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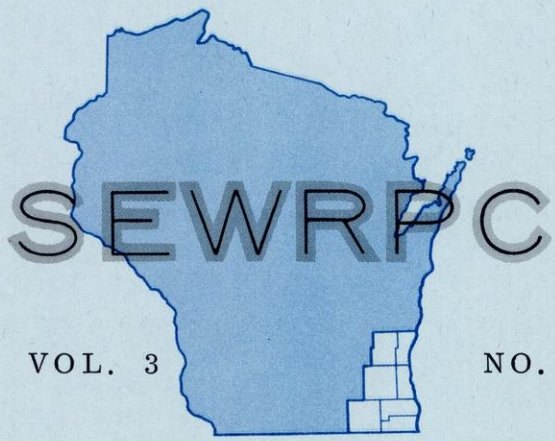
TECHNICAL RECORD



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1968

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THE TECHNICAL RECORD

Volume three Number one

1968

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TRANSIT SYSTEM DEVELOPMENT STANDARDS

by Edward Weiner, Transportation Planning Engineer[1]

INTRODUCTION

Planning is a rational process directed towards attaining objectives. The Southeastern Wisconsin Regional Planning Commission (SEWRPC), as part of its regional land use-transportation planning program, formulated a set of regional development objectives as a basis for land use and transportation plan design, test, and evaluation. Of a total of 15 specific development objectives, 8 related to land use development and 7 to transportation system development. One of the latter related directly to transit service in that it called for "A balanced transportation system providing the appropriate types of transportation service needed by the various subareas of the Region at an adequate level of service." Two additional transportation system development objectives related indirectly to transit service in that they dealt with a reduction of accident exposure and with the alleviation of traffic congestion and reduction of travel time between component parts of the Region.

In order to be useful in the regional planning process, the objectives had to be sound logically and related in a demonstrable and, when possible, measurable way to alternative physical development proposals. The objectives were, therefore, refined by the formulation of a corresponding set of guiding planning principles and a supporting set of specific development standards for each objective. This refinement allowed the objectives to be related to physical development plan proposals and thus used in the processes of plan design, test, and evaluation.

The following definitions indicate the purpose of each of these elements:[2]

1. Objective; a goal or end toward the attainment of which plans, policies, and programs are directed.

2. Principle; a fundamental, primary, or generally accepted tenet used to support objectives and prepare standards and plans.

3. Standards; a criterion used as a basis of comparison to determine the adequacy, correctness, and suitability of plan proposals to attain objectives.

4. Plan; a design which seeks to achieve agreed-upon objectives.

It is the objective which states what is to be achieved; the principle states why the objective is valid; and the standard states how the objective can be met.

TRANSPORTATION SYSTEM DEVELOPMENT STANDARDS

The supporting transportation system development standards fall into two groups: comparative and absolute standards. The comparative standards, as the term implies, serve only as a basis for the comparison of alternative transportation plans. Minimizing the vehicle miles of travel is an example of such a comparative standard. There is no "desirable" value for this standard. Simply, the alternative plan which generates the lowest vehicle miles of travel will best meet this standard.

Absolute standards are measurable in terms of a maximum, minimum, or desirable numeric value. A desirable operating speed for a specific type of highway facility is an example of such an absolute standard.

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[1] *On assignment to SEWRPC from the U. S. Department of Commerce, Bureau of Public Roads, May 1965 to June 1966.*

[2] *See SEWRPC Planning Report No. 7, Volume 2, Forecasts and Alternative Plans--1990, June 1966.*

Transportation System Plan Design

The development of a transportation system plan involves a systematic process of first identifying the deficiencies in the existing plus committed system by comparing various elements against the applicable standards; second, postulating improvements and additions to the existing plus committed system to alleviate these deficiencies; and third, testing the postulated improvements to determine if they do in fact alleviate the deficiencies.

In the testing process, the total person travel demand expected to be generated within the planning area in the plan design year is estimated and divided into portions expected to utilize the two basic modes available, the automobile and public transit. These two segments of the total travel demand are then assigned to specific routes comprising the highway and transit systems. It is at this point that the transportation systems planner must determine whether the postulated facility improvements should be included as part of the total transportation plan. The transportation system development standards are designed to facilitate this determination.

Overriding Considerations

In the preparation of regional transportation plans and in the application of the transportation system development standards, two overriding considerations exist. First, the facilities included in each transportation plan must comprise a complete and integrated system. It is not possible to determine the manner in which the individual facilities comprising a system interact from application of the transportation system development standards per se. This must be done through quantitative test and evaluation of the proposed system utilizing traffic simulation models.

Second, an overall evaluation of each transportation system plan must be made with respect to cost. The cost of meeting the standards must necessarily be considered in order to assure plan feasibility. It may be shown that the attainment of one or more standards are beyond the available financial resources; in which case, the standards must either be lowered or additional financial resources sought.

Thus, decisions made and results reached in one phase of the planning process have ramifications in other phases of the process. The objectives to be achieved and their supporting standards dictate the design of the plan; but the design of the plan and its cost may also cause modifications in the objectives and standards as initially formulated. Also, the decision to change some element of the land use plan may necessitate modification of the transportation plan; and conversely the decision to change some elements of the transportation plan may necessitate modification of the land use plan.

Furthermore, community development objectives are not static but are subject to change over time. These changes must be monitored and suitable revisions in the plan made to ensure that the needs of the people are met by the plan design.

TRANSIT PLANNING

In the recent past, transit planning has been a relatively neglected phase of the overall urban transportation planning process. To some extent this has been due to the relatively minor role that transit plays in many smaller urban areas. But this somewhat cursory treatment of transit planning has also been due, in part, to the lack of a well-developed planning methodology for accomplishing the task.

The design of a transit system is a more difficult task than the design of a highway system, at least within southeastern Wisconsin. The basic highway design problem within the Region consists of providing the traffic capacity required to eliminate deficiencies in the existing plus committed system and to meet anticipated travel demand, while still maintaining an operational system and not destroying environmental amenities. In contrast to the highway system, the existing transit system in southeastern Wisconsin has more than adequate capacity to carry the existing and potential pas-

senger demand. Moreover, transit system capacity determinants, such as frequency of service and type of equipment, are more readily variable so that the capacity of this system is much more flexible than is that of the arterial street and highway system. The design of a transit system thus becomes a problem of creating demand for service rather than that of supplying system capacity to meet an existing demand. This makes it particularly important that the designer understand who will use the system and why.

Users of a transit system can be divided into two groups: those who must use transit (captive riders) and those who choose to use transit (choice riders). The captive riders cannot use the automobile to satisfy their travel needs because either a car is not available to them or they are not able to drive. In the design of a transit system, the provision of service to these captive riders is an important concern. The choice riders decide to use the transit system because such use in some way is more advantageous to them than the use of an automobile. If a transit system is to attract these riders, it is necessary to provide transit service which can compete favorably with the service provided by the highway system. The success that a transit system may achieve in diverting choice trips from highway facilities to transit facilities will, to a considerable extent, determine the balance which will exist within the Region between highway and transit utilization. This ability to divert choice trips thus becomes a second important concern in the design of a transit system.

In that the passenger loads on transit routes and facilities within the Region seldom reach the capacity of the routes and facilities, there is no technique available in transit system design equivalent to the capacity deficiency analysis used in highway system design by which transit improvement proposals can be developed. Furthermore, since highway facilities are generally available throughout the entire Region, an automobile trip can always find a route to and from all areas of the Region. In contrast, transit service is not available throughout the entire Region; and a transit trip consequently cannot be readily made to or from all areas of the Region. Since the number and location of transit trips is dependent in part upon the availability of transit service, no technique is, therefore, readily available to determine what the potential transit demand in any area of the Region may be without first postulating new transit routes.

Four questions thus arise in transit system design:

1. Where should new transit routes be provided?

2. What types of service should be provided for each route?

3. What quality of service should be provided for each route?

4. How much will the service cost?

A fifth question, concerned with who should pay for the transit service, is not a technical question to be treated in the design process but, rather, a policy question to be answered through the political process. It will not be treated here.

As already noted, the transit system design will determine the extent to which transit service will reduce the need for additional highway facilities. These four questions were, therefore, considered in the formulation of transit system development objectives and standards for southeastern Wisconsin, but were considered separately for local and rapid transit.

Local Transit Standards

Local transit service was defined as the transportation of persons by buses operating in relatively frequent service over prescribed surface streets on regular schedules.[3] In long-range, areawide

[3] *SEWRPC Planning Report No. 7, Volume 2, Forecasts and Alternative Plans--1990, page 20.*

planning, it is extremely difficult and of questionable value to plan a local bus system to the detail of setting headways and determining schedules. The operating companies or agencies are generally in a better position to determine the modifications in local service that are required to meet changing needs. Several standards in support of the basic transit system development objective however, served as a guide in planning for local transit service. These were:

1. Local transit service should be provided for all routes within the Region wherein the minimum potential average weekday passenger loading equals or exceeds 600 passengers per day per bus.[4] Local transit service area radius was considered to be one-quarter mile in high-density residential areas and one-half mile in medium- and low-density residential areas.

2. Local transit routes should be provided at intervals of no more than one-half mile in all high-density[5] residential areas.

3. Maximum operating headways for all local transit service throughout the daylight hours (6 a.m. to 8 p.m.) should not exceed one hour.

4. The average distance between local transit stops should not be less than 660 feet for local transit service.

5. Loading factors for local transit service should not exceed the following:

Headways on Route	Maximum Loading Factor for Periods Exceeding 10 Minutes (percent)
10 minutes	100
5-10 minutes	125
Less than 5 minutes	140

6. Transit routes should be direct in alignment, with a minimum number of turning movements, and arranged to minimize transfers and duplication of service.

7. The proportion of transit ridership to the central business district of each urbanized area within the Region should be maintained at least at the present level and increased if possible.

Rapid Transit Standards

Rapid transit service was divided into three subcategories, defined as follows:[6]

Modified rapid transit service was defined as the transportation of persons by buses operating over freeways in mixed traffic.

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[4] *A transit route may be serviced by a single bus if it can make a round trip in one hour or less. If either the route length or the potential revenue passengers increase, additional busses may be required to service the route.*

[5] *"High density" was defined as an area containing 10,000 to 25,000 persons per gross square mile; or from 22.9 to 59.2 persons per net residential acre; "medium density" as containing 3,500 to 9,999 persons per gross square mile, or from 7.3 to 22.8 persons per net residential acre; and "low density" as containing 350 to 3,499 persons per gross square mile, or from 0.5 to 7.2 persons per net residential acre.*

[6] *SEWRPC Planning Report No. 7, Volume 2, Forecasts and Alternative Plans--1990, page 20.*

Bus rapid transit service was defined as the transportation of persons by buses operating over exclusive freeway lanes or exclusive, fully grade-separated rights-of-way to provide high-speed service.

Rail rapid transit service was defined as the transportation of persons by single- or dual-rail trains operating over exclusive fully grade-separated rights-of-way to provide high-speed service.

If the rapid transit system is to alleviate the demand on highway facilities, especially during peak hours, it must provide service attractive enough to divert choice trips from the use of the automobile. The service must be attractive with respect to both route location and speed. In rapid transit system design, therefore, it becomes necessary to provide a high enough level of service to attract sufficient ridership to justify provision of the service and to reduce the demand for highway facilities. To accomplish this objective, the rapid transit plan finally developed for southeastern Wisconsin made maximum utilization of the extensive freeway system proposed for the Region (see Map 1). This freeway system supplies wide areal coverage and occupies the corridors of highest travel demand within the Region (see Map 2).

In the rapid transit plan development, high-speed transit service was initially proposed for all highway corridors exhibiting a high travel demand, without prejudging what type of transit service should be provided. It was not sufficient, however, for plan design purposes to propose only the location of these rapid transit routes; it was also necessary to quantitatively test the proposals to determine if they would indeed serve the purpose for which they were intended and to determine what type and quality of service should be provided. These initial proposals were, therefore, tested using a set of simulation models to determine whether the potential utilization would be sufficient to justify incorporation into the final plan.[7]

The following standards were formulated to aid in the rapid transit plan design, test, and evaluation:[8]

1. Transit service of an appropriate type should be provided for all routes within the Region wherein the minimum potential average weekday revenue passenger loading equals or exceeds the following values:

Type of Transit Service	Minimum Potential Average Weekday Revenue Passengers	Transit Service Area Radius (miles)
Modified Rapid Transit		
A. All day (6 a.m. -8 p.m.)	600/day/bus[9]	3
B. Limited	300/4 hrs./bus	3
Bus Rapid Transit	21,000/day/preempted freeway lane	3
	For separate right-of-way, see Figure 1	3
Rail Rapid Transit	See Figure 2	3

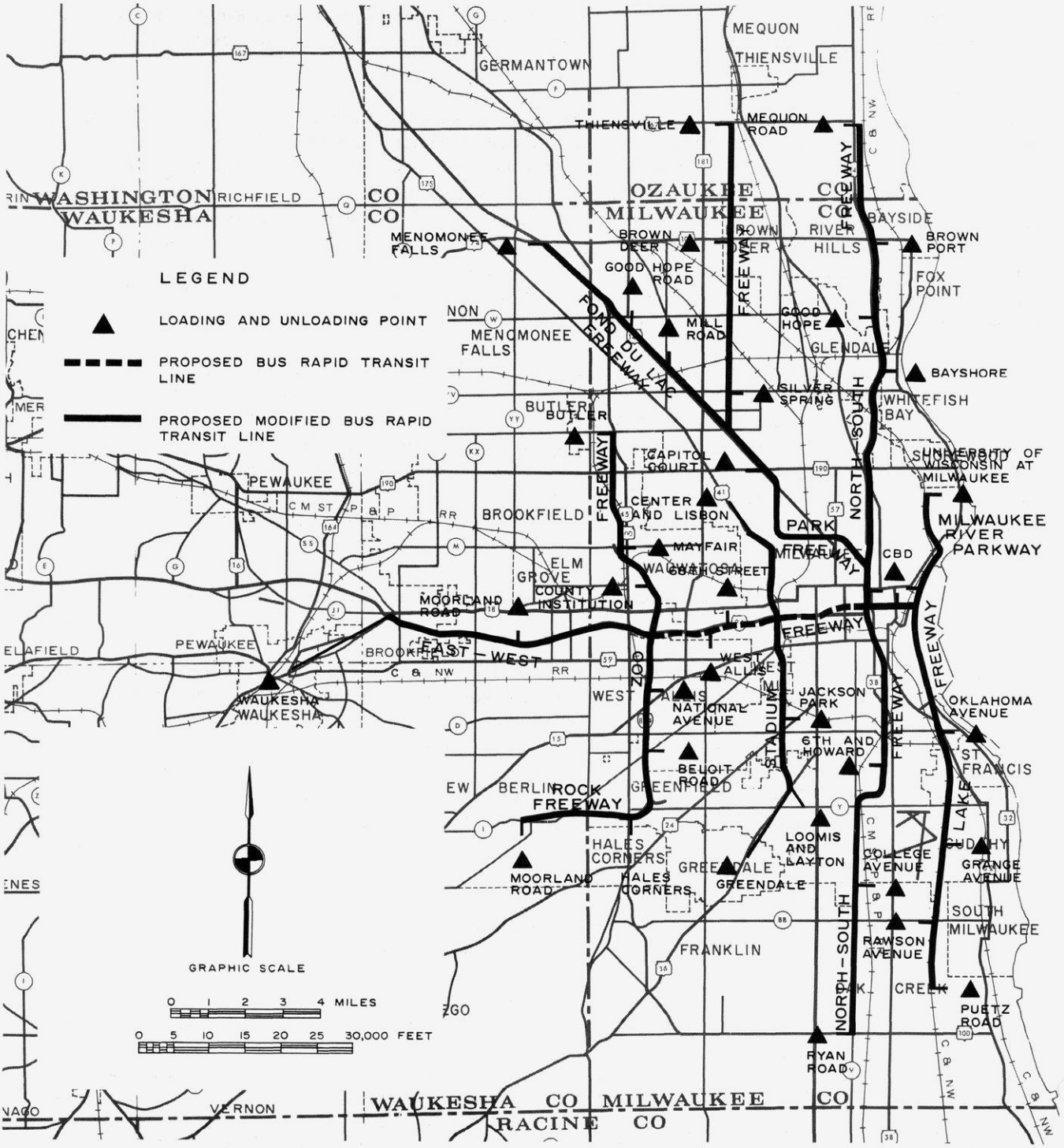
[7] *The various steps in the simulation process are described in several previous SEWRPC publications. Most pertinent to transit system test are SEWRPC Planning Report No. 7, Volumes 1 and 2; SEWRPC Technical Record, Volume 1, No. 3, "Rail and Transit Inventory and Design of the Transit Network"; and SEWRPC Technical Record, Volume 2, No. 6, "A Modal Split Model for Southeastern Wisconsin."*

