements east of Central Station for an extended service to the Civic Center area. With this extension the ridership is expected to increase from the present 70 passengers to about 800, plus some local ridership along the route. In order to maintain or improve present reliability of service, reverse signaling to make possible simpler train movements in both directions on each track would be necessary. Otherwise, more frequent conflicts with freight movements, including a large number of "symbol freight" trains, which have priority over many other trains, can't be avoided.

Costs:

- Capital expenditure, resulting in an annual capital charge of $1.67 million
  0.177 million
- Total annual operating cost 0.777 million
- Total annual cost, providing for 10% contingencies $1.050 million
- Total annual revenue 0.274 million
- In addition: Capital expenditure for reverse signaling: $0.76 million, as a shared cost only $0.19 million

The figures show that the volume of service proposed is rather low. For a relevant comparison between the two alternatives "commuter train" and "new rapid transit" the scope of study of this corridor was too narrow. The potential for a commuter service on a much higher level with substantial capital improvements should be investigated as well. However, the fact that conflicts between passenger and freight traffic will occur presumably limits the success of commuter train operation in this corridor, the same as in the formerly discussed corridors.
1.1.4 Plymouth Corridor

The Chesapeake and Ohio Railway route to Plymouth starts at the Fort Street Union Depot in downtown Detroit. From there it goes to Delray Junction, then along the eastern edge of Ford Motor Company's River Rouge Plant, then diagonally to the northwest, and finally halfway in between of Schoolcraft Avenue and Plymouth Road out to Plymouth. The portion between Union Depot and Delray Junction is the same as for the airport corridor line. Jefferson viaduct and Delray Junction are the heavy obstacles on this section. The extensive through and local freight traffic would not affect too much a modest commuter service and vice versa because of the existence of a Centralized Traffic Control (CTC). However, at present, rail management is not in favor of an inauguration of commuter rail service. It is mainly concerned with its growing and important freight service, especially to the automotive industry, with its delicate scheduling problems.

A level of service of three round trips daily and four intermediate stops at additional stations was assumed.

Costs:

- Capital expenditure $1.18 million
  resulting in an annual capital charge of 0.125 million
- Total annual operating cost 0.652 million
- Total annual cost, providing for 10% contingencies 0.855 million
- Total annual revenue 0.309 million

Again, a life span of 10 years was assumed with a new rapid transit system serving the corridor after this time period. The investigation of commuter service potential seems, therefore, to be too narrow in scope again.

High capital expenditures for eliminating some of the worst obstacles, namely the ones located in the portion between Union Depot and Delray Junction, including the latter one, could be shared with two other corridors, the airport corridor and the Fort Street corridor.

Another solution for improving speed and reliability was mentioned in the SEMTA report, but cost estimates could not be given. This would be a switching from the C&O Plymouth line to the Penn Central's Ann Arbor line (Michigan Avenue Corridor) at their crossing at the northeast corner of the River Rouge Plant. Through this the corridor could benefit from both the better track conditions on this other line and a possible extension of the line from Central Station to the Civic Center area.
1.1.5 Fort Street Corridor

Four existing railroads were considered for their suitability for commuter service between Monroe and downtown Detroit. The Detroit and Toledo Shore Line (DTSL) seems to offer the least problems. It is primarily a single track railroad which had never operated regular passenger service.

With an assumed life span of ten years prior to the inauguration of a new rapid transit line, a service level of three trains daily each way was proposed. For offering the necessary access to the downtown Detroit, trackage rights will have to be acquired from other railroad companies. Trains could thus operate to either Union Depot or Central Station. The preliminary cost estimate is based on the first solution. Capital expenditure includes the acquisition of used rolling equipment and the construction of six new stations.

A more radical improvement program would face partly the same capital expenditures as mentioned for the Airport Corridor, which are the rebuilding of the Jefferson viaduct, the extension to Kennedy Square, a bypass under Delray Junction and the River Rouge drawbridge.

Costs of the less ambitious plan:

- Capital expenditure $1.15 million
  resulting in an annual capital charge of 0.122 million
- Total annual operating cost 0.614 million
- Total annual cost, providing for 10% contingencies 0.810 million
  Total annual revenue 0.160 million

1.1.6 Gratiot Corridor

Grand Trunk Western Railway operates freight trains on its line which is connected at Milwaukee Junction with its other line from Pontiac to Brush Street Depot. The single track line goes roughly parallel to and northwest of Gratiot Avenue with a varying distance of 1/4 to 3 miles out to Port Huron. A service level of three trains daily each way between Port Huron and Brush Street station with six new intermediate stations was assumed together with a life span of ten years. Used rolling equipment would have to be acquired.

