of regional transportation planning and implementation must be that which is stipulated in the regional plan. There is a recognition that much better use must be made of the existing transportation system, that the existing transportation system must and can be operated more efficiently, and that much greater reliance on transit must be selected in future transportation capital and operational investments. The level of understanding of these conclusions varies throughout the region, but the variety of strong rationales that support such conclusions have already been shown to be effective.

From the city's standpoint, broader objectives pertaining to neighborhoods, the downtown, and economic development plans clearly point in the direction of TSM, and the focus brought on the basic nature of the transportation problem facing the city by the deliberation over a freeway withdrawal has done much to educate not only city staff and council members, but also staffs and policy boards throughout the region and the public. For others, such as regional organizations, the rationale for TSM is probably less refined, but specific policy concerns and objectives on problems such as air quality provide essentially the same direction. An important rationale that is instrumental in directing efforts to TSM is the fiscal situation, which has resulted in an acute awareness on the part of many that a new direction must be taken in the development of the transportation system and that an important element in that direction is TSM. Although some problems with TSM remain unresolved, or perhaps even unidentified, it is clear that in Portland the experience to date has been quite positive and that there is an awareness on the part of many that the city and the region as well are only beginning to understand the potential that exists.

REFERENCES


MADISON, WISCONSIN

Warren O. Sonnfeld and Michael Hoffman
Madison Department of Transportation
Thomas Favour
Dane County, Wisconsin, Regional Planning Commission

The city of Madison is located in Dane County, Wisconsin, in the south central part of the state. It is roughly midway between Lake Michigan and the Mississippi River, some 130 km (80 miles) west of Milwaukee and 240 km (150 miles) northwest of Chicago. The city is the state capital, county seat, and home of the University of Wisconsin. As such, its economy is service oriented although there is some industry. The central business district, the Capitol, and almost all of the downtown area are located on a narrow isthmus, approximately 1 km (0.6 mile) at its narrowest, between two lakes (Figure 1). The university campus is located approximately 2 km (1.2 miles) to the west of the Capitol and is connected to the CBD by State Street, an intensively used commercial thoroughfare.

The 1970 population of the Madison SMSA was just under 300 000, and about two-thirds of this population (205 000) is located within the Madison urbanized area. The Madison SMSA is coterminous with Dane County. The county, in addition to the city of Madison, contains four smaller cities: Sun Prairie, 1970 population of 9835; Middleton, 1970 population of 6286; Monona, 1970 population of 10 420; and Stoughton, 1970 population of 6096. Middleton and Monona are part of the Madison urbanized area. The county also contains 28 villages.

Madison's downtown has a residential area where students, young professional workers, and families with children live. In 1970 more than 55 000 people lived in the isthmus area, approximately 4.5 km (2.8 miles) east and west of the Capitol. This area also contains over 50 percent of the region's employment. Suburban shopping malls have attracted much recent retail activity, and the Capitol Square-State Street area, the former retail core, has experienced a decline. The city, however, has become involved in a number of projects including a new civic center on State Street and an extensive mall effort to reverse this trend.

In the past the Madison area has grown quite rapidly, but at present the rate of growth has slowed considerably. Transportation planning efforts have been and are being reviewed and revised, where necessary, to reflect this change.

COMMUNITY GOALS AND OBJECTIVES

Because of the existence of active comprehensive planning programs at both county and city levels, community goals are well articulated. In addition, the Madison Department of Transportation and the Dane County Regional Planning Commission have undertaken extensive public attitude surveys related to transportation objectives.

At a general level Dane County has an adopted land use plan, which sets out policy guidelines for future growth of the area (5). The policy of the Dane County Transportation Study is to plan and direct the extension and expansion of transportation services and facilities in a manner consistent with that plan. In particular the county land use plan designates urban service areas, that is, areas intended to receive the bulk of urban growth during the next 10 to 20 years; and it is desired to confine the extension of urban transportation services to these areas. The city of Madison itself has a developed set of transportation objectives and policies (9, 15), among which are the following:
1. To recognize public bus service as a public expenditure as justifiable as maintenance of the public street system;
2. To minimize the need to use private automobiles and maximize the availability and encourage the use of public transportation and alternative forms of private transportation, such as taxis and bicycles, particularly for commuter travel;
3. To coordinate implementation of the various transportation and parking policies so that disincentives to low-occupancy vehicle use are accompanied by improved transit service and incentives to high-occupancy vehicle use;
4. To provide most city residents with access to the public transportation system within reasonable walking distance of their homes;
5. To use noncapital programs, such as staggered work hours and car pooling, to reduce automobile traffic congestion;
6. To improve the operating efficiency and safety of the existing highway network to maximize fuel economy and minimize air pollution while at the same time implementing programs to minimize the need to bring commuter automobiles into the isthmus area;
7. To discourage through automobile traffic from traveling through the interior of residential neighborhoods.
8. To discourage automobile traffic from traveling through the central area; and
9. To discourage low-occupancy commuter automobile traffic to the central area.

