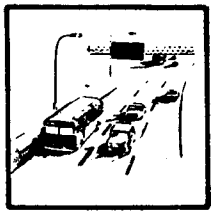
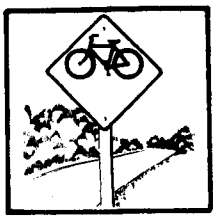


FY79 TRANSPORTATION SYSTEM MANAGEMENT



Des Moines Urbanized Area

	DATE DUE		

THE DES MOINES URBANIZED AREA

TRANSPORTATION SYSTEM MANAGEMENT PLAN

1978 - 79

The preparation of this report has been financed in part through grants from the U. S. Department of Transportation, Urban Mass Transportation Administration, under the Urban Mass Transportation Act of 1964, as amended, and the Federal Highway Administration.

RESOLUTION

WHEREAS, the Central Iowa Regional Association of Local Governments has been designated the Metropolitan Planning Organization (MPO) for the Des Moines Metropolitan Area; and

WHEREAS, the Central Iowa Regional Association of Local Governments, through an agreement for continuing transportation planning in the Des Moines urban area, has been designated as the agency to carry out the requirements of Section 134 of the Federal Aid Highway Act of 1962 as amended, and Section 121 of the Urban Mass Transportation Act of 1964 as amended through November 26, 1974; and

WHEREAS, the Des Moines Urban Area Transportation Policy Committee has been authorized to act for and on behalf of the Association concerning policy matters pertaining to transportation planning in the Des Moines Urbanized Area including A-95 Review; and

WHEREAS, the Des Moines Urban Area Transportation Technical Committee has reviewed the FY1979 Transportation System Management Plan; and

WHEREAS, the Transportation Technical Committee recommends that the Transportation Policy Committee approves the FY1979 Transportation System Management Plan.

Now, Therefore, Be It Resolved By The Des Moines Urban Area Transportation Policy Committee;

That the Transportation Policy Committee approves the FY1979 Transportation System Management Plan and gives A-95 Review approval.

Passed and approved this 19th day of December, 1978.

Central Iowa Regional Association
of Local Governments

Secretary

Des Moines Urban Area Transportation
Policy Committee

Chairman

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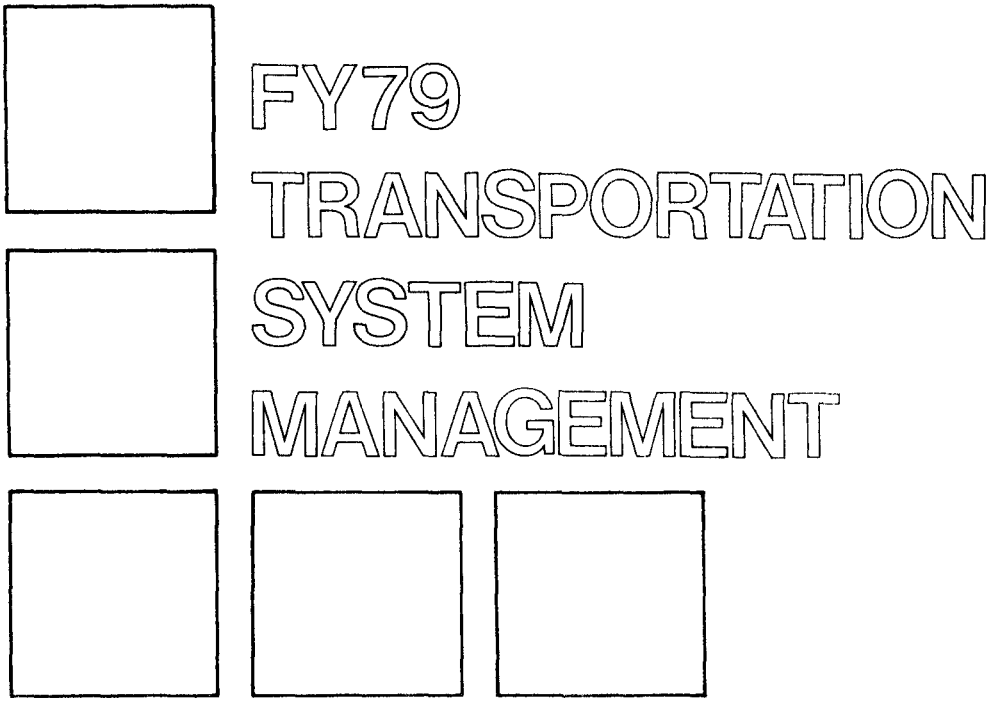


Chapter 1 •
Purpose of TSM

CHAPTER I PURPOSE OF TSM

In the past, transportation planning was oriented toward long-range, capital-intensive highway programs designed to improve urban mobility. Today, however, the cost of constructing new transportation facilities, combined with an awareness of environmental problems (i.e. air pollution, energy consumption) has lead to a recognition that more efficient use needs to be made of existing transportation facilities.

These factors have lead the Federal Highway Administration and the Urban Mass Transportation Administration to require urban areas to develop Transportation System Management (TSM) Elements. These TSM Elements represent low-capital means of improving the existing transportation system. The TSM concept provides for an areawide approach to planning by integrating autos, public transit, bicycles, paratransit modes (e.g small vans, carpool, taxicabs) and railroads into one urban transportation system. The objective of TSM is to coordinate these separate transportation modes through operating, regulatory and service policies.

Need for TSM in the Des Moines Urbanized Area

The Des Moines Urbanized Area is made up of the cities of Des Moines, West Des Moines, Clive, Windsor Heights, Urbandale, Johnston, Pleasant Hill and parts of unincorporated Polk County. This Urbanized Area covers a total of 172 square miles. The population of the area was 255,824 in 1970 and CIRALG projects the population at 279,165 for 1978.

By definition the Des Moines Urbanized Area is auto-oriented* with only 5.3 percent of all work trips being made by transit.** The area is served by a total of 1,232 miles of streets and highways including three interstates and ten state highways.

*Auto oriented areas are defined by UMTA as being characterized by less than 6% of all work trips made by transit.

**Source: Table 82 of 1970 Census - General Social and Economic Characteristics

Travel within the Des Moines Urbanized Area is facilitated by a variety of modes of travel. The Area is served by one transit company, two taxi companies and by more than thirty associations which provide transportation for their client groups. Goods movement is facilitated by several railroad companies which serve the area. This wide variety of transportation options makes areawide planning necessary if a coordinated system is to be developed for the Des Moines Urbanized Area.

TSM Planning Process

In order to obtain the maximum benefit from the TSM concept, a procedure has been established for the TSM planning process. The process begins with the adoption by the Transportation Technical and Policy Committees of a set of Transportation System Management Objectives. The consistency of these objectives with the long range goals, policies and objectives must also be considered. These short range objectives guide the planning process and provide a measure against which the success of planning efforts can be evaluated.

The second step of the process involves an analysis of transportation needs in the area. This phase of the study has been conducted by dividing the transportation system into categories for analysis. The following categories were used in this analysis:

I AREAWIDE TRANSPORTATION CONCERNS

This category is concerned with an overall view of the existing transportation system. Concerns in this area relate to problems that affect the entire Urbanized area. Some of the actions dealing with these concerns are capable of being addressed in this TSM, others may be considered for next year's TSM or have been deferred for future study and consideration.

II FACILITIES

This category is concerned with analyzing highway, transit, paratransit and bikeway facilities. Data on the highway and transit system were available from

previous CIRALG studies, local jurisdictions and the Metropolitan Transit Authority. Information on paratransit systems is from the Des Moines Urbanized Area Elderly and Handicapped Study.

Information on bicycle facilities is not readily available and time has not permitted the collection of addition data. Therefore, the facilities analysis is concerned primarily with highway, fixed route transit and paratransit.

A. Highways - Data used in the analysis of streets are shown in the following table:

TABLE 1

DATA	SOURCE
1. Travel time studies	1977 CIRALG travel time
2. Delay data	1977 CIRALG delay study survey
3. Accidents	1975, '76, '77 accident data supplied by local jurisdications
4. Areas of concern	Segments or intersections identified by local traffic engineers and city administrators as points needing attention

B. Transit

The existing transit routes are analyzed using data furnished by the Metropolitan Transit Authority (MTA). Using operations data, problems (e.g. schedule delay, traffic conflicts) on existing routes were identified. The quantity of transit service available, defined by accessibility and frequency of service, was also considered. In addition, the analysis considered the cost/revenue, and route efficiency of the MTA system.

C. Paratransit

The existing paratransit services in the Des Moines Urbanized Area are discussed in this section, their deficiencies are evaluated and the transportation needs of the elderly and handicapped are given consideration. Alternatives which might serve these needs are also presented.

D. Bicycle Transportation

Very little data are available on bicycle transportation, therefore the analysis

of this focuses on a procedure for identifying bicycle needs and potential. The analysis also identifies design options which need to be considered in planning bicycle routes.

III. INTERNAL TRANSIT MANAGEMENT EFFICIENCY

The MTA's operating policies are examined in this section for potential management improvements.

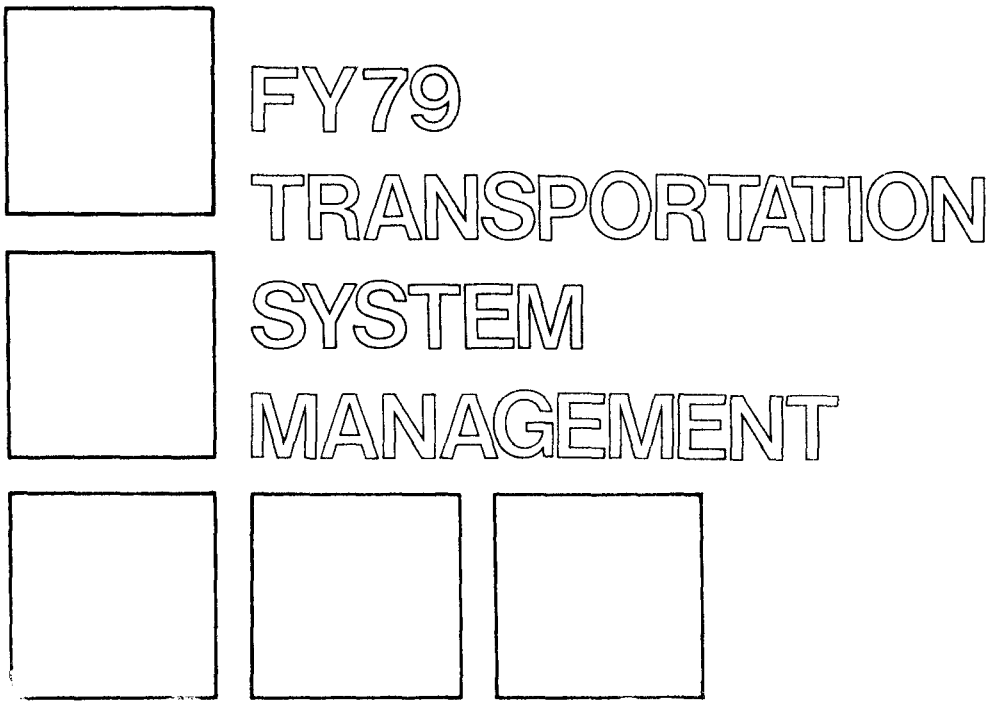
IV. LAND USE

Transportation land use relationships have been considered in this year's TSM. Average trip rates for residential and commercial developments scheduled for completion over the next five years have been developed. The travel demands of these developments has been taken into account since they may result in congestion on adjacent streets.

The third step of the TSM planning process consists of the development of strategies to deal with the problems identified in the preceding analysis. These strategies consist of packages of potential TSM actions which are designed to achieve TSM objectives.

The next step involves the analysis of the projects submitted by local jurisdictions as to their effect on objectives. Projects have also been categorized as to the strategy, or strategies, they affect.

The final step of the TSM process consists of the development of a monitoring and evaluation methodology. Monitoring activities involves the gathering of transportation system performance data (e.g. travel time and delay counting systems), while evaluation consists of the use of criteria to assess the individual and/or collective success of implemented TSM projects.



FY79 TRANSPORTATION SYSTEM MANAGEMENT

Chapter 2 •
TSM Goals, Policies and Objectives

CHAPTER II GOALS, POLICIES AND OBJECTIVES

In any planning process the definition of goals, policies and objectives is an essential first step. Goals and policies are guidelines which give the planning process an overall sense of direction. Objectives are lower order goals which, at least qualitatively, are capable of being measured. The long range goals, policies and objectives adopted by the Des Moines Transportation Policy Committee on August 18, 1976 are as follows:

GOAL

Provide for safe and convenient movement throughout the area.

Provide facilities for modes of travel to meet the needs of different people.

POLICY

1. Combine streets, highways, mass transit, terminals and parking facilities into a coordinated transportation system.

OBJECTIVES

a. To improve land-use transportation relationships.
b. To properly provide an acceptable balance of the various elements of the transportation system.
c. To provide opportunity for transfers from one transportation mode to another.
d. To make the best use of financial resources.

POLICY

2. Coordinate the design of street and highway facilities with land development in the vicinity of intersections and interchanges.

OBJECTIVES

a. To provide for safe movement with minimal delay.
b. To provide safe and convenient access with highway system to major commercial centers, industrial parks, and residential areas.
c. To minimize traffic conflicts on local streets.
d. To make the best use of public expenditures for highway facilities.

POLICY

3. Provide flexibility for additions or modifications to the transportation system by basing right-of-way requirements on an evaluation of transportation needs 20 years ahead.

OBJECTIVES

a. To allow efficient and economical improvements and expansion.
b. To minimize future street disruptions by adjacent development.
c. To allow adaptation of new technology.

POLICY

4. Use the best available technology to manage traffic.

OBJECTIVES

a. To make the most effective use of existing facilities.
b. To develop a coordinated network of arterial streets throughout the metropolitan area.

POLICY

5. Improve transit systems in the region.

OBJECTIVES

a. To provide the most effective use of the transit dollar by coordinating all public and private transportation services.
b. To develop optimum local and "feeder" service.
c. To provide transit service to people who must use mass transit.
d. To develop a marketing program which provides a wider public acceptance of mass transit.

POLICY

6. Guide land development by providing a planned development program of transportation facilities.

OBJECTIVES

a. To relate land use types and densities of existing and planned transportation facilities.
b. To provide access to suburban employment centers from the central city.
c. To encourage construction of parking garages rather than the large surface lots.
d. To provide incentives for development of housing near the central business district.

POLICY

7. Conserve energy resources and abate pollution and congestion.

OBJECTIVES

a. To promote increased development and use of bikeways.
b. To provide improved pedestrian facilities in the central business district.
c. To develop abandoned rail right-of-ways as bikeways, roadways, or hiking trails as appropriate.
d. To encourage staggered work hours and a four day work week where feasible to reduce peak-hour travel.
e. To encourage carpooling, transit, and other forms of ride sharing.

These long range goals, policies and objectives relate to many TSM objectives. They recognize the need to provide for bicycle and pedestrian modes of travel. They also consider the need for energy conservation and reduction of pollution through the use of such TSM actions as staggered work hours, four day work weeks and carpooling programs. In addition, they emphasize the need to coordinate both public and private transportation modes in the Des Moines Urbanized Area. The major shortcoming of these goals, policies and objectives for TSM Planning lies in the objectives. These objectives are not specific enough to aid in developing evaluation criteria by which their achievement may be assessed.

To avoid this problem, measurable short-range objectives were developed for the TSM plan. The objectives were also selected so they would be consistent with the previously selected long range goals, policies and objectives. Selected TSM objectives are shown in the following table (Table 3), along with a comparison of how these objectives relate to the Federal Goals (Table 2) proposed by the Federal Highway Administration and the Urban Mass Transportation Administration in the September 17, 1975 issue of the Federal Register.

TABLE 2

Federal Goals

1. Ensure the efficient use of existing road space through:
   a. Traffic operations improvements to manage and control the flow of motor vehicles.
   b. Preferential treatment for transit and other high occupancy vehicles.

c. Appropriate provision for pedestrians and bicycles including exclusive paths or lanes, pedestrian malls and bike storage areas.
d. Management and control of parking.
e. Changes in work schedules, fare structure and automobile tolls to reduce peak-period travel and to encourage off-peak use of transportation facilities and transit service.

2. Reduce vehicle use in congested areas. Actions in this category would include the promotion of high occupancy vehicles such as carpools and vanpools. Various pricing techniques may also be implemented to discourage the use of low occupancy vehicles in congested areas.

3. Improve transit service. Actions in this category include changes in routing and scheduling, pick up and drop off points and the provision of such things as bus shelters and route maps.

4. Increase transit management efficiency. Actions in this category include improved marketing techniques, cost accounting procedures and management information systems.

TABLE 3

Des Moines Urbanized Area TSM objectives as compared to Federal Goals -

	Local TSM Objectives	Related Federal Goals
1.	Reduction of injuries, deaths and property damage resulting from traffic accidents.	Ensure the efficient use of existing road space. Reduce vehicle use in congested areas.
2.	Optimize the person and goods movement capacity of existing transportation.	Ensure the efficient use of existing road space. Reduce vehicle use in congested areas. Improve transit service. Improve transit management efficiency.
3.	Reduce fuel consumed in urban travel.	Ensure the efficient use of existing road space. Reduce vehicle use in congested areas.
4.	Encourage alternatives to driving private automobiles.	Ensure the efficient use of existing road space. Reduce vehicle use in congested areas.
5.	Provide good quality, affordable transportation services to the transportation disadvantaged.	Improve transit service. Increase transit management efficiency.
6.	Reduce automotive emissions and impacts.	Ensure the efficient use of existing road space. Improve transit service. Reduce vehicle use in congested areas.

The first TSM objective reflects a concern with reducing the total number of accidents on the area's transportation network. The safety of urban travel is a major concern of local traffic engineers and city administrators.

The second objective reflects an emphasis on the efficiency of the transportation system. The emphasis is no longer on vehicles but on the efficient movements of people and goods.

The third objective reflects a concern with the inefficient use of energy resources by the transportation system. This is necessary in view of shrinking domestic energy supplies and growing dependence on foreign oil.

The fourth objective realizes there are social, economic and environmental consequences in not providing for alternatives to the private automobile. These consequences include, among others, traffic congestion at major trip attractors (e.g employment centers), inefficient land use patterns which tend to diminish the tax base of urban areas, air pollution, and inefficient use of energy resources.

The fifth objective realizes the immobility of many individuals in the Des Moines Urbanized Area who are unable to drive or unable to afford a car. These individuals include the low income, the elderly and the handicapped. The emphasis is on improving the operation and coordination of existing systems rather than developing new options.

The sixth objective - reduction of automotive emissions is a major concern in the urbanized area. At present there is nonattainment of Environmental Protection Agency (EPA) standards in regard to carbon monoxide, ozone and particulate matter. Reducing emissions from automobiles can aid in meeting EPA air pollution standards.

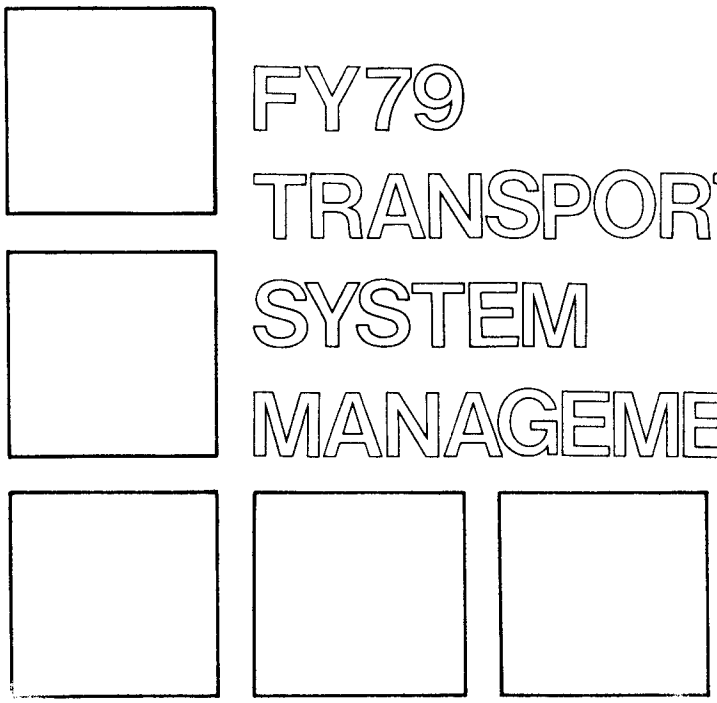
The short range TSM objectives selected by the Transportation Technical Committee are concerned with the safety of urban travel, the efficiency of the transportation system, the mobility of transportation disadvantaged groups and the environmental effects of transportation. The objectives serve four purposes in the TSM planning process:

1. The identification of problems.

2. The selection of a range of TSM actions to be considered for study and/or implementation.

3. The development of measures of effectiveness or evaluation criteria for assessing the impacts of TSM actions on objectives.

4. The development of TSM strategies (packages of TSM actions) to aid in the achievement of the short range objectives.



FY79 TRANSPORTATION SYSTEM MANAGEMENT

Chapter 3 •
Identification of Problems

CHAPTER III IDENTIFICATION OF PROBLEMS

The method of approach used for Transportation System Management (TSM) may vary from one study area to another. It depends upon the size, funding capacity and types of transportation problems in each urban area. Nevertheless, the basic concept of TSM consists of the process of maximizing transportation service while minimizing capital cost.

One of the prerequisites of the TSM process is to determine the condition and quality of current transportation service. Such understanding will assist in identifying problems, assessing needs for improvement and evaluating probable benefits. This chapter reports the results of the analysis of problems in the following categories: (1) Areawide transportation concerns, (2) Facilities including highways, fixed route transit, paratransit systems and bicycle transportation, (3) Internal transit management efficiency, and (4) Land use.

Areawide Transportation Concerns

This analysis consists of identifying problems and solutions of a general type facing the Des Moines Urbanized Area. The problems in this area generally affect the area as a whole and so were not categorized by a specific type of facility such as highways, transit, etc. The solutions of these areawide problems take the form of strategies (packages of TSM actions) which are briefly discussed following the analysis of each problem. The strategies are more extensively discussed in Chapter Four (IV).

Traffic Congestion and Low Vehicle Occupancy

There is traffic congestion around many employment centers during peak hours. Efforts to reduce this congestion have included the widening of streets and the banning of on-street parking along major arterials. Although such actions are important in relieving congestion at major trip generators, the most promising means of improving efficiency is by carpooling or vanpooling programs. The Des Moines Urbanized Area is automobile oriented and its capacity has been underutilized. Research indicates that

the average automobile occupancy rate in the Des Moines Urbanized Area is 1.3 persons per auto.*

Improved automobile occupancy rates would not only reduce congestion around employment centers, but also reduce air pollution and energy consumption (two other TSM related goals). The Des Moines Chamber of Commerce in conjunction with the Iowa Department of Transportation is encouraging carpool programs and providing matching assistance for employers wishing to start such a program.

Iowa DOT efforts to promote ridesharing are consistent with both state and national energy conservation efforts. In the 1975 Energy Policy and Conservation Act (PL94-163) for example, Congress specifies that in order to be eligible for energy conservation grants, state energy conservation plans must include programs to promote the availability and use of carpools, vanpools and public transit. Accordingly, carpool promotion is a key element in the Iowa Energy Policy Council's Energy Conservation Plan.

Currently, approximately 60 firms are participating in carpool programs in the Des Moines Urbanized Area.

If the employer centered matching program is to be successful the work locations and the start and finish time should be the same for all applicants. The employer oriented carpool program is also more likely to be successful if applicants have some knowledge of the kind of person a potential ridesharer might be.

Attracting a large number of applicants to a carpool matching system is central to the system's ability to match applicants. Finding ways to attract commuters to apply for carpool programs is also important. One way of attracting applicants to ridesharing programs is through the use of incentives.

Three incentives which have been successful in promoting ridesharing include preferential parking, monetary incentives and the development of vanpool programs. Preferential parking is a carpool incentive because, by providing a parking space close to the work place entrance, the amount of time spent traveling by carpoolers is reduced

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*Source: 1974 National Transportation Report Urban Data Supplement

Preferential parking may also reduce the commuter's exposure to the elements, particularly during extremely hot or cold weather. In Des Moines, Northwestern Bell and Meredith Printing have preferential parking programs.

Monetary incentives increase ridesharing, because they provide a potential cost savings for commuters who join together to form a carpool. The effect of a parking charge could be increased if subsidized parking is provided to carpoolers. For instance, if parking fee is $2.00 per day each individual of a two member carpool will save $1.00 per day. Central National Bank in Des Moines, for example, has actually provided a cash divident to encourage carpool use.

Perhaps the most promising means of increasing ridesharing is through the use of vanpools. A vanpool is defined as a group of riders using a van-type vehicle with a seating capacity greater than a standard passenger car but generally not more than 15 passengers. Vanpools can serve a large number of commuters if they provide:

1. A high level of service (in terms of travel time) competitive with the private auto.

2. Improved fuel efficiency by eliminating deadheading.

3. Reasonable cost through the use of sunlight drivers who have an 8-5 job when they are not driving. This type driver will pick up the commuter at his home or in a commuter lot, drive him to work, park the vehicle close to the work area and perform the reverse function at the end of the work period. He may receive transportation in lieu of wages or be compensated for the driving time. He will usually be a fellow worker of the commuter.

4. An arms-length relationship where success is not dependent on personal friendships.

5. An employer-oriented program with strong support and cooperation of the employer. The employer has more influence on commuting patterns than any government agency.

6. A home or work orientation. Home or work-oriented vanpools substantially improve compatibility and pool acceptance.

7. Vehicles that vary in size to fit the economics of the group size and distance traveled. Carpools are best for small groups, vans for intermediate groups of 10-15 people, and buses for larger groups.

8. An incentive for the driver and/or riders to maintain ridership levels. (Riders are the most effective sales force.*)

*Source: Frank W. Davis and Stuart Schlossburg. "Transit Planning for Results: A Consumer Oriented Approach."

There is often a concern that peak-hour transit ridership will decrease if ridesharing programs are successful. Research indicated such patronage losses do not occur.** In fact, where fixed route transit systems have helped employers organize carpool matching programs the data has proven useful in developing subscription bus services.

The increased ridesharing that should result from I-POOL can lead to substantial benefits. These benefits can accrue to the general public as well as to participating carpoolers and their employers. For example:

1. The benefits to the general public include:

    a. Reduced congestion on streets and highways.
    b. Reduced land requirements for auto related facilities.
    c. Less air and noise pollution.
    d. Energy savings.

2. Benefits to participating employers include:

    a. Good public relations.
    b. Reduced employee tardiness and absenteeism.
    c. Reduced traffic congestion at employment sites.
    d. Increased opportunity to recruit workers from areas with limited transit service.
    e. Reduced parking facility requirements.
    f. A more positive attitude among employees toward their employer.

3. Carpoolers themselves benefit from:

    a. Significant cost savings.
    b. Reduced auto insurance rates.
    c. Reduced mileage on their cars.
    d. Less tension while commuting.
    e. Convenience.

One of the more interesting facets of increased ridesharing is that these benefits can be realized with only minor disruptions to normal day to day activities. The following table shows a list of firms participating in the I-POOL program.

**Carpooling Incentives and Opportunities. Washington, D.C.: Federal Highway Administration, 1975.

Ronald F. Kirby, et. al. Paratransit: Neglected Options for Urban Mobility. The Urban Institute, 1974.

Paratransit Special Report 164. Washington, D.C.: Transportation Research Board, 1976.

TABLE 4

Des Moines Firms Participating in I-POOL Program

1. Polk County
2. Meredith Printing
3. United Parcel Service
4. Iowa Paint Manufacturing
5. Armstrongs
6. Bankers Life
7. City of Des Moines
8. Firestone
9. John Deere
10. Northwestern Bell
11. Iowa State Government
12. U.S. Federal Building
13. Blue Cross and Blue Shield
14. Des Moines Register and Tribune
15. Employers Mutual Companies
16. Sears
17. Super Valu
18. American Republic Insurance
19. Central National Bank
20. College of Osteopathic Medicine
21. Continental Western Insurance
22. Farmland Insurance
23. Ruan Companies
24. American Federal Savings
25. American Telephone and Telegraph
26. Briggs Corporation
27. Central Life Insurance
28. State Auto Insurance
29. Hawkeye Security
30. Federal Reserve Bank
31. American Institute of Business
32. Parker Brothers Games
33. Bishop Drumm Homes
34. Farm Bureau Insurance
35. Younkers
36. Massey Ferguson
37. Valley National Bank
38. Des Moines Federal Savings & Loan
39. Pioneer Hybrid
40. Plaza State Bank
41. Frenchway Cleaners
42. Staley, Inc.
43. Wheats Company
44. Commercial Printing
45. AMF Lawn and Garden
46. Pittsburgh Des Moines Steel
47. Garner Publishing Company
48. Equitable Life
49. Swift Packing
50. IBM
51. Bankers Trust
52. Diamond Labs
53. Interstate Insurance
54. Hy-Vee Stores
55. Wallace Homestead
56. Great Plains Bag Corporation
57. IMT Insurance
58. Medicenter
59. Bulk Mail Center

Traffic congestion might also be relieved through changes in work schedules. This would involve the use of such actions as variable or flexible work hours or the 4 day work week. These TSM actions are defined in Chapter Four (IV). Although these actions might reduce peak period traffic congestion they would do little to increase the average number of persons per automobile.