Costs:

- Capital expenditure $1.76 million
  resulting in an annual capital charge of 0.187 million
- Total annual operating cost 0.732 million
- Total annual cost $0.919 million
**Additional improvements:**

- **Signaling improvement between Milwaukee Junction and Port Huron**  
  (Incremental annual cost $0.117 million)  
  $1.105 million

- **Push Pull Equipment**  
  (Incremental annual cost $0.028 million)  
  $0.28 million

**Total annual revenue:**  
$0.299 million

### 1.1.7 Discussion of the report's findings

Rail passenger service for both commuter and long-distance trips has been drastically reduced and even discontinued on many lines in the Detroit region. Due to the private enterprise base which understandably couldn't include such social goals as offering transportation service for the poor or helping to reduce the negative impacts of private car traffic, service was gradually reduced as ridership declined. This in turn probably accelerated the decline in railroad ridership. Quite in contrast to European railroads and to a few lines in a couple of United States cities, no efforts were made to upgrade the railroads in the Detroit region and to gradually adapt them to the more pretentious requirements of modest passenger transportation. Track maintenance was neglected with the result that considerable reductions in speed limits were imposed, not so much affecting the freight traffic, but hopelessly destroying the attractiveness of passenger trains. Very few capital expenditures were made to install modern signaling devices and to eliminate the numerous grade crossings with the street network. European railroads usually were not bringing much profit in the last decades. Different kinds of subsidies and financial aid were and are quite common and widely accepted by the public opinion realizing the social component of rail transportation. This aid, however, remained always on a modest scale just enabling the railroads to maintain or usually improve the level of service. Today, for the most part, no problems of revitalization occur involving such huge amounts of capital as the ones mentioned in the SEMTA report.

Of course, other factors were responsible too for the decline of the railroads. Their mentioning is not of great importance in this context. The foregoing comparison of public transportation policies shall only show the importance of a fundamental re-thinking of this country's transportation policy, because changes on this basic level could radically change the scale of and the kind of approach to future revitalization projects.

Based on the assumption that a completely independent (from the existing rail network) rapid transit system will be in existence in about ten years, the SEMTA study was mainly concerned with short-term, minimum cost improvements. An exception was made for the Airport Corridor and the Woodward Corridor. The results for these two corridors, however, suggest that this way of concern was not as wrong as it seems to be, although the ten year span
appears too optimistic. In spite of considerable capital expenditures, the possible level of service remains far below what a new rapid transit system is capable of offering. The main reasons for this shortcoming are the intense freight traffic on all lines which serve the region as one of the most industrialized areas of the country and the inadequate routing of the existing rail network for commuter service. Improved commuter railroads, therefore, can't be considered a full compensation for rapid transit. What the study clearly showed is the need and the feasibility of commuter trains as a supplement to the existing transportation system, as well as to any additional urban transit system.

It would have been interesting if the study had been extended in the way of investigating in addition the costs and benefits of a more fundamental change. Evidently such an idealized system would not be feasible, but it would show more clearly some of the disadvantages of the whole institutional framework. The study proceeded in the way of considering separately corridor after corridor, and where existing, line after line in each corridor. On all lines similar restrictions reduce the potential for commuter service. It can be assumed that an overall study of the freight movement could show much open capacity simply by a more rationalized system. Every line keeps a share of the freight traffic volume, because it represents the only financial base. At some places two or more lines offer exactly the same service which consequently leads to idle capacity for freight traffic. It means at the same time a partial occupancy of each of the lines by freight traffic, thus preventing an efficient commuter service. With the construction of some rail links and perhaps some plant relocations for which rail freight traffic would be disrupted, some lines could be made free of freight traffic.