[8] *SEWRPC Planning Report No. 7, Volume 2, Forecasts and Alternative Plans--1990, Table 2.*

[9] *See footnote 4.*

Map 1

PROPOSED REGIONAL MODIFIED RAPID AND RAPID TRANSIT SYSTEM
1990



Map 2
REGIONAL TRAFFIC FLOW MAP
AVERAGE WEEKDAY TRAFFIC VOLUMES
1990

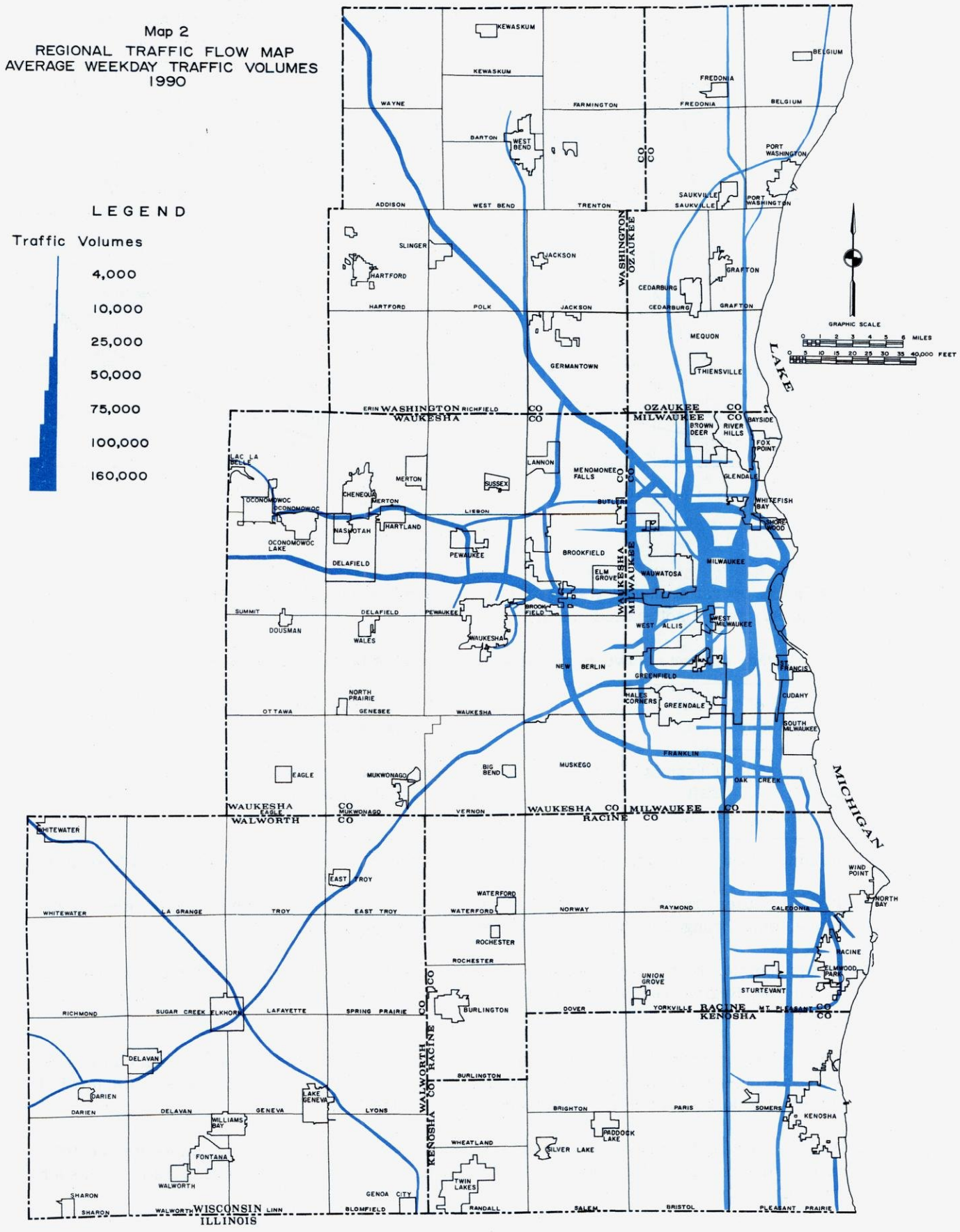
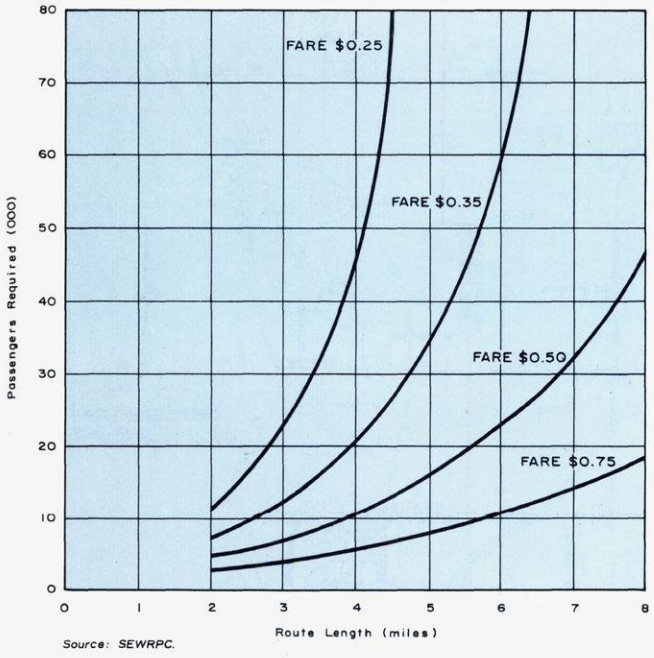
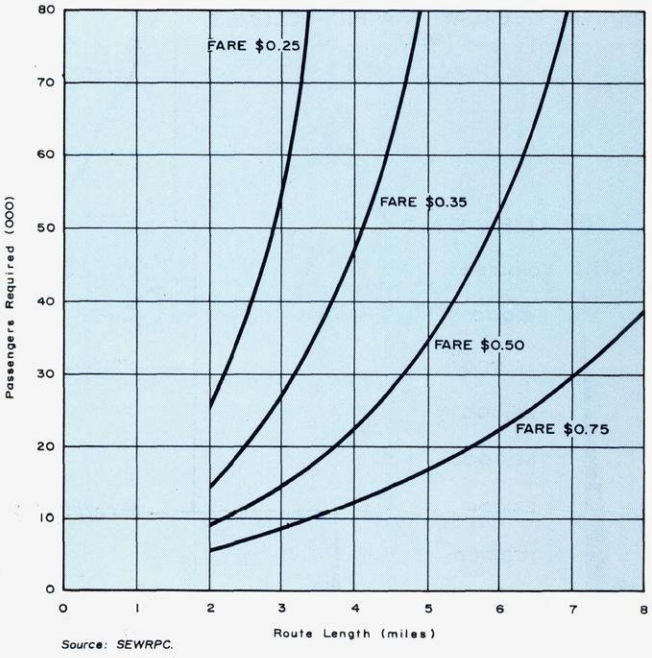


Figure 1
THRESHOLD SERVICE WARRANT CURVES
BUS RAPID TRANSIT



Source: SEWRPC.

Figure 2
THRESHOLD SERVICE WARRANT CURVES
RAIL RAPID TRANSIT



Source: SEWRPC.

2. Maximum operating headways for all transit service throughout the daylight hours (6 a.m. to 8 p.m.) should not exceed one hour.

3. The average distance between transit stops should not be less than:

Type of Transit Service	Average Distance Between Stops
Modified Rapid Transit	No stops between terminal areas
Bus Rapid Transit	2 miles (for line haul sections)
Rail Rapid Transit	2 miles (for line haul sections)

4. Maximum loading factors should not exceed 100 percent for periods greater than 10 minutes.

5. Transit routes should be direct in alignment, with a minimum number of turning movements, and arranged to minimize transfers and duplication of service.

6. The proportion of transit ridership to the central business district of each urbanized area within the Region should be maintained at least at the present level and increased if possible.

7. Modified rapid transit or rapid transit service should be provided as necessary to reduce peak loadings on arterial streets and highways in order to maintain a desirable level of transportation service between component parts of the Region.

8. Parking should be provided at park-and-ride transit stations to accommodate the total parking demand generated by trips which change from auto to transit modes at each such station.

DERIVATION OF RAPID TRANSIT THRESHOLD SERVICE WARRANTS

Standard No. 1 in the previous section can be termed a rapid transit threshold service warrant since it specifies the minimum potential revenue passenger loading which would justify initiation of rapid transit service. The warrants were set on the basis of analyses which require additional description. Two cases were involved, the one concerning the preemption of freeway lanes—analyzed on a quite simple, purely rational basis—and the other concerning the construction of exclusive facilities, analyzed on an economic basis.

Preemption of a Freeway Lane

One method of providing bus rapid transit service is to preempt a freeway lane currently devoted primarily to utilization by automobiles and to use this lane exclusively for the operation of buses. In April of 1964, Mr. E. H. Holmes, then Director of Planning for the U. S. Bureau of Public Roads, stated:

> "Many factors are involved in a decision to reserve a lane for buses, even during peak hours. The Bureau of Public Roads takes the position that such a reservation is reasonable if the usage by bus passengers exceeds the number of persons that would normally be moved in the same period in passenger cars ...."[10]

On an average weekday basis, the number of persons carried by automobile in a freeway lane can be computed as follows:

6-lane urban design capacity[11]	= 85,000 vehicles per day
1-lane urban design capacity	= 14,200 vehicles per day
14,200 x 1.5 (average car occupancy)	= 21,200 persons per day

Therefore, if it can be demonstrated that at least 21,000 passengers per day would be carried by the buses, there is sufficient justification for preempting a lane of freeway.

Bus Rapid Transit on a Separate Right-of-Way

The cost of providing transit service is equal to the sum of the operating and capital costs. The method used to pay for the service—fares with public subsidy or even entirely by public subsidy—does not alter the true cost of providing the service.

Following this reasoning, a series of "threshold service warrant" curves were developed specifying the number of passengers paying an "equivalent fare" required to justify the institution of rapid transit service. The "equivalent fare" was defined as the amount that each transit passenger would have to pay if the total cost of the transit service was to be recovered from the fare box. In this manner, the true cost of providing the service was estimated. The threshold service warrant curves thus provide a common basis for the evaluation of alternate courses of pricing policy, as well as being an aid in system design.

Formula Development: The threshold service warrant curves were drawn from computations based on the basic assumption that the sum of the system operating and capital costs are to be paid by the passenger revenue generated by the system. More specifically:

(a) Passenger Revenue = Operating Costs + Capital Costs

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[10] *Holmes, E. H., "Transit and Federal Highways," presented at the Engineers Club of St. Louis, April 23, 1964.*

[11] *See SEWRPC Technical Record, Volume 2, No. 2, "Capacity of Arterial Network Links." The determination of daily vehicular capacity is a complex problem involving many factors, including specific peak hourly volumes, directional split, design geometrics, and distribution of traffic by lane. The foregoing computations, therefore, represent an approximation based upon average conditions within the Region.*

(b) Total Daily Passenger Revenue = Equivalent Fare x Number of Bus - Loads per Day x Average Number of Passengers per Bus

(c) Total Daily Operating Costs = Operating Cost per Bus Mile x Number of Bus- Loads per Day x Length of Busway x 2

(d) Total Daily Capital Costs = Length of Busway x [Daily Capital Cost for ROW and Construction per Mile of Busway + Daily Maintenance per Mile of Busway]

+ Daily Capital Cost for Terminal Construction

If X = Number of Busloads Per Day
L = Length of Busway
F = Equivalent Fare

and if

Operating cost per bus mile, including depreciation of rolling stock and supporting yards and shops = $0.56 per bus mile (see page 12)

Average number of passengers carried per busload = 26 per bus

Daily capital costs for line right-of-way and construction per mile at a 6 percent rate of return plus daily maintenance costs per mile of busway = $901 per mile per day (see page 13 for derivation)

Daily capital costs for terminal construction at a 6 percent rate of return = $31 per day (see page 13 for derivation)

Daily operating costs = 0.56 (X) (L) (2) = 1.12XL

Therefore, equation (a) can be rewritten as:

(e) 26XF = 1.12XL + 901L + 31

Equation (e) can be solved for "X" (the number of busloads per day on the route), which is multiplied by the average number of passengers carried per bus to yield the number of revenue passengers required at a specified fare to justify the service.

In calculating the data for the construction of threshold service warrant curves, fares of $0.25, $0.35, $0.50, and $0.75 were used, together with route lengths varying from a minimum length of 2 miles to that length at which the revenue passenger loads required exceeded 80,000 per day. The final curves developed are shown in Figure 1.