The Madison Department of Transportation is currently engaged in developing a municipal transportation policy intended to provide a policy base for the city in its dealings with the legislative bodies of the county, state, and federal governments as well as their respective administrative branches. This municipal transportation policy will be a statement of goals, policies, and program objectives, which (as recommendations to the various public entities) represent the consensus of judgment of the Madison policy leaders.

Figure 1. Dane County-Madison urban area.

INVENTORY OF THE EXISTING SITUATION

Travel Patterns

In 1962, an estimated 600,000 daily person trips were made in the Madison urbanized area; by 1970, 992,000 were made each day. The private automobile was the dominant travel mode although transit usage was higher than in most cities of comparable size. In 1970 4.9 percent of the trips that began and ended within the urbanized area and 7.7 percent of the home-to-work trips were made by transit. The latter percentage increased to 9 percent by 1976.

Street Volumes

Madison has a grid street pattern oriented northeast-southwest east of the Capitol and north-south west of the Capitol. The narrow width of the isthmus, however, works as a funnel restricting the number of major streets into the central business district. In 1975 the average annual daily traffic on major approach streets was almost 85,000 from the east, 55,000 from the south, and 72,000 from the west. Traffic volumes are nearing capacity, particularly during the peak periods, although there is room for some additional flow. Vehicle travel through the isthmus has stabilized around an average daily traffic of 115,000 for the last 6 years.

There is little possibility of additional vehicular capacity in the isthmus area because of physical constraints and local policy. A new arterial along a railroad right-of-way is a possibility, but it would probably replace existing capacity rather than add to it. The reason for this is that in recent years there has been increasing local support for removing traffic from arterials that pass through residential areas.

Core Area Parking

Governmental agencies are the major providers of parking space in central Madison. The city and county provide more than 4400 off-street spaces, which when added to on-street meters account for more than half of the available spaces. These spaces are well located with reference to shopping and major employment centers.

Public actions have tried to encourage short-term use of available space by restricting the number of long-term spaces and by having a rate differential (20 cents versus 10 cents) that favors short-term use. This, however, has not been successful since drivers are willing to make one or more extra trips back to the parking facility to feed the meters during the day.

Privately provided off-street parking is relatively limited, and most is directly associated with a specific building. Madison, in contrast with many areas, has limited the amount of parking space that new development can provide and, in some cases, has forced reductions in developer requests. The city intends to continue policies that encourage parking for short-term shopping and service trips.

Transit System

Mass transportation in the Dane County area has had a recovery during the past few years. Threats of service cutbacks or curtailment during the late 1960s have been overcome. Substantial improvements to a declining system including acquisition of new vehicles, improvement of service and initiation of innovative programs, and expansion of marketing efforts have been followed by reversal of declining ridership trends as given below and shown in Figure 2 (14).
tem will require continued vigorous effort to maintain, time 4 years ago, is just now approaching its 1955 level.

area, and Commuters Service, Inc., privately owned the past decade, the proportion of urban area travel private charter operators provide yellow bus service to by contract with Madison Metro. In addition four pri-

ations are made.

In addition to the actions taken at all levels of govern-

In spite of this, the recent growth in urban area automobile travel appears to be about as rapid as the growth in transit ridership. It is estimated that, during the past decade, the proportion of urban area travel made by transit (in terms of person trips or person kilometers traveled) has actually decreased; and current ridership, although about 38 percent higher than at this time 4 years ago, is just now approaching its 1955 level. Hence, although survival of transit in Dane County is now ensured, establishment and preservation of its role as a major element in a multimodal transportation sys-
tem will require continued vigorous effort to maintain, improve, and expand service. A detailed assessment of the existing transit system, in light of these needs and opportunities, is presented below.

Within Dane County, the following bus operators compose the transit system: Madison Metro, owned by the city of Madison and the predominant system operating a fleet of 162 buses within the Madison urban area, and Commuters Service, Inc., privately owned and operating three buses during weekday peak periods between Madison and several communities in the south and southeast portions of the county. The University of Wisconsin also operates a daily campus shuttle service by contract with Madison Metro. In addition four pri-

Yea n Passengers Increase Rides per Person

1971 8 043 000 38.1
1972 9 070 000 11.3 42.8
1973 9 950 000 8.8 46.7
1974 10 992 000 9.5 51.4
1975 11 975 000 8.2 56.7
1976 12 515 000 4.5 61.0

Urban area households that have no automobiles have tended to establish themselves in the older and more centrally located neighborhoods and so have compara-
tively convenient access, by existing transit services, to most sections. All urban area elderly housing de-
velopments are located within the 0.4-km (0.25-mile) service area. All of the most popular destinations as-
associated with transit-dependent groups (e.g., the elderly, young, and handicapped) lie within the 0.4-km (0.25-
mile) service area. However, many of these are not easily accessible to these groups by transit because of the absence of direct routing and the need to transfer. Some are not accessible during evenings or weekends.

