VOLUME THREE

PROJECTIONS
AND
RECOMMENDATIONS
1968 TO 1991

WINNIPEG AREA TRANSPORTATION STUDY

Prepared for
The Council of the Metropolitan Corporation of Greater Winnipeg

by

The Streets and Transit Division
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FOREWARD

The Winnipeg Area Transportation Study was commenced in 1962, when the collection of basic data necessary for such a study was initiated. The results of the first phase of the study describing the existing land use and travel characteristics were published in February, 1966, as *Volume I: Base Conditions*. A second report titled *Volume II: Travel Analysis* was published in July, 1966. Volume II presented an analysis of the relationships between land use and characteristics and travel patterns in the metropolitan area. This report summarized the development of a mathematical model calibrated to the travel characteristics in Metropolitan Winnipeg and described the model's application in the prediction of future travel patterns.

This third and final report of the study presents the projections of anticipated land development, population, employment and economic growth. Relationships between land use and travel characteristics established in phases one and two were used to develop future travel demands and patterns. A number of alternate transportation system concepts were then developed, tested and then evaluated to determine the type of system which would best accommodate the projected travel demands in this area. From this analysis, the recommended plan was developed which, it is considered, would provide an adequate transportation system capable of accommodating the safe and efficient movement of persons and goods within the metropolitan Area and would satisfy the needs and desires of an increasingly mobile urbanized society. If implemented, the recommended plan should not only keep pace with anticipated growth but, in addition, should direct and stimulate orderly development of Metropolitan Winnipeg.

In conjunction with the recommended plan, cost estimates and a recommended schedule of stage construction are included. In this way, it is hoped that a rational program of implementation will be undertaken, utilizing the foregoing information as a guide for long-range planning, budgeting and policy decisions.

This report culminates six years of comprehensive data collection and tabulation, analysis, testing, functional design and evaluation, utilizing the most recently developed techniques for urban transportation planning and systems engineering. As such, it constitutes a realistic presentation of future transportation needs and the financial requirements necessary to meet these needs. Because of the time required to complete this study and the time lag between approval of concept, design construction and operation be given to the recommendations by the Metropolitan Council and the Provincial Government at the earliest possible opportunity.

While the recommended plan will appear at first glance to provide facilities of a more substantial and costly nature than the Greater Winnipeg area needs of can afford, it is only so when viewed in the light of current transportation requirements. The projections of population growth and land use development on which the transportation plan is based are those of a growing and dynamic urban community.

If the growth potential of the area is to be realized, it will have to be served by transportation facilities as well as other public services. Advance planning and provision for these requirements are essential if they are to be provided in the most economical and orderly way.

ACKNOWLEDGEMENTS

The final phase of the Winnipeg Area Transportation Study involved the cooperation of many organizations, agencies and individuals. Foremost among these were the Planning, Assessment and Finance Divisions of the Metropolitan Corporation of Greater Winnipeg whose staffs provided essential statistics and projections for this study.

Particular appreciation is extended to the Dominion Bureau of Statistics and the Campus Planning Office of the University of Manitoba for making their statistical records available.

Computer consulting services for the third and final phase of this transportation study were provided by Kates, Peat, Marwick and Company.

SUMMARY AND RECOMMENDATIONS

BENEFITS OF THE RECOMMENDED SYSTEM

Capital investment in the construction and renovation of industrial, commercial and residential buildings by private and public owners in the Greater Winnipeg Area averaged close to 100 million dollars annually over the past several years. A conservative projection of this investment over the planning period of this study indicates that a total of nearly three billion dollars will be spent on development in this area over the next 23 years. Such development cannot be realized without an accompanying public investment in facilities and utilities necessary to support and serve it. Roads and public transportation constitute one of the most essential elements of such necessary public services. The recommended transportation plan will provide a good level of mobility to the metropolitan area, the benefits of which will be reflected in the following manner:

1. Substantial direct savings to the average motorist should result from the improved mobility, higher average speed and the overall transportation efficiency provided by the system.
2. The higher operating speeds for transit vehicles together with the more efficient transit system will result in reduced travel time and a more convenient and attractive service for transit riders.
3. Significant direct cost savings should accrue to the trucking industry thus reducing the cost of doing business in the area and indirectly affecting the ultimate cost of goods and services to the community.
4. The recommended system will provide a more attractive environment for investment by business and industry.
5. This system should stabilize existing investment and encourage new investment in the Central Business District by providing good vehicular access and circulation as well as a strong downtown oriented public transit system.
6. The transportation system will increase the opportunities of choice of residence and employment location and will make major recreation and park facilities more accessible to the citizens of the area.
7. The general community environment will be improved through the reduction of traffic on heavily congested arterials and the removal of through traffic on secondary and local streets.
8. The proposed rapid transit line should accelerate significant residential and commercial development along the Portage Avenue-Main Street corridor, resulting in a substantial increase in taxable assessment.

SCHEME I

THE TRANSIT SYSTEM

The transit system (Metro Winnipeg Transit System) investigated in Scheme I resembled the present bus system with existing and new radial routes extended to provide bus service in areas of anticipated residential development in the suburbs. Although this system maintained the strong Downtown route orientation which is characteristic of the present system, new crosstown routes were added which utilized some of the proposed East-West and North-South arterial streets. These routes provided for passenger movement between areas outside downtown without requiring the bus rider to enter Downtown streets. Typical of such routes is the proposed McPhillips-Waverley route which would cross the city West of the Downtown area thus providing an important transit connection between the Northern areas of the city and the employment areas and the University of Manitoba in the Municipality of Fort Garry.

The level of service provided by the proposed bus transit system was extensively upgraded by increasing the number of buses on all existing routes and by the introduction of entirely new transit routes. It is anticipated that the entire system would consist of fuel-operated urban buses, with the phasing out of the present trolley fleet having been completed by 1970.

The transit system visualized in this scheme would involve the introduction of 36 different transit routes totalling 622 route miles and requiring a fleet of 1090 buses. Such an operation would ensure that, on the average, in the peak hours, buses in the metropolitan area would be spaced at 3.38 minute intervals along their routes. This compares with 6.43 minutes under the system in operation in 1962.

Approximately 87 percent of the total developed area projected for that time would be with an acceptable walking distance of a transit line. Buses would serve an area of 97.9 square miles in 1991, compared to 55.6 square miles at the present time. Many routes where heavy passenger corridors are already established would operate at headways as low as 30 seconds apart. Typical of such routes are:

E. Kildonan
Portage
Corydon
N. Main
Pembina

TRANSIT PASSENGER FLOW

Plate 19 illustrates the A.M. peak hour transit passenger volumes carried by the surface bus transit system on an average weekday in 1991. In comparing this and similar illustrations in this report to the transit passenger flow illustrations in Volume One, it should be noted that, because of the projected increase in peak hour ridership in 1991, the scale used to measure passenger flows on the opposite page has been reduced from that used in the first report, with the result that the passenger volume bands shown on Plate 19 would actually be twice as wide had they been drawn to the earlier scale. The importance of the downtown area as a major attractor of transit work trips is emphasized by the 1991 pattern of transit passenger flows. Among the heaviest volumes is that projected for the Portage Avenue route where, approaching the downtown area, approximately 3,900 passengers would have to be accommodated. This compares with about 2,190 recorded in 1962. Main Street North and Henderson Highway are two other important carriers of transit passengers with these routes combining to bring 6,400 passengers into the downtown area.

The increase in bus travel to the University of Manitoba in Fort Garry described earlier in this report is demonstrated by the heavy transit passenger travel southbound along Pembina Highway and Waverley Street. In fact, the proposed transit route utilizing the connection between McPhillips and Waverley Streets would be one of the most heavily used crosstown routes located outside the downtown area. Between Mountain Avenue in the north and the entrance to the University of Manitoba in the south, this route carries between 550 and 1,400 passengers in the peak direction.

The ratio of peak directional passenger volume to seating capacity at the downtown cordon line for all routes entering the central area during the morning peak hour is only 0.432 as compared to the 1.044 ratio observed in 1962. This would indicate that although the frequency of bus service offered by the Scheme I transit system is almost double that available in 1962, the overall level of service is not attractive enough to realize a reasonably efficient utilization of the seat capacity provided.