Cost Data: In developing the threshold service warrant curves for a bus rapid transit system, the following construction, maintenance, and operating costs were used:

1. Right-of-Way Acquisition Cost

The average cost of acquiring land through developed portions of Milwaukee County was determined on the basis of past experience to be about $150,000 per acre, including costs

of acquiring and razing existing buildings and structures. A typical cross section for a two-lane exclusive bus roadway was postulated (see Figure 3), which requires approximately 15 acres of land per mile of roadway, resulting in an estimated cost for right-of-way acquisition of $2,250,000 per mile.

2. Construction Costs

The cost of constructing the roadway was estimated as follows:

P. C. C. pavement with valley gutters	$150,000/mile
Storm Sewerage	50,000/mile
Fencing	25,000/mile
Earthwork utility relocation, sodding, and seeding	180,000/mile
Grade separation structures (two per mile)	200,000/mile
Subtotal	$605,000/mile
Engineering, surveys, and contingencies	45,000/mile
Total	$650,000/mile

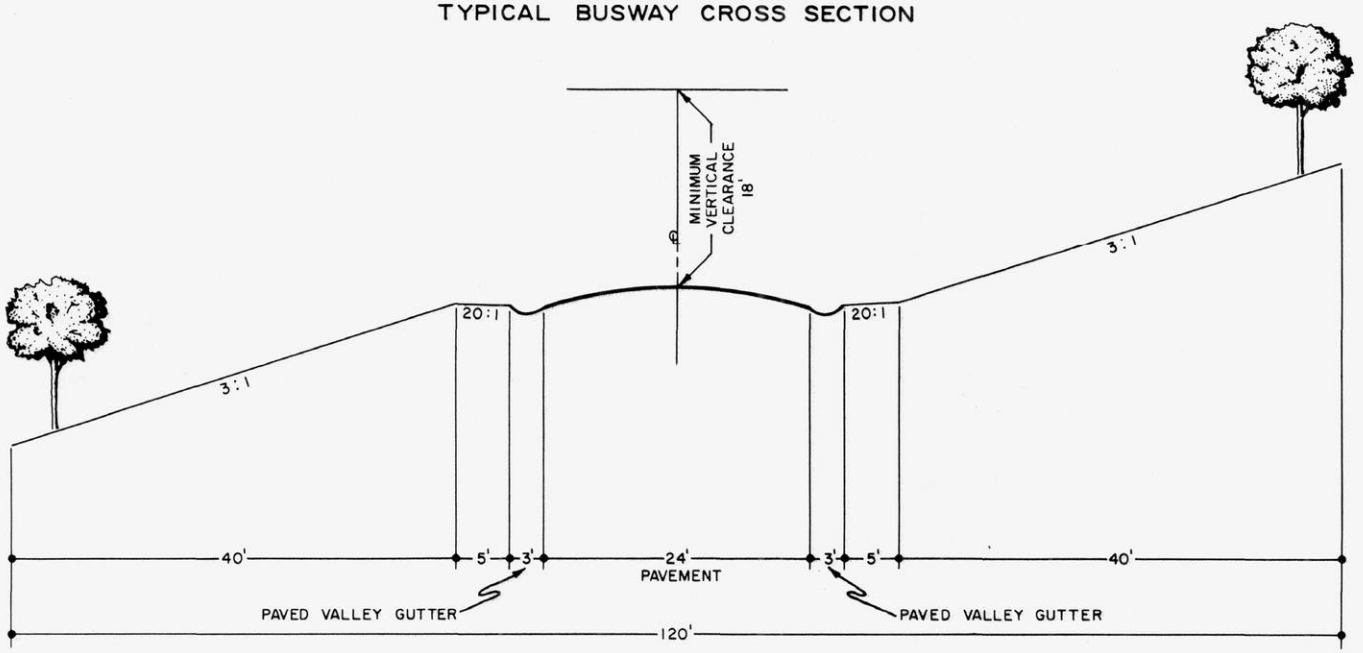
3. Central Terminal Construction Costs

The cost of constructing a transit bus terminal at the downtown end of the line was estimated at $100,000.

4. Maintenance of Way

The cost of maintaining the busway, including snow removal, was estimated at $1,500 per lane mile per year or $3,000 per route mile per year.

Figure 3
TYPICAL BUSWAY CROSS SECTION



Source: SEWRPC.

5. Cost of Bus

The cost of a standard 52-seat bus with air-conditioning and equipped for 60-70 mile per hour running speeds was estimated at $27,750 per bus. Using a 6 percent interest rate, a 12-year service life,and a 5 percent allowance for downtime, the annual cost was estimated at approximately $3,444 per bus.

6. Yards and Shops

The total cost of the necessary yards and shops for equipment storage and maintenance was estimated at $5,000 per bus. Again using a 6 percent interest rate, a 25-year service life and a 5 percent allowance for downtime, the annual cost was estimated at approximately $411 per bus.

7. Operating Costs

The total operating costs, including equipment maintenance, fuel, conducting transportation, traffic, and general overhead, were estimated at 45.6 cents per bus mile. Depreciation on buses and supporting yards and shops was estimated at 10.7 cents per bus mile, giving a total operating cost of approximately $0.56 per bus mile.

It should be noted that the capital costs were divided into three categories: fixed facility costs which vary directly with route length, such as, right-of-way, construction, and maintenance; fixed facility costs, which are independent of route length, such as a central terminal; and rolling stock and costs which can be associated with the number of buses, such as, yards and shops. The first two categories of costs were used to calculate the daily capital cost. The third category was included in the operating costs as depreciation. This was consistent with the plan proposal that a public agency construct the busway and lease its operation to a private transit corporation.

8. Daily Capital Cost

Before calculation of the threshold service warrant curves, it was necessary to reduce all costs to a daily basis. The present worth method was used, the formula being:

$$R = P\frac{i\,(1 + i)^n}{(1 + i)^n - 1}$$

where R = Annual Rate necessary to retire principal and pay interest
P = Present Worth of Investment
i = Interest Rate
n = Number of years to retire principal

The interest rate was set at 6 percent based upon the concept that a public project to be economical should return to the public at least as great a rate of interest as it might through alternative private investment. The number of years to return the principal (n) was set differently for each component of the proposed system based on the estimated physical life of this component. The various return periods used are indicated in the following calculations of daily costs.

The annual cost of bus roadway was calculated as follows:

Right-of-Way (n = 25 years)

$2,250,000 (0.07823) = $176,017.50/mile/year

Construction (n = 25 years)

$ 650,000 (0.07823) = $ 50,849.50/mile/year

Maintenance $ 3,000.00/mile/year

Total $229,867.00/mile/year

To reduce this total to a daily basis, it was divided by 255 average weekdays per year yielding approximately $901 per mile per day.

The annual cost of the bus terminal was calculated as follows:

Terminal (n = 25 years)

$100,000 (0.07823) = $7,823/year or approximately $31/day

Rail Rapid Transit

Formula Development: The rail rapid transit threshold service warrant curves were computed using the same basic equations used in computing the bus rapid transit curves. The following equations were developed:

(f) Passenger Revenue = Operating Costs + Capital Costs

(g) $$\text{Total Daily Passenger Revenue} = \text{Equivalent Fare} \times \text{Number of Car-Loads per Day} \times \text{Average Number of Passengers per Carload}$$

(h) $$\text{Total Daily Operating Costs} = \text{Operating Cost per Car Mile} \times \text{Number of Car-Loads per Day} \times \text{Length of Rail Line} \times 2$$

(i) $$\text{Total Daily Capital Costs} = \text{Length of Rail Line} \times \left[\text{Daily Capital Cost for ROW and Construction per Mile of Rail line} + \text{Daily Maintenance Cost per Mile of Rail Line}\right] + \frac{1}{2}\left[\text{Length of Rail Line} - 2\right]\left[\text{Daily Capital Cost for each Line Station}\right] + 2\left[\text{Daily Capital Cost for each Terminal Station}\right]$$

If X = Number of Carloads per Day
L = Length of Rail Line
F = Equivalent Fare

and if

Operating cost per car mile, including depreciation of rolling stock and supporting yards and shops = $0.73 per car mile (see page 15)

Average number of passengers carried per carload = 28 per car

Daily capital cost for line right-of-way and construction per mile at a 6 percent rate of return plus daily maintenance costs per mile of rail line = $1,456 per day (see page 16 for derivation)

Daily capital costs for each line station (one every two miles) at a 6 percent rate of return = $168 per line station per day (see page 16 for derivation)

Daily capital costs for each terminal station (two required) at a 6 percent rate of return = $322 per terminal station per day (see page 16 for derivation)

Daily Operating Costs = 0.73 (X) (L) (2)

Therefore, equation (f) can be rewritten as:

(j) $28XF = 1.46XL + L \left[1456\right] + 1/2 \left[L-2\right] \left[168\right] + 2 \left[322\right]$

or $28XF = 1.46XL + 1540L + 476$

Equation (j) can be solved for "X" (the number of carloads per day on the rail line), which is multiplied by the average number of passengers carried per car to yield the number of revenue passengers required at a specified fare to justify the service.

In calculating the data for the construction of threshold service warrant curves, fares of $0.25, $0.35, $0.50, and $0.75 were used, together with route lengths varying from a minimum length of 2 miles to that length at which the revenue passenger loads required exceeded 80,000 per day. The final curves developed are shown in Figure 3.

Cost Data: The following construction, maintenance, and operating costs were used in developing the threshold service warrant curves for a rail rapid transit system:

1. Right-of-Way Acquisition Cost

   The same approach was used to estimate the rail system right-of-way cost as was used for the bus system. The estimated cost of right-of-way acquisition for the rail system was $2,250,000 per mile.

2. Construction Costs

   The cost of constructing the rail line was estimated as follows:

Double track line	$ 225,000/mile
Storm Sewerage	50,000/mile
Fencing	25,000/mile
Earthwork, utility relocation, sodding, and seeding	180,000/mile
Grade separation structures (two per mile)	600,000/mile
Electrification	500,000/mile
Signalization	450,000/mile
Subtotal	$2,030,000/mile
Engineering, surveys, and contingencies	210,000/mile
Total	$2,240,000/mile

3. Station and Terminal Construction Costs

   The cost of constructing a rail terminal at each end of the rapid transit rail line was estimated at an average of $1,050,000 per station, including crossovers and storage sidings. The construction cost of line stations at two-mile intervals along the rail line was estimated at $550,000 per station including 250 lineal feet of platform.

4. Maintenance of Way

The total cost of maintaining the rail line, including snow removal, was estimated at $10,000 per track mile per year or $20,000 per line mile per year for a double track line.

5. Cost of Rapid Transit Rail Car

The cost of a rapid transit rail car was estimated at $80,000 per car. Using a 6 percent interest rate, a 25-year service life and a 5 percent allowance for downtime, the annual cost was estimated at $6,571 per car.

6. Yards and Shops

The total cost of the necessary yards and shops for equipment storage and maintenance was estimated at $8,000 per car. Again, using a 6 percent interest rate, a 25-year service life, and a 5 percent allowance for downtime, the annual cost was estimated at $657 per car.

7. Operating Costs

The total operating costs, including equipment maintenance, power, conducting transportation, traffic, and general overhead were estimated at $0.53 per car mile. Depreciation on cars and supporting yards and shops was estimated at $0.20 per car mile, giving a total operating cost of $0.73 per car mile.

It should be noted that the capital costs were again divided into three categories: fixed facility costs which vary directly with route length, such as right-of-way, construction, maintenance, and line station construction; fixed facility costs which are independent of route length, such as a terminal building and a turn-around extension at each end of the rail line; and rolling stock and costs which can be associated with the number of rail cars, such as yards and shops. The first two categories were used to calculate the daily capital cost. The third category was included in the operating costs as depreciation. This was consistent with the plan proposal that a public agency construct the rail line and lease its operation to a private transit corporation.

8. Daily Capital Cost

Before calculation of the threshold service warrant curves, it was necessary to reduce certain costs to a daily basis. The present worth method was used (see page 12 for the formula and definitions). An interest rate of 6 percent was used in accordance with the same reasoning applied to the rapid bus line, as explained on page 12. The period of time required to return the principal (n) was set at 25 years for each component of the rail system based upon the estimated physical life of the component.

The annual cost of the rail line was calculated as follows:

Right-of-Way (n = 25 years)

$2,250,000 (0.07823) = $176,017/mile/year

Construction (n = 25 years)

$2,240,000 (0.07823) = $175,235/mile/year

Maintenance 20,000/mile/year

Total $371,252/mile/year

To reduce this total to a daily basis, it was divided by 255 average weekdays per year yielding $1,456 per mile per day.

The annual cost for each terminal station including crossovers and storage sidings was calculated as follows:

Terminal Station - Complete (n = 25 years)

$1,050,000 (0.07823) = $82,142/year or approximately $322/day

The annual cost for each line station was calculated as follows:

Line Station - one every two miles (n = 25 years)

$ 550,000 (0.07823) = $43,026/year or approximately $168/day

SUMMARY AND CONCLUSION

The objectives and standards, including threshold service warrants for rapid transit service and the supporting cost data described herein were developed for long-range areawide planning purposes. As such, they are necessarily preliminary and will require refinement as the recommendations contained in the now adopted regional transportation plan are implemented. It is anticipated that the first major refinement will be carried out as preliminary engineering plans are prepared for the busway recommended in the adopted plan.

MODIFIED RAPID TRANSIT SERVICE IN THE SOUTHEASTERN WISCONSIN REGION

by Sheldon W. Sullivan, Administrative Officer

INTRODUCTION

On March 30, 1964, the Milwaukee and Suburban Transport Corporation inaugurated a new type of modified rapid transit service within the Region. Appropriately named "freeway flyer" service, this new service, utilizing freeway facilities for nearly the entire length of the line, provided direct nonstop service during the peak commuting periods of each weekday between the Mayfair Shopping Center and "Downtown Milwaukee" (Central Business District of Milwaukee), a distance of approximately nine miles (see Map 1).

Tried initially on an experimental basis, the new service achieved immediate success. Ridership on the line increased steadily from an average of 290 revenue passengers per weekday during the first month of service to 600 by the end of the first year of service, and by January 1967 ridership on the line was approaching an average of 1,000 revenue passengers per weekday (see Figure 1).

The Mayfair Shopping Center offered a number of advantages as the outlying terminus of the line for such an experiment. An excellent commercial facility, having a total site area of approximately 70 acres, Mayfair is surrounded by fine residential areas and is strategically located just 2,000 feet from an interchange on a freeway facility leading directly to downtown Milwaukee. Buses operated over this freeway between Mayfair and downtown Milwaukee reduced travel times over regular bus service operated over surface arterials from 56 minutes to 33 minutes, a reduction of 23 minutes, or 41 percent, a vital factor in the success of the operation. Another very important factor favoring success was the cooperation of the Mayfair management, who made available to freeway flyer patrons without charge 450 off-street parking spaces in a well-lighted, easily accessible portion of the shopping center parking area. Two other factors which also influenced the success of the service were the attractive modern buses placed in this service by the Transport Corporation and the reasonable premium fare charged, which including privilege of one hour free transfer time to other lines, was only five cents higher than regular bus fare of 30 cents.