Strategies which might be used to relieve peak-period traffic congestion and/or low vehicle occupancy include:

1. Improve total vehicular traffic flow (traffic engineering improvement)
2. Increase car-van occupancy
3. Increase transit patronage
4. Institute work hour changes

Energy Consumption

Inefficient energy use by the urban automobile is another problem facing the area. The urban automobile should become a target of energy conservation efforts for two reasons. First, the automobile satisfies the majority of urban passenger travel demands and, as a result, consumes a large quantity of transportation related energy. The urban automobile also consumes fuel inefficiently due to the character of urban traffic. The stop and go nature of urban traffic causes fuel consumption to be 30 to 40 percent higher than it would be in highway driving.*

The strategies available to reduce energy consumption can be grouped into three categories: (1) Reduced automobile trips through mode shifts; (2) improvements in average automobile efficiency; and (3) reductions in vehicle miles of travel (VMT). The first category includes, bicycling and walking. The second category includes traffic engineering procedures that improve traffic flow on city streets. The third category includes TSM actions that could reduce vehicle miles of travel. Thus, the strategies which might be used to reduce energy consumption include:

a. Improve total vehicular traffic flow

b. Reduce vehicle miles of travel

c. Reduce vehicle trips

Air Quality

Air quality is another problem facing the Des Moines Urbanized Area. Because automobiles are responsible for a large percentage of the carbon monoxide (CO), nitrogen oxides (NOx) and hydrocarbons (HC) emitted, the reduction of motor vehicle emmissions is necessary if air quality is to be improved. Transportation related air quality problems in the Des Moines Area include CO, particulates and oxidants.

Excessive CO is associated with congestion so TSM actions that reduce congestion also reduce CO. However, CO in Des Moines is being exceeded for an eight hour period. Thus, reducing peak period demand alone will not allow the area to meet the CO air quality standards of EPA. TSM actions that shift automobile drivers to alternate

*Kenneth C. Orski. "The Potential for Fuel Conservation: The Case of the Automobile." Transportation Research 8 (October 1974)-247-257.

modes (carpools, vanpools, transit) during the peak period will be of value in reducing CO. Traffic engineering actions to improve traffic flow will also help reduce CO, if they do not increase traffic volumes. In order to meet the eight hour CO standards of the Environmental Protection Agency (EPA), it also will be necessary to reduce off-peak traffic. Improvements in off-peak transit service and development of additional facilities for pedestrian and bicycle traffic would be particularly important. Particulates, the second important air quality factor, can also be handled through reductions in vehicle miles of travel.

Oxidants, the final important air quality factor, are a result of atmospheric chemical reactions involving hydrocarbons and nitrogen oxides emitted by automobiles. Unlike CO, oxidant concentrations occur over large areas instead of small geographic areas. Reductions in oxidant levels require that hydrocarbon and nitrogen oxide emissions be reduced on a systemwide scale. TSM actions that affect only peak-period travel will likely have only a minor effect on oxidants. Thus, measures to control oxidants should include TSM actions that reduce both peak and off-peak travel. Such actions include transit improvements, carpool/vanpool programs and other measures that attract automobile drivers out of their cars.

Strategies for improving air quality are the same as those which might be used to reduce energy consumption:

1. Improve total vehicular traffic flow
2. Reduce vehicle miles of travel
3. Reduce vehicle trips

Integration of Taxis into the Transportation System

A fourth problem facing the area concerns the integration of taxicabs into the area's transportation system. Taxi service is currently used for many types of trips. Taxis are used, for example, as the initial or terminal link in intercity airplane trips. They are also used for shopping, personal business trips, etc. The

taxi could be a transportation option for more individuals (e.g. elderly, low income) if its cost was lower.

An option which might be considered for this purpose is shared-ride taxi. In this option individuals needing transportation would call a cab company one hour or more before the service is needed, giving their name, destination, when they need to go and when they need to return. By grouping riders the cost each rider would need to pay could be reduced. The riders would have the benefit of a group fare and could either pay for the ride out of their pocket or by means of a user side subsidy such as a coupon.

Integration of taxis into the transportation system requires cooperation between the private and public sector. The taxicab companies are concerned with their economic security but the public sector cannot guarantee the viability of a private operator. A taxicab company does, however, need guarantees regarding its economic security if it is to cooperate with the public sector. Cooperation will require that contracts mutually acceptable to the cab companies and local governments be negotiated. Integration of taxis into the transportation system also requires that the following questions be addressed:

1. What population groups will be served by a shared ride taxi system - the elderly and/or low income individuals?

2. What area will be served? Service could be limited to the Des Moines Urbanized area or it could be limited to selected zones of the study area.

3. How will the subsidy for a shared ride taxi system be administered? Will the subsidy be given to the user or the taxicab companies?

These questions are dealt with in more detail in the Des Moines Urbanized Area Elderly and Handicapped Study. The strategy developed for this problem is:

Improve the management and coordination of existing paratransit systems.

Coordination/Consolidation of Social Service Agency Transportation Systems

A duplication of service exists in the area since there are over one hundred federal programs under which financial assistance can be obtained to provide trans-

portation to the elderly, handicapped and other client groups. This wide variety of program assistance has contributed to a lack of coordination among agencies and has resulted in a lack of uniformity in accounting for transportation service and expenditures. As a result, transportation services overlap in some instances, while in other instances there are gaps in service.

A solution frequently proposed is to consolidate/coordinate public transportation resources to maximize efficiency and economy. Chapter 601J.4 of the Iowa Code provides that all systems receiving public monies coordinate their services. There are many obstacles, however, which hinder the consolidation/coordination of social service agency transportation systems. The same strategy indicated for integration of taxis into the transportation system will be followed for this consolidation/coordination problem: Improve the management and coordination of existing paratransit systems.

Coordination and Integration of Modes

The Des Moines Urbanized Area transportation system must be viewed as an integrated system consisting of all modes: Automobile, bus, pedestrian and bicycle facilities, taxi, paratransit systems (e.g. Special Service Transportation Corp.) and railroads. Conflicts between modes such as railroads and the automobile and fixed route transit need to be addressed. Duplication of service need to be reduced and the opportunity to transfer between services needs to be maximized. Examples of such efforts would include coordination of SST service with that provided by the MTA's fixed route system. If coordination and integration is to be successful the types of trips and demographic groups best served by fixed transit, taxis and paratransit options such as SST, carpools and vanpools should also be determined.

The strategy used in the two previous problem areas would be applicable here and is expanded: Improve the management and coordination of existing transportation systems in the Des Moines Urbanized Area.

Land Use - Transportation Problems

The short range (0-5 years) traffic impact of new developments proposed for the Des Moines Urbanized Area needs to be considered. Developments currently under construction and others to be initiated over the course of the next one to five years will have an impact on the surrounding transportation network; but estimating these impacts will not be easy. Polk County is developing an impact model to assess the costs of land use development in terms of the traffic generated on adjacent streets. This model will be used in the non-urbanized area of Polk County. A similar impact model would be needed to assess the consequences of land development in the urbanized area of Polk County.

Any detailed study of the short-range consequences of proposed land use developments would have to:

1. Estimate the traffic volumes generated by the proposed land developments.

2. Determine and evaluate the impact of projected traffic on the existing and proposed transportation network. This would involve the distribution and assignment of trips generated by a development to the network.

3. Determine what TSM actions might be needed to accommodate the projected traffic volumes.

The traffic volumes that might be generated by land use development scheduled for the next five years are dealt with in this year's TSM. Strategies to be applied can only be specified if a complete impact analysis is conducted.

Railroads

There are railroad problems in the Des Moines Urbanized Area which need to be addressed. Although no extensive data gathering efforts have been initiated several major problems are evident: (1) delays to motor vehicles and, in some instances, Metropolitan Transit Authority buses at railroad crossings; (2) accidents at grade-crossings; and (3) environmental problems such as noise. A railroad consolidation study will be conducted by a consultant selected by CIRALG and the Iowa Department of Transportation. Development of a consolidation plan to alleviate the problems associated with railroads in the Des Moines Urban Area will then consist of: (1) a more extensive definition and analysis of the problems; (2) development of alternate solutions for the problems; (3) description of a range of alternatives; (4) evaluation of the alternatives; and (5) recommendation of one or more of the alternatives. Development of a strategy for the consolidation of railroad trackage will depend upon a more in-depth study of the problem.

This analysis of areawide problems has produced the following group of stratagies:

1. Improve total vehicular traffic flow
2. Increase car/van occupancy
3. Increase transit patronage
4. Increase use of bicycle/pedestrian facilities

5. Institute work hour changes
6. Reduce VMT
7. Reduce vehicle trips
8. Improve the management and coordination of existing paratransit systems
9. Improve the management and coordination of existing transportation systems in the Des Moines Urbanized Area

The relationship of selected TSM actions to strategies and the compatability of strategies with one another (e.g. supportive, neutral or in conflict) are discussed in Chapter Four (IV). The problems with highway, transit, paratransit and bicycle facilities are analyzed in the next section.

Facilities Analysis - Highways

In order to measure the quality of traffic service in the Des Moines Study Area the operating condition of the transportation system must be analyzed. A comprehensive analysis of the operating condition of a transportation system is a time consuming and complex study. Therefore, for the sake of simplicity the operations to be reviewed were limited as follows:

a)	Intra-urban movement:	The quality of transportation service is measured within the Des Moines Urbanized Area. No measurement has been made of inter-city service quality.
b)	People movement:	The measurement involves people movement only. No goods movement studies have been undertaken.
c)	Auto/Transit:	Auto and transit are the basic travel modes available in the Des Moines Study Area. Transit service is measured in detail in a report entitled "Analysis of the MTA Operating System," July, 1977.
d)	Parameters of measurement:	The quality of service will be measured in terms of time, safety and problem areas.
e)	Indicators of the quality of service:	The indicators that are used to measure each parameter as described above are limited to those shown in Table 5.

TABLE 5

Time	Isochronal Map-developed from travel time surveys; Average peak hour stopped delay gathered on travel surveys
Safety	Traffic accident frequency. Hazardous locations
Problem Areas	Locations identified by the local governments as problem areas

Isochronal Map

Travel time studies were conducted along selected routes in the Des Moines Urbanized Area for the purpose of developing an isochronal map. An isochronal map as defined in this study is a map containing a group of one-minute increment time-contour lines from which the travel time from any point on a contour line to the center point is the same. The center point (zero minute) of the 1977 isochronal map was set at the intersection of Grand Avenue and Second Avenue.

The travel time from origin to destination was measured in terms of minimum travel following the minimum time path. For the 1977 Des Moines Study, the isochronal map was developed based on the 1977 travel time survey of 30 major arterials and the freeways. Approximately 300 selected check points (the majority of which are located on the surveyed routes) were used to develop the map. Travel times to designated locations on the map which were not survey check points were established by interpolation of survey data.

The 1977 isochronal map (Figure 1) is an indicator of service quality with respect to travel time. Such a comparison can provide an indication of service improvement (i.e. travel time) or deterioration since the last measurement. This comparison has been done by laying one isochronal map on top of another. Where the distance or gap between contour lines along a route is very close it indicates that

congestion is present. A comparison of the 1973 and 1977 isochronal maps show the following aspects:

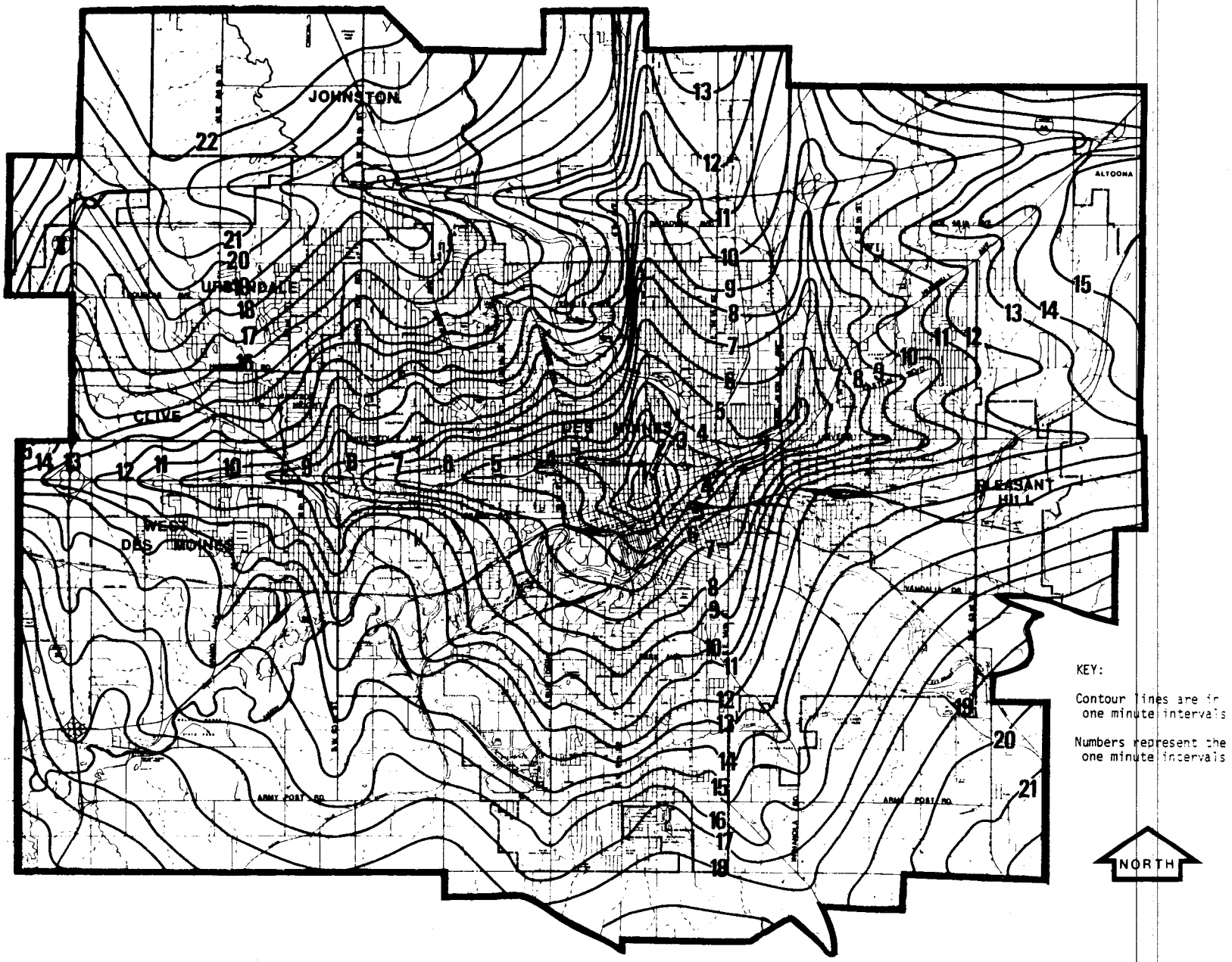
1. Freeway I-235 continues to provide efficient service for east-west traffic movement.

2. On the average, more travel time is needed to travel on north-south routes than on east-west routes.

3. Traffic congestion is present on SW 9th Street from McKinley to Army Post Road, on SE 14th Street from the Des Moines River to Park Avenue, on Merle Hay Road between Hickman Road and Aurora Avenue, and on Harding Road from Hickman Road to Douglas Avenue.

FIGURE 1

1977 ISOCHRONAL MAP



Delay

Delay data were gathered in conjunction with the travel time surveys. The data gathered were average peak hour stopped time delay. This measurement is defined as the average time period that a vehicle is standing still in peak hour traffic due to any factor. Time delays due to acceleration and deceleration time are not included in the calculation of delay. Table 6 indicates those areas where delay was encountered during the travel time surveys and the resulting average peak hour stopped time delay.

ROUTE	LOCATION OF DELAY	AVERAGE PEAK HOUR STOPPED TIME DELAY
E. 14th	Intersection of E. 14th and Broadway	45 "
	Intersection of E. 14th and Army Post	46 "
6th	Intersection of 6th and Euclid	1' 15 "
Indianola	Intersection of Indianola and S.E. 14th	34 "
Keo/Forest/Beaver	Intersection of Beaver and Hickman	1' 5 "
	Intersection of Keo and 5th	36.5"
	Intersection of Beaver and Douglas	32.5"
Euclid/Douglas	Intersection of Beaver and Douglas	34 "
	Intersection of Merle Hay and Douglas	58 "
S.E. 5th	Intersection of S.E. 5th and Army Post	31 "
8th, 73rd, 72nd	Intersection of Douglas and 72nd	46 "
Merle Hay	Intersection of Merle Hay and Douglas	59 "
	Intersection of Merle Hay and Aurora	41 "
63rd	Intersection of 63rd and Grand	50 "
University	Intersection of University and E. 14th	41 "
	Intersection of University and 2nd	37 "
	Intersection of University and 55th	44 "
	Intersection of University and 73rd	31 "
Hickman	Intersection of Hickman and Beaver	44 "
	Intersection of Hickman and Merle Hay	31 "
	Intersection of Hickman and 86th	55 "
	Intersection of Hickman and Harding	48 "
8th - 9th	Intersection of 9th and Grand	34 "
Park	Intersection of Park and E. 14th	33 "
Fleur	Intersection of Fleur and Park	53 "
	Intersection of Fleur and Watrous	35 "
	Intersection of Fleur and Army Post	50 "
Hubbell Ave.	Intersection of Hubbell and East University	38 "
Grand	Intersection of Grand and 9th	29 "
	Intersection of Grand and 63rd	39 "
2nd	Intersection of 2nd and Euclid	50 "
	Intersection of 2nd and Madison	25 "
Vandalia and E. 29th	Intersection of 29th and Euclid	44 "
Court and Dean	Intersection of Dean and E. 13th Street	25.5"
	Intersection of Dean and E. 14th Street	33 "
9th	Intersection of 9th and Park	26 "
	Intersection of 9th and Army Post Road	1' 26 "
Broadway	Intersection of Broadway and E. 29th	34 "
	Intersection of Broadway and Hubbell	35 "
	Intersection of Broadway and E. 14th	1' 18 "

Key: 'Minutes - "Seconds

Accident Analysis

A three year accident analysis was used to determine the top 100 accident locations in the Des Moines Metropolitan Area, and a one year study to determine the top 10 in outlying Polk County. A one year study was done for Polk County because 1975 accident data was not available. Three different criteria were used in the analysis of these locations. They were:

1. The Total Number of Accidents -- This method consists of listing street locations by the number of traffic accidents that have occurred at them in the previous three years (1975-1977). It is the least complicated and most used method.
2. Accident Severity -- Categorizing accidents by severity yields three separate measures of accident occurrances corresponding to the number of property damage, non-fatal injury, and fatal accidents. These types of accidents are assigned weights of 1, 3 and 12 respectively, and are added to give the location a total severity for the three years.
3. Traffic Accident Rate -- This rate is the quotient of the number of traffic accidents that occur at a street location and the number of vehicles passing through the location during the same time period. This is expressed in accidents per million entering vehicles. Thus, this rate reflects not only the accident experience at a location, but also the exposure to traffic. The formula for determining critical accident locations is as follows:

$$\text{Accident Rate} = \frac{N}{MEV}$$

where N = Three year total accidents

MEV = Three year 1,000,000 vehicles entering intersection

The three categories are then placed in descending order, from highest to lowest, and each location is assigned a rank. After this is done for all three categories, the ranks are then added to give an overall total. These are then compared to give a final ranking of hazardous locations. In cases where totals are equal, the traffic accident rate is used to differentiate between totals. The highest accident rate receives the higher ranking.

TABLE 7

TOP 100 ACCIDENT LOCATIONS IN THE DES MOINES METRO AREA

RANK	LOCATION	TOTAL ACCIDENTS	RANK	SEVERITY	RANK	ACCIDENTS MEV	RANK	TOTAL
1.	Army Post Rd. & SW 9th St.	145	2	238	2	4.64	6	10
2.	University Ave. & 6th Ave.	129	3	203	3	4.67	5	11
3.	McKinley Ave. & SW 9th St.	105	10	161	7	6.06	1	18
4.	Euclid Ave. & E. 14th St.	165	1	253	1	3.63	17	19
5.	Fleur Dr. & Grand/Locust	114	5	162	6	3.67	15	26
6.	Beaver Ave. & Douglas Ave.	108	8	152	11	3.86	13	32
7.	Grand Ave. & E. 15th St.	113	6	174	5	3.37	21	32
8.	Hubbell Ave. & E. 38th St.	87	16	135	15	4.86	3	34
9.	Euclid Ave. & 2nd Ave.	111	7	155	8	3.57	19	34
10.	University Ave. & 2nd Ave.	119	4	193	4	3.16	27	35
11.	Watrous Ave. & SE 14th St.	106	9	118	25	4.25	9	43
12.	Delaware & Euclid Ave.	98	12	154	9	3.29	24	45
13.	Army Post Rd. & Fleur Dr.	97	13	153	10	3.02	32	55
14.	McKinley Ave. & SE 14th St.	85	20	129	17	3.53	20	57
15.	Watrous Ave. & SW 9th	79	25	123	21	3.64	16	62
16.	Grand Ave. & E. 14th St.	86	18	138	14	2.86	37	69
17.	Virginia St. & SE 14th St.	82	22	128	18	2.84	38	78
18.	Indianola Rd. & Park Ave.	70	35	100	42	5.23	2	79
19.	Hickman Rd. & Merle Hay Rd.	87	16	119	23	2.74	44	83
20.	Park Ave. & S.W. 9th St.	90	15	128	18	2.62	51	84
21.	Douglas Ave. & Merle Hay Rd.	102	11	142	12	2.36	62	85
22.	Carpenter Ave. & Harding Rd.	70	35	98	47	4.83	4	86
23.	Hartford Ave. & SE 14th	86	18	134	16	2.52	56	90
24.	Maury St. & SE 14th St.	93	14	141	13	2.34	63	90
25.	Penn Ave. & University Ave.	76	28	120	22	2.75	43	93

TOP 100 ACCIDENT LOCATIONS IN THE DES MOINES METRO AREA

RANK	LOCATION	TOTAL ACCIDENTS	RANK	SEVERITY	RANK	ACCIDENTS / MEV	RANK	TOTAL
26.	Army Post Rd. & SE 14th	70	35	112	29	2.99	33	97
27.	Maple St. & E. 15th	66	41	111	33	3.18	26	100
28.	Harding Rd. & Hickman Rd.	85	20	113	27	2.45	59	106
29.	University Ave. & E. 30th	74	31	110	35	2.69	46	112
30.	Grand Ave. & 19th St.	77	26	100	42	2.73	45	113
31.	Walnut St. & E. 14th St.	64	48	90	55	3.86	14	117
32.	Harding Rd. & University Ave.	69	38	94	52	3.13	30	120
33.	University & 19th St.	66	41	112	29	2.64	50	120
34.	Bell Ave. & Fleur Dr.	77	26	96	49	2.56	54	129
35.	Merle Hay Rd. & Urbandale Ave.	69	38	111	33	2.50	58	129
36.	University Ave. & E. 14th	81	23	113	27	2.11	79	129
37.	Holcomb & 2nd Ave.	59	59	109	36	2.80	40	135
38.	University Ave. & 42nd St.	55	69	89	57	4.06	11	137
39.	College & 6th Ave.	59	59	87	60	3.59	18	137
40.	Forest Ave. & 6th Ave.	61	55	93	54	3.14	29	138
41.	Court Ave. & E. 14th	64	48	96	49	2.76	42	139
42.	Euclid Ave. & 6th Ave.	69	38	112	29	2.11	78	145
43.	Court Ave. & E. 15th	64	48	86	63	2.96	36	147
44.	Euclid Ave. & Harding Rd.	80	24	100	42	2.09	81	147
45.	Ingersoll Ave. & 31st St.	61	55	112	29	2.34	64	148
46.	I-235 & University	75	30	119	23	1.09	95	148
47.	Fleur Dr. & Park Ave.	76	28	108	37	1.87	85	150
48.	I-235 & Keo	71	33	125	20	0.96	97	150
49.	University Ave. & E. 13th	60	58	72	85	4.41	8	151
50.	Hull Ave. & E. 14th	65	44	101	40	2.30	68	152

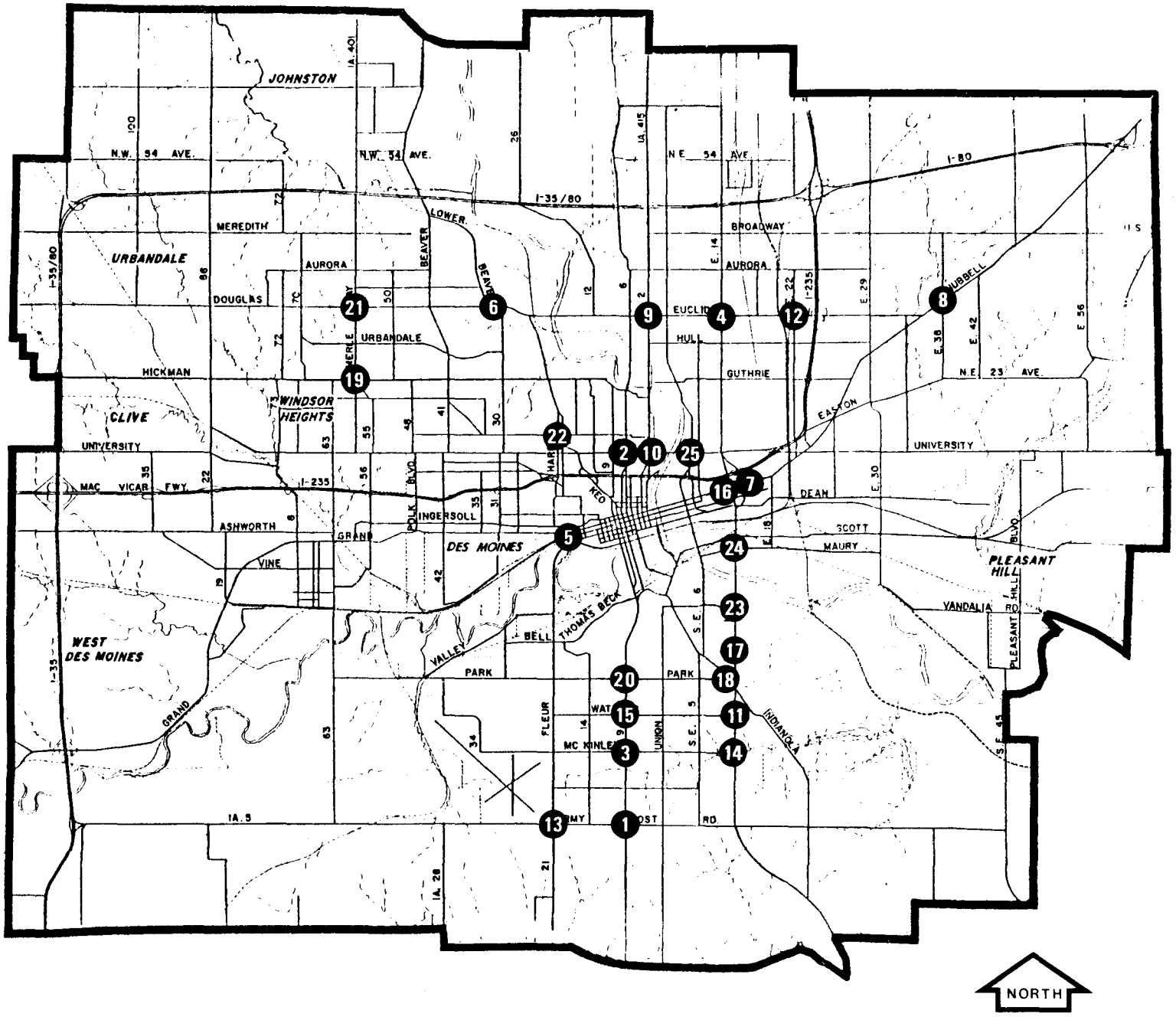
TOP 100 ACCIDENT LOCATIONS IN THE DES MOINES METRO AREA								
RANK	LOCATION	TOTAL ACCIDENTS	RANK	SEVERITY	RANK	ACCIDENTS / MEV	RANK	TOTAL
51.	Ingersoll Ave. & 35th St.	53	72	85	64	3.33	23	159
52.	Cottage Grove & Harding Rd.	53	72	87	60	3.15	28	160
53.	Ingersoll Ave. & 28th St.	56	67	78	75	3.37	22	164
54.	University Ave. & E. 21st St.	62	53	98	47	2.32	65	165
55.	Douglas Ave. & E. 14th	72	32	100	42	1.63	93	167
56.	I-235 & Penn Ave.	71	33	101	40	1.04	96	169
57.	Grand Ave. & 6th Ave.	62	53	94	52	2.30	67	172
58.	Hubbell Ave. & University Ave.	65	44	99	46	1.85	86	176
59.	Day & 7th St.	51	77	81	70	3.10	31	178
60.	Euclid Ave. & Hubbell Ave.	52	76	108	37	2.31	66	179
61.	Harding Rd. & Ingersoll Ave.	58	62	74	83	2.96	35	180
62.	Locust St. & 3rd St.	56	67	88	58	2.54	55	180
63.	Dixon & Euclid Ave.	57	65	88	58	2.52	57	180
64.	Walker & E. 15th	47	84	65	92	4.48	7	183
65.	I-235 & River Bridge	59	59	115	26	0.95	98	183
66.	Indianola Rd. & SE 14th St.	65	44	95	51	1.80	89	184
67.	I-235 & E. 15th St.	64	48	102	39	0.90	99	186
68.	University Ave. & E. 29th St.	61	55	85	64	2.29	69	188
69.	Aurora Ave. & Merle Hay Rd.	57	65	77	79	2.65	49	193
70.	Park Ave. & SE 14th St.	63	52	85	64	2.01	83	199
71.	Forest Ave. & Harding Rd.	66	41	82	68	1.69	91	200
72.	Crocker & 12th St.	42	96	62	95	4.18	10	201
73.	Army Post Rd. & SE 5th	49	81	77	79	2.80	41	201
74.	Fleur Dr. & McKinley Ave.	65	44	81	70	1.71	90	204
75.	Locust St. & 9th St.	53	72	79	73	2.39	61	206