SCHEME II

THE TRANSIT SYSTEM

The Scheme II test was made primarily to investigate the effectiveness of the Suburban Beltway route in providing service to inter-municipal traffic and to determine its effectiveness on relieving the overloaded street system tested in Scheme I. The transit system in Scheme II remained the same as the system tested in Scheme I. Because of the limited access characteristic of the Suburban Beltway route, the circumferential nature of its alignment and the low density of the suburban development served thereby, it was felt that regular bus service on such a route would not be justified and was not included in this test. It is, however, quite possible that special service to concentrated high density areas might be considered if such a need developed and became apparent in the future.

SCHEME III

THE TRANSIT SYSTEM

The results of the Scheme I and II investigations demonstrated that, in order to be attractive to passengers by providing a high level of service, a transit system of the future could not rely entirely upon surface bus lines sharing the surface street system with other traffic. Accordingly, an extensive system of rapid transit lines operating at high speeds on exclusive grade separated rights-of way was developed for testing in Scheme III. The rapid transit system with its station locations and feeder bus network is illustrated on the map. The system would comprise 48.5 miles of rapid transit line and 595 miles of feeder bus routes requiring the operation of 76 subway trains and 705 surface buses. The rapid transit system would be served by 57 stations spaced at 0.44 to 1.89 mile intervals in the intermediate and suburban areas and, on an average, at 0.47 mile intervals in the downtown area.

This system would consist of two lines, a single north-south line and an east-west line which would branch at each end to serve different parts of the metropolitan area.

North-South Rapid Transit Line

This line would connect West Kildonan, Maples, and the North Winnipeg area with South Winnipeg and Fort Garry by a single 15.3 mile route. It would pass through the downtown area along Memorial Boulevard and serve such major trip generators as the Winnipeg General Hospital, Downtown, and the University of Manitoba.

East-West Rapid Transit Line

The two western branches of this line would serve Assiniboia and St. James north of the Assiniboine River and Charleswood and Tuxedo south of the River. They would combine in the vicinity of Polo Park and operate as one line along Portage Avenue to Main Street in the downtown area. At this point, the line would split with one branch proceeding south to serve the cities of St. Boniface and St. Vital, while the other would swing north and then eastward through East Kildonan where it would further divide to serve North Kildonan and Transcona areas separately.

In developing the concept of this extensive rapid transit system, an attempt was initially made to combine the rapid transit routes with the freeway routes described in the scheme. However, as the system developed it became obvious that the locations of the freeway alignments did not lend themselves to favorable rapid transit line locations, in that existing or anticipated high density residential developments and major transit attractors were remote from the freeways. As a result, many of the stations could not easily be reached on foot and would required an additional, sometimes lengthy trip by feeder bus, thus adding trip time and reducing the overall attractiveness of the rapid transit system. However, in the selection of the rapid transit alignments an effort was made to utilize existing railroad line rights-of-way (which might be abandoned in the future or operated jointly) and existing utility transmission lines (where their location permitted the servicing of abutting area). As a result, approximately 45 percent utilizes existing street rights-of-way or presently undeveloped land. Another 47 percent utilizes existing street rights-of-way, thus minimizing land acquisition costs and disruption to the developed area. In other areas, the lines would be located at-grade or would be elevated where they could be acceptably integrated into future plans for urban development. In any event, there would be no level street crossings, thus ensuring continuous uninterrupted operation.

Operating characteristics of the rapid transit system tested were based on systems proven and in operation today. The system would employ equipment which could operate at speeds of up to 50 miles per hour where station spacings were sufficiently great to permit attainment of this speed. The north-south route was assumed to operate at 2.0 minute headways between trains in the peak hour and the east-west route at least 1.5 minute headways along Portage Avenue between Polo Park and Main Street. Where this line splits at each end, successively longer headway times would be experienced.

Because the transit system relies on an extensive network of feeder buses to carry passengers to the stations along the various rapid transit lines, practically the entire area in urban use in 1991 would be within walking distance of some form of transit. The average area encompasses 112.0 square miles, which is twice the area served by the transit system in 1962.

WORK TRIP MODE OF TRAVEL — LEAVING HOME

Utilizing the factors developed earlier in this study and described in detail in Volume Two and referred to again on page 42 of this report, the extent to which the automobile or public transportation would be chosen as a mode of travel to work in 1991 was determined with the Scheme 3 street and transit systems in operation. Plate 37 shows, by individual traffic zone, the proportion of the total person trips made to work which would utilize the automobile, travel by transit or walk in the peak hour period in 1991. as in the previous schemes tested, a total of 128,000 persons would travel to work in the peak hour period. Of these, 67.0 percent would choose to drive or ride by automobile and 26.1 percent would be attracted to the public transportation system with its extensive rapid transit network. Compared to Scheme 2, this represents a slight (1.8 percent) shift from automobile to transit usage for work trip purposes as 2,300 more riders used transit in Scheme 3. However, the incorporation of the freeway system into the major street network had the effect of offsetting the attractiveness of the rapid transit system, since the automobile would continue to be a more attractive mode of travel for two-thirds of the peak hour home-to-work travellers.

MODE OF TRAVEL — ARRIVING AT WORK

Plate 38 shows the proportion of the total number of persons making work trips in the peak hour to each traffic zone who would use the transit system, would drive or ride in automobiles, or would walk in 1991, if the Scheme 3 transportation system were implemented. As in the case of the total trips generated, 67.0 percent would arrive at work by automobile and 26.1 percent would arrive by transit, using bus, rapid transit or a combination of both. The remainder would walk or cycle to work.

The individual zone most noticeably affected by the rapid transit system would be the one in which the University of Manitoba is situated. Of the trips to this zone in the peak hour, 29.4 percent would be made by transit, as compared to 22.9 percent transit travel to this zone under the Scheme 2 transportation system. A total of 3,490 transit riders would arrive for work or classes at the University in the A.M. peak hour, most of them by rapid transit. This represents a very large increase of 584.5 percent over the ridership observed in the base year 1962.

Surprisingly, at the same time, transit trips to the downtown area for work purposes in the peak period registered a fractional percentage decline from that projected in Scheme 2, with 39.6 percent of the workers using transit to jobs Downtown as compared to 39.9 percent in Scheme 2. Obviously, the freeway network with its downtown loop and radial suburban-oriented spokes would provide the rapid transit network with stiff competition for attraction of the travelling worker.

Under this scheme, transit work travel between points of origin and destination outside the downtown area increased noticeably over that projected in Scheme 2, with 19.3 percent of the workers who made such trips using transit, as compared to 16.5 percent in Scheme 2. This indicates that the Scheme 3 rapid transit service and the location of certain transit stations would make transit travel somewhat more attractive than the automobile for these workers.

AUTO AND TRANSIT TRAVEL TIMES

The concentric *isochronal* travel time lines illustrated on the opposite page indicate the travel time required by automobile or transit to reach the intersection of Portage Avenue and Donald Street in the downtown area from any location in metropolitan Winnipeg during the peak hour period in 1991. Unlike the previous illustrations depicting travel time conditions in Scheme 1 and 2, the shapes of the contour lines in this illustration are heavily irregular, corresponding to the obvious time advantages enjoyed by freeway drivers and rapid transit riders on the systems provided in Scheme 3.

Travel times by automobile from all points in the metropolitan area to Downtown underwent a substantial reduction between Scheme 2 and Scheme 3. For example, in Scheme 2 an automobile trip from Transcona to the heart of the downtown area took from 25 to 30 minutes. The same trip in Scheme 3 would require only 15 minutes during the peak period with the addition of the Eastern Freeway. The Perimeter Highway in Fort Garry was about 35 minutes away by automobile from Downtown in Scheme 2. In Scheme 3, this travel time has been cut to 20 minutes.

Although the level of travel service provided on the freeways has not been equaled by any of the previous schemes tested, the freeway system has also had the added effect of substantially improving major surface street travel conditions. Travel times in the downtown area along major arterial radial routes have improved substantially with the introduction of the freeway system and the consequent reduction of traffic on the surface street system. For instance, a trip along Portage Avenue to the downtown area which, in Scheme 2, took 30 minutes could be accomplished under Scheme 3 conditions in about 17 minutes.