Levels of Service

The level of transit service in the Madison area was re-
duced by about 50 percent from 1950 to 1970, but this trend has been dramatically reversed as shown by Fig-
gure 2. Currently available service levels vary by area served, travel origin and destination, time of day, and day of week. Spatial variation in peak-hour service available to urban area residents reflects the fact that transit services are generally available on a more fre-
quent basis to central Madison residents than to sub-
urban area residents. Service is generally less fre-
quent during evening and weekend off-peak periods, especially in suburban areas, some of which have no evening or weekend service.

Recent local experiments with varying service levels suggest that, where latent demands for transit service

in the Madison urbanized area 1971 to 1976.

<table>
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<th>Year</th>
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<td>1972</td>
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<td>1976</td>
<td>12 515 000</td>
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exist, increasing levels of service can stimulate increased transit use. For example, when service frequencies were increased on the Sherman Plaza Flyer, ridership substantially increased. Portions of this report point to areas and groups that present, or are expected to present by 1980, significant increased ridership opportunities.

Fare Structure

The basic (adult) transit fare structure in the Madison area reflects both a long-standing, stabilized fare (the basic fare on the Madison Metro system has increased by only 5 cents—from 20 to 25 cents—since April 1962) and a community willingness to provide necessary operating subsidies to maintain this program.

An array of special fares are also part of the structure, including youth fares, elderly fares, and a shopper's pass. In addition, there is mounting evidence from local experiments that a judicious program of reduced fares can stimulate substantial ridership increases and alter travel habits.

Capital Facilities and Equipment

Substantial improvements to facilities and equipment, especially those of Madison Metro, have occurred within the past few years. These have included the acquisition of new buses, installation of a two-way radio communication system for the Metro fleet, and installation of new passenger shelters in the city and the university campus area. In addition, approvals have been granted for the acquisition of additional new buses, bus shelters, and various support facilities. Improvements to transit support facilities and equipment are under way as outlined above. Additional needs include spare parts; shop equipment; office equipment; supervisor cars; repair and renovation of maintenance, operations, and office areas; land acquisition for additional storage space; and bus storage and service building in the central Madison area to replace the current outdated transit maintenance facility.

TRANSPORTATION PLANNING IN THE MADISON AREA

Comprehensive planning and transportation planning have been going on in the Madison area for a long time. The Madison Department of Transportation has been considering transit and a wide variety of other transportation activities as part of its program for more than 20 years. For example, bus ridership surveys have been conducted since 1955, and a comprehensive central area parking plan was first developed in 1955. Early institutional activities were also important, and the Madison Common Council inaugurated a comprehensive transportation planning process before the Federal-Aid Highway Act of 1962 was passed. The council's action is interesting because of the degree of importance it assigns to the planning process. The resolution adopted by the council May 26, 1960, stated:

Resolved, that the City of Madison embark on a four-step program to improve the local transit system and make it an integral and permanent part of a comprehensive transportation plan for the City. The four steps would be:

1. That the Common Council encourage greater use of the transit system as it exists today by taking those actions which are now available to improve traffic conditions through the activities of the Traffic Engineering, Police, Engineering and Street Departments.
2. That the Traffic Engineering Department cooperate with and assist the Madison Bus Company in making comprehensive studies of routes and coverage, route inventory, passenger load data, service frequency and regularity, transit running time, transit speed and delays, general operating data and passenger ridership habits to determine the need for further improvements according to recommended standards, warrants and objectives for transit services and facilities. Procedures used successfully in other cities should be made a part of these studies.
3. That the ordinances be amended to effect a reorganization of the Traffic Commission and assign to it the additional responsibility of reviewing the plans for traffic, transit and parking activities and facilities for the purpose of advising the Common Council on an overall transportation policy.
4. That the Traffic Engineer and Plan Director develop and submit to the Traffic Commission, Plan Commission and to the Common Council for consideration a comprehensive transportation plan for the city with the improved transit system being integrated and made a permanent part of this overall plan.

This early recognition of the need to plan for the whole transportation system was undoubtedly helpful in bringing the city to its present high level of involvement in transportation. In 1974, a unified City Transportation Commission was established to further develop, coordinate, and guide policy.

Area-wide transportation planning has been in progress since 1961. The initial agreements of the Madison Area Transportation Study (MATS) recognized that sound transportation planning should be integrated with the other elements of area-wide comprehensive planning, especially the land use element. In 1970, the long-range Madison Area Transportation Plan was approved by the participating governmental units (16). The transportation study was then reorganized as a part of the Dane County Regional Planning Commission activities and became the Dane County Transportation Study (DCTS); the study boundaries were expanded outward to the county boundaries. This reorganization provided for (a) refining and updating the earlier prepared Madison Area Transportation Plan through a major plan reappraisal effort; (b) expanding the plan from the Madison urbanized area to be a countywide transportation plan; (c) providing a stronger all-mode, or multimodal, orientation to the transportation planning efforts; (d) providing staff for a continuing, cooperative, comprehensive transportation planning process to further develop and maintain current transportation plans; and (e) integrating transportation planning efforts more closely with comprehensive planning for the realization of overall objectives and goals.