1.1.8 Summary of ridership projections made in the SEPTA report and comparison with total passenger traffic to downtown Detroit

Table 16: Summary of capital expenditure and trip projections for the commuter lines

<table>
<thead>
<tr>
<th>Corridor</th>
<th>Capital Expenditure</th>
<th>TRIPS TO DOWNTOWN</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Million $</td>
<td>All Day</td>
</tr>
<tr>
<td>Woodward</td>
<td></td>
<td></td>
</tr>
<tr>
<td>highest level</td>
<td>41.3</td>
<td>3,300</td>
</tr>
<tr>
<td>medium level</td>
<td>(8.3)</td>
<td>(2,200)</td>
</tr>
<tr>
<td>lowest level</td>
<td>(0.47)</td>
<td>(940)</td>
</tr>
<tr>
<td>Michigan Avenue</td>
<td>1.86</td>
<td>810</td>
</tr>
<tr>
<td>Plymouth</td>
<td>1.18</td>
<td>820</td>
</tr>
<tr>
<td>Fort Street</td>
<td>1.15</td>
<td>585</td>
</tr>
<tr>
<td>Gratiot</td>
<td>3.12</td>
<td>860</td>
</tr>
<tr>
<td>TOTAL</td>
<td>48.61</td>
<td>6,375</td>
</tr>
</tbody>
</table>
The Airport Corridor was not included because it provides specialized shuttle service between the airport and the downtown. It doesn't serve substantially the internal regional transportation needs.

To get an idea about the order of magnitude of the above ridership figures, they are compared with the trip projections made by the CBD transportation study and which are listed in Chapter I:

**Morning inbound peak hour person trips to the CBD:**

<table>
<thead>
<tr>
<th>Total</th>
<th>77,300</th>
</tr>
</thead>
<tbody>
<tr>
<td>By transit</td>
<td>40,940</td>
</tr>
<tr>
<td>(commuter trains 4,180)</td>
<td></td>
</tr>
<tr>
<td>By car</td>
<td>36,360</td>
</tr>
</tbody>
</table>

**12-hour daytime person trips to the CBD:**

<table>
<thead>
<tr>
<th>Total</th>
<th>340,800</th>
</tr>
</thead>
<tbody>
<tr>
<td>By transit</td>
<td>150,800</td>
</tr>
<tr>
<td>(commuter trains 6,375)</td>
<td></td>
</tr>
<tr>
<td>By car</td>
<td>190,000</td>
</tr>
</tbody>
</table>

In percentages of the total trips the share of the commuter trains would be 4.2% for the peak hour and 1.9% for the 12-hour daytime period.

1.2 Rail Commuter Service in Other Cities

A comparison with rail commuter service in other cities might give some understanding of the market potential for such a service.

1.2.1 Philadelphia

Philadelphia was one of the first areas in the United States to develop a network of commuter rail services. It has two high-speed electrified rail systems, the Pennsylvania Railroad (PRR) and the Reading Railroad (RDG), comprising a total of thirteen lines. The system with its 265 miles forms the most extensive commuter line network in the United States. Over 700 trains carry approximately 110,000 passengers daily within this system. 25,000 trips daily or 7.2% of the total 350,000 trips to the downtown Philadelphia are made by train (in one direction). This compares very favorably with the 6,375 projected (!) trips in Detroit.

As in all other cities, public transportation had fallen upon bad times in Philadelphia too. However, the decline in ridership and service never went as far as in most other cities and especially in Detroit. In many cases, the rush-hour use of trains still continued to increase and it was mainly the off-peak use which dropped greatly. Probably due to the many years' experience of the benefits of rail transportation, the threat of

38) see: Southeastern Pennsylvania Transportation Authority, "Commuter Railroad Service Improvements for a Metropolitan Area - SEPACT I", Final report, April 1969.
service cuts and deteriorating equipment was realized and action undertaken. In the fall of 1961, the Southeastern Pennsylvania Transportation Compact - SEPACT was founded between the City of Philadelphia and the counties of Bucks, Chester, and Montgomery with the goal of helping regional rail transportation. Attempts were successfully undertaken even before that date by the City of Philadelphia alone. SEPACT then managed to realize the first federally assisted commuter railroad demonstration project in the nation, called SEPACT I, from 1962 to 1965. The test program included:

- Increased Service: improving timing, frequency, travel time and reliability of trains;
- Fare Reduction: in addition to a simplified system of zone fares, ticket sales and collection;
- New Equipment: adding to the comfort of the commuter and to the image of mass transportation;
- Parking Improvements: in low-density areas, for park-and-ride;
- Bus-Train Transfers
- Promotion, Publicity and Information

Three existing commuter railroad lines out of the 13 lines were selected, adding up to a total track length of 58 miles. The costs were approximately $4.7 million, 2/3 of which were provided by the federal government. The results were an increase in ridership of 42% on the North Penn-Hatboro lines (includes 2 of the 3 lines) and 145% on the Levittown line. The increases in train frequency were 16.1% from 833 to 1,025 trains in a 7-day week on the North Penn-Hatboro lines and 47.3% from 134 to 198 trains on the Levittown line.