Standard "new look" buses seating 53 passengers were used in this service. Operating originally on the Mayfair route with a maximum speed capability of 47 miles per hour, the buses were subsequently modified to increase the maximum speed to about 53 miles per hour. The only other modifications made on these buses were the installations of slightly larger fuel injectors which permitted greater power and right side view mirrors which facilitated passing.

The apparent success of the freeway flyer service at the very beginning was promising indeed; but to more fully evaluate this apparent success, it was necessary to determine whether the service had succeeded in attracting a substantial number of new transit riders or if most patrons had merely changed to the freeway flyer service from regular bus service. If the former were true, the venture could be considered an important achievement, since it would represent a reversal of a 20-year trend within the Region. If, however, the latter were true, the lustre of success would be diminished, since it would mean that freeway flyer patronage consisted mostly of passengers diverted from other Transport Corporation transit lines operating in the corridor in regular service.

To obtain the answer to this key question and to gain a better understanding of the personal characteristics and commuting habits of the freeway flyer users, the Southeastern Wisconsin Regional Planning Commission, in cooperation with the Milwaukee and Suburban Transport Corporation, conducted a survey of freeway flyer passengers on April 15, 1964, a little more than two weeks after the inauguration of the service.

THE 1964 SURVEY

The findings of this survey were reassuring, not only to the Transport Corporation, but to all others concerned with achieving a better balanced transportation system for the Region. Most importantly, it was found that the freeway flyer service had, in fact, attracted many new transit patrons and, very significantly, that most of these new patrons had formerly commuted as auto drivers.

As indicated in Table 1, 73 of a total of 187 respondents had formerly commuted by a mode of transportation other than by bus; most of them—54 or 74 percent of the total—as auto drivers. It is also important to note in Table 1 that only 29 respondents, or 16 percent of the total were captive transit riders in the sense that they could not have commuted as auto drivers even if an automobile had been available.

Table 1

MODE OF TRAVEL PRIOR TO FREEWAY FLYER SERVICE BY AUTO DRIVER STATUS: MAYFAIR, 1964

Auto Driver Status	Auto Driver	Auto Passenger	Bus	Taxi or Train	Total
Licensed	54	12	89	3	158
Unlicensed	0	4	25	0	29
Total	54	16	114	3	187[a]

[a] *Does not include 8 respondents who did not make the trip before Freeway Flyer Service began nor 2 respondents who did not answer this question.*

Source: Milwaukee and Suburban Transport Corporation and SEWRPC.

Moreover, in answer to questions concerning automobile ownership and the availability of an automobile for commuting, 130 respondents, or 66 percent, as shown in Table 2, indicated that they did own an automobile and that an automobile was available for commuting if they had chosen to drive. This represented a very important finding and a surprisingly large percentage considering that results of the 1963 SEWRPC origin-destination surveys revealed that only 9 percent of all transit riders in the Milwaukee urbanizing area had such a choice. This table also points out that automobiles, though owned, were not available at the time of commuting for 49 respondents, or 25 percent of the total, and automobiles were not owned by 17 respondents, or only 9 percent of the total.

Table 2

AUTOMOBILE OWNERSHIP BY AUTOMOBILE AVAILABILITY: MAYFAIR, 1964

Automobile Available at Time of Trip	Automobile Availability	Automobile Owned		Total
		Yes	No	
	Yes	130	0	130
	No	49	17	66
	Not Indicated	1	0	1
Total		180	17	197

Source: Milwaukee and Suburban Transport Corporation and SEWRPC.

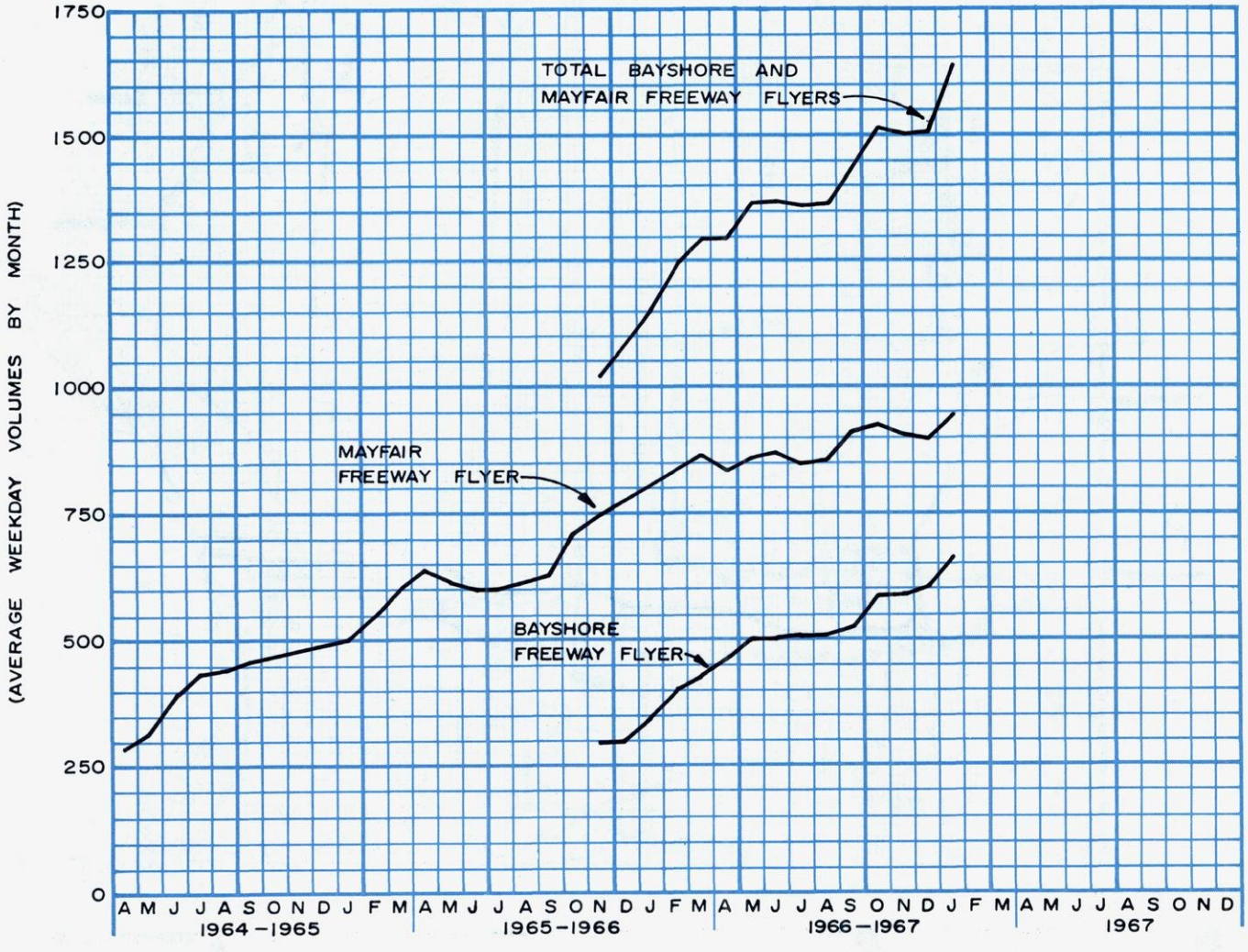
The success of the freeway flyer service was thus clearly established. It had been accepted quickly by the public; it was financially profitable to the Transport Corporation; and the service had attracted many new transit riders, most of whom had commuted by automobile prior to the establishment of freeway flyer service.

By November 1966 a considerable span of time had elasped since the initial survey, and in the meantime freeway flyer patronage had more than tripled at Mayfair, and a new similar service had been provided for an entire year (since November 29, 1965) at Bayshore Shopping Center located six miles north of downtown Milwaukee in the City of Glendale. As at Mayfair, a convenient free parking area had been set aside by the management of the Bayshore Shopping Center; and as at Mayfair, freeway flyer service operating over a freeway facility saved commuters as much as 23 minutes over regular bus service travel times of 49 minutes, notwithstanding one intermediate stop made at an intersection a few blocks from the shopping center (see Map 1). As at Mayfair also, patronage at Bayshore by 1966 had approximately doubled the daily average recorded during the first month of operation (see Figure 1).

With greatly increased patronage at Mayfair and with the new service in operation at Bayshore, it was considered desirable to obtain up-to-date information concerning the characteristics and travel habits of the freeway flyer passengers. Accordingly, as before, the Southeastern Wisconsin Regional Planning Commission jointly with the Milwaukee and Suburban Transport Corporation conducted a survey of freeway flyer passengers at Bayshore on November 16, and another at Mayfair on November 17, 1966.

Figure 1

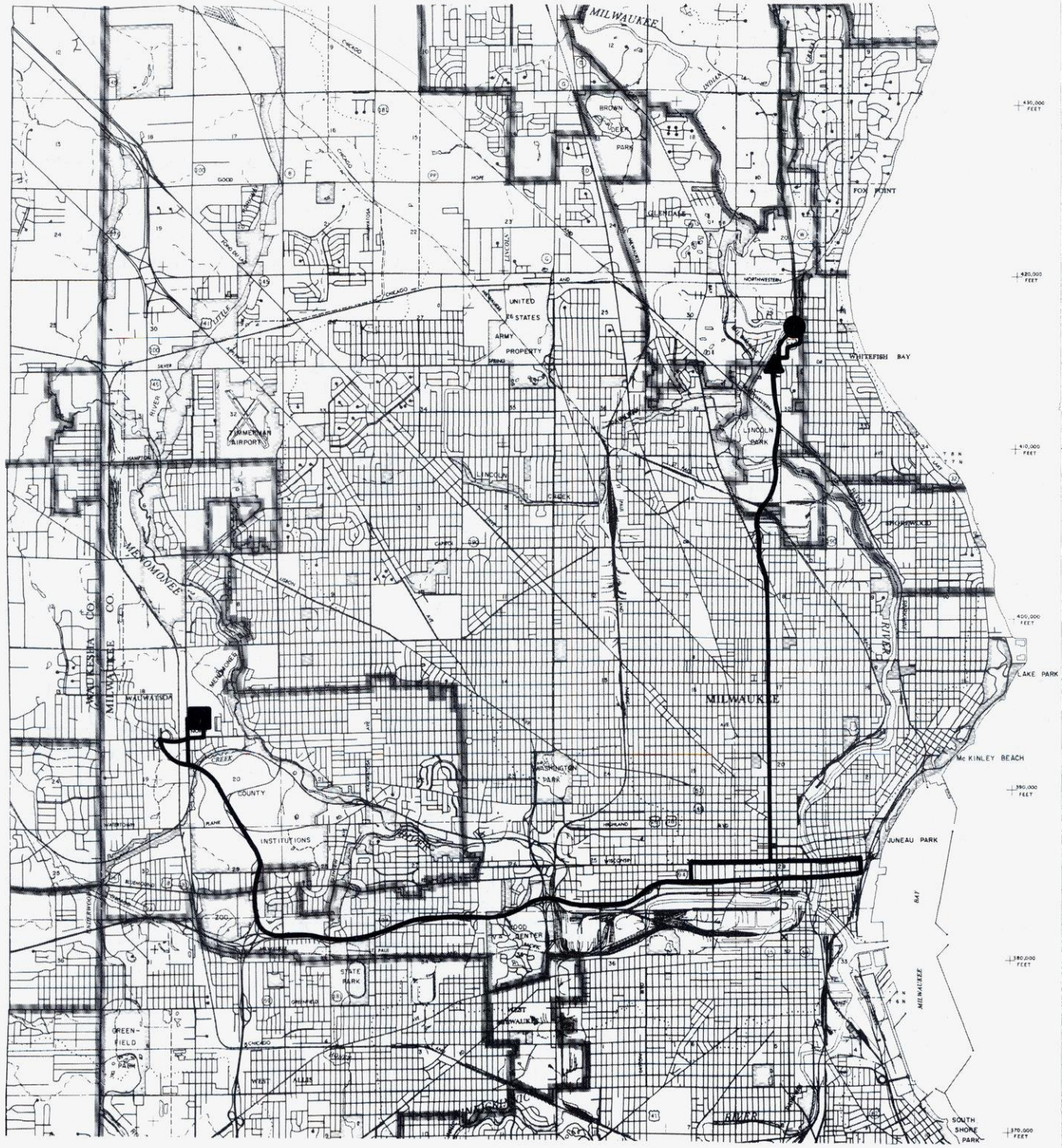
AVERAGE WEEKDAY FREEWAY FLYER PASSENGER VOLUMES FOR BAYSHORE AND MAYFAIR ROUTES



SOURCE: MILWAUKEE AND SUBURBAN TRANSPORT CORPORATION.

Map 1

FREEWAY FLYER ROUTES
MAYFAIR – BAYSHORE
1966



LEGEND

■ MAYFAIR SHOPPING CENTER

● BAYSHORE SHOPPING CENTER

— FREEWAY FLYER ROUTE

▲ INTERMEDIATE STOP

THE 1966 SURVEY

The findings of the new surveys were even more reassuring to transit proponents within the Region than the findings of the initial survey in 1964. First of all, the number of commuters converting to transit service at Mayfair had increased from 73 in 1964 to 227 in 1966, as shown in Table 3; and these conversions, again mostly auto drivers, now represented more than 51 percent of total ridership as compared to 39 percent in 1964, as shown on Table 1. Additionally, similar conversions at Bayshore, surveyed for the first time, numbered 186, or 58 percent of total ridership.

Table 3

MODE OF TRAVEL PRIOR TO FREEWAY FLYER SERVICE BY AUTO DRIVER STATUS: MAYFAIR AND BAYSHORE, 1966

MAYFAIR					
Auto Driver Status	Auto Driver	Auto Passenger	Bus	Taxi or Train	Total
Licensed	182	34	152	7	375
Unlicensed	0	3	60	1	64
Not Indicated. . .	0	0	3	0	3
Total	182	37	215	8	442[a]
BAYSHORE					
Auto Driver Status	Auto Driver	Auto Passenger	Bus	Taxi or Train	Total
Licensed	140	28	88	2	258
Unlicensed	0	14	40	0	54
Not Indicated. . .	1	1	4	0	6
Total	141	43	132	2	318[b]

[a] *Does not include 109 respondents who did not make the trip before Freeway Flyer Service began nor 6 respondents who did not answer this question.*

[b] *Does not include 57 respondents who did not make the trip before Freeway Flyer Service began nor 10 respondents who did not answer this question.*

Source: Milwaukee and Suburban Transport Corporation and SEWRPC.

Another important finding in the new surveys was that, as at Mayfair in 1964, nearly two-thirds of the respondents both at Mayfair and at Bayshore indicated that they had commuted by transit by choice. Of a total of 551 respondents at Mayfair, 343, or 62 percent, indicated that they could have commuted as auto drivers if they had preferred to; and of a total of 371 respondents at Bayshore, 228, or 62 percent, indicated that they could have commuted also in this manner. Although owning automobiles, 176 respondents at Mayfair, or 32 percent, and 127 respondents at Bayshore, or 34 percent, indicated they could not have driven because an automobile was not available at the time of the trip (see Table 4). Less than 5 percent of the respondents both at Mayfair and at Bayshore did not own automobiles, as also shown in Table 4.