The most outstanding improvement from the point of view of trip travel time is evident in the public transportation system. The shape of the 15 minute travel time contour line for the transit system can be clearly related to the shape of the seven legged rapid transit system oriented towards the downtown area. Bus trips to downtown which required 40 minutes in Scheme 2, could, in Scheme 3, be made in 15 minutes along the rapid transit line corridors. The Perimeter Highway would be only 25 minutes travel time from Downtown along the rapid transit lines in Scheme 3, compared to approximately 50 minutes in some cases in Scheme 2.

Scheme 3 is the first scheme tested in which some travellers by transit enjoy an advantage in travel time equal to, or better than, that enjoyed by the automobile driver. There are small areas along the rapid transit corridors where travel time (to the downtown area) by transit would actually be shorter than that by automobile along same corridor. This would occur along Portage Avenue and along Watt Street, where the 15 minute transit contour interval extends beyond the equivalent time contour for automobile travel. However, because of the nature of rapid transit, this equality or advantage would be limited to those residing in the immediate vicinity of rapid transit stations. Transit trips requiring an initial trip by bus to reach the transit station would see this equality or advantage as the bus trip increased in length.

Vehicle speeds along the freeway routes in this system would average 43.2 m.p.h. with the result that the average speed of travel for the entire metropolitan major street and highway system would reach 27.9 m.p.h., compared to only 17.1 m.p.h. in Scheme 1 and 19.6 m.p.h. in Scheme 2.

With the conversion of the bus transit system tested in Schemes 1 and 2 to an extensive rapid transit network in Scheme 3, the combined average transit speed for rapid transit and buses in this scheme would reach 14.5 m.p.h., compared to only 9.5 and 10.5 m.p.h. in the two previous schemes. Although the

average speed attained by the rapid transit trains would be 28.3 m.p.h., the extensive feeder bus system from the neighborhoods and communities in the vicinity of the stations would lower the overall transit speed to that indicated above.

TRANSIT PASSENGER FLOW

The illustration on Plate 43 depicts the anticipated peak hour transit passenger volumes carried by the rapid transit system and its feeder bus network on an average weekday in 1991. The patterns of flow which are most prominent in this illustration are, of course, those coinciding with the rapid transit corridors. Obviously, the downtown area would still be the major area of destination of transit trips. In addition, the importance of the University of Manitoba as a major attractor outside Downtown for transit trips is clearly demonstrated by the flow pattern. Total transit trips to the University area by rapid transit in the peak hour period in 1991 would exceed 3,700. Because the University is located at the terminal of the north-south rapid transit line, the volume of passengers shown along this line in a southbound direction is relatively constant throughout its length south of the River Heights area. The most heavily used section of rapid transit line outside the downtown area is that portion of the northern branch of the east-west line running along Main Street between the C.P.R. Yards and the Redwood Bridge. This section would carry approximately 5,200 passengers in the peak direction. Rapid transit passenger volumes on Portage Avenue approaching the downtown area would total approximately 4,300 in the peak hour period.

On the other hand, relatively light volumes would be experienced on rapid transit lines in outlying areas. The southern branch of the east-west line, providing service to Tuxedo and Charleswood, would contribute only 1,350 passengers to the Portage Avenue flow at Polo Park. Beyond Inkster Boulevard on the north-south rapid transit line, inbound passenger flows of only 1,000 are projected. The branches serving North Kildonan and Transcona would combine 1,100 and 1,500 passengers respectively to form the flow on the line passing through East Kildonan. The St. Vital-St.Boniface branch line would attract only 1,650 passengers south of the Windsor Park station.

The flows illustrated on the opposite page represent a total transit ridership of 40,600 persons, which is an increase of 10.5 percent over the transit passengers carried in the A.M. peak period in Scheme 2. Of this total, 33,400 or approximately 82 percent of the transit tripmakers in the A.M. peak hour would use the rapid transit over some portion of their trip.

The downtown cordon line peak directional passenger volume to seating capacity ratio in this scheme is 0.790 which indicates a substantially improved utilization of the capacity provided over that determined for both Schemes 1 and 2. This is undoubtedly attributable to the superior service of the extensive rapid transit coverage oriented to the downtown area provided in this scheme.

CORDON CROSSINGS BY TRANSIT PASSENGERS

Morning peak hour transit passenger volume crossing the cordon line around the downtown area are shown on Plate 44. During the A.M. peak period in 1991, approximately 27,700 passengers would enter, and 7,800 would leave, the downtown area. Approximately 22,100, or 80 percent, of those passengers entering the downtown area would travel by rapid transit, with the remainder using the surface bus system. Most of the latter represent short distance trips originating from residential areas adjacent to the downtown area. From such areas, a direct trip by bus to the Central Business District would be more convenient and time saving than a bus trip to the nearest rapid transit station and then the trip into town by rapid transit.

In Scheme 3, 7,350 passengers, or 26.5 percent of those entering, actually passed completely through the downtown area. This sharp increase in downtown through travel over that experienced in the two previous schemes is indicative of the attractiveness of this system for longer trip making by transit in the urban area. Moreover, configuration of the rapid transit network is downtown oriented with bypass opportunities limited to only a few feeder bus routes. This feature also contributed to the increase in through transit flows in the downtown area.

The five heavy flows in the illustration represent the downtown penetration of the rapid transit lines in this system. These flows range from a low of 3,500 passengers entering via the south-east rapid transit line from St. Vital and St. Boniface to a high of 5,200 projected for the inbound flow on the north Main Street line. The Portage Avenue rapid transit line contributed 5,150 passengers to the total crossing the cordon line and represents the second heaviest carrier of passengers into Downtown. The most balanced flow is experienced on the line penetrating the downtown area along Osborne Street. This line would carry 4,000 passengers inbound and 2,300 outbound in the peak period. This outbound flow of passengers is the heaviest projected along the cordon line and, as described earlier in this report, is largely made up of trips destined to the University of Manitoba in Fort Garry.

As is indicated on the illustration depicting the rapid transit system, the routes traversing the downtown area form an "H" type configuration. Of the seven rapid transit stations located in the Central Business District, the most heavily used would be that located at Portage and Memorial Boulevard, where it is projected that approximately 10,900 passengers would be accommodated in the peak hour. Because this station is at the junction of the main north-south and east-west rapid transit lines, 73.4 percent of these passengers would use this station for transferring purposes. The station located in the vicinity of Portage Avenue and Main Street would serve the largest number of trips actually destined to the downtown area. Of the 8,050 passengers using the station during the peak period in the morning, approximately 6,700 would leave the rapid transit at this point and walk to their ultimate destination in the vicinity of the station. The three most heavily used downtown stations are located along Portage Avenue. The volumes of passengers boarding or alighting at the other four are relatively light, with volumes ranging from a low of 1,250 at Osborne Street and Broadway station to 2,000 at the station located in the vicinity of Balmoral Street and Notre Dame Avenue.

TRANSIT VEHICLE FLOW

The pattern of transit vehicle flows in this system is illustrated on Plate 45. The flow of rapid transit trains is shown in purple, while the surface bus line vehicle flows, including those for the feeder routes which complement the rapid transit, area indicated by the orange patterns.

The highest level of service within this system would be provided along the east-west rapid transit line on Portage Avenue between Polo Park and Main Street. Trains in this section would operate at one and a half minute intervals. West of Polo Park, the line would divide into two branches with the train units proportioned between them to provide two minute headways on the Portage Avenue line west of this point and six minute headways on the branch line which swings south into the Tuxedo and Charleswood areas.

At Main Street, the east-west rapid transit line would split, with alternate trains proceeding north and south, thus providing three minute service to the St. Boniface-St. Vital and North Winnipeg-East Kildonan areas. In East Kildonan, the northern line would split to provide six minute service to Transcona and North Kildonan.

The north-south rapid transit line would offer a high level of service throughout the peak period with trains spaced at two minute intervals along its entire length between Old Kildonan and Fort Garry.

During off peak periods, a good level of service could be maintained by leaving the headways constant and reducing the number of units per train to correspond with lower capacity demands during these periods of the day. Alternatively, during the off peak periods, peak hour train lengths could be maintained and the headways between trains increased to correspond with passenger demand drop off during this period.