Long-Range Plan

The Madison Area Transportation Plan, adopted in 1970, serves as the long-range plan for the Madison urbanized area. The plan has had about 30 specific facility amendments since 1970, and other possible amendments have been identified for study. Other major changes have also been made: (a) The forecast year is now 2000 rather than 1985, (b) the small-area forecasts of development within the urbanizing area have been reviewed and adjusted as necessary, and (c) the reliability of the computer forecasting models has been checked and verified against an independent data base. An overall transportation plan reappraisal is currently under way and is expected to be in 1977 (3). It will include a broad public discussion of plan alternatives and the testing of goals and objectives and will lead to a single long-range transportation plan for all of Dane County.

Transportation Improvement Program

An annually updated listing of transportation improvements anticipated to be undertaken during the next few years has been developed and approved (6). The pro-
gramming of transportation improvements includes major capital facilities as well as low- and non-capital improvements related to all modes of surface transportation. Further, this document includes major improvements throughout Dane County, regardless of the unit of government undertaking a particular project or improvement. The most recently adopted program was approved by the Dane County Regional Planning Commission in January 1976 and covers the period from 1976 through 1980.

Related Transportation Plans and Studies

Other past and current transportation planning efforts that are pertinent to transportation system management efforts include the following.

1. Work of the Madison Area Transportation Study from 1961 through 1970, which included studies on traffic control devices, parking, and transit;  
2. The Madison Traffic Operation Program to increase Capacity and Safety in 1971, which included minor improvements to be made throughout Madison's transportation system to improve efficiency and safety (13);  
3. A governmental employee staggered work-hour study and implementation program undertaken in 1971 and 1972;  
4. Periodic car-pooling studies and implementation efforts since 1972 to present, which include a computer name-matching program for employees of a new state office building, a computer matching program for more than 30,000 state and university employees in the Madison area, development of an organizational structure and program for an area-wide car-pool matching program (not implemented), and numerous other governmental office and private efforts to encourage car pooling;  
5. Study of potential commuter parking facilities and connecting transit services to the central Madison area (2);  
6. Study of transit services and development opportunities through 1980, including transit operating and capital improvements (10);  
7. A short-range and long-range bikeway plan for the Madison urban area (12);  
8. An intergovernmental pass program in 1972 to achieve increased transit usage through an integrated program of disincentives and incentives, including reduced-rate bus passes made available to employees (not fully implemented);  
9. Studies related to policies and issues of inter-city travel through Dane County, including noncapital improvement recommendations (4);  
10. Various special corridor and area studies that recommended noncapital and capital improvements;  
11. A study and report in 1974 on transportation energy conservation (1);  
12. Various studies of parking supply, pedestrian needs, taxicabs, elderly and handicapped transportation needs, and traffic engineering.

Relation of TSM and Other Plans

Although all of the above transportation plans are related to the TSM planning, the relation to the long-range plan is the most important and fundamental. The long-range plan establishes the basic transportation policy framework for the various TSM elements. Although the long-range plan is currently undergoing a major reappraisal, it is still the foundation on which TSM activities are structured.

TSM PLANNING

The management of the existing transportation system is vested with the governing bodies of the 61 local units of government within this area and the Wisconsin Highway Commission. Coordination efforts are achieved through the Dane County Transportation Study organizational structure, through the annually prepared transportation improvement program, and other means. Coordination in the city of Madison is by the Transportation Commission, which has responsibility for transit, parking, bikeway, and pedestrian facilities; taxicabs; and traffic engineering activities (Figure 3). Staff support in Madison comes from the city Department of Transportation. Currently this department addresses a full range of transportation activities through its Traffic Engineering, Transit, and Parking divisions. Coordination in the other Dane County cities is by their appropriate planning commissions, public works committees, and transportation committees. Coordination within the governmental structure of Dane County is through the County Highway and Transportation Committee, which in turn coordinates many of the town government transportation improvements.

The Dane County Transportation Study (DCTS) provides the coordination among modes and among agencies (Figure 4). The DCTS Technical Coordinating Committee members include representatives of the comprehensive planning agency, transit operators, local governmental units, University of Wisconsin, state transporta
Coordination of transportation planning and improvements within Dane County is the responsibility of the Dane County Regional Planning Commission through the Dane County Transportation Study activities. The commission serves as the advisory areawide transportation planning policy body for this area. The commission integrates transportation with comprehensive planning in a manner that provides for its maximum compatibility with other functional areas. The organizational structure provides for a direct channel of communication and responsibility between the commission and the Technical Coordinating Committee and the Citizen Advisory Committee.