TOP 100 ACCIDENT LOCATIONS IN THE DES MOINES METRO AREA

NK	LOCATION	TOTAL ACCIDENTS	RANK	SEVERITY	RANK	ACCIDENTS MFV	RANK	TOTAL
76.	Locust St. & 7th St.	40	98	60	98	3.94	12	208
77.	Fleur Dr. & Valley Dr.	58	62	80	72	2.16	74	208
78.	Army Post Rd. & SW 14th	55	69	87	60	2.09	80	209
79.	Douglas Ave. & Hubbell Rd.	50	79	78	75	2.40	60	214
30.	Madison Ave. & E. 14th	46	86	76	81	2.65	48	215
31.	I-235 & 42nd St.	58	62	90	55	0.70	100	217
32.	University Ave. & 24th St.	39	99	53	100	3.25	25	224
33.	Railroad & SE 14th St.	55	69	85	64	1.66	92	225
84.	Mulberry & 8th St.	43	93	59	99	2.99	34	226
85.	University Ave. & 9th St.	44	90	74	84	2.62	52	226
86.	Grand Ave. & E. 6th	46	86	62	95	2.66	47	228
87.	Beaver Ave. & Madison Ave.	46	86	68	90	2.61	53	229
88.	Locust St. & 2nd St.	48	82	82	68	2.03	82	232
89.	University & 31st St.	36	100	62	95	2.84	39	234
90.	Grand Ave. & 8th St.	53	72	79	73	1.49	94	239
91.	University & E. 9th St.	44	90	76	81	2.29	70	241
92.	Grand Ave. & 2nd Ave.	48	82	78	75	1.82	87	244
93.	Locust St. & 8th St.	51	77	65	92	2.13	76	245
94.	University Ave. & 55th St.	41	97	77	79	2.19	71	247
95.	Locust St. & 12th St.	47	84	69	89	2.14	75	248
96.	Cleveland & E. 14th St.	44	90	71	87	2.18	72	249
97.	Cornell & Euclid Ave.	50	79	70	88	1.96	84	251
98.	University Ave. & E. 33rd	43	93	67	91	2.17	73	257
99.	Grand Ave. & 17th St.	46	86	72	85	1.81	88	259
00.	Court & 1st-Riverside	43	93	63	94	2.13	77	264

FIGURE 2

TOP 25 ACCIDENT LOCATIONS BY COMBINATION RANK FOR 1975 - 1977



TOP 25 ACCIDENT LOCATIONS BY TOTAL NUMBER OF ACCIDENTS FOR 1975 - 1977

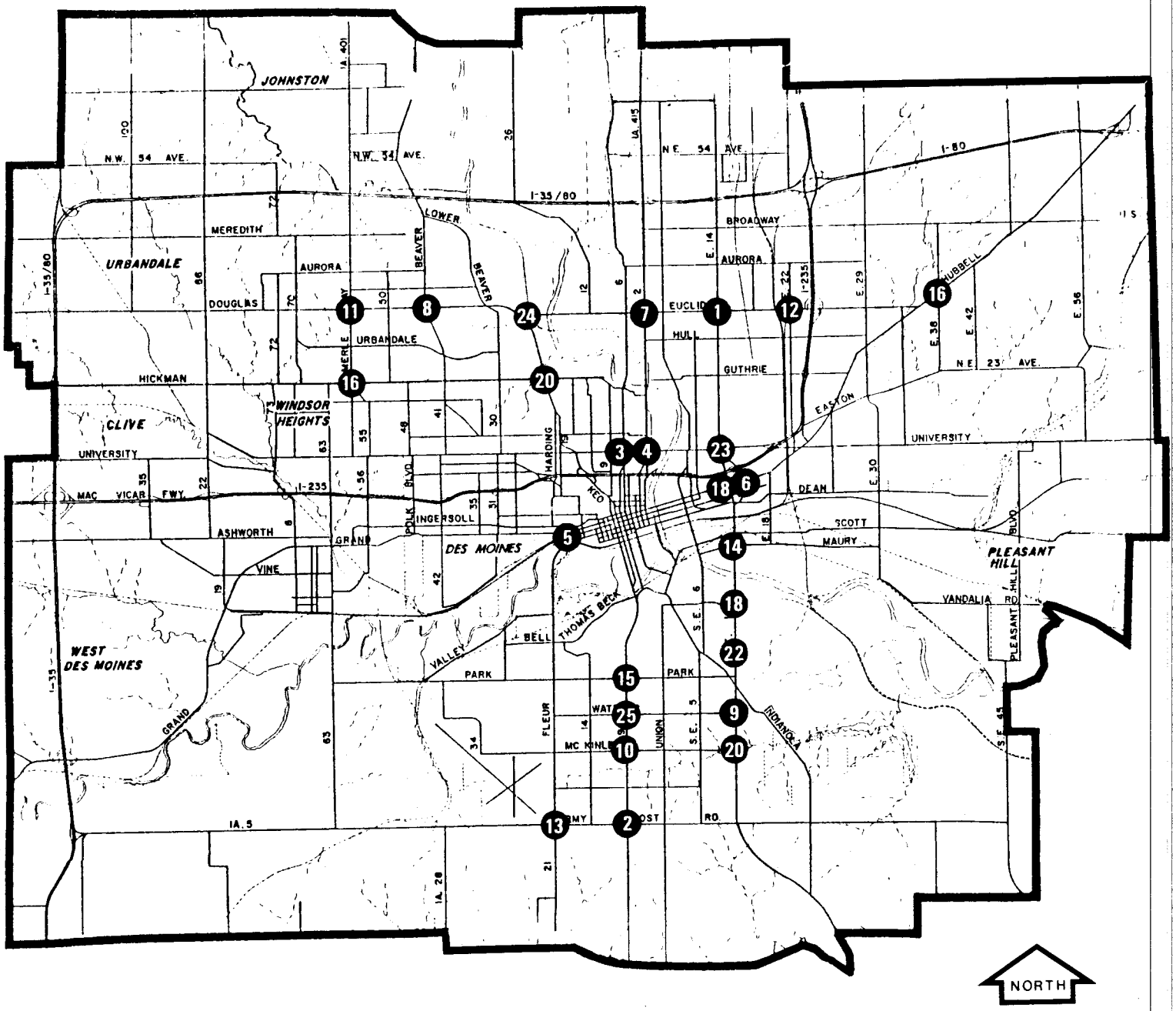
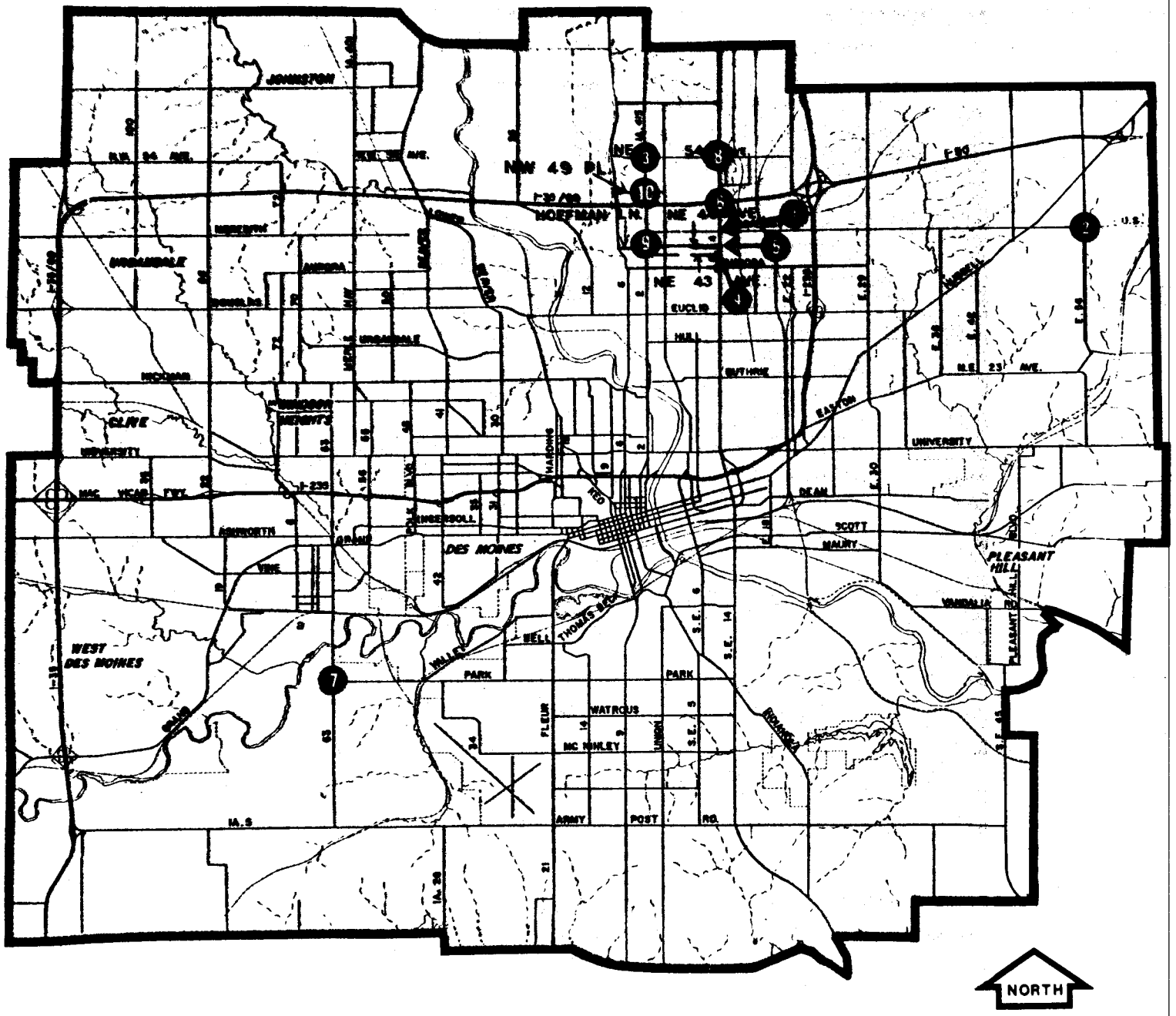


TABLE 8
TOP 10 ACCIDENT LOCATIONS IN UNINCORPORATED POLK COUNTY

RANK	LOCATION	TOTAL ACCIDENTS	RANK	SEVERITY	RANK	ACCIDENTS MeV	RANK	TOTAL
1.	NE 14th St. & NE 46th Ave.	18	1	32	1	2.62	3	5
2.	NE 46th Ave. & NE 56th St.	8	7	16	5	3.04	1	13
3.	NW 2nd Ave. & NW 54th	10	4	18	3	1.85	6	13
4.	NE 14th St. & NE 43rd Ave.	10	4	32	1	1.68	8	13
5.	NE 14th St. & NE 44th Ave.	11	3	13	7	1.95	5	15
6.	NE 14th St. & I-80/35	13	2	17	4	0.93	10	16
7.	SW 63rd & Park Ave.	9	6	13	7	2.31	4	17
8.	NE 14th St. & NE 54th Ave.	8	7	14	6	1.74	7	20
9.	NW 6th Dr. & Hoffman Dr.	7	9	9	10	2.80	2	21
10.	NE 2nd Ave. & NW 49th Pl.	7	9	11	9	1.34	9	27

POLK COUNTY
TOP 10 ACCIDENT LOCATIONS BY COMBINATION RANK
FOR 1977



Street + Highway Problem Areas

Local traffic engineers and city administrators have identified the locations shown on the following charts as significant problem areas in their jurisdictions. Most of these locations are either intersections or mid-block street segments which need to be improved. The problems at these locations include traffic congestion, lack of signalization at railroad crossings and design problems such as inadequate sight distance and narrow intersection approach widths. These problems have a tendency to reduce overall travel speed and to increase load factors, volume/capacity ratios and accident frequencies.

CLIVE

HIGHWAY + STREET PROBLEM AREAS

NAME OF STREET	LOCATION OF PROBLEM	TYPE OF PROBLEM	CAUSES OF PROBLEM	PROPOSED SOLUTION(S)
N.W. 86th & Univ. Ave.	Same Intersection	Congestion from delay caused by left turning vehicles	Growth in traffic	Turn Lane Signal, Additional Lanes
University Ave.	N.W. 86th to 300' W. N.W. 100th	Congestion and turning movements	Two Lane	Widening with Turning lanes
Univ. Blvd. & 86th	Same Intersection	Trains in area cause all lights to flash even when not crossing intersection	Closeness of Railroad tracks to intersection	Engineering Design
Harbach	Harbach & N.W. 86th	Can't get onto 86th because of heavy traffic	Large traffic volume	Traffic activated Signals
N.W. 86th	N.W. 86th & Hickman	Limited left turn	Traffic volume	Left turn lane and Left turn signals
Service road 200' S. of Hickman E. side	At N.W. 86th	Can't turn left or South	Traffic Volume	Right turn only
Univ. Blvd.	At. N.W. 86th	West Bound Turning holds traffic back	Approx. 85% of traffic turns left or south. West Bound uses same lane	Overhead signing on Signals

DES MOINES

HIGHWAY + STREET PROBLEM AREAS

NAME OF STREET	LOCATION OF PROBLEM	TYPE OF PROBLEM	CAUSES OF PROBLEM	PROPOSED SOLUTION(S)
63rd Street	Freeway to Hickman Road	Inadequate Street Width	High Traffic Volumes	Widen to Four Lanes and resignalize Intersections
S.W. 9th Street	Bell Ave. to Army Post Road	Inadequate Street Widths	High Traffic Volumes	Widen, Channelize, and resignalize Intersections
SE 5th Street	E. Hartford to Pioneer Road	Poor Street Surface	High Traffic Volumes	Street Paving
E. 14th Street	E. Euclid to NCL	Inadequate Street Width	High Traffic Volumes	Widening, Channelizing and resignalizing Intersections
E. University Ave.	Hubbell Ave to ECL	Inadequate Street Width	High Traffic Volumes	Widening, Channelizing and resignalizing Intersections
SE 14th Street	River Bridge to Army Post Rd	Inadequate Street Width	High Traffic Volumes	Widening, Channelizing and resignalizing Intersections
Industrial Highway	Central Business District	Capacity Limits of Existing Street System	High Traffic Volumes	New Controlled Access Facility
3rd Street	Court Avenue to Keo Way	Inadequate Street Width	High Traffic Volumes	Widening and Re-Signalizing Intersections
Indianola Road	E 1st Street to Watrous	Inadequate Street Width	High Traffic Volumes	Widening, Channelizing and resignalizing Intersections
Hubbell Avenue	E. 38th Street	Access and Inadequate Street Width	High Traffic Volumes	Widening, Channelizing, Frontage Rd. and Re-signalize Intersection
55th Street	Freeway to Hickman Road	Inadequate North-South Through Street	High Traffic Volumes	Widening and Connecting 55th Street to Merklin Way
Grand Avenue	56th Street to Walnut Creek	Inadequate Street Width	High Traffic Volumes	Widening, Channelizing and resignalization of intersection

DES MOINES

HIGHWAY + STREET PROBLEM AREAS

NAME OF STREET	LOCATION OF PROBLEM	TYPE OF PROBLEM	CAUSES OF PROBLEM	PROPOSED SOLUTION(S)
Guthrie Avenue	Hubbell Avenue	Inadequate Street Width	Heavy Left Turning Volumes	Widening and Re-signalization of Intersection
15th Street	Cherry St to Woodland Ave.	Inadequate Street Width	Heavy Traffic Volumes	Widening and Re-signalization of Intersection
Cherry Street	2nd Ave. to 5th Ave.	No Existing Street	Traffic Circulation Problems in CBD	Street Paving
Park Avenue	S.W. 63rd St. to S.E. 14th Street	Inadequate Street Width	Heavy Traffic Volumes	Widening and Re-signalization of Intersections
Prospect Road	Hickman Rd. to Harding Road	Inadequate Location of Existing Street	Heavy Recreation Traffic	Removal and Re-location of Street
Urbandale Avenue	Harding Road to 44th Street	No Existing Street	Traffic Volumes require better Circulation Pattern	Paving 4 Lane Street
West River Drive	2nd Ave to University Ave.	No Existing Street	Demand from Recreation Traffic	Street Paving
2nd Avenue	University Ave to Aurora Ave	Inadequate Street Width	High Traffic Volumes	Widening, Channelizing and resignalizing Intersections
31st Street	Freeway to University Ave.	Inadequate Street Width	High Traffic Volumes	Widening, Channelizing and resignalizing Intersection
42nd Street	Park Ave to Douglas Ave.	Inadequate N.S. Routes	N-S Traffic Demand	Extend 42nd from Park to River Oaks, Cross-over from 42nd to 41st
41st Street	Beaver Avenue	Pedestrian and Sight Distance	Traffic and Pedestrian Volumes	Intersection reconstruction
Central Business District	Central Business District	Pedestrian and Vehicle Conflict	High Pedestrian and Vehicle Volumes	Elevated Skywalk System

DES MOINES

HIGHWAY + STREET PROBLEM AREAS

NAME OF STREET	LOCATION OF PROBLEM	TYPE OF PROBLEM	CAUSES OF PROBLEM	PROPOSED SOLUTION(S)
Central Business District	Central Business District	Inefficient Traffic Control	Age and Reliability of Existing System	New Master Control System
Fleur Drive	Army Post Road to Locust	Inefficient Traffic Control	Intersection Controls Not Interconnecting	Master Control System
E. 30th Street	E. University to Easton	Inadequate North-South Through Street	High Traffic Volumes	Paving, Widening and Cross-over from E.30th to E. 29th
Harding Road	Ingersoll Ave. to Euclid	Inadequate Street Width	High Traffic Volumes	Widening, Channelizing, resignalizing Intersections
Merle Hay Road	Hickman Road to NCL	Inadequate Street Widths	No Alternate Routes, Projected Traffic Volumes	Widening and Construction of Alternate Routes

JOHNSTON

HIGHWAY + STREET PROBLEM AREAS

NAME OF STREET	LOCATION OF PROBLEM	TYPE OF PROBLEM	CAUSES OF PROBLEM	PROPOSED SOLUTION(S)
Iowa 401 (Merle Hay Rd.)	At Intersection with NW 62nd Ave.	Common to all: - Congestion	Common to all: - Road Geometrics	"U-Step" Project
Iowa 401 (Merle Hay Rd.)	At Intersection with NW 59th Ct.	- Conflicting Movements	- Road Surface - Sight - Distance	In Process
N.W. 62nd Ave.	At Intersection with NW 59th Ct.	- High Accident Rate - Confusion	- High Traffic Volumes - Low Traffic Capacity	1979 Completion
Iowa 401 (Merle Hay Rd.)	From C&NW RR Tracks to NW 78th Ave.(end of Ia.401) (Incls. intersections at NW 78th)	Congestion/High Accident Rates	Road Width, speed, number of intersection/accesses	Widen Road, Reduce speed (DOT-1983)
Iowa 401 (Merle Hay Rd.)	At Intersection with NW Beaver Dr.	Accident Rates Confusion	High Traffic Volume/Low Capacity Signing	D.O.T. Improvement Scheduled for 1983
N.W. Beaver Dr.	At Intersection with NW 55th Ave.	Visibility, Improper Turning Movements	Intersection Geometrics and Configuration	Improvement of Intersection
N.W. Beaver Dr.	At Intersection with NW 57th Ave.	Visibility, Improper Turning Movements	Intersection Geometrics and Configuration	Improvement of Intersection
N.W. Beaver Dr.	At Intersection with NW 62nd Ave.	Visibility, Improper Turning Movements	Intersection Geometrics and Configuration	Improvement of Intersection

JOHNSTON

HIGHWAY + STREET PROBLEM AREAS

NAME OF STREET	LOCATION OF PROBLEM	TYPE OF PROBLEM	CAUSES OF PROBLEM	PROPOSED SOLUTION(S)
N.W. Beaver Dr.	From I-80/35 to Iowa 401 and Iowa 401 to N. City Limits	Congestion, Accident Rates	High Traffic Volume, Road Width	Widen Road
N.W. Beaver Dr.	At Intersection with NW 66th Avenue	Accident Rate, Confusion	Configuration, Geometrics, Speed, Traffic Volumes, Road Surface and Width	Intersection Improvement Planned for 1980-81
N.W. 86th St.	At Intersection with NW 62nd Avenue	Confusion, Accident Potential	Configuration and Geometrics, Speed, Road Width and Surface	Intersection Improvements
N.W. 86th St.	At Intersection with NW 70th Avenue	Confusion, Accident Potential	Configuration and Geometrics, Speed, Road Width and Surface	Intersection Improvements
N.W. 86th St.	From NW 62nd Avenue to NW 70th Avenue	Accident Potential	Pavement Width, old-type Rolled curbs, speed	Remove Curbs and Widen
N.W. 62nd Ave.	At Bridge over Beaver Creek	Congestion, Safety Hazard, Loads, Traffic On Other Roads	Bridge Width, Structurally Unsound and Age	Replacement Scheduled for 1979
N.W. 70th Ave.	From NW Beaver Dr. to NW 86th Street	Accident Potential, Traffic Restriction	Pavement Width, Narrow Shoulders	Widen

JOHNSTON

HIGHWAY + STREET PROBLEM AREAS

NAME OF STREET	LOCATION OF PROBLEM	TYPE OF PROBLEM	CAUSES OF PROBLEM	PROPOSED SOLUTION(S)
NW 55th Ave.	Railroad Crossing	Road Surface Accident Potential Restriction of Traffic	Lack of Maintenance	Re-Build Crossing and Maintain
NW 57th Ave.	Railroad Crossing	Road Surface Accident Potential Restriction of Traffic	Lack of Maintenance	Re-Build Crossing and Maintain
NW 60th Ave.	Railroad Crossing	Road Surface Accident Potential Restriction of Traffic	Lack of Maintenance	Re-Build Crossing and Maintain
NW 62nd Ave.	Railroad Crossing	Road Surface Accident Potential Restriction of Traffic	Lack of Maintenance	Re-Build Crossing and Maintain
NW 70th Ave.	Railroad Crossing	Road Surface Accident Potential Restriction of Traffic	Lack of Maintenance	Re-Build Crossing and Maintain
Iowa 401 (Merle Hay Rd.)	Railroad Crossing	Road Surface Accident Potential Restriction of Traffic	Lack of Maintenance	Re-Build Crossing and Maintain
NW 63rd Ave.	Full Length	Congestion	Insufficient R-O-W	Acquire Additional R-O-W and re-surface
NW 64th Ave.	Full Length	Restriction	Road Surface	Acquire Additional R-O-W and re-surface
NW 66th Ave.	Full Length	Accidents	Parking	Acquire Additional R-O-W and re-surface
NW 51st St.	From NW 62nd Ave to NW 64th Ave.	Accidents	Parking	Acquire Additional R-O-W and re-surface
NW 54th Ct.	From NW 63rd Ave. to NE 66th Ave.	Accidents	Parking	Acquire Additional R-O-W and re-surface
NW 56th Ct.	From NW 63rd Ave. To NW 66th Ave.	Accidents	Parking	Acquire Additional R-O-W and re-surface

POLK COUNTY

HIGHWAY + STREET PROBLEM AREAS

NAME OF STREET	LOCATION OF PROBLEM	TYPE OF PROBLEM	CAUSES OF PROBLEM	PROPOSED SOLUTION(S)
NE 58 Avenue	NE 58 Avenue	RR Crossings	No Automatic Signalization	Install Automatic Signals
SE 44 Avenue	SE 44 Avenue	RR Crossings	No Automatic Signalization	Install Automatic Signals
NE 66 Avenue	NE 66 Avenue	RR Crossings	No Automatic Signalization	Install Automatic Signals
NE 27 Avenue	NE 27 Avenue	RR Crossings	No Automatic Signalization	Install Automatic Signals
NE 62 Avenue	NE 62 Avenue	RR Crossings	No Automatic Signalization	Install Automatic Signals
SW 128 Street	SW 128 Street	RR Crossings	No Automatic Signalization	Install Automatic Signals
NE 51 Avenue	NE 51 Avenue	RR Crossings	No Automatic Signalization	Install Automatic Signals
SW 63 Street and Park Avenue	SW 63 Street and Park Avenue	Intersection	Intersection Channelization	Channelize Intersection
NE 46 Ave and NE 29 Street	NE 46 Ave and NE 29 Street	Intersection	No Signalization	Install Signalization
NE 14 Street and NE Aurora Ave.	NE 14 Street and NE Aurora Ave.	Intersection	No Signalization	Install Signalization
SE 34 Street and SE 40 Avenue	Corner of SE 34 Street and 40 Avenue	Sight Distance	Limit Sight Distance at Corner	Install Signing
SW 42 Street (2 locations)	SW 42 Street	RR Crossings	No Automatic Signalization	Install Automatic Signals

POLK COUNTY

HIGHWAY + STREET PROBLEM AREAS

NAME OF STREET	LOCATION OF PROBLEM	TYPE OF PROBLEM	CAUSES OF PROBLEM	PROPOSED SOLUTION(S)
NW Morning Star Dr.	NW Morning Star Drive	RR Crossings	No Automatic Signalization	Install Automatic Signals
NE 44 Avenue	NE 44 Avenue	RR Crossings	No Automatic Signalization	Install Automatic Signals
NE 3 Street	NE 3 Street	RR Crossings	No Automatic Signalization	Install Automatic Signals

WEST DES MOINES

HIGHWAY + STREET PROBLEM AREAS

NAME OF STREET	LOCATION OF PROBLEM	TYPE OF PROBLEM	CAUSES OF PROBLEM	PROPOSED SOLUTION(S)
63rd (1st)	Grand Avenue to Racoon River	Traffic Volume Congestion	Inadequate Street Width	Widen Street
63rd (1st)	At Railroad Avenue	Turning Movement	Inadequate Street Width	Add turning lanes
63rd (1st)	At Railroad Avenue	Conflict with train traffic	High Volumes vehicular traffic and trains	Viaduct
University Avenue	22nd (8th Street)	Traffic Congestion	Inadequate number of lanes for turning (left)	Add turning lanes to 22nd Street
University Avenue	22nd Street to 35th Street	Traffic Congestion	Inadequate number of lanes to carry traffic	Widen
Ashworth Road	At 35th Street	Deficient traffic Signals, No left turn/arrows	Considerable amount of left turn traffic	Add left turn arrows and add phase to controller(up-grade sigs.)
22nd Street	At Kingman	Accident Problem	High Volume traffic 22nd St.	May need to add traffic signal at Kingman

URBANDALE

HIGHWAY + STREET PROBLEM AREAS

NAME OF STREET	LOCATION OF PROBLEM	TYPE OF PROBLEM	CAUSES OF PROBLEM	PROPOSED SOLUTION(S)
Rocklyn Dr. & Hickman Road	Same Intersection	Intersection	No automatic signalization	Install automatic signal
72nd & Douglas Avenue	Same intersection	Intersection	Street alignment	Widen street
64th & Douglas Avenue	Same intersection	Intersection	Street alignment	Widen street
Douglas Ave. & 77th St to 86th St.	Douglas Ave. & 77th St. to 86th St.	Traffic Congestion	Narrow street	Widen street

Transit

Existing System

The Des Moines Metropolitan Transit Authority (MTA) is a municipal bus system owned by five cities: Des Moines, Clive, Urbandale, West Des Moines, and Windsor Heights. The MTA receives its operating expenses from the five municipalities and State and Federal Grants and is governed by a Board of Directors composed of three members from Des Moines and one member each from the four suburbs.