TRANSIT VEHICLE FLOW: DOWNTOWN AREA

Plate 46 illustrates the flow of transit vehicles in the downtown area. In this scheme, the underground rapid transit train flows are indicated in purple. The surface bus system penetrating the downtown area is distributed in such a manner as to provide a downtown feeder system for passengers transferring to and from the rapid transit stations. Although surface buses would operate along Portage Avenue, Main Street and Osborne Street to provide passengers with local service between rapid transit stations along these routes, they are not shown on this illustration. For purposes of illustration, different scales are used to depict the rapid transit and surface bus volume. The scale used for the latter is identical to that showing bus volumes on the downtown street system in Schemes 1 and 2 on Plates 22 and 34.

As described on page 92, rapid transit trains along Portage Avenue would operate at one and a half minute intervals. Along Memorial Boulevard, the headway between trains would be two minutes, and rapid transit units along Main Street would be spaced three minutes apart.

Only 282 buses would be required to operate on the downtown surface street system during the peak hour period in this scheme. This represents a reduction of 75.4 percent from that number visualized under Scheme 1 and 2, when bus operations in the downtown area would all bus come to a halt as a result of the congestion that bus and other traffic would create.

SCHEME IV

THE TRANSIT SYSTEM

The transit system tested in Scheme IV is identical to that tested in Scheme III. This system, comprises 48.5 miles of rapid transit line and 595 miles of feeder bus routes. As described earlier in this report, the rapid transit system would consist of two operating lines. One line oriented in a north-south direction, would pass through the west end of the downtown area and connect West Kildonan and Maples with Fort Garry. The other would operate in an east-west direction, traversing the heart of the downtown area and dividing at each end to serve the eastern and western suburbs of Metro.

WORK TRIP MODE OF TRAVEL — LEAVING HOME

The determination of choice of mode of travel to work in 1991 with the Scheme 4 streets and transit systems available was carried out in the same manner as previously described in this report on page 42. Plate 49 illustrates, by individual traffic zones, the proportion of the total person trips in the peak hour made to work which would utilize the automobile, would travel by transit or would rely on some other means of transportation such as walking or cycling.

Although Scheme 4 retains the advanced transit system of Scheme 3, including an extensive rapid transit service, but does not provide any radial freeways to supplement the major street system, a surprisingly small increase in transit ridership relative to Scheme 3 is actually projected. Of the 128,000 work trips in the peak hour, 61.2 percent could still be by automobile and 31.9 percent would be by transit. Comparing this modal split with that projected for Scheme 3 indicates that removal of the radial freeways from the transportation system would result in only 7,400 more automobile commuters being attracted to transit for the journey to work.

The North Winnipeg — West and Old Kildonan areas of the city would experience the greatest change in mode of travel with 1,390 persons going to work in the morning using the transit system, who under Scheme 3, travelled by automobile. The smallest change in mode of travel between Schemes 3 and 4 is projected for the Fort Garry area where only 370 more people would use the transit system for travel to work in the latter scheme.

WORK TRIP MODE OF TRAVEL — ARRIVING AT WORK

The proportion of the total work trips made in the peak hour in 1991 that would use the transit system, travel by automobile or walk or cycle to work in each traffic zone is shown on Plate 50. Of the 128,000 person trips made to work, approximately 78,350 would be made by automobile, 40,850 would involve travel by transit, and 8,800 would be made on foot or by cycling.

Over 48 percent of the increase in total travel projected between Schemes 3 and 4 is related to the increase in downtown travel alone. The downtown area would be the destination of 50.3 percent of all of the transit trips made to work during the peak hour in the entire urban area. For the first time in the study, work trips to the downtown area by transit would exceed travel by automobile, with 48.0 percent of total trips to work in this area being made by transit compared to 45.2 percent by automobile. This choice in favor of transit even exceeds that observed in the base year of 1962 when transit carried 43.1 percent of the total work trips to the downtown area. Of course, because of the increase in employment projected for Downtown, there would be a considerable increase in absolute passenger volumes, with 20,550 persons arriving at work Downtown by transit in 1991 compared to only 13,650 in 1962.

In 1991, approximately 19,300 persons would ride or drive to work in the downtown area by automobile. This volume would still exceed travel by auto in 1962 by about 4,500 vehicle person trips for the same purpose during the same time period of the day. Obviously, in Scheme 4, the elimination of the freeway system which served the downtown area in Scheme 3 would elevate the transit system to a relatively high position of attractiveness for downtown trip making compared to the alternative of using the major street system to travel Downtown by automobile.

In this scheme, because the freeway system is not available, an increase in transit ridership to work is projected for trip making between points outside the downtown area. Approximately 20,300 trips would be made by transit in Scheme 4 between points outside of Downtown, compared to 16,450 in Scheme 3. In other words, 3,850 of the "other-than-downtown" trips previously made by automobile in Scheme 3 would convert to transit in Scheme 4.

Since the major internal freeway network was not oriented to serve the University of Manitoba directly in Scheme 3, its removal from the street system and the retention of the Suburban Beltway in the system had only a minor effect in increasing the attractiveness of transit for trip making to the area. An increase in transit ridership of just over 100 trips in the peak period is projected from Scheme 3 to Scheme 4 to the University zone, with approximately 3,600 transit trips being made in Scheme 4.

CORDON LINE CROSSINGS

The implementation of the Scheme 4 transportation system would result in projected vehicle volumes of approximately 24,600 vehicles entering and 6,800 leaving the Downtown Study Area in 1991. Although a large number of trips to Downtown, which were made by automobile in Scheme 3, would now be made by rapid transit, the elimination of the freeway system would once again require the use of the radial surface street system and the downtown streets for crosstown travel. As a result, 24.1 percent of the vehicles entering the downtown area would not be destined to points within the area but would be passing through to destinations beyond the Central Business District. Thus the elimination of the freeway system around the downtown area would have the effect of almost tripling the volume of through traffic using the downtown street system. Without exception, traffic volumes at all major points of entry to the Downtown Study Area would exceed the volumes observed at these points in the base year. As a result, major street and bridge approaches to the central core area would become heavily congested by 1991. For example, Portage Avenue would be required to carry approximately 2,300 vehicles inbound compared to 1,980 in 1962. The Midtown Bridge would have to accommodate 2,300 vehicles compared to 1,540 in the base year, and traffic volumes on the Provencher Bridge entering the downtown area would approach 2,650 vehicles as compared to 1,640 under present conditions.

Although the street system in Scheme 4 approximates the Scheme 1 and Scheme 2 systems, the vehicular traffic volumes at points of entry to the downtown area in Scheme 4 would be slightly lower than those projected for Schemes 1 and 2, because of the shift toward a greater use of transit in this scheme. Total inbound volumes across the downtown cordon line in Scheme 4 are approximately 21 percent lower than in Schemes 1 and 2.

VOLUME-CAPACITY RELATIONSHIPS

The illustration on the opposite page depicts the operating conditions on the Scheme 4 street system in 1991. Intersections where future traffic volumes are projected to be in excess of future capacities are indicated in "red". Traffic would experience major delays and congestion at theses intersections during the peak hour periods. Where volumes would range between 75 and 100 percent of capacity, the intersections are identified by and "orange" symbol. All other major intersections would be required to handle traffic volumes which would be less than 75 percent of their capacities.

Comparing this illustration with those depicting volume to capacity relationships in Scheme 2 and 3 indicates that outlying areas would experience less traffic congestion than in Scheme 2. However, the conditions immediately outside the downtown area would be considerably worse than those projected in Scheme 3. Obviously the removal of traffic by the attraction of work trips to the rapid transit system in Scheme 4 accounts for the relief projected outside the downtown area when Scheme 4 is compared to Scheme 2. However, the removal of the freeway system has the effect of increasing traffic congestion on the fringe of Downtown to the extent that, in Scheme 4, 72.7 percent of the major intersections in this area would operate in excess of capacity compared to only 18.0 percent in Scheme 3.