The general DCTS organizational structure provides for appropriate coordination and liaison activities for conducting areawide transportation planning. The following activities of the Dane County Transportation Study are examples of how this works to tie the long-range transportation planning functions to the TSM functions:

1. Inventory of local unit programs and analysis of these in relation to past and ongoing planning activities in Dane County;
2. Analysis of indications of local policy and public opinion related to planning and implementation of transportation facilities;
3. Review of perceived areas of growth and development to 1980 and analysis of these in relation to the transportation needs;
4. Review and analysis of accident information and possible transportation improvements; and
5. Review of existing transportation system operating characteristics.

Further insight into the TSM process can be gained by examining how specific project-oriented issues have been addressed. One issue was the South Madison Beltline Freeway. The development of plans for this highway had been under way since the mid-1960s. In 1973 public dissatisfaction with the original plan became apparent, and in April 1973 further planning for the facility halted. In May 1973, a contract to replace the Nob Hill Railroad bridge, part of the beltline project, was not signed by the governor, and the overall plans for the highway were "shelved" by the State Highway Commission. The intention was to have a citizen committee review the plans and suggest solutions. At this point the Dane County Regional Planning Commission became involved and acted to both maintain the integrity of the area's transportation planning process and solve the specific problems. The commission formed a citizen committee, which included appointments by the chief executives of the cities of Madison, Monona, and Dane County and by the Regional Planning Commission. The committee was staffed by an interagency group consisting of personnel from the Wisconsin Division of Highways, the Dane County Highway Department, the cities of Madison and Monona, and the Regional Planning Commission. Thus both the committee and the staff represented the diverse interests of all parties involved in the issue.

The committee first examined long-range plans and forecasts and then immediate or short-range actions, including:

1. Alternative transit levels of service,
2. Multiple land use opportunities along this corridor,
3. Alternative roadway cross sections and staging of construction for resultant needed roadway improvements,
4. Multiple-mode approach to travel considerations in this corridor,
5. Proximity of the ultimate facility as planned to the Waunona Way neighborhood,
6. Impact of the facility on the Upper Mud Lake wetlands,
7. Compatibility of the facility with future transit potentials, and
8. Concerns of the Dane County Coliseum manage-
ment over coliseum access and traffic backup.

Some of the committee recommendations were capital intensive, such as the purchase of additional buses and the construction of some freeway segments, but many were integrated into the TSM element, including improved transit service through the use of express routes and peripheral parking lots and the designation of bicycle trails.

Because the DCTS structure provides for these co-ordination and liaison activities, it was not necessary to form any new committees or groups for the TSM process. The existing groups will continue to incorporate transportation system management efforts into their ongoing transportation planning activities. Those efforts will be reflected in the periodic updatings of the transportation system management element; the long-range areawide transportation plan, including the current plan reevaluation activities; and the transportation improvement program actions.

Identification of Needs and Improvement Activities

This section presents the main substance of the transportation system management element (1). The needs are listed, and the proposed activities to meet those needs are discussed. Many of these actions were begun prior to the TSM process and have already been incorporated into the transportation system.

Improve Traffic Operations by Managing and Controlling Flow of Motor Vehicles

In 1967 the Federal Highway Administration initiated a program providing funds for the Traffic Operations Program to Increase Capacity and Safety (TOPICS). Projects of this type have been carried out in Madison since the 1950s and were the subject of a special TOPICS study in 1971. This study surveyed problem locations that needed improvements. Specific projects that have been and will continue to be implemented, even though the TOPICS funding program has changed, include improvements along short segments of roadways, eliminating jogs, improving traffic control measures, improving intersection geometrics, and improving intersection street lighting.

Other traffic operation techniques being used include access control, progressive timing of traffic signals and computerized traffic control on major arterials, accident monitoring and safety improvements, and temporary signs and barricades to direct traffic onto major streets from residential streets.

Provide Preferential Treatment for Transit and Other High-Occupancy Vehicles

One objective of traffic engineering activities is to aid the free flow of transit traffic. These activities include removal of on-street parking when it interferes with transit movement, signal timing, bus pullout bays, bus stop location, and signing and marking.

A central area bus lane has been in operation for 10 years between Campus Drive and Bassett Street on University Avenue. Originally for buses only, the lane was later opened to bicycles and other special vehicles. Two special lanes are designed to be included when this segment of University Avenue is reconstructed: a contraflow bus and bicycle lane on the south side of the street and a lane for buses, bicycles, and right-turning vehicles on the north side of the street. The north lane will be tried on an experimental basis in 1976. Other variations of the bus lane are also scheduled for construction in the central area and will require various accompanying traffic engineering improvements. When the Capitol Concourse, bordering the Capitol Square, is converted to transit and limited automobile use, changes to the outer ring of streets and access streets to Capitol Square will make access to the Capitol and stores and offices on the square more convenient for transit patrons (8). State Street, which connects Capitol Square with the University of Wisconsin campus, will be converted to a transit way for most of its length. The transit way will be open to emergency vehicles and taxicabs serving patrons on the street. Traffic engineering improvements are necessary to coordinate the transit way with automobile traffic on cross streets.