There are eight regular bus routes, 5 express routes and special school routes on the MTA fixed route system*. The eight regular MTA routes consist of approximately 200 route miles which are oriented toward serving passenger trips to and from downtown Des Moines. Service is provided on these fixed routes from approximately 6:00 A.M. until 7:00 P.M., Monday through Friday, and from 6:00 A.M. until 6:30 P.M. on Saturday. No service is provided on weekdays after 7:00 P.M. nor on Sunday. Of the eight regular routes, six operate on 15 minutes frequencies during the A.M. and P.M. peak periods. Off-peak midday service is provided on six of the routes at 30 or 35 minute headways.

In addition to regular route service the MTA also operates school bus routes. The MTA provides bus service for children who cannot be handled by the regular school buses. These school routes are established at the beginning of each school year in accordance with current school district boundaries and state regulations.

The five express routes operate on 30 minute headways in the P.M. peak period and are through with their scheduled runs shortly after 6:00 P.M. in the evening. These express routes are designed to serve the commuter work trip.

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*Route Maps are avilable in the Appendix

The fare schedule for MTA service is as follows:

Adults (18-59)	50¢
Senior Citizens (60 + with I.D.)	25¢ during off-peak hours and all day Saturday
Handicapped (with I.D.)	25¢ during peak or off-peak hours
Students (13 yrs. through high school)	50¢*
Children 6 thru 12	35¢
Children under 6	Free when accompanied by an adult
Transfers	Free on all routes once fare is paid

The MTA also has a system of passes which is used for promotional purposes -

Weekly Pass	$4.50 Good for unlimited rides from 1st day of week thru last day
Bi-Weekly Pass	$7.00 Students - Good for unlimited rides during a 2 week period
Monthly Pass	$20.00 Unlimited rides 1st day of month thru last day
Trip Tickets	
Adults	$5.00
Student and Children 6-12	$3.50
Senior Citizens	$2.50 (Good only during specified hours)

*Reduced fare of 35¢ available through purchase of student bi-weekly passes or student trip tickets.

MTA Fleet

The current inventory of MTA transit as of March 1, 1978 is listed in Table 9* Data from the table indicates: (1) the average age of vehicles is 9.7 years; (2) 55 buses or 61 percent of the fleet have air conditioning, and (3) the average seating capacity of an MTA vehicle is 48 seats.

TABLE 9
DES MOINES METROPOLITAN TRANSIT AUTHORITY
FLEET ROSTER

as of

March 1, 1978

Year of Manufacture	Seating Capacity	Equipment Operations	Number of Vehicles
1976	51	A/C	15
1976	42	A/C	15
1974	51	A/C	25
1963	51	--	5
1961	39	--	3
1960	43	--	1
1958	44	--	7
1955	51	--	19
			90

Average Fleet Age: 9.7 years

Air conditioning is the only amenity that varies throughout the fleet. The distribution of air conditioned coaches, on each route, throughout the day is shown in Table 10.**

*Section 4 of the Title VI Assessment for Capital and Operating Assistance and Title VI Documentation Regarding Technical and Planning Assistance.
**Appendix of the Title VI Assessment for Capital and Operating Assistance and Title VI Documentation Regarding Technical and Planning Assistance.

TABLE 10

DISTRIBUTION OF AIR CONDITIONED VEHICLES

BY ROUTE

Route	Train No.	All Day	AM Peak	PM Peak	Age of Bus	Air Conditioned
1. West Des Moines/ Fairground	1	X			4 yrs.	Yes
	2	X			4 yrs.	Yes
	3	X			2 yrs.	Yes
	4	X			4 yrs.	Yes
	5	X			2 yrs.	Yes
	215		X		4 yrs.	Yes
	215			X	4 yrs.	Yes
	216		X		23 yrs.	No
	216			X	18 yrs.	No
	217		X		4 yrs.	Yes
	217			X	4 yrs.	Yes
	218		X		4 yrs.	Yes
	218			X	23 yrs.	No
	219		X		23 yrs.	No
	219			X	23 yrs.	No
2. Crocker/Scott	191		X		2 yrs.	Yes
	191			X	2 yrs.	Yes
	192		X		2 yrs.	Yes
	192			X	4 yrs.	Yes
3. University/ Highland -Oak Park	23	X			4 yrs.	Yes
	24	X			2 yrs.	Yes
	25	X			4 yrs.	Yes
	26	X			2 yrs.	Yes
	121		X		4 yrs.	Yes
	121			X	23 yrs.	No
	122		X		4 yrs.	Yes
	122			X	4 yrs.	Yes
	123		X		2 yrs.	Yes
	123			X	2 yrs.	Yes
	124		X		23 yrs.	No
	124			X	15 yrs.	No
4. Urbandale/E. 14th	81	X			2 yrs.	Yes
	82	X			4 yrs.	Yes
	83	X			4 yrs.	Yes
	84	X			2 yrs.	Yes
	181		X		15 yrs.	No
	181			X	2 yrs.	Yes
	182		X		4 yrs.	Yes
	182			X	4 yrs.	Yes
	183		X		4 yrs.	Yes
	183			X	20 yrs.	No
	184		X		2 yrs.	Yes
	184			X	4 yrs.	Yes
5. Clark/E. 6th & 9th	42	X			4 yrs.	Yes
	43	X			23 yrs.	No
	44	X			4 yrs.	Yes
	145		X		23 yrs.	No
	146		X		15 yrs.	No
	146			X	23 yrs.	No
	147		X		4 yrs.	Yes
	147			X	2 yrs.	Yes
	148		X		23 yrs.	No
	148			X	23 yrs.	No
6. W. 9th-Douglas/ Indianola-Lacona	75	X			2 yrs.	Yes
	76	X			2 yrs.	Yes
	77	X			2 yrs.	Yes
	78	X			2 yrs.	Yes
	174		X		2 yrs.	Yes
	174			X	2 yrs.	Yes
	175		X		2 yrs.	Yes
	175			X	17 yrs.	No
	176		X		2 yrs.	Yes
	176			X	2 yrs.	Yes
	177		X		2 yrs.	Yes
	177			X	20 yrs.	No
7. Fort Des Moines/ Walker	56	X			2 yrs.	Yes
	57	X			4 yrs.	Yes
	58	X			4 yrs.	Yes
	59	X			2 yrs.	Yes
	101		X		23 yrs.	No
	101			X	2 yrs.	Yes
	102		X		23 yrs.	No
	102			X	23 yrs.	No
	103		X		4 yrs.	Yes
	103			X	20 yrs.	No
	104		X		23 yrs.	No
	104			X	20 yrs.	No
8. SW 14th & Havens	66	X			2 yrs.	Yes
9. Express Routes						
West Des Moines Exp.	9		X		2 yrs.	Yes
	9			X	4 yrs.	Yes
	11			X	23 yrs.	No
Valley Express	10		X		4 yrs.	Yes
	10			X	20 yrs.	No
	13			X	20 yrs.	No
Windsor Hts. Express	13		X		4 yrs.	Yes
	16			X	4 yrs.	Yes
	19			X	15 yrs.	No
Clive Express	14		X		4 "	Yes
	14			X	23 "	No
	17			X	2 "	Yes
Urbandale Express	15		X		4 "	Yes
	15			X	4 "	Yes
	18			X	23 "	No

Assessment of MTA Transit Service

The MTA's service has been evaluated as to its quantity, quality, cost/revenue, and route efficiency.

Quantity -

1. Transit Route Density: This has been calculated for each Census Tract (Table 11 and Figure 5) and shows that most census tracts are covered by more than one route, but very few tracts are more than 75% covered.

2. Directness of MTA bus service. The route network is as follows:

   Routes are radially oriented from the CBD. All routes except Urbie pass through the downtown area. Most of the MTA's routes are in a loop configuration. In this routing method buses operate outbound on one street and inbound on another street for a portion of the route length.

   The MTA route network provides direct service between the CBD and most destinations. There are, however, disadvantages associated with such a route network.

   A. In order to travel between two non-CBD locations an individual must transfer. Example: If one would like to travel from Normandy Terrace in West Des Moines to Drake University he would have to take Route 1 (Fairground/West Des Moines) to the CBD and transfer to Route 3 (Highland-Oak Park/ University).

TABLE 11

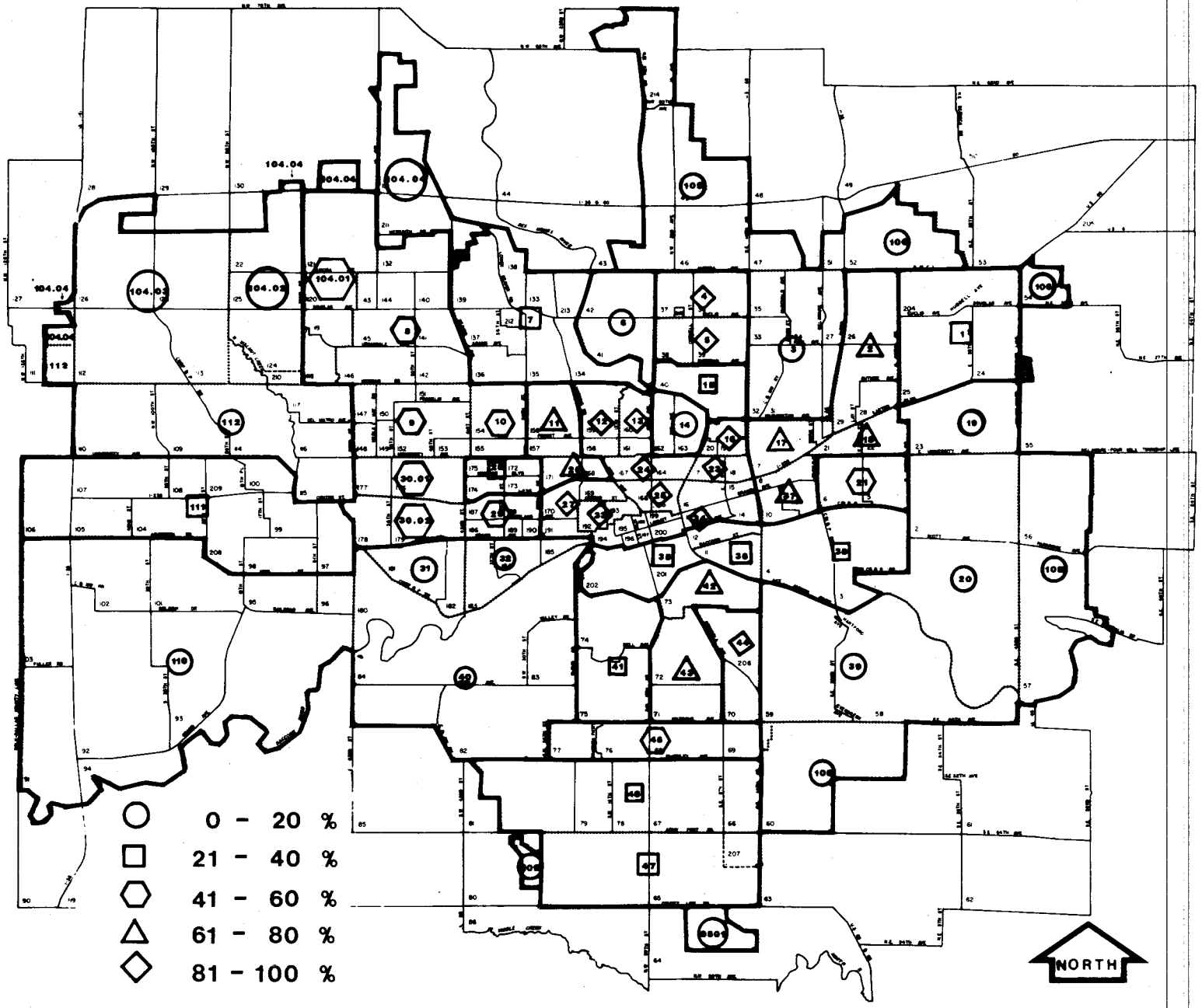
ROUTE COVERAGE OF CENSUS TRACTS

Route No.	Route Name
1	West Des Moines/Fairground
2	Crocker/Scott
3	University/Highland Oak Park
4	Urbandale/E. 14th
5	Clark/E. 6th & E. 9th
6	West 9th-Douglas/Indianola-Lacona
7	Fort Des Moines/Walker
8	SW 14th-Havens

TRACT	ROUTE DENSITY	AREA ROUTE COVERAGE (PERCENT)	ROUTE NUMBER 1	2	3	4	5	6	7	8	Urbie
1	1.00	24.9	X						X		
2	2.78	69.6							X		
3	0.42	10.4				X					
4	3.47	86.7			X	X					
5	4.14	100+			X	X	X				
6	0.62	15.5			X						
7	1.16	28.9				X		X			
8	1.98	49.5				X	X	X			X
9	1.82	45.4			X		X				
10	2.26	56.5			X	X	X				
11	2.56	64.1			X	X	X				
12	5.30	100+				X	X	X			
13	5.22	100+			X		X	X			
14	0.72	18.1			X						
15	1.57	39.2			X	X	X				
16	5.90	100+				X	X				
17	3.09	77.4				X			X		
18	2.78	69.6							X		
19	0.41	10.2	X								
20	0.23	5.7	X	X							
21	1.81	45.3	X								
23	4.00	100.0				X	X		X		
24	3.27	81.8			X		X	X			
25	5.03	100+			X	X	X	X			
26	2.77	69.1			X	X					
27	5.37	100+	X	X	X	X					
28	1.24	31.0		X	X						
29	2.39	59.7	X	X							
30.01	2.07	51.7		X	X						
30.02	1.69	42.1	X								
31	0.17	4.2	X								
32	0.06	1.4		X							
33	5.00	100+	X	X	X	X	X	X			
34	8.74	100+	X	X	X	X	X	X	X	X	
35	1.44	36.1		X				X	X	X	
36	1.60	40.0		X							
37	2.70	68.5	X			X					
38	1.45	36.2		X							
39	0.18	4.4							X		
40	0.23	5.9								X	
41	1.19	32.2							X	X	
42	2.44	61.1						X	X	X	
43	2.54	63.4						X	X	X	
44	3.71	92.6						X			
45	2.07	51.7						X	X	X	
46	1.10	27.4						X	X	X	
47	1.34	33.5						X	X	X	
104.1	1.99	49.7				X		X			X
104.2	0.46	11.3				X		X			X
104.3	0.49	12.3						X			X
105	0.03	0.8				X					
106	0.12	2.9							X		
108	0.11	2.7						X			
110	0.16	4.1	X								
111	1.04	26.0	X		X						
112	0.75	18.7			X		X				X

FIGURE 5

ROUTE COVERAGE OF CENSUS TRACTS



B. An individual who desires to travel to the CBD may have to ride the bus a distance in the outbound direction before it begins moving toward the CBD. Example: If a person wishes to ride downtown from Maury and 28th, he would have to ride around a loop before the bus would head downtown.

3. Level of Service -

The level of service of each of the MTA's regular fixed routes and express routes is evaluated in the following Tables. Level of service is measured by the number of passengers, number of trips and passengers per trip. Table 12* indicates the West Des Moines/ Fairground route transports the most passengers and carries the most passengers per trip. The second best route in terms of passengers and passengers per trip is the University/Highland-Oak Park Route. On the other hand, the Urbie route has the poorest level of service, carrying only 5.20 passengers per trip.

Table 13** indicates that among the express routes the West Des Moines Express transports the most passengers per trip, followed by the Urbandale Express, the Windsor Heights Express, Clive Express and Valley Express.

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*Final Draft 1978 Analysis of the MTA Operating System
**Ibid.

TABLE 12

Weekday Route Level of Service Analysis

Route	Number of Passengers	Number of Trips	Passenger Per Trip
West Des Moines/Fairground	3837	145	26.46
Crocker/Scott	332	36	9.22
University/Highland-Oak Park	2823	154	18.33
Urbandale/East 14th	2143	144	14.88
Clark/East 6th & 9th	2078	133	15.62
West 9th-Douglas/Indianola-Lacona	2092	143	14.63
Fort Des Moines/Walker	1934	150	12.89
South West 14th-Havens	427	25	17.08
Urbie	156	30	5.20
Total	15,822	960	16.48

TABLE 13

Weekday Route Level Of Service Analysis
(Express Routes)

Route	Number of Passengers	Number of Trips	Passengers Per Trip
West Des Moines Express	157	3	52.3
Urbandale Express	141	3	46.9
Windsor Heights Express	112	3	37.4
Clive Express	106	3	35.3
Valley Express	70	3	23.3
Total	586	15	39.0

Quality -

The average travel times and speeds have been calculated for each route and are shown in Table 14. Wait time and travel time were taken from the 1977 Analysis of the MTA Operating System were possible, while the "average" walk time was calculated by:

$$\text{Average Walk Time} = \frac{(A)(.125 \text{ mi.}) + (B)(.375 \text{ mi.}) + (C)(.625 \text{ mi.})}{3 \text{ mph}} \times 60 \text{ min/hr.}$$

where A = Percent Living within 2 blocks

B = Percent Walking to Bus Stop - Percent Living within 2 blocks

C = Percent Riding to Bus Stop

The West Des Moines/Fairground (route 1) is the fastest overall averaging 13 MPH while the slowest is Urbie averaging less than 9 MPH. One of the main reasons Urbie has a slow overall speed is because the route is only 10.1 miles long. The express routes all average over 14 MPH with the Valley Express averaging 16.3 MPH.

TABLE 14

Weekday Average Travel Speeds

Routes Inbound

Route	Route Miles	Approx. Average Wait Time (Minutes)	Approx. Average Walk Time (Minutes)	Average Travel Time (Minutes)	Total Time (Minutes)	Miles Per Hour
1	38.4	4.7	3.8	35.8	44.3	13.0
2	17.4	6.3	3.3	19.5	29.1	9.0
3	23.9	5.2	3.7	28.8	37.7	9.5
4	26.5	5.0*	3.6	27.8	36.4	10.9
5	24.2	4.4	3.7	24.0	32.1	11.3
6	31.2	5.0*	3.9	32.3	41.2	11.4
7	31.1	5.2	4.2	30.3	39.7	11.8
8	13.8	4.3	3.9	13.0	21.2	9.8
Urbie	10.1	5.0*	4.3	8.0	17.3	8.8

Express	Route Miles	Average Wait Time (Minutes)	Average Walk Time (Minutes)	Average Travel Time (Minutes)	Total Time (Minutes)	Miles Per Hour
Clive	22.6	5.0*	3.5	38.5	47.0	14.4
Urbandale	25.2	5.0*	4.3	42.0	51.3	14.7
West Des Moines	20.8	2.8	3.7	38.0	44.5	14.0
Windsor Heights	25.7	5.0*	3.4	43.0	51.4	15.0
Valley	24.7	4.2	3.4	38.0	45.6	16.3

*Assumed

Cost/Revenue

The financial analysis of MTA routes is concerned with their productivity and efficiency. Route productivity is defined as the percent of vehicle capacity used, percent of total ridership carried, passenger revenue and percent of total non-express revenue obtained. Table 15* indicates the West Des Moines/Fairground Route leads all the other routes with nearly fifty-five percent of the vehicle capacity used on a typical weekday. This route also leads all other routes in terms of the percent of total non-express ridership it carries, passenger revenue and percent of non-express revenue. Inspection of Table 15 also shows the Urbie Route has the lowest productivity of the regular fixed routes with approximately eleven percent of its vehicle capacity used on a typical weekday. The Urbie Route also obtains the least passenger revenue and accounts for the smallest percentage of the total non-express revenue.

Table 16** indicates the West Des Moines Express route leads all other express routes in terms of percent of vehicle capacity used, percent of total express ridership, passenger revenue and percent of total express revenue.

*Final Draft 1978 Analysis of the M.T.A. Operating System
**Ibid.

TABLE 15

Weekday Route Productivity Analysis

Route	% Vehicle Capacity	% Non-Express of Total Ridership	Passenger Revenue	Total % of Nonexpress Revenue
West Des Moines/Fairground	54.52	24.30	$1362.52	22.40
Crocker/Scott	19.00	2.10	102.74	1.70
University/Highland-Oak Park	37.85	17.85	1200.78	19.80
Urbandale/East 14th	30.61	13.55	861.83	14.20
Clark/East 6th & 9th	32.19	13.10	744.22	12.20
West 9th-Douglas/Indianola-Lacona	30.20	13.20	792.65	13.00
Fort Des Moines/Walker	26.65	12.20	787.00	12.95
South West 14th-Havens	35.28	2.70	188.69	3.10
Urbie	10.72	1.00	38.96	.65
			$6079.39	100%

TABLE 16

Weekday Route Productivity Analysis
(Express Routes)

Route	% Vehicle Capacity	% Total Express Ridership	Passenger Revenue	% of Total Express Revenue
West Des Moines Express	107.98	26.80	$112.55	39.10
Urbandale Express	96.72	24.10	49.16	17.10
Windsor Heights Express	77.25	19.10	39.06	13.60
Clive Express	72.81	18.10	36.96	12.80
Valley Express	48.71	11.90	50.18	17.40
			$287.91	100%

Route Efficiency

MTA routes have also been evaluated in terms of their efficiency. For the purposes of this analysis, efficiency is defined as the relationship between route operating cost and passenger revenue generated from the farebox and prepaid fare, and the subsidy per passenger trip required to maintain route performance at existing service levels. Previous charts have indicated the West Des Moines/Fairground Route has the best level of service and productivity. But Table 17* shows the West Des Moines/Fairground Route is only third in terms of the percent of breakeven. The highest percent of breakeven is obtained by the University/Highland-Oak Park Route, which covers ninety three and one half percent of its operating cost. This route's percent of breakeven is higher than the heavily traveled West Des Moines/Fairground Route because of its substantially lower operating cost.

Table 18** indicates each of the Express Routes covers a large percentage of its operating cost. The West Des Moines Express Route covers all its operating costs from passenger revenue. In fact, it makes approximately forty two cents per passenger. Among the other express routes, the Urbandale Express requires four and a half cents per passenger, the Valley Express requires approximately six cents per passenger, the Clive Express twelve cents per passenger and the Windsor Heights Express nearly sixteen cents per passenger.

*Final Draft, 1978 Analysis of the M.T.A. Operating System
**Ibid.

TABLE 17

Weekday Route Efficiency Analysis

Route	Revenue Miles	Operating Cost	Passenger Revenue	% of Breakeven	Subsidy/* Passenger
West Des Moines/Fairground	1394.3	$2049.62	$1362.52	66.48	.179
Crocker/Scott	156.9	230.65	102.74	44.74	.384
University/Highland-Oak Park	913.1	1284.19	1200.78	93.50	.029
Urbandale/East 14th	934.0	1372.40	861.83	62.77	.238
Clark/East 6th & 9th	805.4	1183.94	744.22	62.86	.212
West 9th-Douglas/Indianola-Lacona	1052.0	1546.45	792.65	51.26	.360
Fort Des Moines/Walker	1168.2	1708.25	787.00	45.83	.481
South West 14th-havens	72.4	253.43	188.69	74.46	.152
Urbie	151.5	222.71	38.96	17.49	1.177

*Differences between percent of Breakeven and Subsidy/Passenger are due to variance in average fares on a given route.

TABLE 18

Weekday Route Efficiency Analysis
(Express Routes)

Route	Revenue* Miles	Operating* Cost	Passenger Revenue	% of Breakeven	Subsidy/** Passenger
West Des Moines Express	31.3	$46.01	$122.55	244.62	+.425
Urbandale Express	37.8	55.57	49.16	88.46	.045
Windsor Heights Express	38.7	56.89	39.06	68.66	.159
Clive Express	34.0	49.98	36.96	73.95	.122
Valley Express	37.1	54.54	50.18	92.01	.062

*Includes no deadhead

**Differences between percent of Breakeven and Subsidy/Passenger are due to variance in average fares on a given route.

Transit Service Improvements*

Transit improvements have been implemented as a result of citizen involvement and MTA's analysis of their service. These service improvements can be identified as problems of geographic coverage, inadequate passenger capacity and hours of operation.

Geographic Coverage

Inadequate geographic coverage was identified as a problem for routes operating on the eastern and western side of South Union Street. The route on the western side of South Union operated on S.W. 9th, - the route on the eastern side operated on S.E. 14th with some service on S.E. 5th. These routes were twenty-three blocks apart with South Union located within three blocks of the center of both routes. Thus, individuals within two or three blocks of South Union had to walk as many as eleven to twelve blocks to a bus stop.

To improve accessibility for residents in the area transit service was implemented on South Union Street. One bus per day operates on this route with sixty minute headways. The route is also coupled and is a route partner with the S.W. 14th - Havens Route which operates on the same frequency of service.

Inadequate Passenger Capacity

Inadequate passenger capacity was identified as a problem on the West Des Moines/Fairground route and on the Urbandale and West Des Moines Express routes. The West Des Moines/Fairground route has experienced an increase in ridership from approximately 56,000 passengers in 1977 to 77,000 passengers in 1978. This large increase in ridership caused the speed of the route to drop from the scheduled 15 MPH to below 13 MPH. Needless to say this caused schedule delays on the route.

*Final Draft, 1978 Analysis of the M.T.A. Operating System

In order to maintain schedules, operators found themselves exceeding the speed limit or taking risks they would not normally take. This resulted in increased accidents with other vehicles as well as increased incidences of passengers falling on the bus. These injuries were of special concern due to the fact that a high proportion of these riders are senior citizens or handicapped.

These problems were solved by slowing the average speed of the West Des Moines/Fairground to approximately 12 MPH. This reduced speed requires that one additional bus be run on the route during the morning and afternoon peak period.

Overcrowding was also experienced on the Urbandale and West Des Moines Express routes. Both express routes have been so successful that passenger loads often exceed 100% seating capacity during the morning inbound trip. In order to solve this overcrowding problem and to determine what schedule times would best serve to attract new riders the MTA implemented an experimental express schedule.

This experimental express schedule consists of a bus that runs for three hours making two express trips. The first trip is an inbound Urbandale Express which serves workers needing to arrive in the central business district at 7:30 A.M. This same bus then deadheads to the end of the West Des Moines Express route where it makes an inbound trip on this route to serve workers needing to arrive in the central business district at 8:30 A.M. This experimental schedule can also help the MTA determine if an earlier or later express trip will attract new riders.

Hours of Operation

MTA service used to start at approximately 5:30 A.M. on weekdays. Following this schedule buses arrive downtown around 6:45 A.M. and departed at 6:50 A.M. for the outbound portion of the routes. Such a schedule served individuals traveling to work in the central business district at 7:00 A.M. It did not

serve individuals needing to be at work at 7:00 A.M. at such outlying locations as Veterans Hospital, Broadlawns Hospital, Goodwill Industries, Massey Ferguson, Univac, Preferred Risk, etc. To serve this demand MTA has scheduled twelve to fourteen buses approximately forty-five minutes earlier. This earlier service allows one inbound trip from each route to arrive downtown at 6:20 A.M. and to depart to 6:25 A.M. for outlying locations.

Paratransit

The Urban Mass Transportation Administration requires that consideration be given to the mobility of elderly and handicapped individuals. Very little information is available, however, regarding the transportation patterns and needs of the elderly and the handicapped in the Des Moines Urbanized Area. To obtain the necessary data an elderly and handicapped study is being conducted. Three groups of individuals are dealt with in the study: (1) non-elderly handicapped, (2) elderly handicapped and (3) able-bodied elderly.

In this study, the elderly are defined as individuals 60 years of age or older. A handicapped person (elderly or non-elderly) is defined, according to the Urban Mass Transportation Administration's (UMTA) definition, as any individual who, by reason of injury, age, congenital malfunction or other permanent incapacity or disability, is unable without special facilities, or special planning or design, to utilize mass transportation facilities and services as effectively as persons who are not so affected. Based on this definition of handicap, the emphasis in this study is on the functional requirements which affect a person's ability or inability to use public transit, rather than a medical definition of handicap.

The Des Moines Urbanized Area Elderly and Handicapped Study is composed of the following elements:

1. Goals, objectives and policies.
2. Estimation of the size and location of the elderly and handicapped population.
3. Inventory of existing transportation options which serve the elderly and handicapped.
4. Deficiencies of existing elderly and handicapped transportation services.

5. Current travel behavior and unmet needs of the elderly and handicapped.

6. Alternatives developed to meet transportation needs of the elderly and handicapped.

7. Evaluation of alternatives.

8. Recommendations of a mix of alternatives to serve the elderly and handicapped.

Goals, Objectives, Policies

The following goals, objectives and policies have been developed through the efforts of the Des Moines Urbanized Area's Citizens, Technical and Policy Committees. The Transportation Policy Committee adopted these goals, objectives and policies on February 28, 1978 to guide, and provide a framework for evaluating all transportation planning activities and improvements regarding elderly and handicapped individuals in the Des Moines Urbanized Area.