1.2.2 Chicago

Due to the size and shape of this city, commuter trains are a very important element in the whole transportation system. They are operated by six private railroad companies without any kind of subsidies. Although not usually profitable, they have continued in operation. In addition to these six, several railroad companies operate one or two trains each during the peak morning and afternoon periods. The six major companies operate on 12 lines, all radiating from the central core of the city, and going as far as about 40 miles as a maximum. The railroads do not operate through-routings across downtown Chicago; each commuter train terminates in a downtown terminal. From there, usually no facilities for collection and distribution of passengers within the central area exist to date. Improvements, however, are planned for the near future. The following list of the modal split of the daily number of passengers entering the Central Business District shows the importance of commuter railroads.

Table 17: Modal split of trips made to the CBD Chicago (Time 7:00 a.m. to 7:00 p.m., Year 1967, area bounded by Roosevelt Road, Lake Michigan, and the Chicago River)

<table>
<thead>
<tr>
<th>Mode</th>
<th>Number of entering passengers</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Private autos</td>
<td>295,266</td>
<td>33</td>
</tr>
<tr>
<td>C.T.A. buses</td>
<td>136,613</td>
<td>16</td>
</tr>
<tr>
<td>All other buses</td>
<td>19,440</td>
<td>2</td>
</tr>
<tr>
<td>Taxicabs</td>
<td>44,726</td>
<td>5</td>
</tr>
<tr>
<td>Service vehicles</td>
<td>19,306</td>
<td>2</td>
</tr>
<tr>
<td>Subway and &quot;El&quot;</td>
<td>252,875</td>
<td>29</td>
</tr>
<tr>
<td>Railroads</td>
<td>115,033</td>
<td>13</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>883,259</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

Mass transportation accounts for 60% of all trips for a 12-hour period. For rush-hour traffic this share is still higher. The figure of 115,033 corresponds to the one of 1942. There was a peak of 158,000 in 1946. Since then the volume steadily decreased until 1964 on a level of 105,004. After that date, ridership increased again.

2. New Rail Rapid Transit

2.1 The SEMTA Project

Early in 1970, SEMTA began its investigations of rapid transit. In a first phase, ending at about the end of the year, a broad-scale evaluation of alternative rapid transit technologies was undertaken to identify opportunities that can be expected to be available in the foreseeable future and effects that technological selection would have on long-term costs and benefits for the region as a whole. The technologies considered were steel rail rapid transit, lightweight rubber traction, suspended monorail, buses on exclusive subways, and buses on conventional highways. Based on a number of criteria, the first one turned out to be the most favorable. The following criteria were used: system costs (property acquisition, fixed facilities, vehicles), annual operating costs, user costs (time), increased arterial congestion, and increased regional air pollution. Additional criteria were judged as not showing significant differences between the technologies evaluated.

Early in 1971, the Authority Board made the decision to examine in greater detail the opportunities for development of rail rapid transit in the Woodward corridor. Of course, the Woodward line would be only the first step towards a whole network of lines. The decision where to start with the


implementation of such a network is not an easy one for political reasons. However, out of the existing travel and land use patterns, the Woodward line must evidently be considered as having first priority, the more as it is a general belief that the first existing line should prove even in the short-range its advantages. The location of the largest number of major institutional centers along this line already guarantees a certain level of ridership. Some of these centers are the Detroit Medical Center, Wayne State University, the Detroit Public Library, the Detroit Institute of Arts, Michigan State Fair Grounds, and the Detroit Zoo which all give rise to large travel volumes.

The report by L. Klauder and Associates investigated the alternative possibilities of alignment and profile for such a rail rapid transit in the Woodward corridor. The following scheme shows the alternatives for each of the four segments. The segments were established in order to allow a staging for the implementation. The alternatives selected by SEMTA are the ones in a frame.