A device for bus preemption of traffic signals can be considered for selective sites in the future, especially in connection with exclusive bus lanes. In addition, related traffic engineering improvements, such as intersection modifications, special signing, and perhaps exemption for buses from turn restrictions, will be incorporated into all bus lane projects as necessary.

Provide Appropriate Improvements for Bicycles and Pedestrians

The need for improvements to bicycle and pedestrian traffic flow is increasingly being recognized. The 120 000 bicycles in Madison outnumber cars three to two. Nearly 10 000 pedestrians were counted on one block of State Street during a summer day. An increasing number of plans are being made to improve facilities for pedestrians and bicycles.

A bikeway program including route signing and intersection curb ramps was undertaken in the early 1970s. A more extensive long-range bikeway program was developed for the entire urban area in 1974 and adopted in 1975, together with the short-range improvement program within the city of Madison (12). Other portions of the urban area have also scheduled bikeway improvements. The system is coordinated with the university campus routes and plans and with county bikeway routes. A Madison resolution directs that bikeway facilities be considered for inclusion in all street projects. Planned bikeway facilities will be a part of several major improvement plans including University Avenue (Bassett to Babcock), John Nolen Drive Causeway, South Madison Beltline Freeway corridor, Capitol Concourse, and Mineral Point Road. A bicycle system is planned as part of the transportation system for the University of Wisconsin Center for Health Sciences, and additional bicycle ways are scheduled for construction on the University of Wisconsin campus. Using the railroad corridor from central Madison to Middleton as a bicycle way is also being studied. Large apartment complexes are asked to provide secure bicycle storage, and storage facilities will be a part of the Capitol Concourse-State Street Mall projects.

Facilities for bicycle travel are being provided in other jurisdictions as well. Dane County promotes safer and more convenient bicycle travel through two programs: a shoulder paving program for county roads and a program for cooperative financing of bikeways, sharing the cost on a 50-50 basis with local units of government.

Since trips beginning and ending in the CBD or campus areas are relatively short, a higher proportion of them can be made on foot. Walking can be encouraged by providing more carefully designed facilities. Pedestrian facilities will be stressed in the Capitol Concourse-State Street Mall projects and will be extended when the
Murray Pedestrian Mall on the lower campus is completed. A pedestrian circulation system is also planned as part of the University of Wisconsin Center for Health Sciences. A Campus Drive pedestrian overpass is scheduled for construction in 1976. Stoughton Road, where a study is being conducted, and the South Madison Beltline Freeway are other possible locations. Capitol Square has all-way walk lights. Traffic signalization improvements for pedestrians are part of continuing traffic engineering considerations.

Increase and Improve Management and Control of Parking Facilities

The general trend of parking policy in the Madison CBD and campus areas, where competition has been more intense and the impact of stored cars more severe, has been toward favoring short-term parkers through changes in public parking space allocation and parking rates. Long-term spaces in city-owned facilities are being converted to short-term spaces at the rate of 8 to 10 percent per year and long-term meter rates have been raised to 20 cents/hour. Parking on Madison CBD streets is being phased out. Fines and towing enforce these restrictions.

The amount of private parking is influenced in the city of Madison by zoning ordinances, which do not require parking to be provided in the central area, and by building permit regulations. There is no government regulation of private parking pricing.

Adjustments in the amount and price of parking in the central city must be handled in a way that preserves a difficult balance, maintaining and enhancing the central city as an employment-retail-institutional-cultural center of the area and as a desirable place to live. Favoring short-term parking can encourage visitors to the central area, maximize the use of space by a large number of people, and reduce the need for additional capital investment in parking facilities. Reduction of on-street parking can improve the flow of personal travel, whether by automobile, transit, bicycle, or foot. Reduction of all-day parking must be balanced against parking revenue needs and against the availability of transportation alternatives for those who work in the downtown area, such as attractive transit service combined with peripheral parking facilities. Parking will continue to be studied as an important factor in managing the transportation system.

Peripheral parking and express transit service to the downtown area well established (2). The Sherman Plaza Flyer and local buses serve the Sherman Plaza. Express and local bus service to a Copps peripheral lot on the South Madison Beltline Freeway at Stoughton Road began in 1976. Efforts will continue to secure other peripheral parking lots in the Middleton area, the Nakoma Plaza area, and other areas.

Continue Efforts to Reduce Peak-Hour Travel and Encourage Off-Peak Use of Transportation Facilities and Services

Staggered work and school hours are currently in force for state of Wisconsin and city of Madison employees and for the city of Madison students. Efforts will continue to extend staggered work hours to other groups of employees. Reduced transit fares are available to elderly and handicapped transit riders during off-peak hours. In addition, a shopper’s pass for riding transit offers unlimited rides during the nonpeak period for the 55-cent price of a single round-trip ride.

Continue Action to Reduce Vehicle Use in Congested Areas

Actions to reduce vehicle use in congested areas have already been discussed in the previous paragraphs, and the following comments supplement rather than repeat previous comments.