Goals, Objectives, Policies for E & H Transportation Planning

Goal: Improve the quality of life of E & H persons in areas of demonstrated need.

Objective: Increase E & H mobility through improved transportation services and facilities.

Policy: Increase number of trips provided to E & H.

Policy: Increase accessibility of vehicles and facilities.

Policy: Increase hours/day and days/week that service is available.

Policy: Expand transportation service coverage accessible to E & H.

Policy: As much as is practicable, integrate private transportation providers into the total transportation system.

Goal: Make efficient use of public dollars supporting transportation.

Objective: Eliminate duplication or overlapping of existing transportation services provided by publicly-supported agencies operating similar services.

Policy: Greater efforts toward coordination of services between publicly supported transportation providers.

Objective: Protect or strengthen publicly supported transportation related enterprises.

Policy: As much as is practicable integrate publicly supported transportation providers into the total transportation system.

Goal: Continued responsiveness to E & H transportation needs.

Objective: Continuing planning activities regarding E & H transportation needs.

Policy: Monitoring/Surveillance activities will be performed on an annual basis to update the E & H transportation study.

Policy: Increase public awareness of existing services.

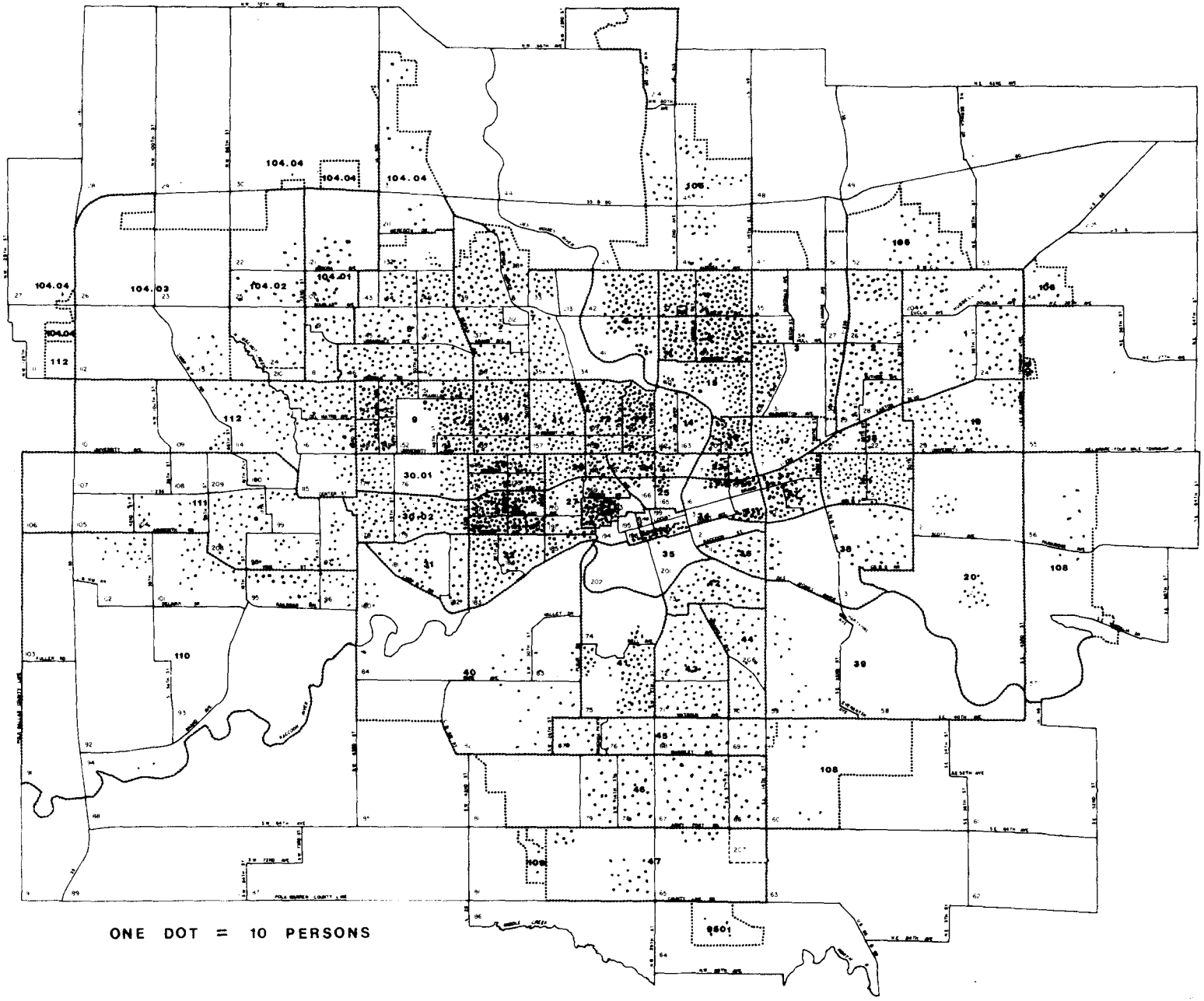
In planning for the elderly and handicapped their location as well as their numbers should be estimated. Unfortunately, current information on the location of the elderly and handicapped is unavailable. The 1970 census lists the number and geographic location of the elderly by census tract. Although the 1970 census is the best data source available, it should be pointed out that it provides only a rough estimate of the present location of elderly individuals. The death and migration rates of the elderly since 1970 are not taken account of in these figures. Figures 6 and 7 indicate the number and percentage, respectively, of persons 60 and over living in each census tract as of 1970.

In order to gain some indication of the location of transportation handicapped individuals in the study area we have assumed they are uniformly distributed throughout the general population. Regional incident rates were applied to each census tract to obtain estimates of handicapped individuals. Figures 8 and 9 indicate the number and percentage, respectively, of transportation handicapped individuals in each census tract as of 1970.

FIGURE 6

LOCATION OF ELDERLY

(NUMBER OF ELDERLY BY CENSUS TRACT)



LOCATION OF ELDERLY

(% ELDERLY BY CENSUS TRACT)

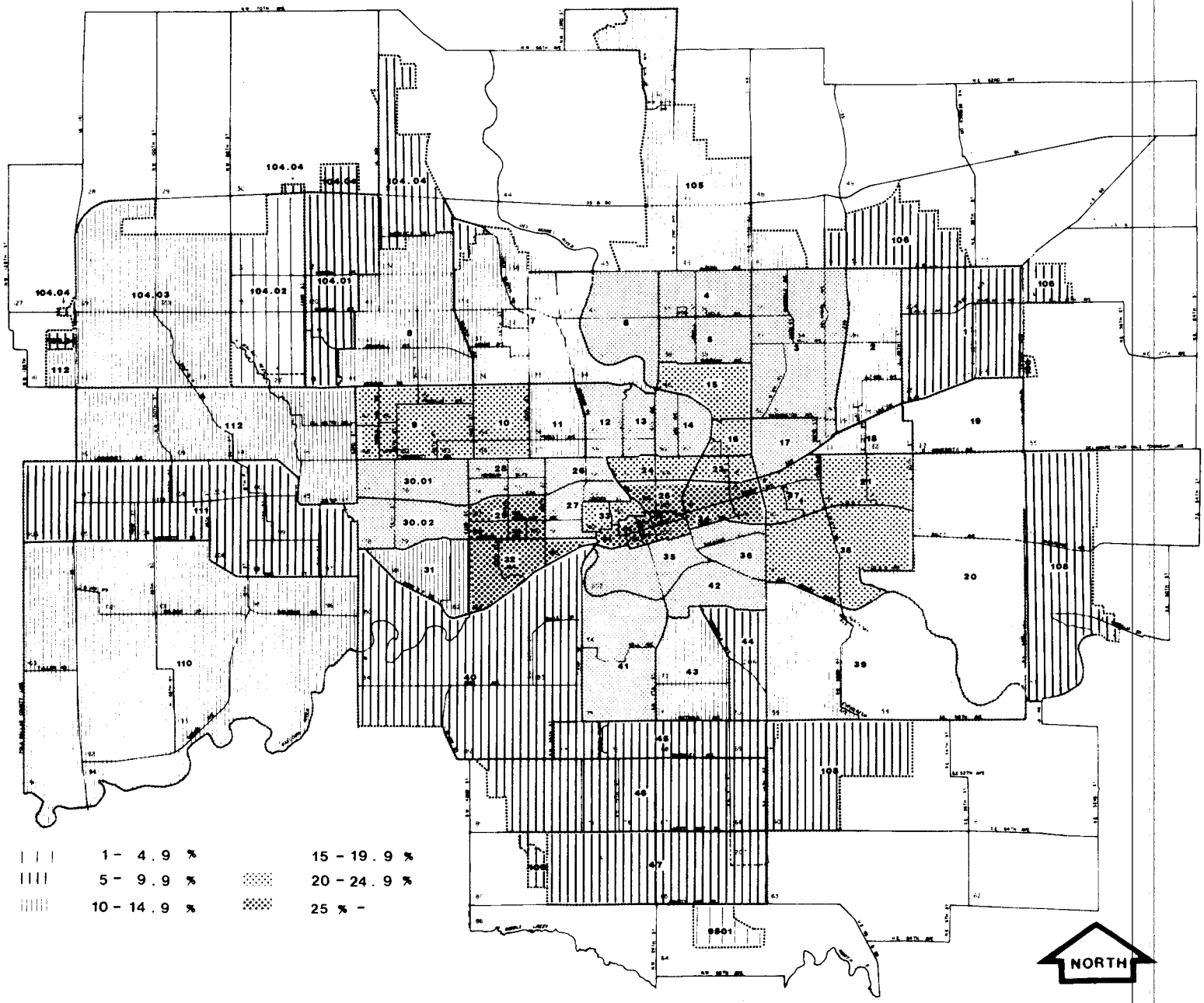
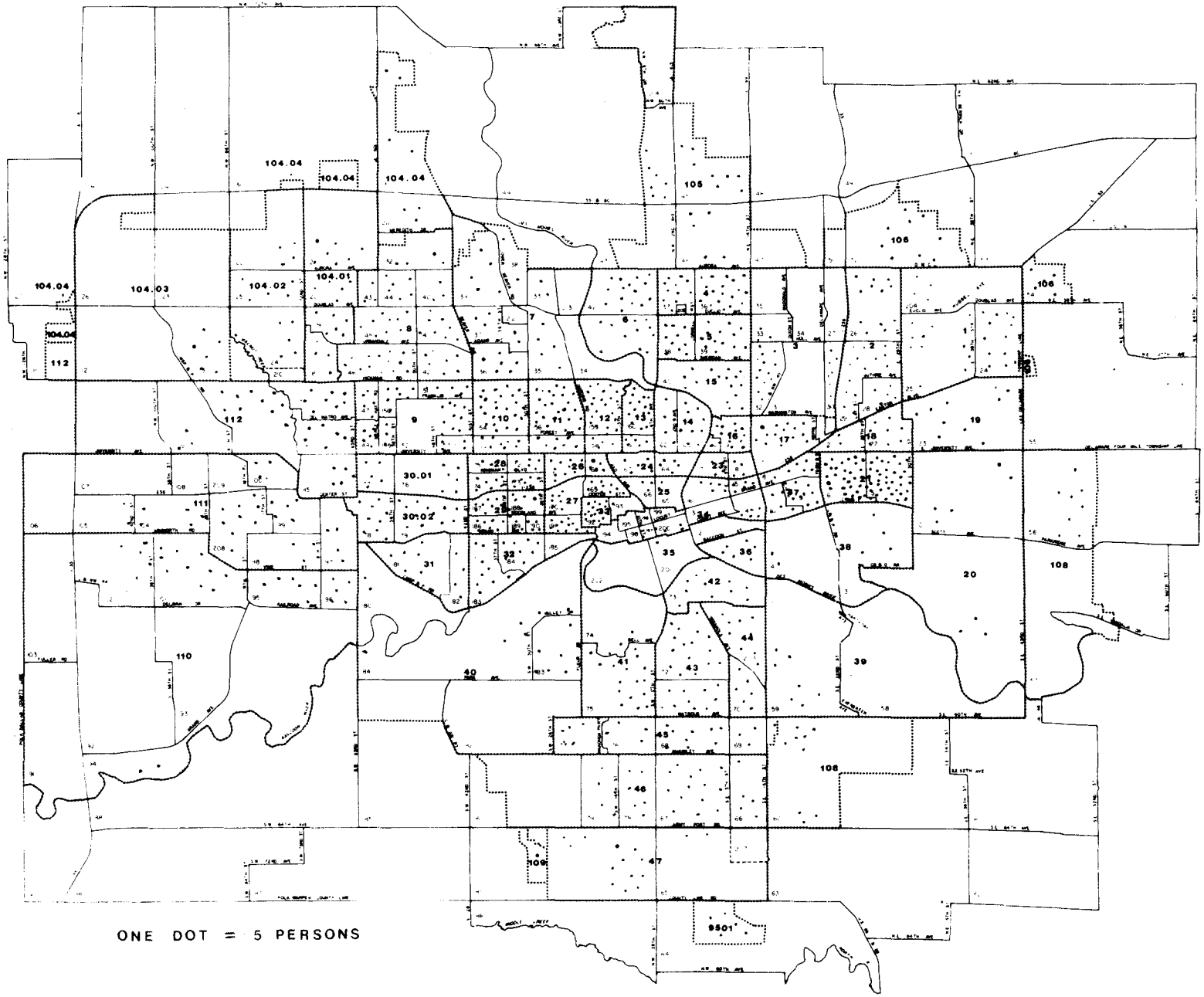


FIGURE 8

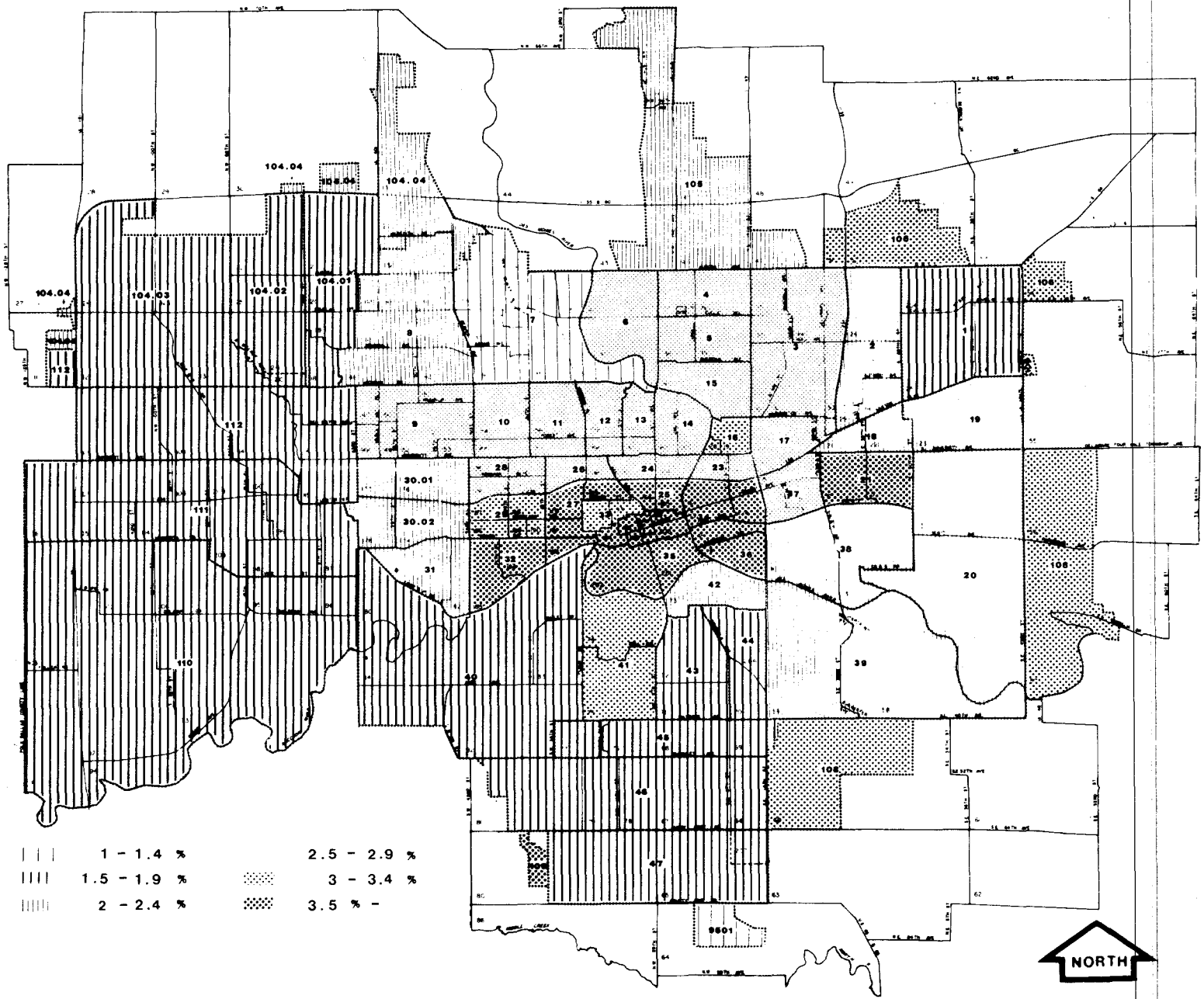
LOCATION OF HANDICAPPED

(NUMBER OF HANDICAPPED BY CENSUS TRACT)



LOCATION OF HANDICAPPED

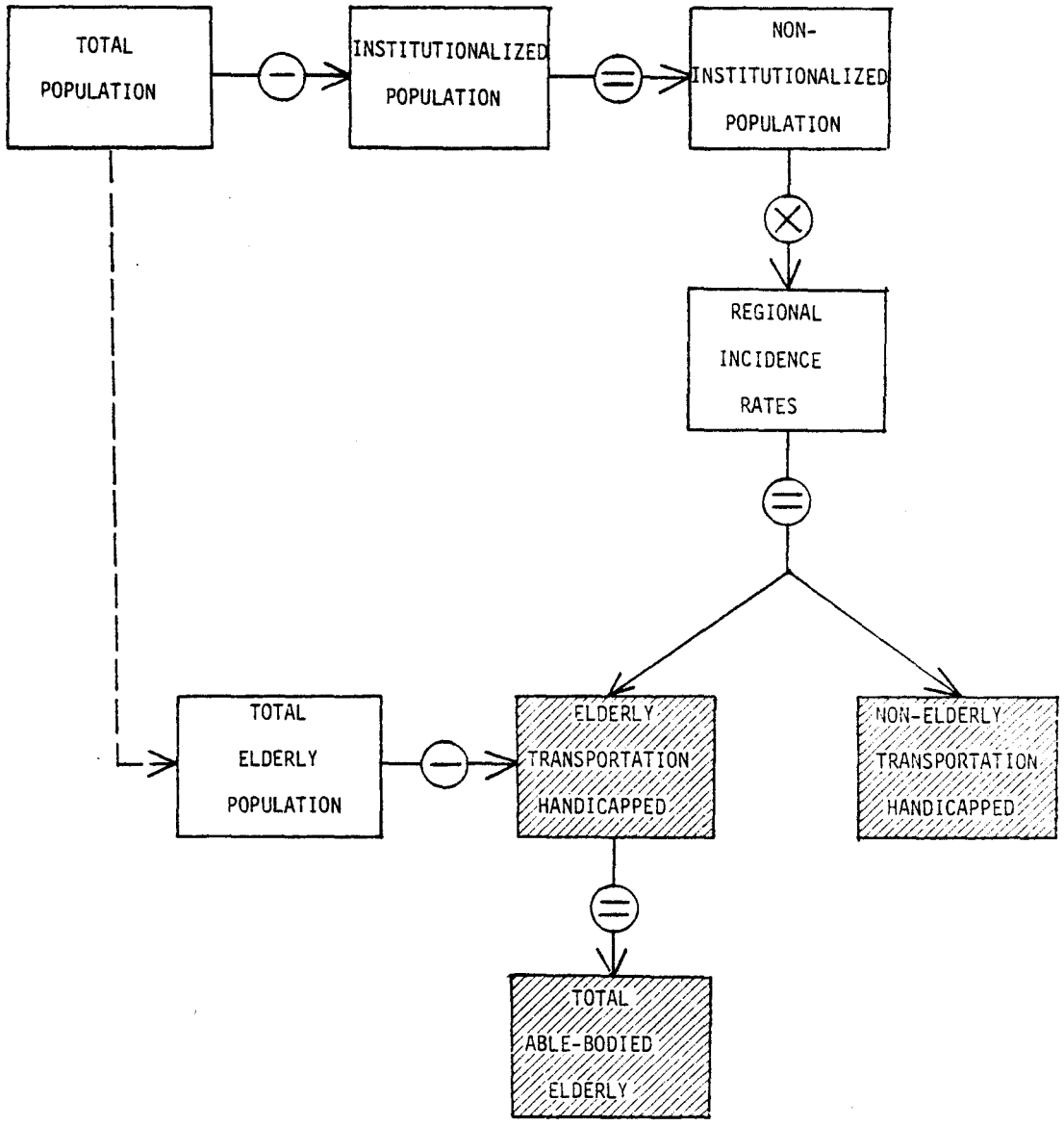
(% HANDICAPPED BY CENSUS TRACT)



Number and Location of Target Groups

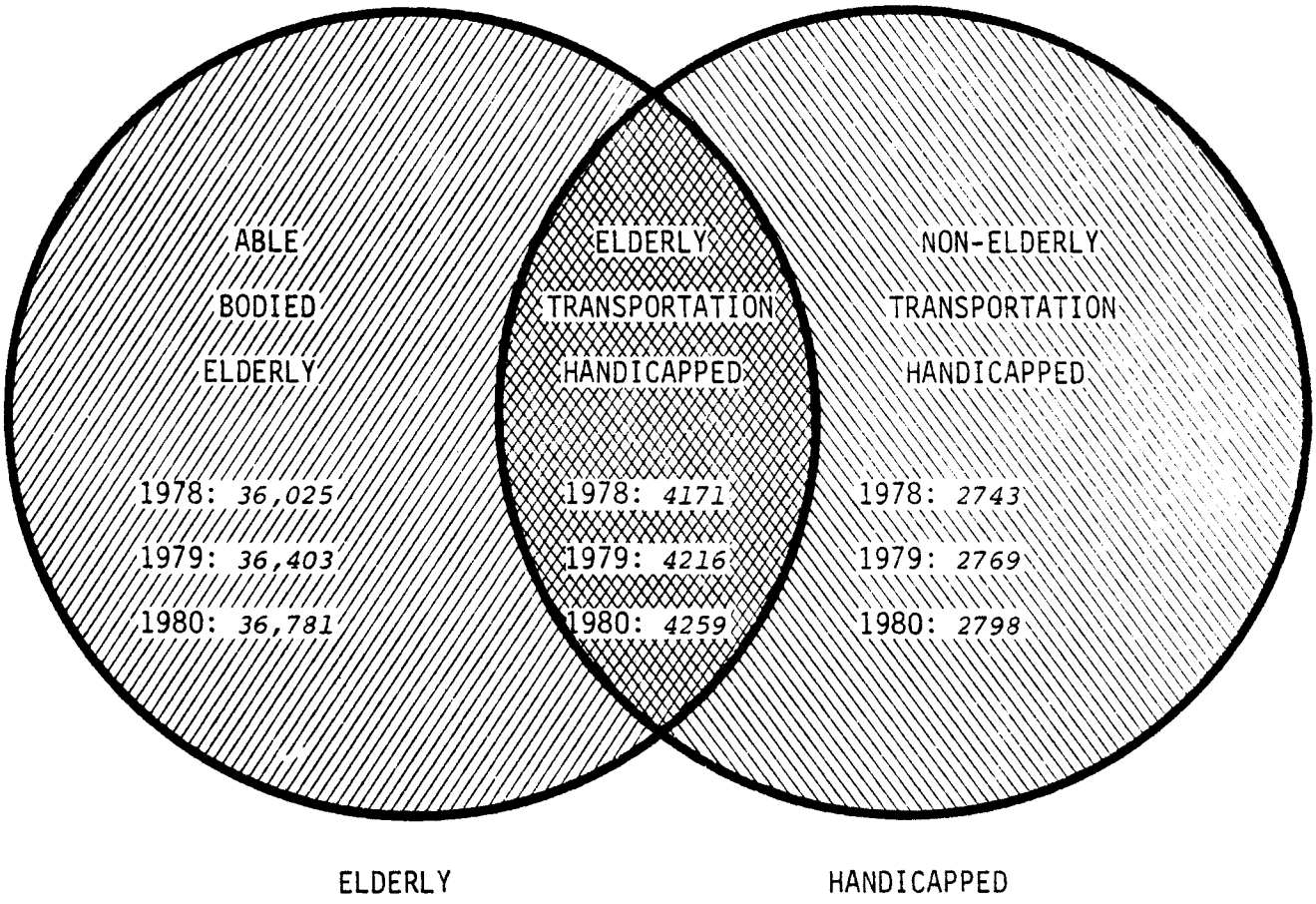
The number of non-elderly transportation handicapped, elderly transportation handicapped and able-bodied elderly in the Des Moines Urbanized Area was estimated by the following procedure:

DERIVATION OF MARKET SEGMENT POPULATION



This procedure gives the following estimates of each market segment for the years 1978, 1979 and 1980. Further details on the methodology used for these forecasts can be found in Chapter II of the Des Moines Urbanized Area Elderly and Handicapped Transportation Study.

MARKET SEGMENT POPULATION



Existing Paratransit Services and their Limitations

The following discussion is restricted to an examination of the limitations of existing paratransit systems (e.g., taxis, Special Service Transportation Corp., other van services).

All three (e.g., non-elderly handicapped, elderly handicapped, able-bodied elderly) of interest in this study are homogeneous in that they possess, to a large extent, common problems in using existing transportation services. One of the most important of these problems is auto availability - defined as availability of a car to the individual as either a driver and/or a rider. Many of the elderly and handicapped do not have a license or are unable to drive because of their physical condition. Others are unable to pay the cost of owning and maintaining a car due to low income.

Some of the elderly and handicapped unable to drive a car secure rides with friends or relatives. However, many of them do not have friends or relatives nearby who can provide rides when needed. The elderly and handicapped faced with this situation must rely on some other form of transportation. Options available include walking, bicycling, taxi, fixed route transit, Special Service Transportation Corp. and social service agency transportation.

Results of the elderly and handicapped survey (discussed later in this section) indicate few of them walk or bicycle for any given trip purpose. It is difficult for many elderly and handicapped to walk even short distances (e.g., one-half to one mile) to activities. Their physical condition also prohibits most from riding a bicycle.

Taxicabs

Taxis are selected by many elderly and handicapped individuals for travel. Currently, there are two taxi companies operating in the Des Moines Urbanized Area: Yellow and Capitol Cab. They have a combined fleet of over 150 vehicles which serve the area on a 24 hour/day, seven days/week basis. The standard cab fare is:

Yellow	Capitol
90¢ for the first 1/6 of a mile + 20¢ per 1/2 mile thereafter	70¢ for the first 1/6 of a mile + 20¢ per 1/3 mile thereafter

Limitations of Taxi Service

The greatest barrier to broader use of taxi service by the elderly is its cost. Since a disproportionate percent of the elderly have low incomes compared to the general population, cost is a very significant factor in the number of times taxi service will be used by them.

The handicapped use taxis more than the elderly, but they are also faced with limitations. The major deficiencies of taxi service in providing transportation to the handicapped are as follows:

1. The cost is so high many of the handicapped cannot afford to use taxi service. Because of their employment problems handicapped people are generally poorer than the non-handicapped.
2. It is difficult for wheelchair users to get into and out of a taxi.
3. Taxis may not be available to handicapped individuals when needed in certain parts of the city.
4. Taxi drivers have no financial incentive to provide the time-consuming attention needed to help handicapped individuals into and out of the taxi.

Special Service Transportation Corp.

The Special Service Transportation Corp. (SST) is a van service designed to provide transportation service to elderly, handicapped and low income persons in the Des Moines Urbanized Area. Elderly are defined as individuals 60+ (plus). Handicapped are identified by possession of an M.T.A. handicapped I.D. card or a doctor's statement certifying they are unable to use fixed route transit. Low income individuals are certified as meeting income guidelines by the Community Service Administration (CSA) development site office.

The SST Corp. was incorporated on September 15, 1976 and began providing transportation services to the elderly and handicapped on January 31, 1977. Its Board of Directors consists of representatives of the Des Moines Metropolitan Transit Authority, Capitol Cab Company, Yellow Cab Company, and two representatives from the City of Des Moines.

The SST Corp. receives transportation requests from participating agencies and private individuals. These individuals are then assigned to either MTA busses, SST Corp. vans, or taxicabs. The SST Corp. dispatcher determines which means of transportation should be used, based upon: an individual's disability or lack thereof, the type of trip (e.g., congregate meal, medical) and the availability of space on the SST vans.