<table>
<thead>
<tr>
<th>1st Segment:</th>
<th>2nd Segment:</th>
<th>3rd Segment:</th>
<th>4th Segment:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Union Depot to State Fair</td>
<td>State Fair to Ten Mile Road</td>
<td>Ten Mile Road to Big Beaver</td>
<td>Big Beaver to M-59 (Pontiac)</td>
</tr>
<tr>
<td>Woodward Avenue, Underground throughout, 9.2 miles, $315.30 million*</td>
<td>Woodward Avenue, Underground throughout, 2.8 miles, $79.37 million</td>
<td>Woodward Avenue, Elevated viaduct, 6.9 miles, $129.19 million</td>
<td>Woodward Avenue to Wilson Ave., West Side GTW, Elevated viaduct and at grade, 8.2 miles, $128.03 million</td>
</tr>
<tr>
<td>Woodward Avenue turning into State Fair Grounds, Underground throughout, 9.3 miles, $315.80 million</td>
<td>State Fair Grounds turning into GTW, at grade through Ferndale yard, elevated viaduct north, 2.9 miles, $73.34 million</td>
<td>GTW, Elevated viaduct to 11 Mile, existing fill north, 7.0 miles, $82.24 million</td>
<td></td>
</tr>
<tr>
<td>Woodward Avenue turning into State Fair Grounds, Elevated viaduct from McNichols north, 9.3 miles, $306.84 million</td>
<td>State Fair Grounds turning into GTW, at grade through Ferndale yard, elevated viaduct north, 2.9 miles, $76.85 million</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* construction costs

The selected alternative has a total length of 27.4 miles, and total construction costs of $573.94 million. The frequency of service was assumed as follows:

Table 18: Frequency of service on projected Woodward line

<table>
<thead>
<tr>
<th>Period</th>
<th>Hours</th>
<th>Maximum Headway (minutes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Morning</td>
<td>5 a.m. - 7 a.m.</td>
<td>6</td>
</tr>
<tr>
<td>Morning Peak</td>
<td>7 a.m. - 9 a.m.</td>
<td>3</td>
</tr>
<tr>
<td>Midday</td>
<td>9 a.m. - 4 p.m.</td>
<td>6</td>
</tr>
<tr>
<td>Afternoon Peak</td>
<td>4 p.m. - 6 p.m.</td>
<td>3</td>
</tr>
<tr>
<td>Evening</td>
<td>6 p.m. - 8 p.m.</td>
<td>6</td>
</tr>
<tr>
<td>Night</td>
<td>8 p.m. - 12 p.m.</td>
<td>10</td>
</tr>
<tr>
<td>Owl</td>
<td>12 p.m. - 5 a.m.</td>
<td>20</td>
</tr>
</tbody>
</table>

Once the third and fourth segments are implemented, a skip-stop service on all stations north of Eight Mile Road will be introduced in the time between 5 a.m. and 8 p.m.

2.2 Ridership of New Rapid Transit

Ridership projections represent an important issue in any discussion about new rapid transit lines. The main reason is, of course, its importance for the revenue projection. But even if the principle of covering either the total costs or only the operating costs through the fares is abandoned, a high ridership still has to be considered as an important criteria.

A special study was undertaken to make ridership projections for the Woodward line. Only the 1990 figures for the selected alternative (see 2.1) and for the final stage with all four segments in existence are given below:

Table 19: Ridership projections for Woodward line

<table>
<thead>
<tr>
<th>Description</th>
<th>Ridership (1990)</th>
</tr>
</thead>
<tbody>
<tr>
<td>24-Hour inbound trips to the CBD</td>
<td>52,403</td>
</tr>
<tr>
<td>24-Hour inbound trips, off at Mack/Medical Center</td>
<td>6,325</td>
</tr>
<tr>
<td>24-Hour inbound trips, off at Warren</td>
<td>7,007</td>
</tr>
<tr>
<td>24-Hour inbound trips, off at Grand Boulevard</td>
<td>3,716</td>
</tr>
<tr>
<td><strong>TOTAL 24-HOUR PRIMARY INBOUND RIDING</strong></td>
<td>69,451</td>
</tr>
</tbody>
</table>

"Primary riding" is defined here as opposed to reverse, intraline, and external riding which means:

- reverse riding: a from-home transit trip that originates in the corridor and travels outbound toward Pontiac;

- intraline riding: inbound ridership originating at and destined for stations north of Grand Boulevard, i.e. north of the Central Functions Area;

- external riding: a transit trip that has either an origin or destination (but not both) within the corridor.