An examination of the conditions in the downtown area clearly demonstrates that the Scheme 4 street and highway system would be unable to cope with downtown traffic problems. the attraction of riders to the rapid transit system would not remove sufficient numbers of vehicles from the downtown street system to allow freedom of vehicle movement in this area during peak period. Projections indicate that, with the Scheme 4 street system in operation, 66.0 percent of the major intersections in the downtown area would experience traffic loads in excess available capacity in 1991. The equivalent figure was only 21.4 percent in Scheme 3. By comparison, in 1962, only 13.8 percent of the major intersections in the downtown area operated in the over capacity category.

The following table summarizes the operating conditions projected for the Scheme 4 street system. The most significant statistic in this table is that more than one-third of all the major intersections in the urban street network would be required to handle traffic volumes in excess of their capacity. This means that traffic congestion would be experienced at 135 major intersections in 1991. In contrast, only 30 intersections, or 11.7 percent of the present street system's major intersections were overloaded in 1962, and as shown on page 102, only 36, or 9.0 percent of the Scheme 3 system's major intersections would be overloaded if that scheme were implemented by 1991.

PERCENT OF TOTAL MAJOR INTERSECTIONS

Volume-Capacity Ratio Greater than 1.00	Volume-Capacity Ratio Between 0.75 and 1.00	Volume-Capacity Ratio Less than 0.75
37.1%	28.0%	34.9%

AUTOMOBILE AND TRANSIT TRAVEL TIMES

The illustration on the opposite page illustrates, by the use of travel time contour lines, the time required by automobile and transit to reach the intersection of Portage Avenue and Donald Street in the downtown area from any location in the metropolitan area during the peak hour in 1991.

The contour lines representing travel on the public transit system are very similar to those shown on Plate 42 describing conditions in Scheme 3. The reason for this similarity is that this transit system is the same as that investigated in Scheme 3 and the rapid transit lines which greatly influence travel times to Downtown by transit operate on exclusive rights-of-way with fixed running times which are not affected by surface traffic conditions. Slight variations in the contour line patterns between Scheme 3 and 4 for the transit system are the result of variations in travel times experienced by the supporting feeder bus system, the operation of which is affected by traffic conditions on the surface streets.

Unlike the transit travel time contour lines, the isochronal lines representing travel time to downtown by automobile vary considerably between Scheme 3 and Scheme 4. With the removal of the internal freeway system envisaged in Scheme 3, the automobile travel time contours are very similar to those illustrated in Scheme 2. In this system, there are may areas of the city, particularly in the vicinity of the rapid transit lines themselves, where travel to the downtown area in the peak period would be less time consuming by transit than by automobile. However, in the large land masses lying between the rapid transit lines, the advantage of travel by rapid transit is offset by the slower operation of the feeder bus lines, by the indirect path of travel and by loss in time through transferring associated with a trip requiring travel on the feeder system to a rapid transit station. As a result, travel by automobile to Downtown is more direct and slightly faster from these areas than a trip by transit.

The greatest advantage in travel time to the downtown area enjoyed by transit travellers occurs along Portage Avenue. In this corridor of travel, transit passengers would reach the downtown area in 15 minutes from the vicinity of Sturgeon Road. This same trip along Portage Avenue by automobile would require approximately 27 minutes. On the other hand, Downtown could be reached from the Brooklands area of the City of St. James in 10 to 15 minutes by car compared to 20 to 25 minutes by transit. Transit and automobile trips from the City of Transcona to the downtown area would be of approximately equal duration in 1991 under the Scheme 4 transportation system.

With this system of major streets and highways in operation, the average speed of travel by automobile on the entire system would reach 22.6 miles an hour, which is faster than that projected for Schemes 1 and 2 and slower than the Scheme 3 average vehicle operating speed.

Although the average speed of travel on the rapid transit system with its exclusive rights-of-way would be the same (28.3 m.p.h.) as that in Scheme 3, the overall average speed of the entire transit system including the feeder bus network would be 12.9 miles per hour in Scheme 4 compared to 14.5 miles per hour in Scheme 3. This drop in average speed reflects the more difficult travel conditions confronting the surface transit buses which must operate on a more congested street system as described by the illustrations comparing traffic volume and street capacity for the two schemes.

TRANSIT PASSENGER FLOW

Plate 55 illustrates the anticipated peak hour transit passenger volume for the rapid transit system and its feeder bus network on an average weekday in 1991. Because the transit systems tested in Schemes 3 and 4 are identical, the passenger flow patterns in these schemes are very similar. If a comparison of Plates 43 and 55 is made, it will be noted that the passenger flows in Scheme 4 are noticeably heavier, reflecting the move from automobile to transit as a means of travel in this scheme.

The flows illustrated on the opposite page represent a total peak hour ridership of 49,600 persons. This is an increase of 22.2 percent or 9,000 persons over that projected for the same period in Scheme 3. Of this increase, approximately 8,500 passengers would use some portion of the rapid transit system during the peak period, with the remaining 500 converting from automobile travel to surface bus travel for the entire trip between origin and destination.

As in the case of Scheme 3, the rapid transit line approaching the downtown area along north Main Street would carry the heaviest directional passenger load with 6,700 riders projected in Scheme 4. the line entering the downtown area via Osborne Street accounts for one of the greatest numerical increases in ridership between Scheme 3 and 4. Passenger volume on this line between River Avenue and Broadway is projected to be 5,400 persons, an increase of 1,400 or 35 percent over that projected for Scheme 3. The increase in transit trips to the University of Manitoba falls considerably short of the overall average increase projected between Scheme 3 and 4, with only 120 additional trips added to the 3,700 projected in Scheme 3. Obviously, the existence of the Suburban Beltway in the major street and highway system in this scheme provides an attractive automobile route as an alternative to rapid transit for persons destined to the University area.

Although increases in ridership are reflected throughout the entire transit system, peak volume on most of the outlying sections of the rapid transit would still be extremely light.

The passenger volume to seating capacity ratio at the cordon line of 0.998 indicates an almost ideal utilization of the capacity provided if the objective is to provide comfortable and attractive yet reasonably efficient service. Obviously, if economy of service is the controlling factor, a ratio considerably in excess of 1.00 would be the objective, which, of course, could be achieved only by carrying standing passengers on most routes throughout the peak hour. As the transit systems in both schemes are identical, the improvement of Scheme 4 volume-capacity ratio over Scheme 3 undoubtedly reflects the effects of removing the freeway network from the transportation system for the Scheme 4 test.

CORDON CROSSINGS BY TRANSIT PASSENGERS

During the A.M. peak period in 1991, approximately 35,000 passengers would enter, and 10,800 would leave, the downtown area by transit. Of the total passengers entering the downtown area, approximately 28,700 or 82 percent would do so by rapid transit. More passengers than in any previous scheme would travel through the downtown area via transit. Approximately 10,300 passengers, or 29.4 percent of the total volume entering the Central Business District, would actually be destined for points beyond. As described in the previous scheme, the downtown orientation of the rapid transit network and the limited opportunities to bypass this area by surface bus route contribute to the relatively heavy through transit passenger volumes.

The heaviest rapid transit passenger penetration of the downtown area is projected for Main Street North, where 6,700 passengers would be carried by this line in the peak hour period. The rapid transit line on Portage Avenue West is a close second with 6,450 passengers entering the downtown area from this direction. Lowest volumes are again projected for the line serving St. Boniface and St. Vital, which would bring 4,800 passengers into the Central Business District.

A total of 36,300 passengers would use the seven downtown stations in the A.M. peak period. Of this total, approximately 14,300 would be involved in transferring between rapid transit lines or between rapid transit and surface bus lines. The rapid transit station at Portage and Memorial Boulevard would have to accommodate more passengers than any other station. Of the 12,900 riders who would use this station, 71.1 percent would use it as a major transfer point in the system. The largest number of passenger trips actually destined to the downtown area would be served by the Portage Avenue and Main Street station. At this location, approximately 8,750 passengers would alight from the rapid transit to walk to their nearby place of work of business. As in Scheme 3, the three most heavily used stations would be those along Portage Avenue. The other four stations would be required to accommodate much lighter volumes, ranging from 1,650 at the Osborne and Broadway station to 2,850 at the station located in the vicinity of City Hall and the Cultural Centre.

TRANSIT VEHICLE FLOW

Since the Scheme 4 transit system is identical to the system tested in Scheme 3, the pattern of transit vehicle flows illustrated on Plate 57 is identical to that shown for Scheme 3 on page 111.