Three very important findings of the new surveys were, therefore, that: 1) freeway flyer service had continued to attract a very substantial number of new transit riders both at Mayfair and at Bayshore, 2) most of these new transit users had commuted as auto drivers prior to the establishment of freeway flyer service, and 3) nearly two-thirds of the freeway flyer patrons could have commuted as auto drivers if they had so desired.

The survey results provided one piece of information surprising to all connected with the survey. It had been commonly believed that a large majority of freeway flyer riders used the service in both directions each weekday. As shown in Table 5, however, less than 50 percent of the respondents made two-way trips on each of the three survey dates. Two reasons for the unexpectedly low number of two-way trips may be that: 1) freeway flyer schedules do not coincide with the times

Table 4

AUTOMOBILE OWNERSHIP BY AUTOMOBILE AVAILABILITY: MAYFAIR AND BAYSHORE, 1964

MAYFAIR				
Automobile Available at Time of Trip	Automobile Availability	Automobile Owned		Total
		Yes	No	
	Yes	343	0	343
	No	176	24	200
	Not Indicated	8	0	8
Total		527	24	551[a]
BAYSHORE				
Automobile Available at Time of Trip	Automobile Availability	Automobile Owned		Total
		Yes	No	
	Yes	228	0	228
	No	127	14	141
	Not Indicated	2	0	2
Total		357	14	371[b]

[a] *Does not include 6 respondents not indicating auto ownership.*
[b] *Does not include 10 respondents not indicating auto ownership.*

Source: Milwaukee and Suburban Transport Corporation and SEWRPC.

Table 5

NUMBER OF PERSONS MAKING ROUND TRIPS AND ONE-WAY TRIPS: MAYFAIR, 1964 AND 1966, AND BAYSHORE, 1966

Type and Time of Trip	MAYFAIR - 1964	MAYFAIR - 1966	BAYSHORE - 1966
Round Trips	90	255	183
A. M. Trips Only. . . .	49	151	122
P. M. Trips Only. . . .	58	151	80
Total	197	557	385

Source: Milwaukee and Suburban Transport Corporation and SEWRPC.

desired by many patrons, and 2) many patrons obtain rides in one direction with friends or fellow workers. If the former is true, an adjustment in freeway flyer schedule might permit many patrons now commuting one way to commute both ways via freeway flyers.

In all three surveys, trips made directly between home and work accounted for the very large majority of all freeway flyer travel, as shown in Table 6. Such trips at Mayfair comprised 87 percent in 1964 and 88 percent in 1966 of total trips, and at Bayshore such trips comprised 83 percent of total trips. Trips between home and school were the only other major trip purpose of freeway flyer patrons.

The 1966 origins of inbound trips and the destinations of outbound trips, which represent in most instances the residences of freeway flyer passengers, are shown for both Mayfair and Bayshore routes on Map 2. Similar information is included in Table 7 for Mayfair in 1964 and 1966 and for Bayshore in 1966. As shown in Table 7, 84 percent of the trip ends on the Mayfair route in 1964 were located within 3 miles of the line terminus at the shopping center; another 21 percent were located within 3 to 6 miles, and only 5 percent were located beyond 6 miles. By 1966 these percentages at Mayfair had changed to 74 percent within 3 miles of the line terminus, 18 percent within 3 to 6 miles, and 8 percent beyond 6 miles. The trip ends located beyond 6 miles from Mayfair

Table 6

NUMBER OF FREEWAY FLYER TRIPS BY TRIP PURPOSE "TO" BY TRIP PURPOSE "FROM": MAYFAIR, 1964 AND 1966, AND BAYSHORE, 1966

MAYFAIR - 1964					
Trip Purpose	Work	Home	School	Other	Total
Work	1	117	0	12	130
Home	132	0	3	6	141
School	2	3	0	0	5
Other	1	6	0	2	9
Total	136	126	3	20	285[a]
MAYFAIR - 1966					
Trip Purpose	Work	Home	School	Other	Total
Work	17	353	3	10	383
Home	345	0	39	9	393
School	2	13	0	0	15
Other	1	3	1	0	5
Total	365	369	43	19	796[b]
BAYSHORE - 1966					
Trip Purpose	Work	Home	School	Other	Total
Work	8	212	2	8	230
Home	224	0	50	2	276
School	5	5	0	1	11
Other	0	1	1	7	9
Total	237	218	53	18	526[c]

[a] *Does not include 2 respondents who did not indicate one or both trip purposes.*
[b] *Does not include 16 respondents who did not indicate one or both trip purposes.*
[c] *Does not include 42 respondents who did not indicate one or both trip purposes.*

Source: Milwaukee and Suburban Transport Corporation and SEWRPC.

Table 7

INBOUND TRIP ORIGINS AND OUTBOUND TRIP DESTINATIONS BY DISTANCE FROM SHOPPING CENTER: MAYFAIR, 1964 AND 1966, AND BAYSHORE 1966

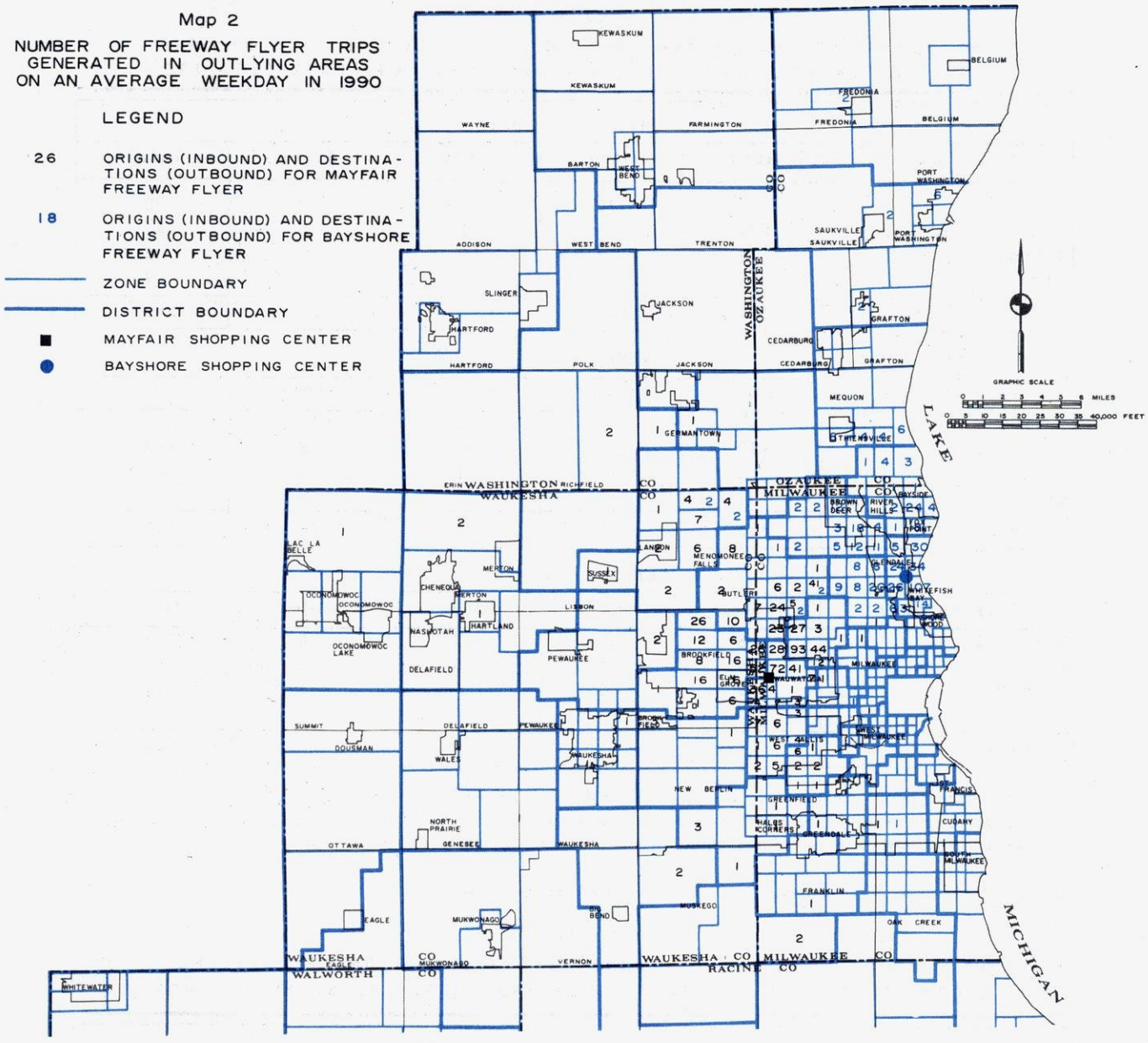
Miles	MAYFAIR - 1964		MAYFAIR - 1966		BAYSHORE - 1966	
	Trips	Accumulated Percent	Trips	Accumulated Percent	Trips	Accumulated Percent
0 - 1.0	103	37.1	124	15.8	133	26.2
1.1 - 2.0	84	67.3	266	49.8	169	59.6
2.1 - 3.0	46	83.8	192	74.2	47	68.8
3.1 - 4.0	23	92.1	77	84.1	71	82.8
4.1 - 5.0	6	94.3	51	90.6	20	86.8
5.1 - 6.0	2	95.0	9	91.7	16	89.9
Over 6.0	14	100.0	65	100.0	51	100.0
Total	278[a]	---	784[b]	---	507[c]	---

[a] *Does not include 9 respondents who did not give precise locations.*
[b] *Does not include 28 respondents who did not give precise locations.*
[c] *Does not include 61 respondents who did not give precise locations.*

Source; Milwaukee and Suburban Transport Corporation and SEWRPC.

Map 2

NUMBER OF FREEWAY FLYER TRIPS GENERATED IN OUTLYING AREAS ON AN AVERAGE WEEKDAY IN 1990



were widely scattered except for a modest concentration in the Menomonee Falls area to the northwest. On the Bayshore route in 1966, 69 percent of the trip origins and destinations were located within 3 miles of the line terminus at the shopping center; 21 percent were located within 3 to 6 miles, and 10 percent were located beyond 6 miles. As at Mayfair the trip ends located beyond 6 miles from the line terminus were scattered except for a modest concentration in southeastern Ozaukee County to the north.

The other ends of these trips, that is, the destinations of inbound trips and the origins of outbound trips, representing in most instances the work locations of the freeway flyer passengers, are shown for both Mayfair and Bayshore routes in 1966 on Map 2. Similar information is included in Table 8 for Mayfair in 1964 and 1966 and for Bayshore in 1966. As shown in Table 8, 98 percent of these trip ends on the Mayfair route, in both 1964 and 1966, and 94 percent of such trips on the Bayshore route in 1966 were concentrated, as expected, within one-mile radius of the Milwaukee City Hall, located at the intersection of N. Water Street and E. Kilbourn Avenue. In all three surveys, 99 percent of these trip ends were located within a 3-mile radius of that center.

Table 8

INBOUND TRIP DESTINATIONS AND OUTBOUND TRIP ORIGINS OF FREEWAY FLYER PASSENGERS BY DISTANCE FROM THE MILWAUKEE CITY HALL: MAYFAIR, 1964 AND 1966, AND BAYSHORE, 1966

Miles	MAYFAIR - 1964		MAYFAIR - 1966		BAYSHORE - 1966	
	Trip Ends	Accumulated Percent	Trip Ends	Accumulated Percent	Trip Ends	Accumulated Percent
0 - 1.0 . .	279	98.2	787	97.6	495	94.4
1.1 - 2.0 . .	1	98.6	7	98.5	18	97.9
2.1 - 3.0 . .	2	99.3	6	99.3	5	98.9
3.1 - 4.0 . .	2	100.0	3	99.6	3	99.4
4.1 - 5.0 . .	0	100.0	0	99.6	2	99.8
5.1 - 6.0 . .	0	100.0	0	99.6	1	100.0
Over 6.0. . .	0	100.0	3	100.0	0	100.0
Total. . .	284[a]	---	806[b]	---	524[c]	---

[a] *Does not include 3 respondents who did not give precise locations.*

[b] *Does not include 6 respondents who did not give precise locations.*

[c] *Does not include 44 respondents who did not give precise locations.*

Source: Milwaukee and Suburban Transport Corporation and SEWRPC.

The distribution patterns of freeway flyer riders by age group, shown for each survey in Table 9, are not appreciably different from the pattern found for all transit riders in the 1963 origin-destination surveys except in the age groups under 20 years and the age group over 64 years. These age groups would not be expected to use, at least in large numbers, a service primarily intended for commuting workers.

Table 9 also points out that female freeway flyer riders outnumbered males in each of the three surveys, although barely so at Mayfair in 1964 and at Bayshore in 1966. Despite the female majority, however, the survey results indicated a greater acceptance by males of freeway flyer service than of regular bus service, since in 1966 male riders accounted for approximately 45 percent of total freeway flyer trips, while in 1963 when only regular bus service was available male riders accounted for only 37 percent of the total. It is interesting to note in this table that in the two age groups between 16 and 24 years, female riders greatly outnumbered males and that in age groups above 24 years in every instance except one male riders outnumbered females. Marriage and the responsibilities of raising children probably account for much of the drastic decrease in female ridership in the age groups above 24 years. Upholding tradition, 43 female riders compared to only 4 male riders refused to divulge their ages in the 1966 surveys; unaccountably all female riders gave their ages in the 1963 survey.

In response to a question concerning the mode of travel used to reach the shopping center on the way to downtown Milwaukee, at both Mayfair and Bayshore nearly one-half of the respondents, 45 percent and 49 percent, respectively, reported that they drove automobiles; about one-third; 29 and 34 percent, respectively, were auto passengers; about one-sixth walked, 16 percent and 15 percent, respectively; and 5 percent and 9 percent, respectively, rode buses to the shopping center and transferred to freeway flyers (see Table 10).