Reverse, intraline, and external ridership = 20% of primary inbound riding

Total 24-hour primary inbound riding = 13,890

Both ways - twice as much, daily 24-hour ridership on the line = 69,451

The peak-hour volume of the primary inbound riding was projected at 15,934. This includes trips to destinations outside the CBD, but within the Central Functions Area. The annual revenue based on this ridership was estimated at $23.2 million.

It might be interesting to compare these estimates with the projections made in the CBD transportation study which was described in the first chapter:

- Trip attractions to the CED, by transit in the daytime = 150,800
- Trip attractions to the CED, by transit in the nighttime = 23,600
- Trip attractions to the CED, by transit in 24 hours = 174,400

The two corresponding figures show a reasonable proportion with 174,400 transit trips to the CBD from all corridors on one side and something more than 52,403 on the Woodward line on the other. However, it must be considered that the CBD study is based on an employment of 150,000 while the Woodward line projections result from an employment of 125,000 only. A proportional adjustment of the 174,400 figure to the lower employment level amounts to 145,000 transit trip attractions to the CED. Probably this figure would still be lower because of the lower congestion on the highways due to the reduced total number of trips to downtown.

The Project Definition Report did not make a ridership projection. But it had to base its revenue-expenditure considerations on assumed ridership figures which were:

44) It is more because reverse and external riding is not yet included in this figure.

- Low figure = 40,000 trips (reflects current volumes on bus services in the Woodward corridor)
- Medium figure = 120,000 trips
- High figure = 200,000 trips (represents an optimistic view of maximal diversion of riders to rapid transit)

These are the trips expected on the whole line between Union Station and Pontiac, in both ways and per day. Preliminary results of the Demand Analysis were available for these assumptions.

Operating costs (without interests and amortization of capital expenditures, but with sinking fund from which to finance replacement of equipment) and farebox revenues were estimated for the three levels of ridership:

<table>
<thead>
<tr>
<th>Level</th>
<th>Revenues</th>
<th>Operating costs</th>
<th>Balance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>4.46</td>
<td>9.13</td>
<td>-4.67 million $</td>
</tr>
<tr>
<td>Medium</td>
<td>13.39</td>
<td>13.50</td>
<td>-0.11 million $</td>
</tr>
<tr>
<td>High</td>
<td>22.32</td>
<td>17.92</td>
<td>+4.40 million $</td>
</tr>
</tbody>
</table>

With the projected ridership of 166,681 a level between "medium" and "high" would be reached, resulting in a positive balance of about 2 million dollars per year.

It might be interesting to compare these projections with the ridership figures of the Toronto subway system, together with some other characteristics:

- Toronto: Daily passengers 1972 in all directions, from 6 a.m. to 2 a.m. \(^{47}\) 553,246
- Detroit: Daily passengers 1990 on Woodward line from Downtown to Pontiac 166,681


\(^{47}\) Toronto Transit Commission, "Subway Station Usage Counts", 1972.
Table 20: Comparison of projected figures for Detroit with data from Toronto

<table>
<thead>
<tr>
<th></th>
<th>Toronto</th>
<th>Detroit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length of rail rapid transit system</td>
<td>20.73</td>
<td>27.4</td>
</tr>
<tr>
<td>(subway and other) in miles</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of stations</td>
<td>45</td>
<td>23</td>
</tr>
<tr>
<td>CBD area in square miles</td>
<td>3.5</td>
<td>1.25</td>
</tr>
<tr>
<td>(Toronto: bounded by Spadina Ave., Bloor Street, Sherbourne St., and the Gardiner Expressway)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Daily transit passengers entering the CBD (on the systems discussed here)</td>
<td>225,199</td>
<td>52,403</td>
</tr>
<tr>
<td>Number of transit trips entering the CBD in the peak-hour (Toronto 8 a.m. to 9 a.m.)</td>
<td>57,060</td>
<td>Something less than 15,934</td>
</tr>
</tbody>
</table>