In 1974, the Dane County Transportation Study developed a program to coordinate and expand car-pooling efforts already begun by state agencies and the city of Madison. The program envisioned focusing on regular travel to and from significant activity centers in the Madison urban area and using computer matching and extensive marketing. Although there was some initial disappointment at lack of response to some of the programs implemented, a recent spot check showed that an increasing number of employees of state agencies car pool to work. Car poolers at these agencies have high priority in obtaining on-site parking spaces. Future efforts will include further car-pool monitoring and assistance in car-pooling efforts including possible use of Dane County funds earmarked for car-pool promotion. Increased automobile occupancy, or car pooling, is a key element of the Dane County Transportation Study Plan Reevaluation (3).

Continue Action to Improve Transit Service

Significant improvements to the transit services provided in this area have resulted in substantial ridership increases, particularly during the past 5 years. A detailed study of transit services and improvements to services during the next 5 years was prepared and adopted in early 1975 (10). Recent actions taken to promote efficient use of the existing transit system include

1. Route changes to improve efficiency, give better service, and expand the area covered;
2. Combined express routes for more direct service;
3. Contractual agreements to provide service to surrounding areas;
4. Headways of the shuttle service linking the University of Wisconsin campus and the Capitol Square reduced from 10 to 7 min from 11 a.m. to 2 p.m.;
5. Coordinated Madison Metro system service, including transfer arrangements, and its contracted service with the university campus system;
6. Service by the university campus system to campus peripheral lots;
7. Scheduled start-up of special demand-responsive service for the institutionalized and handicapped elderly to be provided by three specially equipped buses;
8. Convenient 20-ride tickets;
9. Fares during the off-peak hours reduced to 10 cents for the elderly and handicapped;
10. Continuing program to provide bus shelters at transfer points and other high-use bus stops; and
11. Downtown Transit Information Center to answer bus service questions.

Improvements undertaken in the Madison urban area during 1975 included:

1. For areas already served, improved peak-hour frequency, experiments with off-peak-hour fare structures, increased frequency of State Street shuttle, and experiments with improved weekend service frequencies and reduced weekend fares; and
2. For currently unserved areas, peak-hour service to newly developing parts of the urban area, staggering
of middle and high school hours and possibly updat-
ing central Madison staggered work-hour program, direct financial incentives to increase transit usage (including 20-ride ticket and token packs, reduced fares for handicapped, and possible reduced off-peak fares for all), expanded marketing program, con-
tinued gradual conversion of long-term central area parking supply to short-term and regulated parking rates coordinated with transit service improvements, limited-use lanes for transit, continued coordination with traffic engineering activities related to transit, and Downtown Transit Information Center to improve the quality and dissemination of transit information to the public.

Improvements planned in the Madison urban area for 1976-1980 include

1. For areas already served, improved routing to allow for connections between east side routes and campus bus system, increased levels of service in the South Madison Beltline Freeway corridor, peak-hour headways reduced to 10 min on main-line routes, peak-hour headways re-
duced as required by areawide employee bus-pass pro-
gam, and improved service to far west campus area, including possible Highland Avenue shuttle; and

2. For currently unserved areas, peak-hour service to newly developed areas, peripheral parking, and commuter service to outlying county areas.

In addition basic transit system routing will be re-
structured to reflect proposed 1980 system structure, including possible increased express service availability in suburban neighborhoods, expanded (north-south) crosstown route system, extension of central Madison area shuttle service, improved directness of service to East Towne area, and limited-use lane for transit along University Avenue.

Transportation for the elderly and handicapped is being provided by the Madison Department of Transporta-
tion, by taxicab companies, and by private nonprofit agencies. The private nonprofit agencies will be able to expand their services with vans and buses acquired by UMTA grants. The Wisconsin Department of Trans-
portation will help monitor how these private agency vehicles are used and how services are coordinated. A Wisconsin Department of Transportation survey of elderly and handicapped services in the state will also aid in planning future services.

Continue Actions to Increase Transit Management Efficiency

Continuing efforts to improve transit management ef-
iciency include the following:

1. Market research effort to identify expanded rider-
ship opportunities;
2. Two-way radio equipment for scheduling, equip-
ment breakdown, and emergency information;
3. Bicentennial bus to provide more than 1000 hours of free riding time in 1976;
4. Driver training programs and school safety pro-
grams;
5. Expanded transit services to University Center for Health Sciences; and
6. Paratransit ordinance regulating vehicles carry-
ing persons commercially.

Problems in Implementation

The main problem in TSM implementation involves con-

flict between different policies or objectives. Some-
times two transportation policies may be incompatible, and often a transportation policy will clash with some other community objective. In addition there is the continuing problem of trying to use an orderly, rational process in a dynamic, changing political environment.