The frequency of rapid transit service on all routes and its capacity and flexibility are exactly the same as those described for Scheme 3. For more information reference should be made to page 110.

TRANSIT VEHICLE FLOW: DOWNTOWN AREA

The flow of transit vehicles in the downtown area is indicated in purple for rapid transit and in orange for surface buses in the accompanying illustration. As in the case of Scheme 3, the bus network illustrated would serve short distance trips by transit from areas located immediately outside the downtown area and also would provide a downtown feeder system for passengers transferring to and from the downtown stations. Attention is drawn to the different scales used in the illustration to depict rapid transit and surface bus volumes.

The operations and characteristics of the downtown transit system are identical to those described in Scheme 3 on page 112 and reference should be made to this part of the report if further details about transit in the downtown area are desired.

SUMMARY OF SCHEME 4 AND INTRODUCTION TO SCHEME 5

In the development of the transit oriented Scheme 4 transportation plan, it was expected that, relative to Scheme 3, the projections would indicate a shift from the automobile to transit as a mode of travel. Results of tests on this scheme substantiate this anticipated change in travel mode. However, this change was not sufficient to suggest that a network of rapid transit of the extent envisioned in Scheme 4 would be required in the planning period or that the street system expansion could be limited to a Scheme 2 type of system. Comparing Scheme 3 to Scheme 4, the absence of the internal freeway network from the latter's street system resulted in the diversion of fewer than six percent of A.M. peak hour work trip makers from private automobile to public transportation. Although the volumes carried by the Scheme 4 transit system would be approximately one-third greater than those projected for Schemes 1 and 2, it is obvious from the extremely low ridership on the outlying sections of the system that such an extensive network of rapid transit lines is not warranted.

The road network in Scheme 4 would be required to carry the lowest total traffic volume so far in this study, yet would operate only slightly better than the Scheme 2 street system, providing a very low standard of service for this area, and one which would undoubtedly have an adverse effect on the economic development of Metropolitan Winnipeg.

The results of the tests to this point in the study indicate that a continuation of the present practice of road building and transit operation as described in Schemes 1 and 2 would not provide an acceptable level of service for this growing area. The Scheme 4 tests indicated that emphasis in one particular direction of transportation development does not provide the answer. Although a scheme emphasizing travel by automobile and minimizing transit operations was not tested, the performance of the Scheme 3 freeway system suggested that it would not cope adequately with future vehicular traffic loads if the complementary transit system was limited to a surface bus operation as tested in Schemes 1 and 2. The most extensive system of transportation, offering the traveller attractive facilities for public and private travel, was tested in Scheme 3. However, the transit system and the road system were both out of scale with the urban development and transportation requirements projected for 1991.

Accordingly, a transportation system of public transit and road facilities, proportional to the configuration and population projected for the metropolitan area for the year 1991, was developed for final testing. Utilizing the desirable characteristics of previous schemes, the Scheme 5 major street and highway system consisted of a basic network of major streets supplemented by an internal freeway system providing additional radial corridor capacity where necessary and by the Suburban Beltway accommodating circumferential urban movement. The complementing transit system would comprise a relatively short rapid transit line through the downtown area, a system of express bus routes along certain freeways and a network of surface bus routes to serve local areas of the city and to provide feeder service to the rapid transit line.

SCHEME V

THE TRANSIT SYSTEM

The main component of the transit system developed for testing in Scheme V is a high capacity 5.4 mile grade separated rapid transit line between Polo Park and Main Street and along Main Street to Burrows Avenue, at which point it would swing east across the Red River and terminate in the vicinity of Hespeler Avenue and Henderson Highway in East Kildonan. The rapid transit line would be served by a network of surface bus routes oriented towards the 11 stations along its length. A total of 660 buses would be required to provide the level of service visualized in this scheme.

In addition, 13 miles of proposed freeways would be utilized for freeway bus routes. These freeway bus routes would provide intermediate capacity, high speed, limited stop (Express) bus service from the suburban areas to Downtown. Passengers served by these routes in the north, east, south-east, and south-west sectors of the metropolitan area would be picked up by buses operating on major streets in these areas and carried directly Downtown by the same vehicle on the freeway. A freeway bus fleet of 95 vehicles would be required to operate this portion of the transit system. Freeways chosen for this system were those providing direct penetration into the downtown area, from areas not conveniently served by the rapid transit corridor.

Four of the 11 rapid transit stations would be located in the downtown area between Memorial Boulevard on Portage Avenue and the cultural Civic Centres on Main Street. All bus routes extending west of the St. James Bridge route would be oriented towards the station located between the Polo Park Shopping Centre and the sports and recreation complex comprising the Winnipeg Stadium, Arena and adjacent facilities.

Existing parking facilities in the Stadium-Arena area could serve downtown commuters who chose to drive their car to this terminal station and to complete the trip to Downtown by rapid transit. These parking facilities are used primarily during the evenings and on Sundays in conjunction with major spectator events at the sports centre and therefore would be available for the work and shopping traveller during the day. Conversely, when sporting events occur at these facilities the rapid transit line would be attractive to large numbers of spectators, thus alleviating growing street congestion in the vicinity of the Shopping Centre and Arena. Although not available at the present time, parking facilities could be provided at the other terminal of the rapid transit line east of the Red River to the area north of the C.N.R. Mainline east of the Red River would be oriented towards the terminal station at Henderson Highway and Hespeler Avenue.

In order to minimize disruption to existing development, the rapid transit line in this scheme is visualized as being underground, utilizing existing street rights-of-way over almost its entire length. Operating characteristics of the rapid transit line were assumed to be identical to those tested in Schemes III and IV. Spacing between subway train units during the peak periods was set at 2.0 minutes in both directions of travel.

The proposed total transit system would permit convenient access to public transportation throughout one area of 98.3 square miles, compared to a transit coverage of 55.6 square miles in the base year.

RECOMMENDED PLAN

THE RECOMMENDED TRANSIT SYSTEM

The public transportation system in the recommended transportation plan for the metropolitan area of Greater Winnipeg comprises a high capacity 5.4 mile grade separated rapid transit line extended from Polo Park on Portage Avenue West in the City of St. James to the intersection of Hespeler Avenue and Henderson Highway in the City of East Kildonan. This rapid transit corridor is complimented by a network of feeder surface routes oriented towards the 11 stations along its length, 4 of which are located in the Downtown Area. Available or planned parking areas in the vicinity of the rapid transit terminal station would provide "park n ride" facilities for transit riders who wish to use their cars for part of the trip from home to the terminal station. Complimenting the rapid transit line and feeder bus system are a number of Freeway Express bus routes which utilize 4 of the 5 proposed internal radial freeways and provide high speed limited stop service from the suburban areas to Downtown.

The Southern Freeway is used by Express buses connecting the downtown area with the University of Manitoba via Pembina Highway and the southern part of the Charleswood and Tuxedo areas via the extension of Taylor Avenue beyond the freeway terminal. The South Eastern freeway provides for Express bus connections from Downtown to the St. Vital area, where St. Mary's and St. Anne's Roads are utilized for passenger distribution. The Eastern Freeway bus route connects Regent Avenue in Transcona with McDermot and Bannatyne Avenues in the downtown area, and the Northern Freeway is used as a route for freeway buses which enter the downtown area on Broadway via the Sherbrook-Maryland one-way street pair.

When complete, this system will require 660 buses and 15 rapid transit subway trains to provide the level of service visualized in the Scheme V test. The cost of the public transportation system, assuming the rapid transit line and stations were constructed underground and including supporting rolling stock and maintenance facilities, is estimated in 1968 dollars to be $158.21 million. This cost includes provision for the replacement of depreciated equipment during the period from 1968 to 1991.

RAPID TRANSIT — PRELIMINARY ALIGNMENT & LOCATION OF STATIONS

RAPID TRANSIT: POLO PARK TO SHERBROOK STREET

The next three plates illustrate the preliminary horizontal and vertical alignment for the single rapid transit line which has been recommended for inclusion in the transit system by 1991. As in the case of the freeway plates, these illustrations are not engineering construction drawings, and detailed studies and investigations would have to be conducted subsequently to refine the concept depicted here.