These figures show that the Detroit system must expect a much lower ridership in 1990 than the present ridership of the Toronto system, and this in spite of its longer length. Judging from this, it could be assumed that the proposed Woodward line will not, by far, be as successful as the Toronto system. However, such a comparison cannot be taken as the only one criteria because the external benefits can sometimes justify the construction of a subway at much lower levels of ridership. The CBD transportation study, in spite of its car orientation, called for some sort of rapid transit handling nearly 42,000 peak-hour trips to and from the CBD with part of it assigned to the Woodward line. Given such a need for a new system the question gets very important as to how much simultaneous improvement of the private vehicle system is still compatible in order to have the new system working satisfactorily.

2.3 Potential for Development and Revitalization

This is a relatively new and at the same time very controversial aspect of rapid transit. Originally the role of rapid transit was to alleviate congestion and to bring more people in a shorter time to special places, usually to the CBD. It was mainly in the last decade with its efforts to overcome the phenomenon of decaying central cities that this additional, potential role was increasingly realized. So this issue is also of particular relevance for the Detroit CBD.

48) This figure is compiled from the figures in 1).
Two characteristics of a rail rapid transit system are mainly responsible for its potential for development or redevelopment. Of course, this is to some extent true for other major investments in the traffic sector, but the influence of rail rapid transit might be the most effective one. The first characteristic is the enormous capital which is locally fixed for very long periods of time. This creates an atmosphere of stability in these locally restricted areas which often lacks in many urban regions of the United States, due to the high mobility of individuals and firms. Big building developments can also -- and usually do -- bring stability to an area, but the still longer life span and the higher amount of capital of transportation facilities make the latter ones more effective. The second characteristic results from the high capacity and speed of rail rapid transit. Areas connected or adjacent to such a system get a substantial advantage through their increased accessibility. That is why route location of a rapid transit system is more than just accommodating certain trip patterns and why it can be an important political question. An equally distributed accessibility pattern, as it is perhaps represented the closest by a street system with no expressways, is completely changed with a rapid transit system. Very sharp differences in accessibility are superposed to the original pattern. The preferential areas obviously get a potential for development.

One of the best examples throughout the world of this new role of rapid transit is Toronto. But it was rather a welcome consequence than really intentioned and planned. Nevertheless, it gives some empirical base for applying it as a tool in the future. On both lines, the Yonge line and the Bloor-Danforth line, a rapid growth occurred in the years following their inauguration, and it continues still today. The development impacts of the Yonge-line which was completed from Union Station to Eglinton Avenue Station in the spring of 1954 are described in a publication. The length of this lines is 4.5 miles thereof 3 miles are underground. It is probably impossible to say in how far the development took place as a consequence of the subway construction and in how far it is a mere coincidence. But it is a fact anyway that the area along the line experienced a remarkable boom which is shown by the following figures:

- Between 1952 and 1962, the increase in tax assessment in districts contiguous to the Yonge line was:
  45% in the downtown area and
  107% from College Street to Eglinton Avenue which is an area extending from the northern border of downtown to the northern terminal of the line.

The corresponding figure for the rest of the city is only 25% on the average.

- The districts along the Yonge line had the following share in new development in the city of Toronto which contains 24 of these districts.

49) It can be this for other reasons too.

Table 21: Development in the planning districts along the Yonge line (five-year period between 1959 and 1963)

<table>
<thead>
<tr>
<th>Planning districts</th>
<th>Kind of development</th>
<th>Square feet developed</th>
<th>% share of whole city</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yorkville, Annex, Deer Park, Eglinton Park</td>
<td>high-rise apartments</td>
<td>4.133 million</td>
<td>48.5</td>
</tr>
<tr>
<td>Downtown, Yorkville, Eglinton Park</td>
<td>offices</td>
<td>5.036 million</td>
<td>90.0</td>
</tr>
</tbody>
</table>

Similar developments occurred along the other subway line, the Bloor-Danforth line which was completed in February 1966.51

Whether the same phenomena could be expected in Detroit after completion of a subway can only be guessed in the following way: Development or redevelopment will probably be accelerated and intensified in the areas which are served by the new rapid transit system, including the Detroit CBD. However, it is doubtful whether this process will be of the same magnitude as in Toronto.