Although group trips and emergency medical trips have priority, service is also available to individuals on a seat-available basis. Service is provided on a door-to-door basis with passengers calling the dispatcher one day in advance (except for emergency medical trips) to make trip reservations. SST is primarily oriented to meeting the following travel needs within the Des Moines Urbanized Area:

1. Congregate meals
2. Medical trips
3. Business
4. Shopping
5. Recreation

The trip purposes served are dependent upon the service contracts signed with the following funding sources:

1. Des Moines Independent School District
2. Iowa Methodist Medical Center
3. Bishop Drumm Group Home
4. Foster Grandparent
5. Comprehensive Employment and Training Act (CETA)
6. Community Services Administration
7. CIRALG Aging Component (Area Agency on Aging)

Limitations of SST Service

SST's limitations relate to both operations and planning. In terms of operation SST needs an operations manual covering such things as:

1. Scheduling and dispatching practices
2. Type of individuals who will receive escort service
3. Waiting period drivers are required to wait for a passenger
4. Job specifications detailing the duties of drivers, dispatcher, administrator, etc.

In terms of planning SST needs to strengthen its evaluation procedures. A monitoring system is needed that can quickly answer the questions of funding agencies and simultaneously provide information needed to manage the system. The information collected needs to be such that the twin objectives of increased service and improved efficiency can be served.

Other Paratransit Services

In order to determine paratransit services currently available to elderly and handicapped persons in the Des Moines Urbanized Area, an extensive inventory was undertaken. It was initiated by compiling a list of potential transportation providers in the Des Moines Urbanized Area. Agencies included in the list were public agencies, private profit and non-profit agencies. Upon completing the list, a telephone survey was conducted and over 200 agencies were contacted.

Of the agencies contacted 57 indicated that they do provide transportation to their clients. Thirty-six of these 57 agencies provide transportation service to the elderly and handicapped. The remaining 21 agencies do not presently have any elderly or handicapped individuals using their services. Most of these operators are social service agencies whose primary function is other than to operate transportation systems. However, each agency has developed a separate transportation program in order to meet the needs of their transportation disadvantaged clients who without special transportation services would be unable to utilize their social services. In most cases these agencies have been forced to develop their own transportation programs becuase there has been no specialized transportation agency that could provide this service. Although these agencies have provided a public service by meeting the special transportation needs of many elderly and handicapped individuals, two unfortunate results have occurred: (1) Service agencies have had to divert some of their staff's time and talents to operate a transportation program and cannot give 100% of their efforts toward their primary purpose for existence; and (2) Public funds are being provided to a variety of agencies which are all operating a similar transportation service within the same geographic area to individuals with similar transportation needs. With a fragmented system of transportation providers, public funds cannot be used efficiently. However overlapping and duplication of services can be eliminated through consolidation or coordination efforts.

TABLE 19
Direct Transportation Providers
"BUDGET AND DESCRIPTION OF SERVICE"

AGENCY NAME	ANNUAL TRANSPORTATION EXPENSES		AMOUNT AND SOURCE OF FUNDS	FARE STRUCTURE	TYPE OF SERVICE		VEHICLES		AVERAGE VEHICLE CAPACITY	NUMBER OF VEHICLES WITH SPECIAL EQUIPMENT			MONTHLY RIDERSHIP	MONTHLY VEHICLE MILES	MONTHLY VEHICLE TRIPS	TRIP PURPOSES SERVED
	CAPITAL	OPERATING			PROGRAM SPECIFIC	GENERAL	OWNED	LEASED		W.C. LIFT OR RAMP	W.C. SECURING DEVICE	COMM. EQUIP.				
TRANSIT																
Metropolitan Transit Auth.	2639267	1591583	1324045 City 2906805 Fed.	**		X	90	0	N/A	0	0	90	***300821	***170639	N/A	All
TAXI																
Capital Cab Company	N/A	N/A	N/A	#		X	42	0	6	0	0	42	N/A	N/A	N/A	All
Yellow Cab Company	N/A	N/A	N/A	#		X	117	0	6	0	0	117	35000	49950	26000	All
PARATRANSIT																
American Cancer Society		678	678 P/P	None	X		0	10*	6	0	0	0	26	260	26	Medical
American Red Cross	868	3304	4172 P/P	None		X	2	0	6	0	0	2	100	350	23	Medical, Other
Bethel Rescue Mission	0	3000	3000 P/P	None		X	2	0	7	0	0	0	75	600	50	Medical, Work
Bidwell Riverside	0	10000	10000 P/P	None	X		2	0	6	0	0	0	300	1000	300	All
Calvin Manor	0	2000	2000 Other	None	X		0	*	N/A	0	0	0	120	N/A	10	Medical, Shopping, S/R/C
Central Iowa Lutheran Home	0	510	510 Other	None	X		1	0	12	1	0	0	60	75	15	Medical, Shopping, S/R/C
Convalescent Home for Child.	0	14,400	14,400 P/P	None			0	7*	6	0	0	0	250	1250	250	Medical, Shopping, S/R/C E/R, Religious, Other
Delaware Community Center	1884	11,294	8378 Fed. 2400 Cnty. 2400 P/P	None		X	0	1	12	0	0	0	3750	2500	465	Medical, Shopping, S/R/C, E/R, Meals
Des Moines Public Schools, Smouse & Van Meter	70000	280,000	350000 State	None	X		33	0	33	7	7	33	14760	33000	2600	Educational
Developmental Day Care	N/A	N/A	N/A	None	X		1	0	N/A	1	1	0	230	N/A	50	N/A
Easter Seal Society of Iowa	0	875	875 Other	None	X		1	0	16	1	1	0	N/A	N/A	N/A	Medical, S/R/C, E/R, Other
Easter Seal Center of Polk County	0	8000	240 Fed. 3520 P/P 4240 Other	None	X		1	0	8	0	0	0	60	1500	55	Medical, S/R/C, E/R, Work
F.I.S.H.	N/A	N/A	N/A	None		X		62*	6	0	0	0	165	N/A	165	Emergency Only
Goodwill	0	14490	14490 Cnty.	None	X		3	1	19	0	0	0	4354	3167	800	Medical, Shopping S/R/C, E/R, Work, Religious
Heather Manor		10416	10416 Other	None	X		0	1	14	0	0	0	800	1100	175	Medical, S/R/C, Religious
Homes of Oakridge	N/A	N/A	N/A	None	X		1	2*	7	1	1	0	40	35	20	Medical, Shopping, S/R/C, E/R

N/A - Not Available
E/R - Educational/Rehabilitational
S/R/C - Social/Recreational/Cultural
P/P - Public or Private Donations

* Volunteer Driver or reimbursed for use of private auto.
** ½ fare (25¢) for elderly & handicapped individuals
*** Computed average from Jan.-May,1977

#-$1.10 first mi., 60¢/mi. thereafter

Direct Transportation Providers

"BUDGET AND DESCRIPTION OF SERVICE"

AGENCY NAME	ANNUAL TRANSPORTATION EXPENSES		AMOUNT AND SOURCE OF FUNDS	FARE STRUCTURE	TYPE OF SERVICE		VEHICLES		AVERAGE VEHICLE CAPACITY	NUMBER OF VEHICLES WITH SPECIAL EQUIPMENT			MONTHLY RIDERSHIP	MONTHLY VEHICLE MILES	MONTHLY VEHICLE TRIPS	TRIP PURPOSES SERVED
	CAPITAL	OPERATING			PROGRAM SPECIFIC	GENERAL	OWNED	LEASED		W.C. LIFT OR RAMP	W.C. SECURING DEVICE	COMM. EQUIP.				
Iowa Methodist Medical Center	5000	10488	15488 other	*	X		2	0	7	2	2	0	334	1574	200	Medical, Shopping, S/R/C, E/R
Lawn Haven Boarding House	N/A	N/A	N/A	None	X		2	0	12	0	0	0	350	N/A	100	Medical, Shopping, S/R/C, E/R, Work
Medicenter	N/A	N/A	N/A	None	X		0	1	5	0	0	0	5	15	5	Medical
Model Cities Senior Citizen	N/A	N/A	63,000 County	None		X	0	4	N/A	1	0	0	N/A	5144	N/A	N/A
Polk Cnty. Assn. for Retarded Children	7890	57860	44435 Fed. 19363 State 6500 P/P	None	X		2	3	17	2	2	0	5000	11000	420	S/R/C, E/R
Ramsey Memorial Home	306	1394	1700 other	None	X		1	0	5	0	0	0	40	150	40	Medical, Shopping, S/R/C, E/R, Religious
Royal View Manor	1300	9468	10768 P/P	None	X		1	0	8	1	0	0	750	N/A	N/A	All
Salvation Army	1320	11880	13200 P/P	None		X	5	0	16	0	0	4	400	1500	94	Medical, Shopping, S/R/C, E/R, Religious
Settlement Services	0	51730	38798 County 12932 City	None		X		15*	6	0	0	0	2310	9306	1987	Medical, Shopping, Other
S. E. Pioneer & Columbus	10600	42400	53000	None		X	0	3	13	0	0	0	2524	4469	N/A	Medical, Shopping, S/R/C, E/R, Meals, Religious
Spanish Speaking Center	0	2000	740 Cnty. 740 City 520 P/P	None		X	0	4*	6	0	0	0	750	500	250	Medical, S/R/C, E/R, Meals, Religious
Special Services Trans.Corp.	8000	82000	7000 State 83000 Fed.	None		X	0	5	13	1	1	0	4500	6700	N/A	Medical, Shopping, S/R/C, E/R, Meals, Other
United Cerebral Palsy	0	7815	7815 P/P	None	X		1	0	8	1	0	0	95	250	20	Medical, S/R/C, E/R
Valley View Village	0	3449	3449 P/P	None	X		1	0	12	0	0	0	285	800	28	All
Villa Inn Home	2436	1800	4236 Other	None	X		1	0	5	0	0	0	120	850	120	All
W.D.M. Opportunity Center	0	1200	1140 Fed. 60 P/P	None		X	1	0	15	0	0	0	960	N/A	700	Medical, Shopping, S/R/C, E/R, Meals, Other
YWCA	0	N/A	N/A	None	X		1	0	15	0	0	0	840	560	75	S/R/C, E/R

N/A - Not Available
E/R - Educational/Rehabilitational
S/R/C - Social/Recreational/Cultural
P/P - Public or Private Donations

* Volunteer Driver or reimbursed for use of private auto.
** ½ fare (25¢) for elderly & handicapped individuals
*** Computed average from Jan.-May,1977

#-$1.10 first mi., 60¢/mi. thereafter

Current Travel Behavior and Unmet Transportation Needs

Three different types of surveys were conducted to obtain the data needed to understand current travel patterns and unmet needs of the elderly and handicapped in the Des Moines Urbanized Area: (1) a mail questionnaire of the elderly and handicapped, (2) a telephone survey of nursing homes and senior centers, and (3) an on-board survey of users of the Special Services Transportation Corp. Each of these surveys will be discussed in turn.

Elderly and Handicapped Survey

The choice of research procedure for the elderly and handicapped study was constrained by the type of information required and by financial considerations. Although the questionnaire was short it would have been difficult to administer over the phone to elderly and handicapped individuals. This left the use of personal interviews or a mail survey. The number of staff available and the time available for the study made a home interview infeasible. Thus, a mailed questionnaire was used to survey the elderly and handicapped.

The elderly and handicapped were surveyed by two different methods. The names of retired individuals were selected from the 1977 R.L. Polk City Directory. When completed this list equalled approximately 18,000 names out of which a sample of approximately 1,000 households was needed.

A systematic random technique was used to obtain the required number of households. The names were widely scattered throughout the directory with no consistent number of names on any page. Thus, to avoid a bias in the ordering of households, addresses were typed in alphabetical order, eighteen to a page. Division of 18,000 by 1,000 indicated that every eighteenth name on the list should be used. A random number table was then used to pick one of the first eighteen households on the list. Since the number eleven was chosen, the

eleventh household was the first to be chosen, then every eighteenth household was chosen. Questionnaires were then mailed to the selected households with a prepaid return envelope.

Because there was no comparable source of information on addresses of the handicapped, a different technique was used for their survey. Agencies and organizations that serve the handicapped were contacted. Each agency willing to participate was then asked to distribute questionnaires to a representative sample of their clients.

The elderly and handicapped survey was designed to obtain information on demographic characteristics, mobility limitations, current travel habits, unmet travel needs and opinions in regard to the service characteristics of transportation systems.

The demographic variables collected include age, sex and income. A checklist of physical disabilities was also included in the questionnaire to obtain an understanding of the personal mobility of respondents.

Two questions were asked regarding the travel habits of elderly and handicapped respondents. The first requested information about the mode used to make trips for work, personal business, shopping, medical, social/recreational, school and religious activities. The second asked for the average number of trips made in a week.

The questions on unmet needs were included to determine the degree of difficulty (e.g. always, sometimes and never) elderly and handicapped individuals had in traveling for various trip purposes and the types of trips they would like to make more often.

The question on service characteristics was designed to indicate which characteristics need to be improved. The question provided an indication of the importance of selected characteristics to the elderly and handicapped. A copy of the elderly and handicapped survey appears in the appendix of the TSM.

A total of 3,025 questionnaires were mailed to elderly and handicapped individuals and 555 were returned. This represents a return rate of eighteen percent. Of the 555 surveys returned, 532 of them were useable. The number of returned questionnaires from each of the market groups is:

1.	Non-elderly handicapped	226
2.	Elderly handicapped	126
3.	Able-bodied elderly	180
Total		532

The confidence limits of the elderly and handicapped survey results, which follow, can be found in the appendix of the TSM.

Elderly and Handicapped Survey Results

Profile of Survey Respondents

Tables 20, 21, 22 on the following pages indicate the age, income and sex distribution of the survey respondents.

The age distribution of the sample indicates that nearly 41% of the non-elderly handicapped respondents were 40-59 years of age, approximately 35% were 25-39 years of age and nearly 18% were 18-24. Comparatively few (6.2%) of the non-elderly handicapped were less than 18 years old.

The vast majority (77.8%) of the elderly handicapped were 65 years of age or older, while less than a fourth (22.2%) were in the 60-64 age group. Most of the able-bodied elderly (85.6%) were also 65 years or older, with less than fifteen percent (14.4%) 60-64 years of age.

As expected, the incomes of handicapped individuals--elderly and non-elderly alike--is relatively low. Sixty-one percent of the non-elderly handicapped and nearly sixty-two percent of the elderly handicapped have incomes below $7,000 a year. On the other hand, only 42.1% of the able-bodied elderly have incomes of less than $7,000. Many of the non-elderly handicapped tend to have low incomes because of difficulty in securing employment. The elderly handicapped also have low incomes because many of them cannot find part-time employment to supplement social security benefits. Despite these difficulties 15.3% of the sampled non-elderly handicapped and 8.9% of the elderly handicapped have incomes of more than $16,000 a year.

There were more female than male respondents among all three groups of interest in this study. Fifty-six and a half percent of the non-elderly handicapped were female and 43.5% were male. The elderly handicapped were divided

into 55.3% female and 44.7% male. The largest percentage of female (71.9%) and lowest percentage of males (28.1%) was found among the able-bodied elderly.

A question was also asked on the self-reported mobility limitations of the survey respondents. The able-bodied elderly do not appear in Table 23 since by definition they are without physical limitations that prevent transit use. The largest percentage of the non-elderly handicapped indicated they need an assistive device (e.g. cane, walker, wheelchair) to get around outside their houses. The greatest limitation facing the elderly handicapped was moving around freely.

TABLE 20

POPULATION BY AGE

	Non-Elderly Handicapped	Elderly Handicapped	Able Bodied Elderly	ROW TOTALS
65 and Greater	*	98 77.8%	154 85.6%	252
60-64	*	28 22.2%	26 14.4%	54
40-59	92 40.7%	*	*	92
25-39	80 35.4%	*	*	80
18-24	40 17.7%	*	*	40
Under 18	14 6.2%	*	*	14
COLUMN TOTALS	226 100%	126 100%	180 100%	532 100%

*Not Applicable

TABLE 21

POPULATION BY INCOME

	Non-elderly Handicapped	Elderly Handicapped	Able-Bodied Elderly	TOTAL
Less Than $3999	84 41.7%	50 40.8%	26 17.1%	160
$4000 - $6999	39 19.3%	26 21.1%	38 25.0%	103
$7000 - $9999	20 9.9%	18 14.6%	38 25.0%	76
$10000 - $12999	17 8.4%	11 8.9%	21 13.8%	49
$13000 - $15999	11 5.4%	7 5.7%	8 5.3%	26
$16000 or More	31 15.3%	11 8.9%	21 13.8%	63
TOTAL	152 100%	123 100%	202 100%	477 100%

TABLE 22

POPULATION BY SEX

	Non-elderly Handicapped	Elderly Handicapped	Able-Bodied Elderly	Total
Male	91 43.5%	51 44.7%	47 28.1%	189
Female	118 56.5%	63 55.3%	120 71.9%	301
Total	209 100%	114 100%	167 100%	490 100%

TABLE 23

POPULATION BY TYPE OF HANDICAP

	Non-elderly Handicapped	Elderly Handicapped	Total
Need Help of Another Person	47 15.5%	23 11.8%	70
Need Assistive Device	104 34.2%	48 24.7%	152
Trouble Moving Around Freely	80 26.3%	81 41.8%	161
Visual Difficulties	57 18.8%	24 12.4%	81
Hearing Difficulties	16 5.2%	18 9.3%	34
Total	304 100%	194 100%	498 100%

Importance of Travel Characteristics

The respondents were asked to rate nine level-of-service characteristics on a three point scale, on which 1 represented not important, 2 represented average importance, and 3 represented extremely important. The mean score in the following chart was developed by adding up the number of points and dividing by the total number of responses. An example of the calculation of a mean score for dependability by the able-bodied elderly is as follows:

Not Important	=	1 point
Average Importance	=	2 points
Extremely Important	=	3 points

Dependability:

24 responses not important	-	24
50 responses average importance	=	100
65 responses extremely important	=	195
Total Points		319

Total Responses = 139 $\frac{319}{139}$ = 2.29 mean score

TABLE 24- MEAN SCORE OF LEVEL OF SERVICE CHARACTERISTICS

Level of Service Characteristics:	Mean Score
Non-Elderly Handicapped	
Low Cost	2.44
Dependability of on-time arrival	2.40
Short walking time	2.33
Short waiting time	2.28
Ease of entry and exit	2.27
Travel weekends and holidays	2.26
Travel evening hours	2.20
Benches and Shelters	2.15
Short riding time	1.94
Elderly Handicapped	
Short walking distance	2.41
Low cost	2.33
Ease of entry and exit	2.27
Dependability of on-time arrival	2.22
Short waiting time	2.21
Benches and Shelters	2.17
Travel weekends and holidays	1.95
Short riding time	1.82
Travel evening hours	1.71

Able-Bodied Elderly	
Dependability of on-time arrival	2.29
Low Cost	2.28
Short waiting time	2.29
Short walking distance	2.15
Benches and shelters	2.13
Travel weekends and holidays	2.06
Ease of entry and exit	1.91
Short riding time	1.81
Travel evening hours	1.78

The range of mean scores for the non-elderly handicapped is from 2.44 (low cost) to 1.94 (short riding time). Among the non-elderly handicapped the only characteristic of less than average importance (less than 2 mean score) is overall riding time. The elderly handicapped consider travel on weekends and holidays, short riding time and ability to travel during evening hours of less than average importance. The able-bodied elderly consider ease of entry and exit, short riding time and ability to travel evening hours as of less than average importance. Only short riding time is considered of less than average importance by all three groups. Transportation during evening hours is also of less than average importance to both the handicapped and able-bodied elderly. The lifestyle of elderly individuals is such that few desire to travel after 6 or 7 o'clock in the evening.

The following table lists level of service characteristics (in rank order) by percentage of respondents selecting the characteristic as extremely important.

TABLE 25- IMPORTANCE OF LEVEL OF SERVICE CHARACTERISTICS

Non-Elderly Handicapped	% Extremely Important
Low Cost	55.0
Dependability of on-time arrival	54.6
Short walking distance	50.2
Ease of entry and exit	49.3
Short waiting time	44.9
Travel weekends and holidays	42.6
Travel evening hours	41.0
Benches and Shelters	39.2
Short riding time	23.2
Elderly Handicapped	
Short walking distance	61.3
Low cost	43.8
Ease of entry and exit	50.5

Dependability of on-time arrival	47.9
Short waiting time	47.2
Benches and shelters	45.1
Travel weekends and holidays	28.7
Short riding time	27.2
Travel evening hours	21.7

Able-Bodied Elderly

Dependability of on-time arrival	46.8
Low cost	42.9
Short waiting time	41.1
Short walking distance	38.1
Benches and shelters	36.2
Travel weekends and holidays	32.8
Ease of entry and exit	25.6
Travel evening hours	22.9
Short riding time	19.8

The results from the foregoing table show that low cost, dependability and short walking distance are the most important service characteristics to the non-elderly handicapped. The elderly handicapped find short walking distance, low cost and ease of entry and exit to be most important. Service characteristics most important to the able-bodied elderly are dependability, low cost and short waiting time. Low cost is extremely important to all three groups. This is to be expected since a significant number of the elderly and handicapped live on less than $7,000 a year. Their low income makes it hard for them to pay for transportation services.

Dependability is in the top three characteristics for the non-elderly handicapped and the able-bodied elderly. Short walking distance is another characteristic rated highly by elderly and non-elderly handicapped individuals. Both groups have mobility limitations which prevent them from walking long distances to obtain transportation.

The first question asked concerned the mode of transportation used by each group for each trip purpose. Table 26 presents this information for the work trip.

TABLE 26- TRANSPORTATION BY MODE - WORK

	Non-Elderly Handicapped		Elderly Handicapped		Able-Bodied Elderly		Total	
	No.	%	No.	%	No.	%	No.	%
Auto driver	53	27.6%	19	21.6%	40	28.6%	112	27.0%
Auto passenger	33	17.2%	6	6.8%	8	5.7%	47	11.0%
Bus	28	14.6%	3	3.4%	9	6.4%	40	9.0%
Taxi	3	1.6%	1	1.1%	0	0	4	1.0%
Van	6	3.1%	1	1.1%	0	0	7	2.0%
Walk/Bicycle	4	2.1%	0	0	3	2.1%	7	2.0%
Wheelchair	0	0	0	0	0	0	0	0
Never travel for this reason	65	33.9%	58	65.9%	80	57.2%	203	48.0%
Total	192	100%	88	100%	140	100%	420	100.0%

As expected, the private automobile is by far the most commonly used transportation mode among all three groups. The second most common travel mode is as a passenger in a private automobile. The non-elderly handicapped rely on others for transportation to a greater extent than either the elderly handicapped or the able bodied elderly. Non-elderly handicapped also rely more heavily on bus transit than either group of elderly. Table 26 also indicates other transportation modes are used very seldom by the elderly and handicapped for work trips.

An interesting point brought out by Table 26 is the rather large percentage(33.9%) of individuals in each market group who do not travel at all for work purposes.

Table 27 presents a summary of transportation modes used by all three groups for personal business trips.

TABLE 27 - TRANSPORTATION BY MODE - PERSONAL BUSINESS

	Non-Elderly Handicapped		Elderly Handicapped		Able-Bodied Elderly		Total	
	No.	%	No.	%	No.	%	No.	%
Auto driver	77	38.1%	50	46.7%	93	59.2%	220	47.5%
Auto passenger	45	22.3%	17	15.9%	23	14.6%	85	18.0%
Bus	29	14.4%	17	15.9%	21	13.4%	67	14.0%
Taxi	6	3.0%	7	6.5%	5	3.2%	18	4.0%
Van	6	3.0%	1	.9%	1	.6%	8	2.0%
Walk/Bicycle	9	4.5%	4	3.7%	5	3.2%	18	4.0%
Wheelchair	2	1.0%	0	0	0	0	2	.5%
Never travel for this reason	28	13.7%	11	10.4%	9	5.8%	48	10.0%
Total	202	100%	107	100%	157	100%	466	100%

The automobile is the most commonly used mode of transportation for personal business. Among the non-elderly handicapped and the able-bodied elderly, obtaining a ride with a friend or relative is the second most common mode of transportation. The elderly handicapped, however, rely on the bus as much as they do friends for transportation. Fixed route transit is also relied upon by the non-elderly handicapped and able-bodied elderly for many of their personal business trips. Another interesting fact shown in Table 27 is that only a small percentage of each group do not make personal business trips. Fewer personal business trips are made by the handicapped (elderly and non-elderly), as compared to the able-bodied elderly. The mobility limitations of the handicapped probably account, in large part, for their decreased travel for personal business.

In Table 18 the transportation modes used by survey respondents for shopping trips are shown.

TABLE 28 TRANSPORTATION BY MODE - SHOPPING

	Non-Elderly Handicapped		Elderly Handicapped		Able-Bodied Elderly		Total	
	No.	%	No.	%	No.	%	No.	%
Auto driver	75	36.8%	47	40.9%	98	59.8%	220	45.0%
Auto passenger	71	34.8%	29	25.2%	36	22.0%	136	28.0%
Bus	20	9.8%	20	17.4%	17	10.4%	57	12.0%
Taxi	11	5.4%	5	4.3%	3	1.8%	19	4.0%
Van	7	3.4%	4	3.5%	0	0	11	2.5%
Walk/Bicycle	6	2.9%	4	3.5%	8	4.9%	18	4.0%
Wheelchair	7	3.4%	0	0	1	.6%	8	1.5%
Never travel for this reason	7	3.5%	6	5.2%	1	.5%	14	3.0%
Total	204	100%	115	100%	164	100%	483	100%

Once again the private automobile is the most commonly used mode of transportation and riding as a passenger in an automobile ranks second. The elderly handicapped use the bus for shopping trips more than the non-elderly handicapped or able-bodied elderly. Futhermore, very few individuals in any target group fail to make shopping trips.

In Table 29 a summary is presented of transportation modes used by the three market groups for medical trips.

TABLE 29 - TRANSPORTATION BY MODE - MEDICAL

	Non-Elderly Handicapped		Elderly Handicapped		Able-Bodied Elderly		Total	
	No.	%	No.	%	No.	%	No.	%
Auto driver	75	36.6%	45	39.5%	95	60.9%	215	45.0%
Auto passenger	67	32.7%	31	27.2%	25	16.0%	123	26.0%
Bus	29	14.1%	16	14.0%	19	12.2%	64	13.5%
Taxi	15	7.3%	10	8.8%	11	7.1%	36	8.0%
Van	9	4.4%	6	5.3%	1	.6%	16	2.0%
Walk/Bicycle	3	1.5%	3	2.6%	1	.6%	7	1.5%
Wheelchair	6	2.9%	1	.9%	2	1.3%	9	2.0%
Never travel for this reason	1	.5%	2	1.7%	2	1.3%	5	1.0%
Total	205	100%	114	100%	156	100%	475	100%

Inspection of Table 29 indicates that the modes used by all groups in rank order are: (1) auto driver, (2) auto passenger, and (3) bus. The importance of medical trips is also highlighted by the fact that less than 2% of each group make no trips for medical purposes. In fact, only 1% of the total respondents fail to travel for medical purposes.

A summary of the transportation modes used for social/recreational purposes is presented in Table 30.

TABLE 30- TRANSPORTATION BY MODE - SOCIAL/RECREATIONAL

	Non-Elderly Handicapped		Elderly Handicapped		Able-Bodied Elderly		Total	
	No.	%	No.	%	No.	%	No.	%
Auto driver	63	32.1	34	35.6%	79	53.7%	176	39.0%
Auto passenger	78	39.9%	22	23.2%	32	21.8%	132	29.0%
Bus	10	5.1%	6	6.3%	6	4.1%	22	5.0%
Taxi	6	3.1%	3	3.2%	3	2.0%	12	3.0%
Van	11	5.6%	3	3.2%	2	1.4%	16	4.0%
Walk/Bicycle	4	2.0%	0	0	1	.7%	5	2.0%
Wheelchair	3	1.5%	1	1.1%	1	.7%	5	2.0%
Never travel for this reason	21	10.7%	26	27.4%	23	15.6%	70	16.0%
Total	196	100%	95	100%	147	100%	438	100%

About 70% of the elderly and handicapped travel by private automobile, either as a driver or passenger. Overall, the percentage of drivers is greater than that of passengers (39% as compared to 29%). However, the non-elderly handicapped are more commonly passengers (39.9%) than drivers (32.1%), which makes them more dependent on others for the satisfaction of their social/recreational travel needs as compared to the elderly handicapped and able-bodied elderly. It can be argued that the high dependence on the automobile, either as a driver or passenger, for social/recreational trips is due to the lack of adequate bus service for this trip purpose. Fixed route, fixed schedule bus service cannot carry most of the elderly and handicapped to desired social/recreational activities.

A summary of the transportation modes used for school/training activities is given in Table 31.