The plate on the opposite page shows the most westerly section of the proposed dual-track electrified rapid transit line. The most westerly station in the system recommended for construction by 1991 would be Polo Park Station, located immediately north of the Polo Park Shopping Centre and south of the Winnipeg Stadium and Arena. The location of a station at this point would be particularly appropriate, in that the shopping centre, sports and recreational complex and rapid transit would be mutually beneficial. Service by rapid transit would enhance access to the area. Additional shoppers (during the day) and spectators (in the evening or on weekends) could enter the area without increasing the requirement for parking, while those who elected to drive despite the attractive transit alternative would find the roadways around the complex less congested. The stadium-arena parking facilities would in turn function as an adjunct to the rapid transit station in that during the day, when not required for parking associated with sporting or cultural events in the area, these facilities would provide for the "park and ride" rapid transit user.

The arrows emerging from the symbol for Polo Park Station indicate that it is anticipated that this station would serve as the focal point for a system of grade separated pedestrian connections to the various attractions in the area. Thus, not only would the rapid transit lines be immune to the effects of inclement weather, but also the buildings adjacent to certain stations could be reached by the transit user without intermediate exposure to the weather.

From Polo Park Station, the rapid transit line would swing onto the Portage Avenue alignment as directly as possible. Maintenance, storage and yard facilities for the rapid transit line have not been illustrated, but have been allowed for in the cost estimates. Such facilities probably could be located on the presently undeveloped area east of Omand's Creek, and would connect to the rapid transit section between Polo Park and Erin Stations.

Each of the most easterly three stations depicted on the facing plate would be located near the intersection of Portage Avenue with a north-south arterial street or major thoroughfare. Erin Station would be at the south end of the Erin-Wall one-way street pair. Burnell Station would lie between Arlington Street and the future major thoroughfare connecting McPhillips and Waverley Streets. Sherbrook Station would be positioned beneath Portage Avenue between Sherbrook and Maryland Streets, a one-way street pair between Academy Road and the Northern Freeway. Each of these stations would serve passengers arriving on foot or transferring from surface bus routes on the aforementioned streets intersecting with Portage Avenue.

RAPID TRANSIT: SHERBROOK TO JAMES AVENUE

The section of the proposed rapid transit line between Memorial Boulevard and James Avenue would constitute the downtown section of the system. The four stations along this section would serve the heart of the Central Business District, accommodating passengers destined to work or to shop Downtown.

As in the case of the Polo Park Station, these stations could be connected directly to significant office or commercial buildings by a system of pedestrian ways. These stations could ultimately serve as the nucleii for a comprehensive network of grade separated pedestrian facilities obviating the necessity for the majority of downtown pedestrians to venture outdoors during inclement weather and reducing vehicle-pedestrian conflict at intersections.

Memorial Station would serve those wishing to reach the intercity bus terminal and the University of Winnipeg, as well as those shopping or working in the vicinity of the station. This station might ultimately be expanded to accommodate a second rapid transit line running from north to south, as visualized in Scheme 3.

Hargrave Station would be the central station on the rapid transit line, approximately equidistant from either terminal and with an equal number of stations (five) on either side of it. This station would serve the heart of Winnipeg's downtown retail district, and would be heavily used by shoppers throughout the day.

Main Station has been located as close to the intersection of Portage Avenue and Main Street as design requirements for this alignment would permit. That is, a rapid transit station must be located on a straight section of line having no more than a very slight gradient. Grade separated pedestrian facilities from this station could connect directly to the planned pedestrian concourse under Portage Avenue and Main Street intersection providing convenient passage from the office buildings in the area to the rapid transit station.

The most northerly of the four downtown stations would be that situated near the intersection of James Avenue and Main Street. Grade separated pedestrian connections could be made to the Civic Offices and Cultural Centre situated on either side of Main Street near this location. Since the existing buildings in the Cultural Centre are to be supplemented with additional construction in the course of urban renewal and redevelopment, James Station would serve an area of increasing importance.

Various downtown sections of the rapid transit line would, according to projections, carry from 4,000 to 6,500 peak direction passengers during the 1991 A.M. peak hour. Main Station would be the most heavily used rapid transit station in the downtown area. Projections indicate that more than 7,000 persons would alight from or board the rapid transit at this station during the 1991 A.M. peak hour. Memorial Station would be the second most active station, handling an anticipated volume of approximately 3,600 persons. James and Hargrave Stations would be used by approximately 3,100 and 2,500 rapid transit riders respectively.

RAPID TRANSIT: JAMES AVENUE TO HENDERSON HIGHWAY

The plate on the opposite page illustrates the most northerly and easterly part of the proposed rapid transit line. This section would coincide with north Main Street over much of its length, and would swing to the east and cross beneath the Red River immediately south of the existing Redwood Bridge to serve the Elmwood and East and North Kildonan areas.

The only station east of the Red River would be Henderson Station, situated in the Elmwood area of the City of Winnipeg. Henderson Station would be in a position to receive passengers transferring from various surface bus routes running throughout the north-east quadrant of the metropolitan area. As well, parking areas to serve "park and ride" passengers could be constructed adjacent to the station.

Projections indicate that almost 2,900 passengers would board the rapid transit line at Henderson Station during the 1991 A.M. peak hour. Passengers boarding at Burrows Station and Dufferin Station would swell the volume to approximately 6,500 at the point at which the rapid transit line would penetrate the Central Business District from the north.

Throughout the rapid transit line illustrated on this and other plates, horizontal and vertical curvature and gradient would be well within the range of design values generally accepted for such lines. The rapid transit alignment shown reflects the need to avoid existing underground utilities and to keep subway stations level and straight. In addition to being functional, underground stations should be aesthetically pleasing and the eleven stations in the initial system would represent ample opportunities to exercise considerable architectural imagination.

Although the alignment illustrated on these plates is shown entirely underground it is not inconceivable that further detailed engineering investigations, and planning and architectural studies, would indicate that an alternative elevated configuration might be economically integrated into existing development and future plans for the city.

IMPLEMENTATION PROGRAM — 1968 TO 1991

RECOMMENDED STAGING — 1968 to 1991

One of the most important functions of any urban transportation study is to develop an effective program of implementation of the recommended plan. Staging of the plan can provide for an orderly approach to the solution of the transportation problems of a growing urban area. Costs associated with the staging establish the financial obligations inherent in the program thus providing the basis for the preparation of a long term capital works budget.

The programming and staging of the construction of the various segments which make up the recommended plan are based on interim projections of urban growth and related travel demands between 1968 and 1991. In addition, the development of a program of construction priorities and staging has also taken into consideration the following:

1. As growth and development of the city takes place, an acceptable level of transportation service should be provided throughout the road and transit network.
2. There should be a reasonable distribution of costs throughout the total period required to implement the plan. However, staging should not be jeopardized by an attempt to adhere to a rigid rate of expenditure budget should reflect an objective assessment of need.
3. Each stage, where possible, should be planned and achieved with a maximum of benefit to the citizens of this area and with a minimum of disruption to existing travel service.
4. With the completion of each stage of development, the transportation system should function satisfactorily even though the plan has not been completed in its final form.

For purposes of presentation, the staging of construction for the 24 year projection span has been divided into four periods of time. The level of accuracy of staging recommendations diminishes with time as the location and extent of urban growth becomes more difficult to predict. The first stage covering the period 1968 t 1971 provides the most realistic assessment of need because the deficiencies of today's transportation system are apparent and measurable. The need for the improvements found in the second and third stages, which span the five year periods 1971 to 1976 and 1977 to 1981 respectively, can be predicted with a reasonable degree of confidence. Stage 4, the longest stage of all, covers the final ten year period between 1982 and 1991 and represents the best estimate that can be made of project priority based on land use and travel forecasts. The construction and right-of-way costs are indicated in terms of 1968 dollars and are related to current contract prices and property values in the Winnipeg area.

Obviously, the program of construction priorities must be reviewed periodically and revised or adjusted should actual patterns of development of the area differ significantly from those anticipated in the projections. This underlies the importance of keeping the study current by updating the analysis of project priorities at relatively frequent intervals of time.