Riders of each route were asked if the location of the freeway flyer terminus at a shopping center had effected a change in their shopping habits at the respective shopping center. Of 536 respondents at Mayfair, 293 or 55 percent, indicated no change, 139, or 26 percent, indicated a slight increase, and 104 or 19 percent indicated a considerable increase in their shopping at Mayfair Shopping Center as a result of their use of the freeway flyer service. Of 360 respondents at Bayshore, 188 or 52 percent indicated no change, 113, or 31 percent indicated a slight increase and 59, nearly 17 percent, indicated a considerable increase in their shopping at Bayshore Shopping Center. These findings, proportionately similar in the two routes, should be important to the

Table 9

AGE OF FREEWAY FLYER PATRONS BY SEX: MAYFAIR, 1964 AND 1966, AND BAYSHORE, 1966

Sex	Age Groups										Total
	11 15	16 19	20 24	25 29	30 34	35 44	45 54	55 64	Over 64	Not Given	
MAYFAIR - 1964											
Male	0	3	5	8	11	21	23	21	3	0	95
Female	0	18	16	10	6	20	19	11	2	0	102
Total	0	21	21	18	17	41	42	32	5	0	197
MAYFAIR - 1966											
Male	0	8	19	29	23	63	47	39	6	1	235
Female	1	48	86	19	16	42	54	21	4	28	319
Total	1	56	105	48	39	105	101	60	10	29	554[a]
BAYSHORE - 1966											
Male	3	13	16	19	18	44	34	25	6	3	181
Female	3	40	40	12	8	27	29	20	5	15	199
Total	6	53	56	31	26	71	63	45	11	18	380[b]

[a] *Does not include 3 respondents who did not indicate either age or sex.*

[b] *Does not include 5 respondents who did not indicate either age or sex.*

Source: Milwaukee and Suburban Transport Corporation and SEWRPC.

Table 10

MODE OF TRAVEL TO SHOPPING CENTER BY FREEWAY FLYER PATRONS ON INBOUND TRIPS: MAYFAIR AND BAYSHORE, 1966

Shopping Center	Auto Driver	Auto Passenger	Walked	Another Bus	Total
Mayfair 1966	180	139	66	20	405[a]
Bayshore 1966	149	88	46	21	304[b]
Total	329	227	112	41	709

[a] *Does not include 4 respondents who did not indicate mode of travel.*

[b] *Does not include 8 respondents who did not indicate mode of travel.*

Source: Milwaukee and Suburban Transport Corporation and SEWRPC.

operators of these shopping centers, as well as to operators of other shopping centers where express bus service could be established, in the evaluation of the benefit of such service to their operations.

Of 180 respondents at Mayfair and 149 respondents at Bayshore who reported driving to the shopping center, 157, or 87 percent, at Mayfair and 119, or 80 percent, at Bayshore indicated that they

parked at the respective shopping center. Although the question was not asked, it is probable that the majority of those who drove to, but did not park at, the shopping centers were accompanied by a family member, who then drove home or elsewhere (see Table 11).

Taking advantage of the space provided on the questionnaire for the purpose, approximately one-half of the respondents on both Mayfair and Bayshore routes made suggestions for the improvement of the service or offered opinions concerning the quality of service. The most frequent suggestion, made by 95 respondents, concerned the provision of daytime service in off-peak hours. Many respondents, 41, requested additional outbound buses in the busiest part of the late afternoon peak period; and 31 respondents requested that outbound service be extended through the early evening hours. The extension of the Bayshore service 4 miles north over the North-South Freeway to the Brown-Port Shopping center, located on that freeway at its interchange with STH 100, was suggested by 24 respondents, while 20 respondents asked that the Mayfair service be extended a few miles to the west over the East-West Freeway. Less common suggestions were for service on Saturday, no standees, and special fare coupons or tickets. Many respondents on both routes used the space provided for suggestions to pay compliments to the excellence of the service, while many of those not making suggestions for improvement were, no doubt, giving tacit approval of the service.

Table 11

NUMBER OF AUTO DRIVERS WHO PARKED THEIR AUTOMOBILES AT THE SHOPPING CENTER AND BECAME FREEWAY FLYER PASSENGERS: MAYFAIR AND BAYSHORE, 1966

		MAYFAIR - 1966	BAYSHORE - 1966
Parked at Shopping Center	Yes	157	119
	No	23	30
Total		180	149

Source: Milwaukee and Suburban Transport Corporation and SEWRPC.

RELATIONSHIP TO REGIONAL PLAN

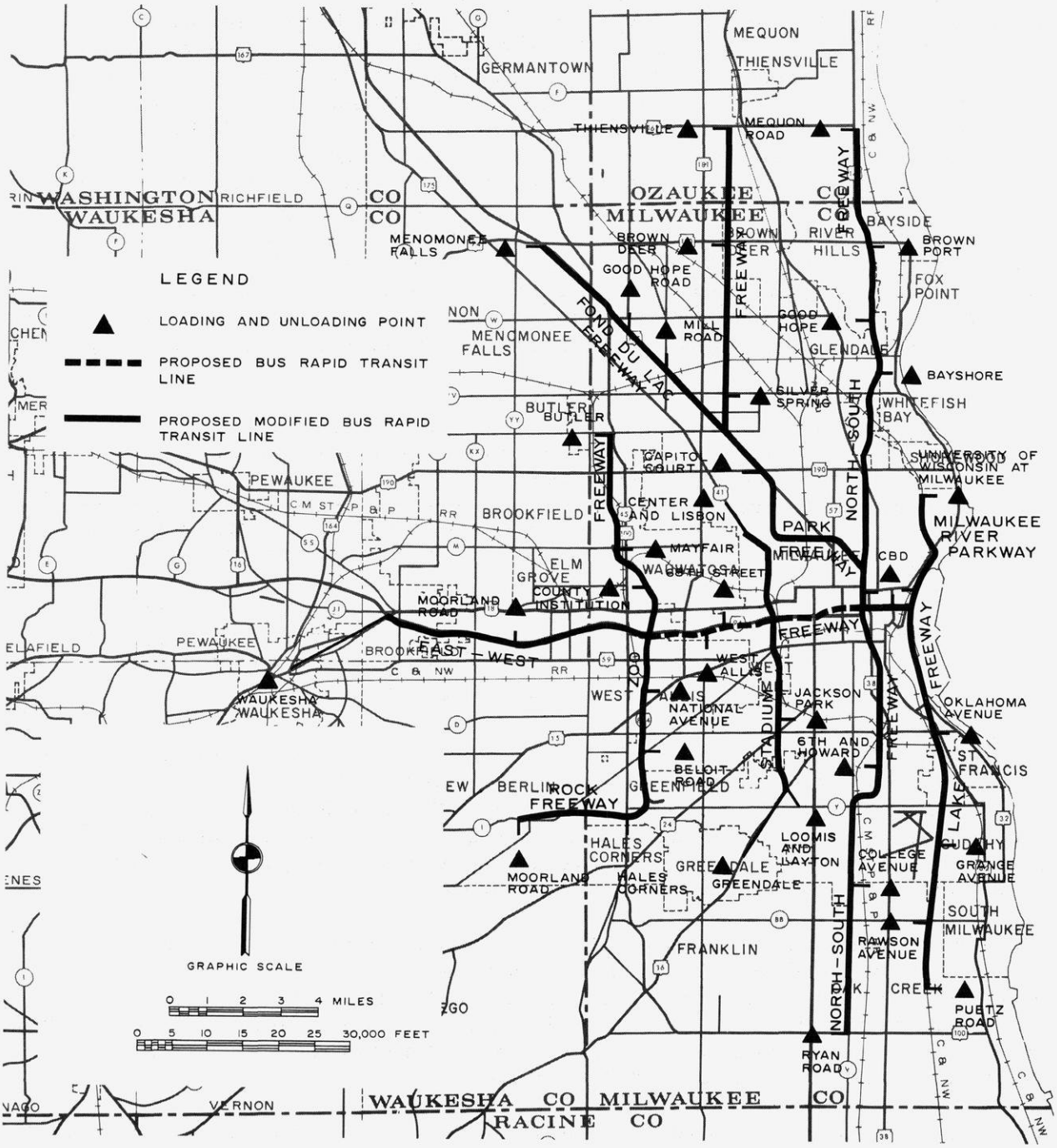
The freeway flyer service now operating between each of the two regional shopping centers and downtown Milwaukee are prototypes of the proposed modified rapid transit lines proposed as a part of the regional transportation plan by the Southeastern Wisconsin Regional Planning Commission. The successes achieved by these prototypes in gaining public acceptance, in attracting new transit riders, and in converting auto-driver commuters to mass transit users, have, therefore, provided strong support of, and encouragement to, the plan proposals.

Under the regional transportation plan, the transit system proposed to serve the Region would consist of an integrated network of ordinary surface bus lines, modified rapid transit (freeway flyer) bus lines, and a true rapid transit bus line. Under the modified rapid transit and rapid transit system proposal, motor coaches would operate partly over freeway facilities in mixed traffic and partly over a connecting fully grade-separated private right-of-way, for the exclusive use of buses, paralleling the East-West Freeway (see Map 3).

The flexibility of the modified rapid transit and rapid transit system would enable motor coaches to collect passengers near their homes and proceed directly to the reserved right-of-way for uninterrupted travel to the destination area, where the motor coaches, circulating on local streets, could unload passengers at or near their places of work and, in a similar manner, of course, collect and return the passengers to their homes at the end of the workday. The proposed transit system would thus provide fast, regular, one-seat, and nearly door-to-door service to a maximum number of residents in the highly urbanized portions of the Region and would serve not only to reduce peak freeway loadings, thus alleviating traffic congestion, but also to reduce parking demand in downtown Milwaukee, the heart of the Southeastern Wisconsin Region.

Map 3

PROPOSED REGIONAL MODIFIED RAPID AND RAPID TRANSIT SYSTEM
1990



In view of the survey findings, the Southeastern Wisconsin Regional Planning Commission forecast of an increase in average weekday transit trips within the Region from 324,000 in 1963 to 353,000 in 1990 appears easily attainable if the recommended regional land use and transportation plans are implemented. Implementation of the plan would increase the number of modified rapid transit collection points in outlying areas from 2, totaling approximately 15 route miles at present, to 34, totaling approximately 84 route miles by 1990; and would expand the service area to all of the most highly urbanized areas of the Region (see Map 3).

A BACKWARD GLANCE

by Jean C. Meier, Research Assistant, and
Sheldon W. Sullivan, Administrative Officer

HIGHWAY DEVELOPMENT IN SOUTHEASTERN WISCONSIN

Part II - Highways Come of Age 1900-1966

INTRODUCTION

A previous article, published in SEWRPC Technical Record Volume 2, No. 5, traced the history of highway development in southeastern Wisconsin from the time of the Indian trails found by the first European settlers in the early decades of the nineteenth century through the eras of the construction of the military roads, the territorial roads, the plank roads, and the town roads in the middle and late decades of that century. This article will trace the history of highway development in southeastern Wisconsin from the beginning of the twentieth century.

At the turn of the new century, although a network of generally poorly improved town roads existed, and although a somewhat better improved system of "city" streets existed within urban areas, little progress had been achieved within the Region in the development of an integrated system of intercity rural highways or in the construction of an integrated system of improved farm to market highways. The state could not aid road construction at this time because of a constitutional provision prohibiting state participation in works of internal improvement. The responsibility for nearly all road construction still remained under town, city, and village supervision; and while work in some local areas was well done,it was generally deficient. Intercommunity travel was still dominated by the steam and electric inter-urban railroads. Highway traffic consisted mostly of horse-drawn vehicles making intra-community trips to the market, mill, or meeting place; and only the most meager highway facilities were constructed to accommodate this travel.

At the close of the last century, increased public interest in highway improvement was slowly developing through the efforts of a number of leading citizens who, impatient with the indifference shown toward highway betterment, organized the "Better Road Groups" throughout the state to unify public demand for improved highway facilities. Additional demands for such improvement were being made at the same time by the Wisconsin Division of the League of American Wheelmen which was a national body of bicyclists. The popularity of the bicycle was such that the demands made by this group resulted in the authorization by the Wisconsin Legislature in 1901 of the construction and maintenance by the counties of bicycle side paths along public roads and streets.

But a new era in transportation was about to begin, for the development of the motor vehicle was underway. Considered by many at first as a novelty and a noisy nuisance that "would never replace the horse," this new invention soon enchanted a delighted public, an enchantment which exists to this day. By 1905, however, there were slightly fewer than 1500 motor vehicles registered in Wisconsin and at about that time came the rather cautious prediction that "the automobile may eventually become of sufficient importance as a commercial factor to demand permanent improvement of highways."[1]

THE TURNING POINT

The first real step in the systematic improvement of highways in Wisconsin was taken when the State Legislature enacted the county aid highway laws in 1907. One of the important parts of these laws provided that any town could, by making an appropriation for highways, secure a similar amount of money from the county. The counties were required to select systems of highways upon which improvements were to be made and to elect a county highway commissioner to carry out the improvements.

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[1] "*Highway Construction in Wisconsin,*" *Highway Survey Bulletin No. X, 1903.*

The Legislature of 1907 also created the first State Highway Department. The duty of this department, then a division of the State Geological and Natural History Survey, was to study highway improvement and, when requested, to advise local officers in the construction of highways and bridges. The advisory work of the department continued until the enactment of the State Highway Aid Law in 1911, when it was merged with the supervisory work of the State Highway Commission.

THE STATE AID MOVEMENT

In the period between 1907, when the county aid highway laws were enacted, and 1911, when a state aid highway law was finally passed, it had become increasingly apparent that local units of government alone were not going to be able to construct and maintain the highway facilities which were needed and which were being demanded, and that public opinion was becoming crystalized in favor of not only a great increase in highway improvement, but also in favor of a more centralized control of highway construction and maintenance.

Finally, after considerable effort and debate including the passage by the Legislatures of 1905 and 1907 of the necessary resolution to provide for the submission of a constitutional amendment and the approval of this resolution by popular vote in 1908, the State Highway Aid Law was enacted in 1911, following the failure of the 1909 Legislature to agree as to the scope of such a law. The new statute provided that the financing of improvement of state highways was to be a cooperative effort among the state, the counties, and the towns, and other local units of government. To provide the engineering skills and the centralized direction necessary for the comprehensive development of state highways, the Legislature of 1911 established the State Highway Commission to which it delegated supervisory power and authority over all highway development in which the state assisted in financing.

The first state aid law appropriated a state highway fund of $350,000 and provided for a direct state tax levied equally upon all property in the state. The proceeds of this tax and the additions from the general fund and automobile license fees were allocated to the counties in proportion to their assessed valuation. In order for a county to be entitled to receive its allotment of state aid, it was necessary for the towns in that county to have voted taxes for state aid improvements in an amount equal at least to the state aid allotted. The statutes specified that each county board should select and lay out a county system of prospective state highways. The systems so specified, not to exceed 15 percent of the total highway mileage in a county, would be eligible for state aid. After any highway on the prospective state highway system had been improved with state funds in a manner acceptable to the State Highway Commission, the responsibility for continued maintenance remained with the county. By 1912 all counties and the majority of towns had complied with the law and were proceeding with improvements of their highways under the state aid laws.

By the end of 1916, after five years of work under state aid, the total mileage of highways on the county system of prospective state highways was approximately 20,000 miles; and of this mileage, more than 4,800 miles, or 24 percent, had been improved with state aid. Within the Region during this period, the total mileage of highways on the prospective state highway system was 1,481 miles; of which 372 miles, or about 25 percent, had been improved (see Table 1).