TABLE 31 - TRANSPORTATION BY MODE - SCHOOL/TRAINING

	Non-Elderly Handicapped		Elderly Handicapped		Able-Bodied Elderly		Total	
	No.	%	No.	%	No.	%	No.	%
Auto driver	43	24.2%	8	10.4%	26	20.8%	77	20.0%
Auto passenger	26	14.6%	3	3.9%	3	2.4%	32	8.0%
Bus	16	9.0%	1	1.3%	1	.8%	18	5.0%
Taxi	6	3.4%	0	0	0	0	6	2.0%
Van	6	3.4%	0	0	0	0	6	2.0%
Walk/Bicycle	4	2.2%	1	1.3%	0	0	5	1.0%
Wheelchair	1	.5%	0	0	0	0	1	0
Never travel for this reason	76	42.7%	64	83.1%	95	76.0%	235	62.0%
Total	178	100%	77	100%	125	100%	380	100%

Table 31 indicates that the non-elderly handicapped rely on the automobile, as either a driver or passenger for trips to school/training activities. The elderly handicapped and able-bodied elderly who make such trips tend to drive their own automobiles. Very few of the elderly handicapped (3.9%) or the able-bodied elderly (2.4%) travel as a passenger to school/training activities, as compared to the non-elderly handicapped. The bus is also used to a greater extent by the non-elderly than by the elderly (handicapped and able-bodied) for this trip purpose. Most of the non-elderly handicapped travelling for this purpose are individuals without an automobile available. On the other hand, the majority of the elderly can drive and have a car available for making school/training trips.

Table 32 presents a summary of the transportation modes used for religious purposes by the survey respondents.

TABLE 32- TRANSPORTATION BY MODE - RELIGIOUS TRIPS

	Non-Elderly Handicapped		Elderly Handicapped		Able-Bodied Elderly		Total	
	No.	%	No.	%	No.	%	No.	%
Auto driver	55	28.0%	33	33.0%	70	50.0	158	36.0%
Auto passenger	65	33.0%	34	34.0%	30	21.5	129	30.0%
Bus	4	2.0%	3	3.0%	7	5.0	14	3.0%
Taxi	6	3.0%	1	1.0%	1	0.7	8	2.0%
Van	4	2.0%	1	1.0%	0	0	5	1.0%
Walk/Bicycle	5	2.5%	2	2.0%	8	5.7	15	3.0%
Wheelchair	6	3.0%	1	1.0%	2	1.4	9	2.0%
Never travel for this reason	52	26.5%	25	25.0%	22	15.7	99	23.0%
Total	197	100%	100	100%	140	100%	437	100%

Table 32 shows that over half of the able-bodied elderly travel to religious activities driving their own car. This is to be expected since they do not have physical difficulties which prevent their driving an automobile. Nearly equal percentages of the elderly handicapped travel as a driver or passenger in an automobile. Most of the non-elderly handicapped (33%) rely on others for religious oriented trips. A large percentage of the non-elderly handicapped also drive their own automobiles for such trips (28.0%).

The main points of interest relative to mode of transportation seem to be (1) use of the automobile as a driver is the most commonly used mode of travel for all trip purposes, and (2) traveling as a passenger in an automobile is the second most common mode of transportation, (3) the non-elderly handicapped tend to travel most often as a passenger in an automobile for social/recreational and religious trips, (4) the bus is the third most commonly used mode of transportation by all three groups. Its use is highest among all three groups for shopping, medical and personal business trips. (5) The non-elderly handicapped use the bus more than the elderly for school/training and work trips.

TABLE 33 - TRIP PURPOSES FOR WHICH ELDERLY AND HANDICAPPED WOULD LIKE TO TRAVEL MORE OFTEN

	Non-Elderly Handicapped (% wishing to travel more often)	Elderly Handicapped (% wishing to travel more often)	Able-Bodied Elderly (% wishing to travel more often)
Work	30.5%	11.6%	3.3%
Personal Business	27.9	20.9	12.6
Shopping	48.2	34.1	22.0
Medical	24.8	29.5	10.4
Social/Recreational	50.0	24.0	20.9
School/Training	20.8	3.1	1.1
Religion	24.8	22.5	18.1

Table 33 shows the trip purposes affected by lack of adequate transportation in decreasing order of frequency. A large percentage of the needed trips are those essential for an individual's well being -- namely personal business, shopping and medical trips. A large percentage of the non-elderly handicapped also need to make additional work (30.5%) and school/training (20.8%) trips. There are also unmet needs for social/recreational and religious trips. Such trips may be considered discretionary in nature, except for their importance to the social and spiritual dimensions of an elderly and handicapped person's life. Automobile unavailability, physical limitations, cost, transit related problems, etc. mentioned in Chapter III account for these unmet travel needs.

Bikeways

The designation of bicycle routes, the formation of bicycle groups and an increasing awareness by the public of the value of exercise have encouraged bicycle use. Currently, there are signed bicycle routes in the Des Moines Urbanized Area. There are also bikeway-pedestrian paths along the Des Moines Riverfront. These existing bikeway-pedestrian paths are in Ashworth Park and run from the Riverview Amusement Park to the Birdland and Union Park area. Another section of the riverfront bikeways from Birdland and Union Park to Southeast Fourteenth Street is scheduled to be constructed in the next year. Contracts have been let (1978) for the construction of this bikeway section. Other sections of the proposed riverfront bikeway plan will be constructed as Federal Funds become available.

A bikeway-pedestrian path connecting Euclid Avenue with the Saylorville Reservoir is also scheduled for construction within the next two years. Development of this project is a joint venture of the Conservation Commission and the U.S. Army Corp. of Engineers.

A network of Metropolitan bike trails was also proposed for the Des Moines Urbanized Area in the 1974 Metropolitan Bike Trails Plan. However, no comprehensive data exists for the planning of such an integrated bikeway plan. Thus, if the full potential of the bicycle as a mode of transportation is to be realized several activities need to be undertaken.

First, the demand for the bicycle as a mode of travel must be determined. This will involve surveys of cycling groups and area residents for the following types of information:

1. Trip purposes now served by bicycling (e.g recreational, personal business, school, etc.) and their frequency.
2. Time of day and trip length of bicycle trips.
3. The origins and destinations between which bicyclists desire to travel. This information would provide an indication of the residential areas and trip generators which should be connected.

The routes identified through these surveys and the demand for travel could then be used to develop a priority construction program for a Metropolitan Bikeway Plan. On proposed routes where there is no significant demand alternate routes may be developed. In planning a metropolitan bicycle facility two general principles should be kept in mind: (1) Facilities should be constructed in locations where they can serve a variety of travel purposes; and (2) Facilities should be constructed where they will be most heavily used.

A decision must also be made as to the types of bikeways to be constructed. There are basically three types of bikeways available. Type I is known as the bicycle path. This is the most desirable, and also the most expensive of the alternatives. This option is a strip which is usually paved and completly separated (except for intersections with highways) from automobile traffic.

Type II facilities are known as bicycle lanes. This is a clearly marked lane on the side of a street or highway separated from automobile traffic by a paint stripe and, in many cases, dividers.

Type III facilities are called bicycle routes. These facilities are currently available in the Des Moines Urbanized Area. They are designated on streets having low traffic volume, and are marked by signs, paint on street surfaces, or a combination of both techniques.

Theft of bicycles is a major problem which needs to be considered in bicycle planning. Secure bicycle storage areas at major traffic generators may encourage bicycling if the locations are connected to residential areas by some type of bikeway.

Pedestrian Facilities

Walking is the most widely used mode of transportation. Nearly every trip begins and/or ends as a pedestrian movement. Yet, pedestrian needs have received little consideration as compared to other modes of transportation. In the

Des Moines Urbanized Area pedestrian needs are being taken into consideration through several projects.

Sidewalk Improvements

The location of municipally funded sidewalk construction is determined each year as part of the capital improvements program. These locations are selected based on need and estimated safety benefits resulting from their installation. Curb cuts and reduced inclines on sidewalks are part of the sidewalk program in the City of Des Moines. These barrier-free sidewalks are a means of increasing the mobility of handicapped individuals.

Downtown Skywalk System

The largest pedestrian related project is the downtown skywalk system that will be located within the Des Moines Central Business District in an area bounded by 8th Street, 4th Street, Mulberry Avenue and Grand Avenue. This nine block core area contains over 500 business establishments with an estimated 14,000 employees. With approximately 14,000 employees in the core area, a substantial number of pedestrian trips are being generated. It has been estimated that approximately 145,000 pedestrian trips are being made in this area in a twelve hour period.

Analysis of pedestrian travel patterns and vehicular movements in the core area indicates that fifty percent (50%) of pedestrian crossings at intersections within the core area of the skywalk and fifty (50%) percent of pedestrian trips will be diverted to the Skywalk System. Nearly 49,000 or one third (1/3) of the total pedestrian trips will be diverted to the Skywalk. In a recent skywalk study* it was determined that this reduction of pedestrian/vehicle conflicts will provide for:

*Transportation Analysis of the Proposed Des Moines Skywalk System, Barton-Aschman Associates, Inc. (August, 1978)

(1) reductions in vehicular/pedestrian congestion and delay,

(2) improved pedestrian safety,

(3) an estimated savings of $550,125 per year for motorists and pedestrians, and

(4) an annual savings of 16,400 gallons of gasoline and 5.9 tons of carbon monoxide emissions.

Other benefits include an increased or stabilized tax base, improved business and social environment, improved air quality for pedestrians, reduction in noise exposure, and improved civic image. These benefits are difficult to estimate on a dollars and cents basis.

A final goal of the Skywalk System is to reduce the traffic conflicts within the core area, itself, caused by the numerous bus stops. With the Skywalk System, bus stops can be located at the perimeter and key interior points to provide convenient interchange between the bus system and the skywalk system. This will allow bus riders to walk to their destination in the climate controlled environment of the Skywalk System. This should generate new transit trips to the CBD. Further details on the Skywalk System may be found in the Skywalk Project Concept Statement February, 1978, or the Transportation Analysis of the Proposed Des Moines Skywalk System by Barton-Aschman Associates, Inc. (August 1978).

Internal Transit Management Efficiency

The efficiency of the Metropolitan Transit Authority's (MTA) management system can be evaluated as to how well its objectives are being met. The following objectives have been selected by the MTA:

1. Provide a fast, convenient and reliable transit service.
2. Increase the mobility and accessibility of public transit to our service area population.
3. Operate an efficient and productive transit system.
4. Reverse previous trends of declining patronage and revenue.
5. Develop the necessary monitoring techniques to assess the demographic characteristics of the service area and their impact on transit ridership.

Statistics indicate the MTA has reversed previous trends of declining patronage and revenue. During the last fiscal year, ridership and revenue have increased by approximately 20-22 percent. At the same time, the number of revenue miles operated increased only 0.5 percent. The productivity of the MTA system, defined as passengers per mile, has also increased over the last fiscal year from 1.51 to 1.76, an increase of nearly 17 percent. A surveillance procedure to collect data on transit corridors and individual routes has also been developed. This data may be found in the document, "Analysis of the MTA Operating System" - July, 1977 and in future updates of the MTA Surveillance Manual.

This data indicates the MTA is meeting the objectives specified above. However, the MTA also has several projects which are designed to produce future improvements in management efficiency. The objective of the following projects is to use management and administrative resources as effectively as possible.

1. The implementation of Financial Accounting and Reporting Element (FARE) programs required by Federal guidelines.
2. Investigate the feasibility of park-n-ride service to one or more communities outside the Des Moines urbanized area. By October, 1979 such a service could be implemented if it proves to be financially viable.
3. A driver training program has been implemented which includes course work in defensive driving, safety and public relations, Cardio-Pulmonary Resuscitation (CPR) and first aid. It is hoped this program will reduce accidents on the MTA system.
4. A feasibility study of coordination between MTA and the Special Service Transportation Corp. Problems which must be investigated before coordination can occur include union negotiations regarding the drivers of SST, dispatching requirements, implications of the added fleet requirements and the accounting system needed for isolating the funding of the two systems.
5. An on-going marketing program which includes the following elements:

    A. The MTA will conduct a marketing research study in its service area. The purpose of this study will be to design a marketing program that can meet the needs of current transit users and non-users. Results of the study will be used to increase usage by existing transit riders and to attract non-users to transit.

A random household survey will be designed to obtain information on the transit knowledge possessed by users and non-users as well as their attitudes toward various service characteristics. Answers to the following types of questions will be obtained as a result of the marketing research for both users and non-users:

1. What knowledge do users as opposed to non-users have of the MTA system? Do non-users have adequate information to use the MTA system? The level of awareness of transit service avilable needs to be assessed for various groups of people so that knowledge deficiencies can be corrected through selection of appropriate media and message content.

2. Which service characteristics of the present system are rated most favorably and least favorably? Cost may, for example, have less importance than schedule frequency to certain individuals.

3. Which service characteristics are most important and which are the least important?

4. Which service characteristics need to be improved to attract non-users or to increase ridership among users?

The use of market research to identify transit characteristics that attracted present users and to identify the attitude of the non-user toward transit is important as it will allow the transit operator to develop specific marketing programs that can influence the attitude of the non-user. Also, the information gathered will be beneficial to the operator in determining what characteristics must be reflected in new service if they are to attract the maximum number of choice riders.

B. Vehicle Rehabilitation Program. This program is designed to improve the physical appearance of older MTA buses. The aim of the program is to build a positive image of the MTA system in present and future MTA service areas.

C. Passenger Amenities: Bus Shelters and Bus Stop Signs. Shelters are designed to serve major traffic generators throughout the system including schools, hospitals, apartment complexes and major employment centers. The MTA has attempted to determine which of these generators create the highest portion of ridership. As this is determined, the traffic generators are contacted as to their interest in having the shelter installed. If there is interest, then the necessary variances and permits can be obtained and the shelter can then be installed.

Bus stop signs are located throughout the community along each route. The policy of determining location and installation of bus stop signs is a very simple one.

The bus will stop at each intersection along the route to board and alight passengers. The only exceptions made to this policy are in the event it is determined a specific spot or intersection may create a safety hazard for either the transit vehicle or passenger. If this is the case, often times the sign may be located mid-block so the person will not have to walk more than one block to the next stop.

D. Promotional Activities:

1. Telephone information service which operates from 7:00 AM until 6:00 PM, Monday thru Friday, and from approximately 9:00 to 1:00 on Saturdays.

2. Distribution of color-coded route maps and schedules to pass outlets.

3. Radio advertisements describing the benefits of riding the MTA.

4. Informational and promotional material presented once a month at the shopping malls.

5. Information on route changes implemented regularly as monitoring data indicates the need for such changes.

6. Citizen involvement in the form of advance public notice of Board of Trustees meetings and the formation of citizen committees in member cities to advise their respective city councils and the MTA. Also, the MTA, in cooperation with city councils and citizen committees, periodically schedules public meetings for the sole purpose of gaining public input regarding their desires related to public transit, both generally and specifically.

7. The Employer Support Program was implemented in the spring of 1975. Generally, the Employer Support Program (ESP) is a program in which employers purchase monthly or weekly passes and trip tickets from the MTA at full price and make them available to their employees. at a discounted rate. Specifically, there are 17 major employers participating in the program, 14 of which make bus passes available to their employees at a range of 25% to 60% discount. In the last year the popularity and success of ESP has grown rapidly. In 1977, an average of $8,000 per month was generated through ESP. In 1978, monthly revenue has exceeded $15,000.

8. Develop a speakers program designed to encourage speaking invitations to the MTA from area fraternal and service organizations. Also, tours are occasionally conducted of the MTA premises for interested groups.

9. The customer relations supervisor works in conjunction with the promotion manager of the Des Moines library system to enlist participants for sessions held in the five city libraries. The program participants, who average from 150-175 per session, are acquainted with MTA's service and reduction in fare for elderly persons. They are given route maps, schedules and application forms for MTA elderly citizen identification cards. These sessions are publicized a week in advance by MTA and further promoted by each of the libraries. Because of the success of these sessions, the senior citizen promotion now includes applications for handicapped citizens and will soon be expanded into the suburban library systems.

Land Use -- Transportation

Land use-transportation relationships need to be considered for both short range (0-5 years) as well as long range planning purposes. The travel demand generated by land use developments scheduled for completion over the next one to five years may generate sufficient traffic to increase congestion on adjacent streets.

Interviews with local community development agencies provided estimates of the number of dwelling units proposed for residential development and the square footage of commercial establishments. This data is shown in Table 34. Average trip rates* were then used to forecast the travel demand (e.g trip production and attractions) which may be generated by these new housing and commercial developments. These average trip rates are expressed in trips per dwelling unit for residential uses and gross floor area (per 1,000 sq. ft.) for commercial uses.

*Trip Generation by Land Use. Maricopa Association of Governments, April, 1974, FHWA Publication.

TABLE 34

	Trips per dwelling unit
Single family	9.51
Duplex	8.69
Apartment	6.89
	Trips per 1,000 sq. ft.
General office	10.32
General commercial	63.77
Shopping (Supermarket)	42.65
Shopping (discount store)	81.21
Industrial (Light manufacturing)	4.94

Based on the trip rates shown, the above Table is converted into the zonal trip demand shown in Table 35. Figures 10 and 11 indicate the productions and attractions calculated by applying the trip rates. Examination of Figure 10 shows that most of the home based trip productions will be concentrated in the western suburbs of the Des Moines Urbanized Area. However, there will also be a large quantity of home-based production in the southern portion of Des Moines along Southeast Fourteenth and Army Post Road due to the residential development expected to occur in this area. It is difficult to determine the effect of these trip demands without additional trip distribution and assignment analysis. Nevertheless, it is expected that facilities such as Southeast Fourteenth will double its present traffic volume by 1983.

Figure 11 shows that many trips will be attracted to land development in traffic zones 107, 108, 209, 123 and 124. The developments in traffic zones 107, 108 and 209 may increase access and congestion problems on University Avenue, and 35th and 86th streets. Similarly, the developments in zones 123 and 124 have the potential to create traffic and access problems on Douglas Avenue or Northwest 86th Street.

FIGURE 10

NON-HOME BASED TRIP ATTRACTION DUE TO ADDITIONAL LAND DEVELOPMENT

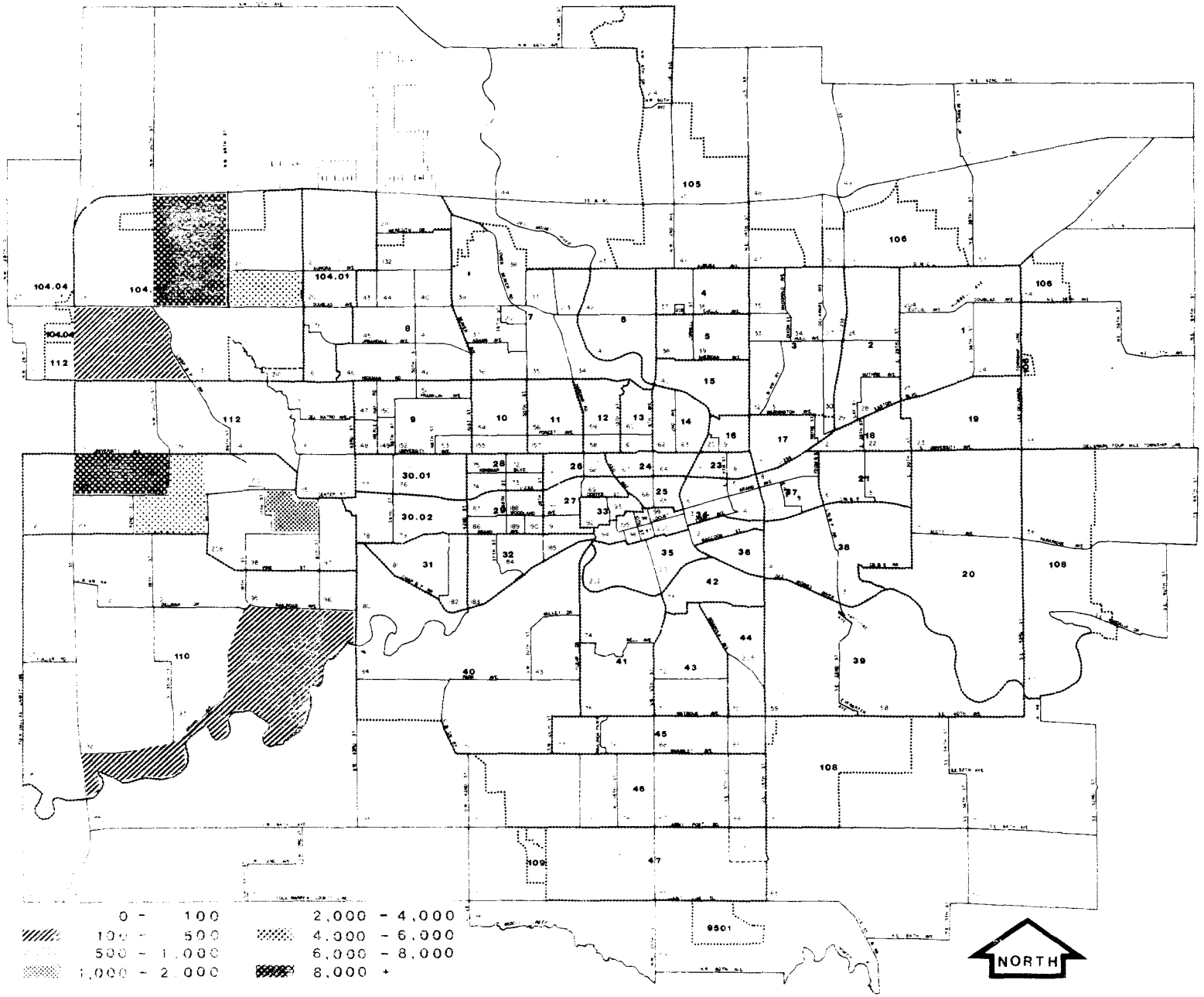


FIGURE 11

HOME-BASED TRIP PRODUCTION DUE TO ADDITIONAL LAND DEVELOPMENT

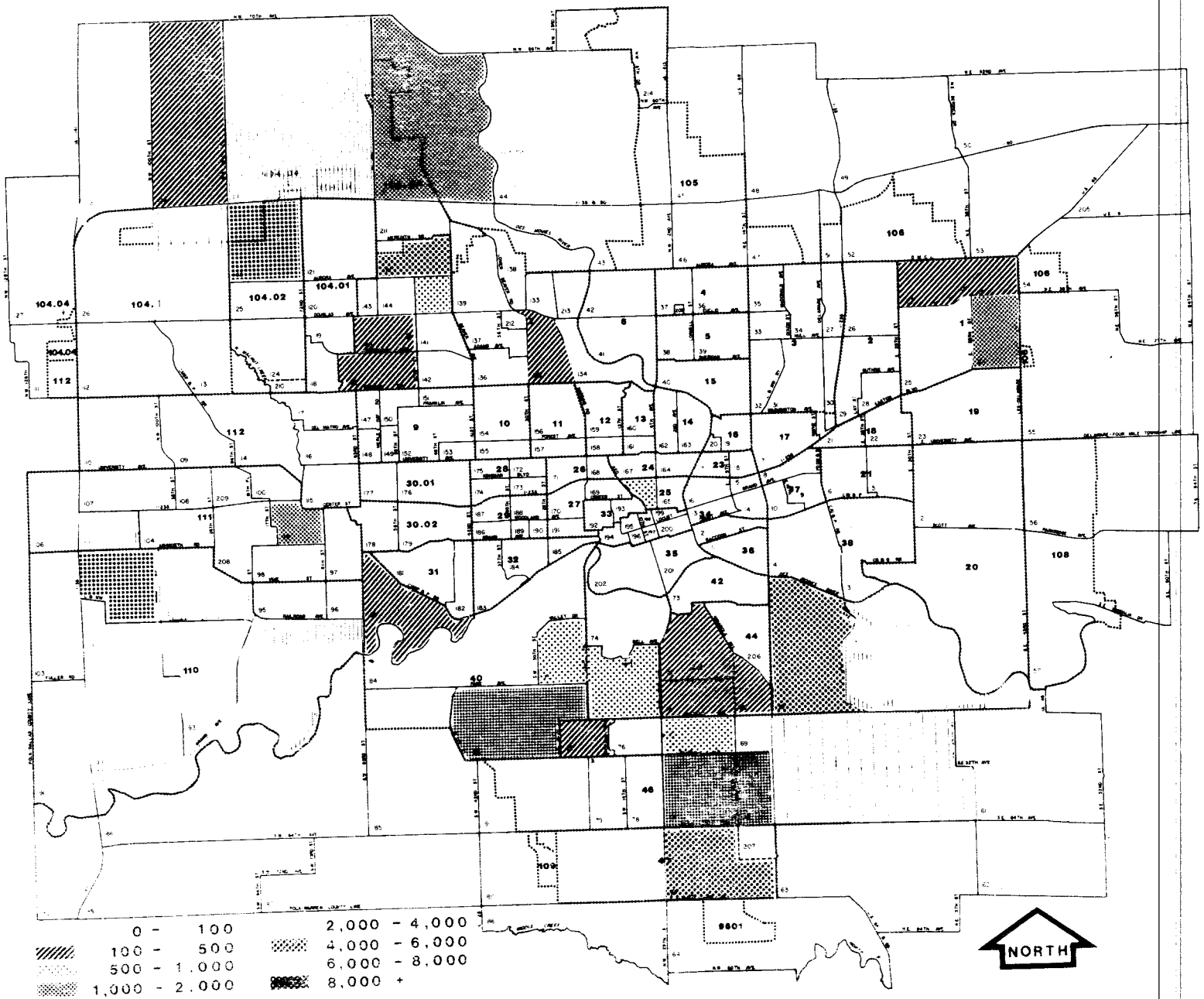


TABLE 35

IMMEDIATE URBAN LAND USE DEVELOPMENT
TABULATED BY TRAFFIC ZONE
1978 - 1983
DES MOINES URBAN AREA

Data Source: Local Planning/and Community Development Agencies

	ZONE	S.F. IN D.U.	M.F. IN D.U.	APT. IN D.U.	OFFICE SPACE IN SQ.FT.	GENERAL COMM. IN SQ. FT.	SHOPPING CENTER IN SQ. FT.	GROCERY S. C. IN SQ. FT.	IND. IN SQ.FT.	PSP INSTITUTE IN SQ. FT.	RECREATION CENTER IN SQ. FT.	NOTES
	204			48								
	24	202										
	58	175		240								
	60			1102								
	59	86	36	504								
	70			72								
	71	46										
	68	41		60								
	66	129										
	67	46		96								
	65			840								

IMMEDIATE URBAN LAND USE DEVELOPMENT
TABULATED BY TRAFFIC ZONE
1978 - 1983
DES MOINES URBAN AREA

Data Source: Local Planning/and Community Development Agencies

	ZONE	S.F. IN D.U.	M.F. IN D.U.	APT. IN D.U.	OFFICE SPACE IN SQ.FT.	GENERAL COMM. IN SQ. FT.	SHOPPING CENTER IN SQ. FT.	GROCERY S. C. IN SQ. FT.	IND. IN SQ.FT.	PSP INSTITUTE IN SQ. FT.	RECREATION CENTER IN SQ. FT.	NOTES
	72			50								
	76	9										
	75	66										
	83			144								
	77	14										
	82	174										
	166			144								
	183	4										
	180			48								
	146	20										
	145	15										

IMMEDIATE URBAN LAND USE DEVELOPMENT
TABULATED BY TRAFFIC ZONE
1978 - 1983
DES MOINES URBAN AREA

Data Source: Local Planning/and Community Development Agencies

	ZONE	S.F. IN D.U.	M.F. IN D.U.	APT. IN D.U.	OFFICE SPACE IN SQ.FT.	GENERAL COMM. IN SQ. FT.	SHOPPING CENTER IN SQ. FT.	GROCERY S. C. IN SQ. FT.	IND. IN SQ.FT.	PSP INSTITUTE IN SQ. FT.	RECREATION CENTER IN SQ. FT.	NOTES
	92	100	150									WDM
	94			300					50,000			
	99			170	100,000							
	101	350										
	102	350		240								
	104				70,000							
	105	200		300								
	107				50,000		200,000					
	108				300,000							
	209				100,000*	100,000*						*rough estimate

IMMEDIATE URBAN LAND USE DEVELOPMENT
TABULATED BY TRAFFIC ZONE
1978 - 1983
DES MOINES URBAN AREA

Data Source: Local Planning/and Community Development Agencies

	ZONE	S.F. IN D.U.	M.F. IN D.U.	APT. IN D.U.	OFFICE SPACE IN SQ.FT.	GENERAL COMM. IN SQ. FT.	SHOPPING CENTER IN SQ. FT.	GROCERY S. C. IN SQ. FT.	IND. IN SQ.FT.	PSP INSTITUTE IN SQ. FT.	RECREATION CENTER IN SQ. FT.	NOTES
	112								100,000			Urbandale
	113										400,000*	*estimate
	122	215	164	350								
	123	535	300					100,000				
	124					50,000						
	125				50,000							