Only the most significant road improvements are itemized for each stage and the order of presentation in the stage does not necessarily constitute project priority within the stage. It is also conceivable that, in the actual implementation of the plan, it may be necessary due to unpredictable circumstances to overlap projects between stages although, for purposes of presentation, all projects within a particular stage are assumed to be completed within the period of years designated for that stage. The total implementation cost in each stage includes costs of engineering, construction and right-of-way for new facilities, and, in addition, the cost of reconstruction of existing roadways and bridges projected to become obsolete during that period of time. Paralleling the approach to costs that has been taken in the staging of the street system, transit costs also include expenditures necessary for replacement of obsolete rolling stock during the 24

year period of plan implementation as well as the costs of construction and of new rolling stock related to increases in fleet size or to introduction of a new service such as freeway buses or rapid transit.

STAGE ONE — 1968 TO 1971

The improvements listed in the first stage include substantial projects committed or under construction as part of the current year's capital works program but minor improvements in this and subsequent years have been omitted for brevity. A start on Winnipeg's freeway system would be made in this first stage, with construction of a section of Northern Freeway over the C.P.R. Yards to permit removal of the Arlington Street Bridge and with construction of a section of the Southern Freeway immediately east of the C.N.R. Station in conjunction with redevelopment of that area. The listed transit costs exceed those for the two subsequent stages due to inclusion of costs of the new Metro Transit Base now under construction on Osborne Street. The most significant sections of street to be widened or constructed during the first stage would be as follows:

Transit expenditures during this stage would include:

Metro Transit Base (Osborne Street)— property acquisition and construction
Bus Fleet— rolling stock purchases

FIRST STAGE: 1968 TO 1971
ESTIMATED CAPITAL EXPENDITURES
(in millions of dollars)

	CONSTRUCTION	PROPERTY	TOTAL
MAJOR STREETS	48.04	5.00	53.04
FREEWAYS	16.38	5.43	21.81
TOTAL (MAJOR STREETS AND FREEWAYS)	64.42	10.43	74.85
	CONSTRUCTION AND PROPERTY	**ROLLING STOCK**	**TOTAL**
TRANSIT	**7.12**	**5.17**	**12.29**
TOTAL CAPITAL EXPENDITURES 1968-1971			**87.14**
AVERAGE YEARLY EXPENDITURE FIRST STAGE			21.79

STAGE TWO — 1972 TO 1976

The completion of the first operative section of the Southern Freeway between Pembina Highway and the downtown area and the completion of the South Eastern Freeway from the Grant Avenue extension to Broadway would permit freeway bus operations to the southern sector of the Greater Winnipeg area to begin during this stage. A start would be made on construction of the Western Freeway in the St. James area. Construction of the eastern bypass section of the Southern Freeway would provide a direct freeway connection from Pembina Highway in Fort Garry to the Disraeli Bridge route. This time period would see the initiation of Suburban Beltway construction in Fort Garry and St. Vital. The extension of Inkster Boulevard would provide a high capacity east-west route in the northern part of the metropolitan area similar to the Grant Avenue extension constructed during the first stage. A complete list of major street projects proposed for the second stage, other than those consisting of renewal of deteriorated roadways, is as follows:

Capital expenditures on the transit system during this stage would be confined to:

Metro Transit Base (Osborne Street)—construction of additional storage bay
Bus Fleet—rolling stock purchases

SECOND STAGE: 1972 TO 1976
ESTIMATED CAPITAL EXPENDITURES
(in millions of dollars)

	CONSTRUCTION	PROPERTY	TOTAL
MAJOR STREETS	33.73	7.53	41.26
FREEWAYS	77.20	23.73	100.93
TOTAL (MAJOR STREETS AND FREEWAYS)	**110.93**	**31.26**	**142.19**
	CONSTRUCTION AND PROPERTY	**ROLLING STOCK**	**TOTAL**
TRANSIT	**1.00**	**6.67**	**7.67**
TOTAL CAPITAL EXPENDITURES 1972-1976			**149.86**
AVERAGE YEARLY EXPENDITURE SECOND STAGE			29.97

STAGE THREE — 1977 TO 1981

During these years, the Western Freeway would be extended east to the Red River, completing the northern bypass of the downtown area and its connection to the eastern bypass. A major downtown river crossing would be constructed to connect the northern bypass to Des Meurons Street in St. Boniface. All major river crossings on the Suburban Beltway route would have been completed by the end of 1981. Major construction projects on the street system would take place on the following street sections:

No major capital expenditures are recommended for the transit system during this period other than:

Bus Fleet—rolling stock purchases

THIRD STAGE: 1977 TO 1981
ESTIMATED CAPITAL EXPENDITURES
(in millions of dollars)

	CONSTRUCTION	PROPERTY	TOTAL
MAJOR STREETS	19.05	9.41	28.46
FREEWAYS	89.43	39.72	129.15
TOTAL (MAJOR STREETS AND FREEWAYS)	**108.48**	**49.13**	**157.61**
	CONSTRUCTION AND PROPERTY	**ROLLING STOCK**	**TOTAL**
TRANSIT	**—**	**8.22**	**8.22**
TOTAL CAPITAL EXPENDITURES 1972-1976			**165.83**
AVERAGE YEARLY EXPENDITURE SECOND STAGE			33.17

STAGE FOUR — 1982 TO 1991

The fourth and longest stage of the recommended schedule of implementation would include the beginning of rapid transit construction in Winnipeg, and the completion of the 5.4 mile section which constitutes the rapid transit system recommended for 1991. It is visualized that by 1991, the freeway system which has been recommended would be constructed in its entirety. Freeway bus operations would be introduced on the Eastern Freeway upon its completion during this stage. Construction of certain sections the Suburban Beltway might not be required to full freeway standards by 1991, although the estimates listed for construction costs are based on completion of this facility to ultimate design standards. It should be noted that the grade separations listed for this and other stages would not be the only grade separations constructed during those stages. Others would be built as part of major widening or construction projects. When a grade separation is specifically listed as such, the road facility be grade separated is an existing street or would have been constructed or widened during an earlier stage without grade separating at that time. Expenditures per year on road construction in this stage would be less than the equivalent figures for the second and third stages, but the overall cost per year of major transportation facilities would continue to rise due to vastly increased transit expenditures to rapid transit construction.

The capacity of the street system would be increased during the fourth stage by the construction or widening of the following sections of street:

During Stage 4, the recommended transit system would involve capital expenditures on the following items:

Bus Fleet—rolling stock purchases
Rapid Transit—construction of rapid transit line, stations and storage and maintenance facilities
Rapid Transit—rolling stock purchases

FOURTH STAGE: 1982-1991
ESTIMATED CAPITAL EXPENDITURES
(in millions of dollars)

	CONSTRUCTION	PROPERTY	TOTAL
MAJOR STREETS	44.36	12.47	56.83
FREEWAYS	159.63	18.08	177.71
TOTAL (MAJOR STREETS AND FREEWAYS)	**203.99**	**30.55**	**234.54**
	CONSTRUCTION AND PROPERTY	**ROLLING STOCK**	**TOTAL**
TRANSIT	**105.55**	**24.48**	**130.03**
TOTAL CAPITAL EXPENDITURES 1982-1991			**364.57**
AVERAGE YEARLY EXPENDITURE FOURTH STAGE			36.46

SUMMARY OF ESTIMATED CAPITAL EXPENDITURES
(IN MILLIONS OF DOLLARS)
1968 TO 1991

		FIRST STAGE 1968-1971	SECOND STAGE 1972-1976	THIRD STAGE 1977-1981	FOURTH STAGE 1982-1991	TOTAL 1968-1991
MAJOR STREET SYSTEM	Construction	48.04	33.73	19.05	44.36	
	Property	5.00	7.53	9.41	12.47	34.41
	Total	**53.04**	**41.26**	**28.46**	**56.83**	**179.59**
FREEWAY SYSTEM	Construction	16.38	77.20	89.43	159.63	
	Property	5.43	23.73	39.72	18.08	86.96
	Total	**21.81**	**100.93**	**129.15**	**177.71**	**429.60**
TRANSIT SYSTEM	Construction and Property	7.12	1.00	—	105.55	
	Rolling Stock	5.17	6.67	8.22	24.48	44.54
	Total	**12.29**	**7.67**	**8.22**	**130.03**	**158.21**