An example of conflicts between different transporta-
tion objectives is the case of the Madison central business district. One goal is to limit automobile access to this area to alleviate congestion, minimize pedestrian-
automobile conflict, encourage transit use, and so on. Another goal is to facilitate automobile access to the area to maintain the economic vitality of the retail core. Part of the solution, of course, involves strategies that segregate automobile trips by purpose, but the basic conflict remains.

A second major conflict involves efficient use of streets: maximizing existing street capacity versus removing through traffic from residential neighborhoods. In the Madison isthmus, where there are a limited num-
er of existing arterials, where street volumes are near capacity, and where the public would probably view any major new facility with disapproval, the options are limited (11).

A more general problem is balancing vehicle efficiency in terms of fuel costs, depreciation, time, and driver stress against public demands to slow down and ban automobiles. In dealing with this problem, the trans-
portation planner must address mutually inconsistent goals, some of which may well have significant negative effects on transportation but may nonetheless be desir-
able from a community standpoint.

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RESPONSE

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The first question that I find myself struck by is, What are the problems to which TSM is addressed? I think that I understand the background from which TSM has emerged. I think the causes have to do with the constraints on facility and service expansion in the late 1960s and early 1970s. The highway expansion ran into a variety of constraints largely of a nonfiscal nature. In the mid-1970s, transit is also running into serious constraints on service expansion mainly of a fiscal nature. There is concern as well about lack of integration of the costs of the system. But I think that there is still a lack of clarity about the problems of urban transportation that transportation policy may be trying to alleviate or to solve.

The case studies suggested that congestion is the primary problem and that TSM is the new traffic engineering strategy for alleviating congestion. But in the discussion of urban transportation more generally, one often has the sense that the primary objectives today have to do with increased equity, increased amenity in the urban area generally, air quality improvement, energy conservation, and so on. It is not always clear the extent to which TSM is addressed explicitly to these other issues or the extent to which it is an instrument for dealing with them.

Traffic engineering has been the historic strategy during most of our history for dealing with congestion. In the late 1950s through the early 1970s we had a brief burst of a construction orientation associated with the interstate program in urban areas, but it was unprecedented and appears to have been a relatively brief episode. And now we are returning to a traffic engineering orientation under a new name. In a sense, I think, we have rediscovered the wheel. We now call it system management, but it bears a great deal of resemblance to the enthusiasm of the late 1940s and early 1950s over things such as one-way street systems, staggered traffic lights, and so on. The question is, What else will TSM be besides the new traffic engineering? Will it incorporate new objectives in important ways and new conceptions to the urban transportation problem? Will it focus on the management of institutions, transit institutions for example, and on cost control as well as on the management of urban street systems?

The second question that I find myself pondering is, How great is the challenge of integrating the new planning requirements that have been imposed, largely at federal initiative, on urban areas for the past several years? First there was the thrust to integrate highway and transit planning, and increasingly paratransit planning is being added to that. Paratransit, of course, incorporates a great many things under a single title, and it involves the integration of many parts of the system that are under different ownership and management, that is, dial-a-ride systems that may be under public transit management, van-pool and car-pool systems that may be under private management, and taxicab systems that are also privately regulated management. Then, there is the integration of long- and short-term planning. That may be the most difficult form of integration of all. How does one integrate the 6-month to 1-year perspective with the 20-year perspective, which has guided transportation planning during most of the postwar period? And there is the capital and operating integration. The idea of integrating the forms of operating planning with capital planning seems particularly difficult because the coordination of operations involves day-to-day coordination of action, not just the coordination of the intellectual activity of planning, and then the delegation to individual modal agencies to carry out those plans.

If one takes those various types of planning—highway, transit, paratransit, long- and short-term capital and operating—and builds a matrix, there would be 12 cells in that matrix; but of course it is much more complicated than that. The question that I would like to have addressed is, To what extent is this proving to be a nearly insuperable burden or one that in fact is proving to be quite manageable in urban areas?

A related question is, Does it matter if the TSM projects are not closely integrated and not all built into a comprehensive plan if TSM is essentially ad hoc and opportunistic in its orientation and requires only that major conflicts be ironed out and major priorities be set in some regional form? In that context, does it matter whether the region has a major capital agenda? A casual observation of my own has been that, in those regions that still have major highway, transit, and capital-intensive transit projects on their agendas, key policy makers and even planners are finding it difficult to focus on TSM and paratransit kinds of issues. It is in those areas that do not have rail rapid transit on their agendas and that do not have major expressway issues on their agendas that TSM is proving to be highly used. This I say in spite of the Boston case study. My own observation is that in spite of this imaginative project in downtown Boston, which is a very special case, major policy makers in Boston have found it difficult to focus on TSM because of their continuing preoccupation with major capital projects, which, of course, stems from a long and reasonable history in that region.

The third question involves the issue of the constituencies for TSM. Every major initiative, if it is going to have much of an impact on urban America, has to have political constituencies associated with it. At the moment, I think that I perceive that TSM is a professional initiative that has emerged out of the transportation professions, particularly those professionals who sit in Washington, but has received a favorable response from those who operate out of the states and regions and