But there had been a lack of coordination in much of the improvements since many of the improvements had been made on the basis of local considerations only, and an integrated network of improved highways throughout the state simply did not exist. During this period highway funds from legislative appropriations, together with automobile license fees, had increased from $350,000 in 1911 to approximately $1,200,000 in 1916; and motor vehicle registrations within the state had increased from just over 21,300 in 1911 to nearly 125,000 in 1916. This rapid increase in motor vehicle registrations was accompanied by an increased demand for a coordinated system of highways which "started somewhere and went somewhere."

Table I

TOTAL MILEAGE OF RURAL PUBLIC HIGHWAYS, OF COUNTY SYSTEMS OF PROSPECTIVE STATE HIGHWAYS, AND OF IMPROVED HIGHWAYS ON COUNTY SYSTEMS OF PROSPECTIVE STATE HIGHWAYS BY COUNTY, REGION, AND STATE: 1916

County	Total Mileage of Rural Public Highways	Total Mileage on County Systems of Prospective State Highways	Total Mileage of Improved Highways
Kenosha	486	147	50
Milwaukee	509	217	133
Ozaukee	496	128	15
Racine	606	191	46
Walworth	1,076	307	43
Washington	946	190	28
Waukesha	1,120	301	57
Regional Total	5,239	1,481	372
Wisconsin Total	75,922	20,254	4,846

Source: Report of Wisconsin Highway Commission of 1924.

THE FEDERAL AID MOVEMENT

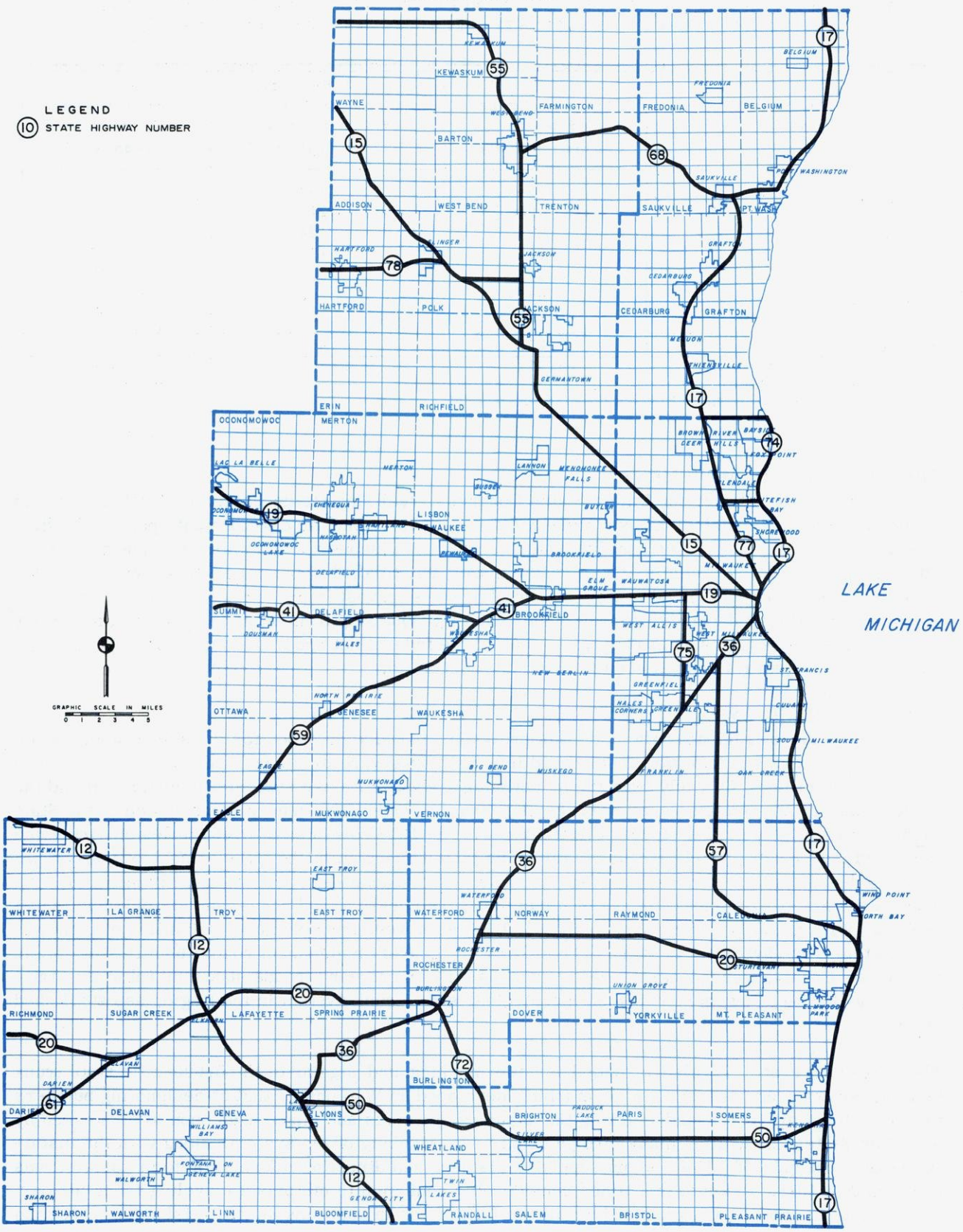
Just at this point in time, the United States Congress, realizing the necessity of a national system of highways for interstate transportation and for national economic development, passed the first federal aid highway law. The benefits which accrued to Wisconsin under this law made it possible for the State Highway Commission, already a well-established department, to proceed with the establishment of a coordinated system of state highways, a vast improvement over the aggregation of sometimes illogical county systems then existing. One requirement of the federal aid highway law was that the state assent to the provisions of the federal act and make provision for the maintenance of the highways improved with state and federal aid.

STATE AID HIGHWAYS

The Legislature of 1917 not only made this provision, but also provided for the selection of a state trunk highway system to which federal aid improvements were to be confined, such system not to exceed 5,000 miles. By early 1918 the selection of highways for the system was completed and the maintenance of the system taken over by the counties under the general supervision of the State Highway Commission. The 4,999 miles taken over in 1918 consisted of 3,065 miles of earth- and sand-surfaced roads, which accounted for more than 60 percent of the total mileage on the system; 1,127 miles of gravel-surfaced roads; 675 miles of macadam-surfaced roads; 120 miles of concrete-surfaced roads; and 12 miles of miscellaneous-type-surfaced roads, such as brick and sheet asphalt. Within southeastern Wisconsin in 1918, there were approximately 430 miles of highways on the state trunk system. Of these, 298 miles were gravel or macadam roads; 68 miles mostly in Milwaukee County, were concrete roads; and 64 miles were earth roads shown in Table 2. Map 1 shows the location and numbering of the original state trunk system in the Region as established in 1918.

The Legislature of 1917 also provided for the marking and signing of the 5,000-mile state trunk highway system; and the system of marking developed in Wisconsin, that of designating numbers for state highway routes and marking the numbers on routes and maps, was soon to be adopted by all other states, as well as many foreign countries. Marking of the system, along with the installation of thousands of official signs supplying distance and direction information to motorists, was completed in 1918. Prior to that time, considerable confusion to motorists traveling from one part of the state to another was created by either a lack of, or in some instances, misleading direction

Map 1
WISCONSIN STATE TRUNK HIGHWAY SYSTEM IN THE REGION: 1918



Map 2

WISCONSIN STATE TRUNK HIGHWAY SYSTEM IN THE REGION: 1965

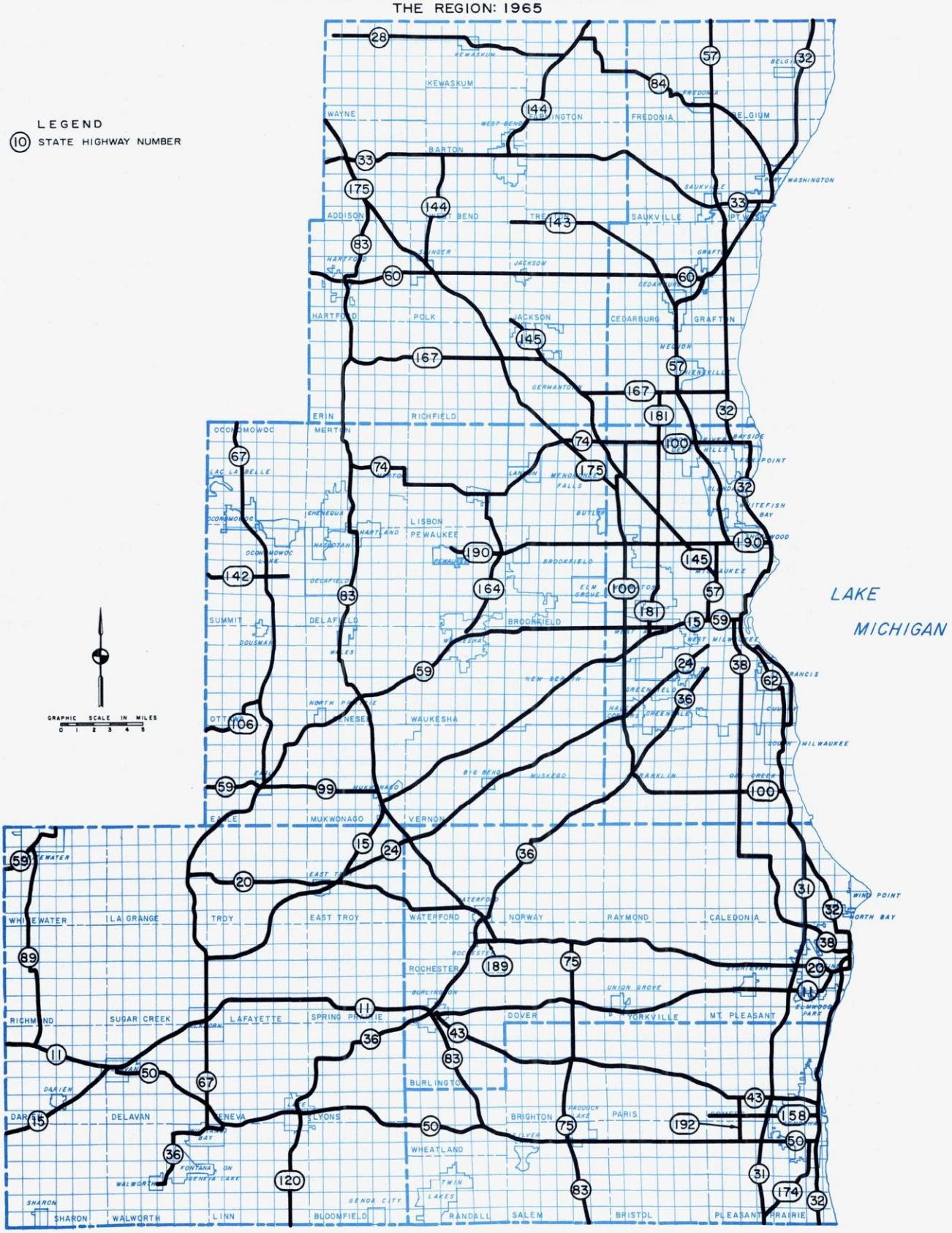


Table 2

MILEAGE OF STATE TRUNK HIGHWAYS BY TYPE, BY COUNTY, REGION, AND STATE: 1918, 1921, AND 1924

County	Concrete Surfaced			Gravel and Macadam Surfaced			Earth Surfaced			Totals		
	1918	1921	1924	1918	1921	1924	1918	1921	1924	1918	1921	1924
Kenosha.	10	29	43	22	17	28	4	7	7	36	57	78
Milwaukee.	50	64	96	16	15	5	3	0	0	69	79	101
Ozaukee.	0	8	33	33	48	43	2	3	0	35	59	76
Racine	7	41	81	41	28	35	18	3	4	66	72	120
Walworth	1	31	78	75	112	68	14	0	0	90	143	146
Washington	0	22	61	50	50	66	13	0	0	63	72	127
Waukesha	0	52	119	61	112	85	10	0	0	71	164	204
Regional Total.	68	247	511	298	382	330	64	13	11	430	642	852
Wisconsin Total	120	649	1,398	1,814	4,350	4,951	3,065	2,458	3,131	4,999	7,457	9,480

Source: Report of Wisconsin Highway Commission of 1924.

signs. The excerpt from a 1916 Wisconsin Motorist Tour Book shown in Figure 1, demonstrates an example of probably the best tour information available to motorists in the period before the marking system was developed.

Aided by legislative amendments to the State Highway Aid Law in 1919 and 1923, each of which provided for the expansion of the existing 5,000-mile state trunk highway system by an additional 2,500 miles, highway development increased rapidly during the period 1918 to 1924. Within the Region the number of miles of state trunk highways increased from 430 miles in 1918 to 852 miles in 1924, an increase of 96 percent. Not only was there an improvement in the quantity of such highways, but there was a marked improvement in the quality as well. The number of miles of concrete paved highways on the state trunk highway system within the Region increased from 68

Figure 1

ROAD TOUR GUIDE--
MILWAUKEE TO OCONOMOWOC

.0 MILWAUKEE--Set speedometer at .0, at Grand Ave. bridge and go west.
.8 Jog slightly left and continue on Grand Ave. to 23rd St.
1.6 Turn right on 23rd St. Caution--for several trolley crossings.
2.6 Turn left on Lisbon Ave. Soon pick up and go along with trolley.
3.1 Cross R. R.
3.9 Leave trolley and go straight ahead on Lisbon Road.
5.0 Fork, Keep left. Roadhouse in fork.
6.1 Thru diagonal crossroads, passing brick roadhouse at left.
7.6 Thru diagonal crossroads.
8.7 Thru crossroads. Brick school on right.
9.2 Oak Hill cemetery on right.
9.6 Fork. Take right. Sign in fork, "Lisbon 7 miles." Pass immediately thru hamlet of Butler (post-office on right) and at once thru diagonal cross-roads.
12.1 Thru crossroads. Sign at right, "Merton 12 miles."
13.5 Thru hamlet. Stone church on left.
14.1 Pass left hand road.
15.1 Thru crossroads, leaving wires.
16.2 Thru crossroads.
17.1 Cross R. R.
18.3 Pass right hand road. Sign at right, "Pewaukee 4 miles."
18.7 Pass left hand road. (Left hand road goes to Pewaukee 3 miles.) Sign, "Merton 5 miles."
20.1 Fork, take left, with wires.
20.8 Thru crossroads.
23.3 Caution--for reverse curve down hill and across bridge.
24.0 Enter Hartland and go thru.
24.8--HARTLAND--With pump in road at right, bear left and immediately right, slightly up grade.
25.7 Avoid left road, which crosses R. R.
26.2 Pass right hand road, which goes to Pine and North lakes.
26.8 Pass Pine lake at right.
27.7 NASHOTAH--Station on left. Continue straight thru.
28.9 Okauchee lake at right.
29.9 Bear left with main wires, passing thru village of OKAUCHEE.
30.7 Caution--cross bridge, and take bad double turn under R. R.
31.3 Pass Hotel Gifford at left and at once along shore of Oconomowoc lake.
31.7 Cross bridge. Danforth Lock at right.
32.3 Turn sharp right, across bridge over R. R. and immediately sharp left.
33.0 OCONOMOWOC--Milwaukee, West Ave. and Main Sts.