It is not intended to make an analysis of the similar and differing factors and constraints influencing the growth pattern in both cities. But it should be mentioned that both cities have much in common although they differ in a few important features. Both are strong industrial cities. The same as Detroit today, Toronto did not have a tradition of having an attractive city center, and high-rise apartments did not exist prior to the implementation of the subway. The decentralization is perhaps further advanced in Detroit than it was in Toronto twenty years ago. The fact that Detroit would have to start with the same processes twenty years later cannot be neglected either. But again, both cities have many strong ethnic groups, with the obvious difference of a much higher black population in Detroit. Two diverging features are the variety of industry and business and the degree of competition with other cities. The automotive industry of the Detroit region, together with a whole set of dependent industries and establishments, is nationally and internationally oriented. Toronto with a high variety of industries has the advantage that some of them are much more related and committed to the region or even the city. They usually assume more responsibility for and interest in their home city than an international company. Unlike Detroit, Toronto does not have many competitors. In the national frame it can consider itself as a successful rival of Montreal only.

51) Toronto Transit Commission, "Development Follows Toronto Subway".
Some considerations on the influence of rail rapid transit on housing were already made in the first chapter (4.2). The rather pessimistic view that housing could be threatened by an accelerated growth was mentioned there. This problem of some European cities obviously did not occur in Toronto, at least on a city-wide basis, as the table on the following page shows:
Table 22: Yearly Changes in Housing Stock for the City of Toronto

<table>
<thead>
<tr>
<th>Year</th>
<th>Apartment Units</th>
<th>Other Rental Units</th>
<th>Conversions</th>
<th>Total</th>
<th>Units Demolished (estimated)</th>
<th>Conversions</th>
<th>Total</th>
<th>Net Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>1962</td>
<td>1,273</td>
<td>140</td>
<td>391</td>
<td>1,804</td>
<td>1,050</td>
<td>7</td>
<td>1,057</td>
<td>+747</td>
</tr>
<tr>
<td>1963</td>
<td>3,471</td>
<td>161</td>
<td>75</td>
<td>3,707</td>
<td>1,500</td>
<td>11</td>
<td>1,511</td>
<td>+2,196</td>
</tr>
<tr>
<td>1964</td>
<td>2,603</td>
<td>162</td>
<td>68</td>
<td>3,833</td>
<td>1,130</td>
<td>21</td>
<td>1,151</td>
<td>+2,682</td>
</tr>
<tr>
<td>1965</td>
<td>6,537</td>
<td>428</td>
<td>89</td>
<td>7,059</td>
<td>2,040</td>
<td>15</td>
<td>2,055</td>
<td>+5,004</td>
</tr>
<tr>
<td>1966</td>
<td>7,998</td>
<td>471</td>
<td>38</td>
<td>8,507</td>
<td>1,720</td>
<td>16</td>
<td>1,736</td>
<td>+6,771</td>
</tr>
<tr>
<td>1967</td>
<td>3,610</td>
<td>331</td>
<td>66</td>
<td>4,007</td>
<td>1,300</td>
<td>43</td>
<td>1,343</td>
<td>+2,664</td>
</tr>
<tr>
<td>1968</td>
<td>5,070</td>
<td>351</td>
<td>104</td>
<td>5,524</td>
<td>1,250</td>
<td>46</td>
<td>1,296</td>
<td>+4,228</td>
</tr>
<tr>
<td>1969</td>
<td>3,488</td>
<td>239</td>
<td>179</td>
<td>3,906</td>
<td>930</td>
<td>63</td>
<td>993</td>
<td>+2,913</td>
</tr>
<tr>
<td>1970</td>
<td>4,787</td>
<td>198</td>
<td>60</td>
<td>5,045</td>
<td>750</td>
<td>76</td>
<td>826</td>
<td>+4,219</td>
</tr>
<tr>
<td>Total 1966-1970</td>
<td>24,953</td>
<td>1,590</td>
<td>447</td>
<td>27,000</td>
<td>5,950</td>
<td>244</td>
<td>6,194</td>
<td>+20,795</td>
</tr>
</tbody>
</table>

52) Obtained from the City of Toronto Planning Board. The figures have been derived from Building Department records and relate to year of permission, not completion.
Figure 2
Existing and committed parking structure space
Literature


24. Toronto Transit Commission, "Development Follows Toronto Subway".