Milwaukee to Oconomowoc, via Lisbon Ave.--33.0 Miles.

Source: 1916 Wisconsin Motorist Tour Book.

miles in 1918, or about 16 percent of the total miles, to 511 miles in 1924, or about 60 percent of the total miles; and the number of earth-surfaced roads decreased from 64 miles in 1918, or about 15 percent, to about 11 miles in 1924, less than 2 percent of the total miles (see Table 2).

COUNTY TRUNK HIGHWAYS

During the same period, 1918 to 1924, in addition to the state trunk highway system which the counties were required by law to maintain under the supervision of the State Highway Commission, each county within the Region assumed voluntarily the responsibility for the improvement and maintenance of an additional number of miles of highway. This was done through the broad general power of the county to construct or improve any highway within the county under state statute. The systems thus established were called county trunk highways.

Four counties within the Region; namely, Kenosha, Milwaukee, Racine, and Waukesha, had established county trunk highway systems as early as 1918. These systems of highways in 1918 totaled 338 miles. In the following year, Ozaukee, Walworth, and Washington counties also established county trunk systems; and by 1924 the total mileage of county trunk highways within the Region had increased to 875 miles (see Table 3).

Table 3

MILEAGE OF COUNTY TRUNK HIGHWAYS AND STATE TRUNK HIGHWAYS BY COUNTY, REGION, AND STATE: 1918, 1924, AND 1930

County	1918		1924		1930	
	County Trunk	State Trunk	County Trunk	State Trunk	County Trunk	State Trunk
Kenosha	36	36	110	78	119	83
Milwaukee	82	69	113	101	109	150
Ozaukee	0	35	86	76	109	84
Racine	70	66	93	120	109	137
Walworth	0	90	157	146	189	158
Washington	0	63	150	127	158	138
Waukesha	150	71	166	204	349	226
Regional Total	338	430	875	852	1,142	976
Wisconsin Total	2,021	4,999	9,369	9,480	13,526	10,186

Source: Report of Wisconsin Highway Commission of 1924, and 1930.

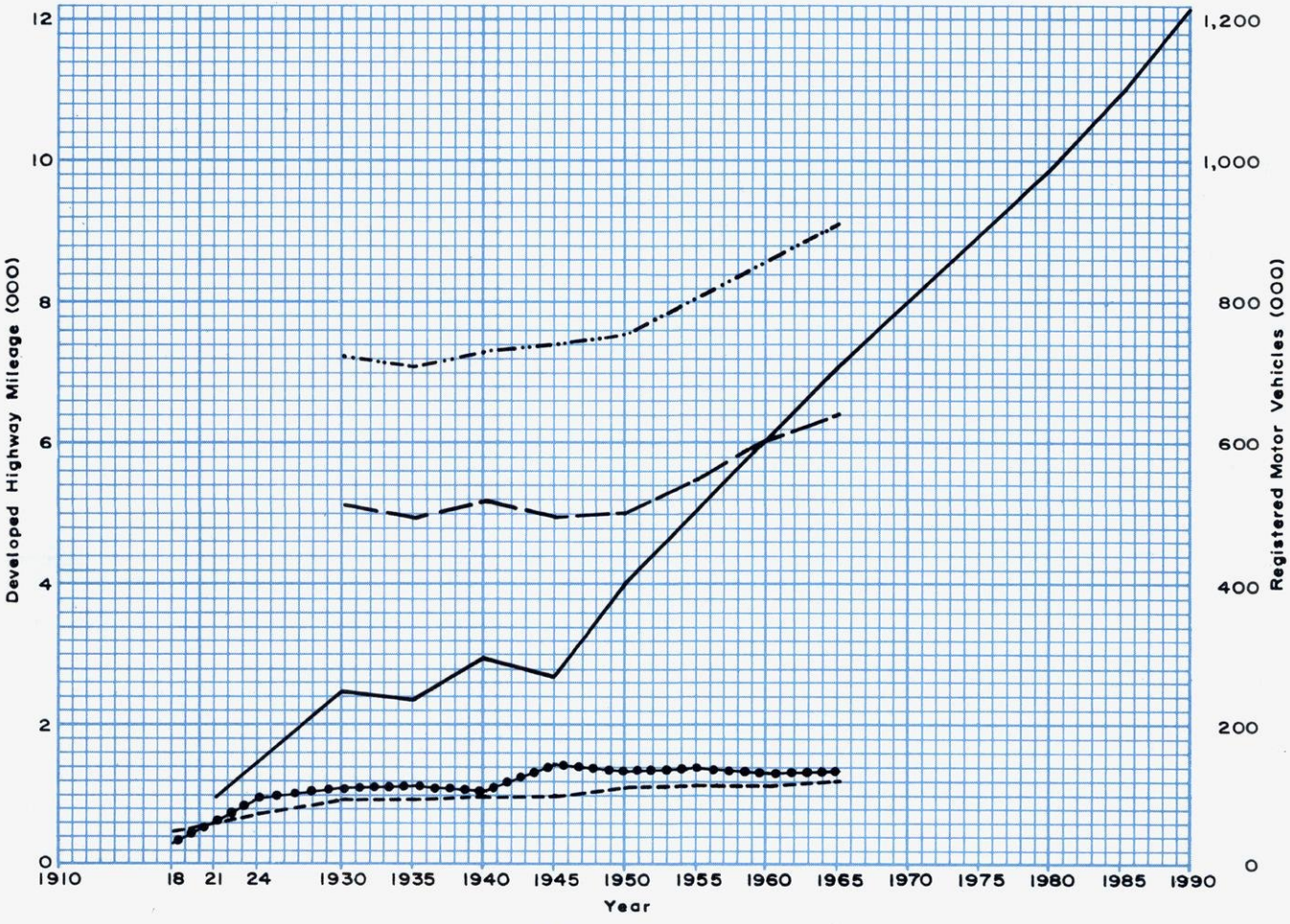
Recognizing the need for county trunk highway systems, the Legislature of 1925 authorized and directed the county boards throughout the state to select such systems exclusive of the state trunk highway systems and to mark, sign, and maintain such systems. All roads so selected were to become a part of the county system of prospective state highways and were, therefore, eligible for state aid.

In the period 1924 to 1930, the number of miles added to state trunk and county trunk highway systems within the Region, although substantial, were, nevertheless, far fewer than that added during the previous six-year period. State trunk highway mileage increased from 852 miles in 1924 to 926 miles in 1930, an increase of 74 miles; and county trunk highway mileage increased during the same period from 875 miles to 1,142 miles, compared to increases of 432 miles in the state trunk highway system and 537 miles in the county trunk highway system in the period 1918 to 1924.

As shown in Figure 2 and Table 4, the mileages of both state trunk and county trunk highway systems within the Region remained relatively unchanged during the years of economic depression and of slow recovery between 1930 and 1940. By the end of World War II in 1945, however, county trunk highway mileage had increased to 1,448 miles and, after dropping to slightly less than 1,400

Figure 2

DEVELOPED HIGHWAY MILEAGE AND
MOTOR VEHICLE REGISTRATION IN THE REGION 1918-1965 AND
FORECAST REGISTRATION 1970-1990



Source: Wisconsin Motor Vehicle Department, State Highway Commission Reports, and SEWRPC.

in 1950, has remained quite stable since that time. The mileage of state trunk highways within the Region has increased gradually from 1,008 miles in 1940 to 1,227 miles in 1965.

Figure 2 and Table 4 also show that the mileage of local roads and streets remained relatively stable during the period 1930 to 1950 and increased substantially during the following 15-year period, from 5,060 miles in 1950 to 6,452 miles in 1965. Much of this rapid increase in local road and street mileage can be attributed to the requirements of newly developed, low-density urban areas in the rural-suburban portions of the Region.

Figure 2 also shows that motor vehicle registrations have increased at a rate much higher than that of highway construction within the Region except during the early years of economic depression and during the war years in the following decade. This figure also shows that motor vehicle registrations within the Region are expected to reach approximately 1.2 million by 1990 and indicates the urgent need for a continuing program of highway development in the construction of high-

Table 4

STATE, COUNTY, AND LOCAL STREET AND HIGHWAY MILEAGE IN THE REGION: 1930 - 1965

County	1930				1935				1940				1945			
	State	County	Local	Total	State	County	Local	Total	State	County	Local	Total	State	County	Local	Total
Kenosha	83	119	452	654	83	84	490	657	104	70	520	694	104	245	344	693
Milwaukee	150	109	1,520	1,779	155	121	1,475	1,751	156	139	1,546	1,841	161	138	1,630	1,929
Ozaukee	84	109	343	536	83	87	365	535	83	103	355	541	86	103	358	547
Racine	137	109	693	939	137	125	556	818	141	135	561	837	141	142	568	851
Walworth	158	188	796	1,142	159	185	804	1,148	166	182	807	1,155	166	196	791	1,153
Washington	138	158	692	988	137	162	690	989	136	174	679	989	151	160	685	996
Washesha	226	349	645	1,220	223	423	563	1,209	223	266	741	1,230	223	464	571	1,258
Total	976	1,141	5,141	7,258	977	1,187	4,943	7,107	1,009	1,069	5,209	7,287	1,032	1,448	4,947	7,427
County	1950				1955				1960				1965			
	State	County	Local	Total	State	County	Local	Total	State	County	Local	Total	State	County	Local	Total
Kenosha	117	235	360	712	117	249	392	758	114	249	430	793	123	254	464	841
Milwaukee	193	107	1,689	1,989	200	66	1,896	2,162	200	76	2,017	2,293	218	76	2,178	2,472
Ozaukee	99	101	361	561	94	134	361	589	98	108	414	620	98	110	436	644
Racine	159	143	560	862	160	142	601	903	154	142	657	953	159	150	690	999
Walworth	191	178	798	1,167	191	178	795	1,164	192	178	827	1,197	190	178	870	1,238
Washington	161	155	689	1,005	186	196	655	1,037	188	196	685	1,069	187	190	717	1,094
Waukesha	239	458	603	1,300	242	442	795	1,479	242	430	998	1,670	252	434	1,096	1,782
Total	1,159	1,377	5,060	7,596	1,190	1,407	5,495	8,092	1,188	1,379	6,028	8,595	1,227	1,392	6,451	9,070

Source: State Highway Commission of Wisconsin and SEWRPC.

type facilities, such as freeways and expressways, and in the improvement of existing arterial streets and highway facilities as recommended in the SEWRPC adopted regional land use and transportation plans.

FREEWAY DEVELOPMENT

In the period from 1958, when the first length of freeway was completed, to the end of 1966, more than 104 miles of freeway were opened to traffic within the Region. The first length to be completed was a 2.6 mile section of the East-West Freeway (Interstate Highway 94) in Waukesha County in September, 1958. By the end of 1966, freeways were directly serving all but Ozaukee and Washington Counties within the Region. By the end of 1966, there were 47.3 miles of freeway completed in Milwaukee County, nearly half of the Regional total; 24.6 miles in Waukesha County; 12.0 miles in Kenosha County; 11.7 miles in Racine County; and 8.6 miles in Walworth County.

By 1970 freeway facilities will directly serve every county in the Region, and by 1990, under the recommended regional transportation plan, the number of miles of freeways within the Region would increase from the 1966 total of approximately 104 miles to over 440 miles in 1990, an increase of more than 320 percent. Under this plan, freeway mileage would increase between 1966 and 1990 in Kenosha County from 12.0 miles to 24.4 miles; in Milwaukee County from 47.3 miles to 111.5 miles; in Ozaukee County from 0 miles to 54.3 miles; in Racine County from 11.7 miles to 38.1 miles; in Walworth County from 8.6 miles to 73.4 miles; in Washington County from 0 miles to 41.6 miles; and in Waukesha County from 24.6 to 96.9 miles (see Table 5).

Table 5

MILES OF FREEWAYS WITHIN THE REGION BY COUNTY FOR SELECTED YEARS: 1958-1966, AND 1990

County	Mileage Developed in Year:							Total	
	1958	1960	1962	1963	1964	1965	1966	1966	1990
Kenosha	---	12.0	---	---	---	---	---	12.0	24.4
Milwaukee	---	---	9.1	9.1	5.8	1.0	22.3	47.3	111.5
Ozaukee	---	---	---	---	---	---	---	---	54.3
Racine	---	11.7	---	---	---	---	---	11.7	38.1
Walworth	---	---	---	---	---	8.6	---	8.6	73.4
Washington	---	---	---	---	---	---	---	---	41.6
Waukesha	6.2	---	---	13.2	5.2	---	---	24.6	96.9
Regional Total	6.2	23.7	9.1	22.3	11.0	9.6	22.3	104.2	440.2

Source: State Highway Commission of Wisconsin and SEWRPC.

THE PERMANENCE OF HIGHWAYS

Among the most permanent of all man-made features on the landscape of the Region are its highways. Indeed, the present-day alignment of many highways within the Region still very closely follows the location and alignment of the primitive roads cut through forests by builders of the U. S. military roads, the territorial roads, and the plank roads as much as over a century and a quarter ago.

The location and alignment of an historic military road, for example, connecting Fort Howard at Green Bay and Fort Dearborn at what is now Chicago, via Milwaukee and Racine, is still closely approximated by STH 57 and STH 32 for much of its length and by certain county trunk highways, town roads, and city and village streets for most of the remainder of its length through the Region. Similarly, the location and alignment of a military road constructed as early as 1838 between Milwaukee and Madison and later to the Mississippi River via Blue Mounds is still preserved as the Blue Mound Road over a portion of the old route and as county highways and town roads in much of the remainder of the route across the Region. In similar fashion the alignments of three other military roads, from Southport, now Kenosha, to Beloit via Lake Geneva; from Racine to Janesville via Spring Prairie and Delavan; and from Sauk Harbor, now Port Washington, to Dekorra on the Wisconsin River, are still nearly intact within the Region through combinations of existing state trunk, county trunk, and in some instances, local roads.

In a similar manner, also, territorial and plank road location and alignments have been retained as existing highways. In the case of certain plank roads not only have the location and alignments been retained but their names have been retained as well, such as the present-day Watertown Plank Road, Janesville Road, Fond du Lac Road, and Lisbon Road.

Thus there is a permanence about highways which transcends several cycles of surrounding land use, land once used for highways almost invariably remains in that use. Much less permanence exists in the use of the land served by the highways. As the development of the Region has occurred, forests have become agricultural land, agricultural land has been converted to urban uses, old urban uses in turn have been replaced by new urban uses; and the process continues as the development of the Region continues.

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KENOSHA · MILWAUKEE · OZAUKEE ·
WAUKESHA · WASHINGTON · WALWORTH · RACINE ·
SOUTHEASTERN
WISCONSIN
REGIONAL
PLANNING
COMMISSION