IMMEDIATE URBAN LAND USE DEVELOPMENT
TABULATED BY TRAFFIC ZONE
1978 - 1983
DES MOINES URBAN AREA

Data Source: Local Planning/and Community Development Agencies

	ZONE	S.F. IN D.U.	M.F. IN D.U.	APT. IN D.U.	OFFICE SPACE IN SQ.FT.	GENERAL COMM. IN SQ. FT.	SHOPPING CENTER IN SQ. FT.	GROCERY S. C. IN SQ. FT.	IND. IN SQ.FT.	PSP INSTITUTE IN SQ. FT.	RECREATION CENTER IN SQ. FT.	NOTES
	129	15										
	130	170	100	200	50,000	30,000			58,000			
	131	30	70	100	10,000	20,000		16,000	50,000			

IMMEDIATE URBAN LAND USE DEVELOPMENT
TABULATED BY TRAFFIC ZONE
1978 - 1983
DES MOINES URBAN AREA

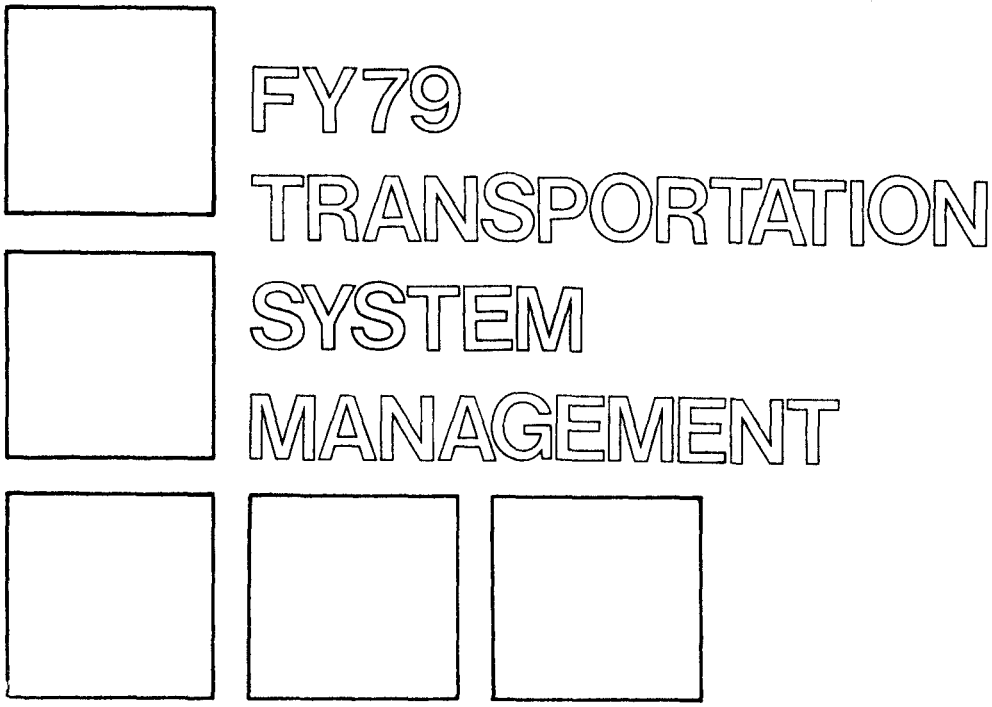
Data Source: Local Planning/and Community Development Agencies

	ZONE	S.F. IN D.U.	M.F. IN D.U.	APT. IN D.U.	OFFICE SPACE IN SQ.FT.	GENERAL COMM. IN SQ. FT.	SHOPPING CENTER IN SQ. FT.	GROCERY S. C. IN SQ. FT.	IND. IN SQ.FT.	PSP INSTITUTE IN SQ. FT.	RECREATION CENTER IN SQ. FT.	NOTES
	140			79								
	132	53	145	540								
	135			72								

TABLE 36

ADDITIONAL TRAVEL DEMAND GENERATED BY LAND USF DEVELOPMENT WITHIN NEXT 5 YEARS
(HOME BASED TRIP PRODUCTIONS)

ZONE	SINGLE FAMILY	MULTIPLE FAMILY	APARTMENTS	TOTAL
24	1921			1921
58	1664		1654	3318
59	818	313	3473	4604
60			7593	7593
65			5788	5788
66	1227			1227
67	438		661	1099
68	390		413	803
70			496	496
71	438			438
72			345	345
75	628			628
76	86			86
77	133			133
82	1655			1655
83			992	992
92	951	1304		2255
94			2067	2067
99		1171		1171
101	3329			3329
102	3329		1654	4983
105	1902		2067	3967
122	2045	1425	2412	5882
123	5088	2607		7695
129	143			143
130	1617	869	1378	3864
131	285	608	689	1582
132	504	1260	3721	5485
135			496	496
140			544	544
145	143			143
146	190			190
166			992	992
180			331	331
183	38			38
204			331	331
TOTALS	28,962	9,557	38,097	76,614



Chapter 4 •
The Transportation System Management Plan

TSM Actions Considered for the Des Moines Study Area

The identification of possible TSM actions for the Des Moines area was achieved with the cooperation of the Transportation Technical Committee. A comprehensive inventory of TSM actions was drawn up and a set of actions was then selected from the list. This selection was based upon funding constraints, technical feasibility, political acceptability and the ability of actions to meet the objectives specified in Chapter II. The analysis produced the following list of TSM actions considered for the study area:

Definition of TSM Actions

1. Variable Work Hours - Staggered Work Hours

   Under this system the employee's starting and quitting times occur more frequently than usual (e.g. 10 min., 15 min., rather than 30 min. intervals and either before or after the normal peak period). A staggered work hour program, however, does not change the hours or the number of days the employees work.

   Flexible Work Hours

   Employees adjust their working schedules to fit their preferences. The hours worked include a block of time within which all employees must be present. This core time would be, for example, from 10:00 A.M. - 12:00 P.M. and from 1:00 P.M. - 3:00 P.M. Under a flex time arrangement, the work week remains at 40 hours. (The State Department of Transportation is presently using this system).

2. 4-Day Work Week

   4-day, ten hour schedule. Under this option all employees start work one hour earlier and leave one hour later.

   4-day schedule in which less than 40 hours are worked per week. There are five scheduling options available under this type of program. The options are as shown in Table 37.

TABLE 37

FOUR-DAY WORK SCHEDULE	PERCENT OF FOUR DAY EMPLOYEES WORKING ON A GIVEN DAY					
	M	TU	W	TH	F	S
1. Equally rotated M-F	80	80	80	80	80	-
2. 1/2 M-TH; 1/2 TU-F	50	100	100	100	50	-
3. Equally rotated M-S	67	67	67	67	67	67
4. 1/3 M-TH; 1/3 TU-F; 1/3 W-S	33	67	100	100	67	33
5. 1/2 M-TH; 1/2 W-S	50	50	100	100	50	50

3. Peak-Hour Restriction

   Trucks are permitted to load and unload only during off-peak travel periods. This action applies only to trucks which provide pick-up and delivery services.

4. Higher Parking Cost

   A change of the parking rate structure to discourage parking. The parking rates may be structured to discourage long-term parking and encourage short-term parking or vice versa. A parking rate increase can also be used to discourage the use of the private automobile and encourage the use of other means of transportation.

5. Reduced Parking Fee for Carpools or Vanpools

   Reduction of parking fees for carpools and vanpools for the work trip.

6. Reduced Bus Fares for Elderly and Handicapped and for Non-Peak Riders

   Reduction of bus fares during all hours of bus operation for elderly and handicapped. Reduction of bus fares during off-peak periods for non-peak riders.

7. Transit Marketing

   The direct transit marketing objectives are to increase transit patronage and to gain overall public support for the system. The marketing techniques range from public information service to advertising and promotional programs. The scale of programs depends upon the cost of implementation.

8. Transit Route Improvement

This action consists of both operational and physical improvements for the fixed route transit service. Operational improvements include but are not limited to -

(a) bus scheduling,
(b) schedule reliability,
(c) route plan and layout,
(d) loading location.

Physical improvements include but are not limited to:

(a) turning radii at intersections,
(b) radio service,
(c) preferential treatment for traffic control purposes.

9. Integration of Transit Services

Three different types of integration are possible:

(a) Institutional integration-mergers of fixed route and paratransit services.

(b) Operational integration:

(1) a single transit network which avoids, as far as possible, duplication of service,
(2) a common fare structure,
(3) a schedule which ensures that patrons can transfer between vehicles with a minimum of waiting time, and
(4) an areawide management information system.

(c) Physical integration-this includes the standardization of vehicles, fare collection equipment and joint use of rolling stock.

10. Carpools, Vanpools

Carpools and vanpools organized by employers through matching programs.

11. Removal of On-Street Parking

This action usually is implemented in the CBD. It involves either permanent removal of on-street parking space or restriction of on-street parking during peak-periods.

12. One-Way Street System

On a one-way street, all lanes of traffic move in the same direction.

13. Traffic Control Improvement

Traffic control on urban or rural streets include the following types of improvements:

(a) Lane markings
(b) Lighting projects
(c) Guardrails
(d) 2-way stop sign
(e) 4-way stop sign
(f) Isolated intersection signal control
(g) Open network control
(h) Closed network control

The signal control concepts for (f), (g) and (h) fall into two categories:

(a) pretimed control, and
(b) traffic-actuated control.

14. Unbalanced Flow

Reversible lanes are set up (during peak hours) to increase the capacity of the roadway in the direction of peak flow.

15. Eliminating Unnecessary Traffic Control Devices

The elimination of traffic control devices, particularly traffic signals and stop signs, that do not meet the warrants for such devices adopted by Federal and State agencies. Frequently unwarranted traffic control devices result from changing traffic patterns.

16. Signal Visibility Upgrading

The modernization of traffic signals by improving the visibility of the signals.

17. Intersection Improvement (Channelization)

The establishment of exclusive right or left turn lanes through painted or physical barriers.

18. Mid-block Improvement (2-way Left Turn Lanes)

Space is provided so that vehicles can pull out of through lanes and wait for an opportunity to turn left.

19. Mid-block Improvement (Access Control)

Barrier type medians that prevent mid-block left turns can be used, although this is not practical where access has already been granted.

Another option is to provide access through a street layout that allows drivers to make a right turn properly after circling the block. The most desirable alternative is to provide access from a side street after turning left at an intersection.

20. Intersection widening

Widening may be achieved by removal of parking, the addition of one or more lanes to provide additional lanes for left and/or right turns and the improvement of intersection geometrics.

21. Pedestrian Walk and Pedestrian/Bicycle Safety Projects

The Skywalk will provide direct access between buildings, reducing pedestrian/vehicle conflict. The Des Moines Skywalk System will be located within the central business district, in an area bounded by 8th Street, 4th Street, Mulberry Avenue and Grand Avenue.

Bicycle safety projects consist of bikeways which are:

(a) totally separated from pedestrian and vehicular traffic,
(b) on restricted rights-of-way, or
(c) on shared rights-of-way with pedestrians and/or vehicles.

Development of Strategies

The selection of possible transportation system management actions is only a first step in the development of a transportation system management plant for two reasons. First, most transportation system management actions have only a marginal effect on the achievement of objectives. Second, many transportation system management actions are mutually supportive and work better in combination than alone. Therefore, packages of mutually supportive actions (strategies) offer the best capability of achieving transportation system management objectives. The following transportation system management strategies and objectives, which have been selected, grew out of the analysis of areawide problems in Chapter III.

Transportation System Management Strategies and Objectives

Objective:	Optimize the person and goods movement capacity of existing transportation facilities
Strategies:	Improve Total Vehicular Traffic Flow
	Increase Car/Van Occupancy
	Increase Transit Patronage
	Increase Use of Bicycle/Pedestrian Facilities
	Institute Work Hour Changes
Objective:	Encourage alternatives to driving private automobiles
Strategies:	Increase Transit Patronage
	Increase use of Bicycle/Pedestrian Facilities
	Increase Car/Van Occupancy
	Institute Work Hour Changes
Objective:	Provide good quality affordable transportation services to the transportation disadvantaged.
Strategy:	Improve management and coordination of existing paratransit fixed route transportation systems.
Objective:	Improve Air Quality
Strategy:	Reduce VMT
	Reduce Vehicle Trips
Objective:	Reduce Fuel Consumed in Urban Travel
Strategy:	Reduce VMT
	Reduce Vehicle Trips
	Improve Total Vehicular Traffic Flow

Objective: Reduce injuries, deaths and property damage resulting from traffic accidents.

Strategies: Reduce vehicle trips

Reduce VMT

Improve Total Vehicular Traffic Flow

To assess the utility of each strategy, relationships between each transportation system management action and each strategy have been identified. Table 38 indicates the relationship of the strategies to the transportation system actions selected for the Des Moines Urbanized Area. An asterisk (*) in a cell of a matrix indicates the transportation system management action is essential to the strategy; a zero (0) indicates the action has no effect on the outcome of the strategy; a minus (-) indicates the measure would negatively effect the strategy; and a plus (+) indicates the action aids in achieving the strategy.

The effect of a transportation system management action on the strategies has been determined from a review of transportation system management related literature. However, the actual effect of implementing any given transportation system management action may be different than the suggested effect due to local conditions.

TABLE 38

RELATIONSHIP OF TSM ACTIONS TO STRATEGIES

Key to Chart: * Essential Part of Strategy + Supportive Action o Neutral Action - Conflicting Action	Improve Total Vehicular Traffic Flow	Increase Car/Van Occupancy	Increase Transit Patronage	Institute Work Hour Changes	Increase Use of Bicycle/ Pedestrian Facilities	Improve the Mngmnt & Coordination of Existing Trans. Sys. in DM Urbanized Area	Improve the Management & Coordination of Existing Paratransit Systems	Reduce VMT	Reduce Vehicle Trips
Staggered Work Hours	+	-	+	*	o	o	o	-	-
Four Day Work Week	+	-	+	*	o	o	o	-	-
Peak-Hour Truck Restriction	*	o	o	o	o	o	o	o	o
Higher Parking Cost	+	*	*	o	*	o	o	+	+
Reduced Parking Fees for Carpools and Vanpools	+	*	-	-	o	o	o	+	+
Reduced Bus Fares for Elderly and Handicapped	o	o	*	o	o	o	o	+	+
Transit Marketing	+	-	*	+	-	+	+	+	+
Transit Route Improvement	+	-	*	+	-	+	+	+	+
Integration of Transit Services	o	-	+	o	-	*	*	+	+
Carpools, Vanpools	+	*	-	-	o	o	o	+	+
Removal of On-Street Parking	*	o	-	o	o	o	o	-	o
One-Way Street System	*	-	-	o	o	o	o	-	o
Traffic Control Improvement	*	-	-	o	o	o	o	-	o
Unbalanced Flow	*	-	-	o	o	o	o	-	o
Eliminating Unnecessary Traffic Control Devices	*	-	-	o	o	o	o	-	o
Signal Visibility Upgrading	*	-	-	o	o	o	o	-	o
Intersection Improvement	*	-	-	o	o	o	o	-	o
Mid-Block Improvements (Two Way Left Turn Lanes)	*	-	-	o	o	o	o	-	o
Mid-Block Improvements (Access Control)	*	-	-	o	o	o	o	-	o
Intersection Widening	*	-	-	o	o	o	o	-	o
Pedestrian/Walk, Pedestrian/ Bicycle Safety Projects	o	-	-	o	*	o	o	+	+

Compatibility of Strategies

The relationship between each transportation system management action and each strategy has been identified in the previous chart. It is also important to consider the interrelationships between strategies. These interrelationships reflect basic differences in the ways strategies impact objectives.

The transportation system management strategies selected for the Des Moines Urbanized Area are examined in the following chart to determine whether the measures are:

1) Supportive to each other (signified by a plus (+)).
2) Independent of each other. Transportation system management actions in one strategy have no effect on the actions in another strategy. (This is signified by a zero (0)).
3) Strategies which are counterproductive. One strategy works against the other. (This is signified by a minus (-)).

TABLE 39

COMPATIBILITY OF STRATEGIES

+ Supportive

0 Neutral

- Conflicting

	Improve Total Vehicular Traffic Flow	Increase Car/Van Occupancy	Increase Transit Patronage	Institute Work Hour Change	Increase Use of Bicycle/Pedestrian Facilities	Improve Management and Coordination of Existing Paratransit Fixed Route Transportation Systems	Reduce VMT	Reduce Vehicle Trips
Improve Total Vehicular Traffic Flow	N/A	0	-	0	0	0	-	-
Increase Car/Van Occupancy	0	N/A	0 or -	-	-	-	+	+
Increase Transit Patronage	-	0 or -	N/A	0	0	+	+	+
Increase Work Hour Changes	0	-	+	N/A	0	0	-	-
Increase Use of Bicycle/ Pedestrian Facilities	0	-	0	0	N/A	0	+	+
Improve Management and Coordination of Existing Paratransit Fixed Route Transportation Systems	0	0	+	0	0	N/A	+	-
Reduce VMT	-	+	+	+	+	+	N/A	0
Reduce Vehicle Trips	-	+	+	+	+	+	+	N/A

N/A - Not Applicable

Examples of the interrelationships shown in the chart are given below:

A strategy of improving total vehicular flow is counterproductive to a strategy of increasing transit patronage. This is true because improvements in traffic flow increase the automobile's attractiveness relative to transit. On the other hand, increases in transit patronage on given highway sections, may improve traffic flow by reducing the number of individuals driving automobiles. When this is the case, improvements in vehicular flow do not need to be implemented. Transit actions have the potential to substitute for traffic engineering measures.

Strategies to increase car/van occupancy and to increase transit patronage may either be independent or they may overlap with each other. With proper planning carpool/vanpool programs do not reduce transit patronage. If planning is inadequate, however, carpool/vanpool and transit programs may attract the same user market.

Transportation System Management actions to increase transit patronage and those which encourage walking and bicycling tend to support one another. Transit and other modes, particularly bicycles, can be combined. Facilities for bicycle storage at major transit stops may enable trips that would ordinarily be made by automobile to be made by a combination of bicycle and transit.

KEY TO CHART:
* = Positive Impact on MOE
\- = Negative Impact on MOE
UNK = Impact unknown
NI = No Impact

TSM PROJECT	TSM ACTION(S)	PROJECT COST	MEASURES OF EFFECTIVENESS									
			REDUCE THE NUMBER OF ACCIDENTS	DECREASE VOLUME/ CAPACITY RATIO	REDUCE DELAY TIME	INCREASE OVERALL TRAVEL TIME	REDUCE VEHICLE MILES OF TRAVEL	INCREASE PASSENGERS PER TRIP	INCREASE ELDERLY & HANDICAPPED ACCESSIBILITY	INCREASE BUS SCHEDULE RELIABILITY	INCREASE AUTOMOBILE DRIVERS SHIFTED TO TRANSIT	REDUCE WAITING TIME
Paving Modification - Intersection of 35th and NW100th Street with University	Intersection Improvement	$34,500	+	+	UNK	+	NI	NI	NI	NI	NI	NI
Intersection of 35th and NW100th with University	Traffic Control Improvement	$30,000*	+	+	UNK	+	-	NI	NI	NI	NI	NI
Intersection of Hickman and NW86th Street	Traffic Control Improvement, Intersection Widening	$85,000**	+	+	UNK	+	-	NI	NI	NI	NI	NI
Intersection of Harbach and NW86th Street	Traffic Control Improvement	$27,000	+	+	UNK	+	-	NI	NI	NI	NI	NI

* Cost to be shared by Clive and West Des Moines.
** Cost to be shared by Clive and Urbandale.

KEY TO CHART:
* = Positive Impact on MOE
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TSM PROJECT	TSM ACTION(S)	PROJECT COST	MEASURES OF EFFECTIVENESS									
			REDUCE THE NUMBER OF ACCIDENTS	DECREASE VOLUME/ CAPACITY RATIO	REDUCE DELAY TIME	INCREASE OVERALL TRAVEL TIME	REDUCE VEHICLE MILES OF TRAVEL	INCREASE PASSENGERS PER TRIP	INCREASE ELDERLY & HANDICAPPED ACCESSIBILITY	INCREASE BUS SCHEDULE RELIABILITY	INCREASE AUTOMOBILE DRIVERS SHIFTED TO TRANSIT	REDUCE WAITING TIME
Intersection of 35th Street and NW 100th Street with University	Traffic Control Improvement	$30,000*	+	+	UNK	+	-	NI	NI	NI	NI	NI

* Cost to be shared by Clive and West Des Moines.

KEY TO CHART: + = Positive Impact on MOE - = Negative Impact on MOE UNK = Impact unknown NI = No Impact TSM PROJECT	TSM ACTION(S)	PROJECT COST	MEASURES OF EFFECTIVENESS									
			REDUCE THE NUMBER OF ACCIDENTS	DECREASE VOLUME/ CAPACITY RATIO	REDUCE DELAY TIME	INCREASE OVERALL TRAVEL TIME	REDUCE VEHICLE MILES OF TRAVEL	INCREASE PASSENGERS PER TRIP	INCREASE ELDERLY & HANDICAPPED ACCESSIBILITY	INCREASE BUS SCHEDULE RELIABILITY	INCREASE AUTOMOBILE DRIVERS SHIFTED TO TRANSIT	REDUCE WAITING TIME
Intersection of Hickman and NW 86th Street	Traffic Control Improvement, Intersection Widening	$85,000**	+	+	UNK	+	-	NI	NI	NI	NI	NI

** Cost to be shared by Urbandale and Clive.

KEY TO CHART:
* = Positive Impact on MOE
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TSM PROJECT	TSM ACTION(S)	PROJECT COST	MEASURES OF EFFECTIVENESS									
			REDUCE THE NUMBER OF ACCIDENTS	DECREASE VOLUME/ CAPACITY RATIO	REDUCE DELAY TIME	INCREASE OVERALL TRAVEL TIME	REDUCE VEHICLE MILES OF TRAVEL	INCREASE PASSENGERS PER TRIP	INCREASE ELDERLY & HANDICAPPED ACCESSIBILITY	INCREASE BUS SCHEDULE RELIABILITY	INCREASE AUTOMOBILE DRIVERS SHIFTED TO TRANSIT	REDUCE WAITING TIME
Park Accessibility for the Handicapped - Various Locations	Pedestrian-Walk and Pedestrian-Bicycle Safety Projects	$25,000	UNK	NI	NI	NI	NI	NI	+	NI	NI	NI
Bike Trails - between Gray's Lake and Hawthorne Park	Pedestrian-Walk and Pedestrian-Bicycle Safety Projects	$19,000	+	NI	UNK	NI	NI	NI	NI	NI	NI	NI
Bike Trail Rehabilitation - between Ashworth and Water Works Parks	Pedestrian-Walk and Pedestrian-Bicycle Safety Projects	$15,000	+	NI	UNK	NI	NI	NI	NI	NI	NI	NI
Sidewalk Program - City Wide	Pedestrian-Walk and Pedestrian-Bicycle Safety Projects	$150,000	+	UNK	NI	UNK	+	NI	NI	NI	NI	NI

KEY TO CHART: + = Positive Impact on MOE - = Negative Impact on MOE UNK = Impact unknown NI = No Impact TSM PROJECT	TSM ACTION(S)	PROJECT COST	MEASURES OF EFFECTIVENESS									
			REDUCE THE NUMBER OF ACCIDENTS	DECREASE VOLUME/ CAPACITY RATIO	REDUCE DELAY TIME	INCREASE OVERALL TRAVEL TIME	REDUCE VEHICLE MILES OF TRAVEL	INCREASE PASSENGERS PER TRIP	INCREASE ELDERLY & HANDICAPPED ACCESSIBILITY	INCREASE BUS SCHEDULE RELIABILITY	INCREASE AUTOMOBILE DRIVERS SHIFTED TO TRANSIT	REDUCE WAITING TIME
Downtown Skywalk System	Pedestrian-Walk and Pedestrian-Bicycle Safety Projects	$100,000	+	+	+	UNK	+	NI	NI	NI	NI	NI
Des Moines City Wide Traffic Signals, Channelization and School Crossing Protection Program	Traffic Control Improvement	$461,000	+	+	UNK	+	UNK	NI	NI	NI	NI	NI

KEY TO CHART:
+ = Positive Impact on MOE
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TSM PROJECT	TSM ACTION(S)	PROJECT COST	MEASURES OF EFFECTIVENESS									
			REDUCE THE NUMBER OF ACCIDENTS	DECREASE VOLUME/ CAPACITY RATIO	REDUCE DELAY TIME	INCREASE OVERALL TRAVEL TIME	REDUCE VEHICLE MILES OF TRAVEL	INCREASE PASSENGERS PER TRIP	INCREASE ELDERLY & HANDICAPPED ACCESSIBILITY	INCREASE BUS SCHEDULE RELIABILITY	INCREASE AUTOMOBILE DRIVERS SHIFTED TO TRANSIT	REDUCE WAITING TIME
Fleet Modernization (10 Transit Coaches)	Transit Marketing	$990,000	NI	NI	NI	NI	NI	+	+	+	+	NI
Accessory and Miscellaneous Equipment	Integration of Transit Services	$92,000	NI	NI	UNK	NI	NI	NI	NI	+	NI	NI
Maintenance of Existing Operations	Transit Route Improvement	$2,322,248	NI	+	NI	+	UNK	NI	NI	NI	UNK	NI
Management Training	Transit Route Improvement	$6,000	NI	NI	NI	UNK	UNK	+	NI	UNK	NI	NI

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TSM PROJECT	TSM ACTION(S)	PROJECT COST	MEASURES OF EFFECTIVENESS									
			REDUCE THE NUMBER OF ACCIDENTS	DECREASE VOLUME/ CAPACITY RATIO	REDUCE DELAY TIME	INCREASE OVERALL TRAVEL TIME	REDUCE VEHICLE MILES OF TRAVEL	INCREASE PASSENGERS PER TRIP	INCREASE ELDERLY & HANDICAPPED ACCESSIBILITY	INCREASE BUS SCHEDULE RELIABILITY	INCREASE AUTOMOBILE DRIVERS SHIFTED TO TRANSIT	REDUCE WAITING TIME
Iowa 46 (E. 30th) South of Dean Ave. Pedestrian Underpass	Pedestrian-Walk and Pedestrian-Bicycle Safety Projects	$89,000	+	UNK	NI	UNK	+	NI	NI	NI	NI	NI
Intersection of US 6 with 86th Street	Traffic Control Improvement	$85,000	+	+	UNK	+	-	NI	NI	NI	NI	NI
Intersection of US 6 with 63rd Street	Traffic Control Improvement	$69,000	+	+	UNK	+	-	NI	NI	NI	NI	NI
Intersection of Iowa 401 with Madison Avenue	Signal Visibility Upgrading	$35,000	+	NI	NI	NI	NI	NI	NI	NI	NI	NI

KEY TO CHART:
+ = Positive Impact on MOE
- = Negative Impact on MOE
UNK = Impact unknown
NI = No impact

TSM PROJECT	TSM ACTION(S)	PROJECT COST	MEASURES OF EFFECTIVENESS									
			REDUCE THE NUMBER OF ACCIDENTS	DECREASE VOLUME/ CAPACITY RATIO	REDUCE DELAY TIME	INCREASE OVERALL TRAVEL TIME	REDUCE VEHICLE MILES OF TRAVEL	INCREASE PASSENGERS PER TRIP	INCREASE ELDERLY & HANDICAPPED ACCESSIBILITY	INCREASE BUS SCHEDULE RELIABILITY	INCREASE AUTOMOBILE DRIVERS SHIFTED TO TRANSIT	REDUCE WAITING TIME
Intersection of Ia. 401 with NW 62nd and NW 59th in Johnston	Intersection Widening	$75,000	+	+	UNK	+	NI	NI	NI	NI	NI	NI
Intersection of Ia. 5 with SW 9th Street	Right of Way Acquisition (Intersection Improvement)	$234,000	+	+	+	+	NI	NI	NI	NI	NI	NI
I-35 Interchange with I-80 from CRI R.R. to CNW R.R.	Intersection Improvements	$500,000	+	NI	NI	+	NI	NI	NI	NI	NI	NI
US 6 from E. 37th Street to E. 38th Street	Traffic Control Improvement (Intersection Improvement)	$640,000	+	+	UNK	+	-	NI	NI	NI	NI	NI
US 69 from Park Avenue to King Avenue	Right of Way Acquisition (Mid-Block Improvement)	$275,000	+	+	+	+	NI	NI	NI	NI	NI	NI
Intersection of US 69 with Euclid	Right of Way (Intersection Improvement)	$326,000	+	+	+	+	NI	NI	NI	NI	NI	NI
Intersection of Ia. 163 with Ia. 46	Right of Way (Intersection Improvement)	$500,000	+	+	+	+	NI	NI	NI	NI	NI	NI

KEY TO CHART:
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UNK = Impact unknown
NI = No Impact

TSM PROJECT	TSM ACTION(S)	PROJECT COST	MEASURES OF EFFECTIVENESS									
			REDUCE THE NUMBER OF ACCIDENTS	DECREASE VOLUME/ CAPACITY RATIO	REDUCE DELAY TIME	INCREASE OVERALL TRAVEL TIME	REDUCE VEHICLE MILES OF TRAVEL	INCREASE PASSENGERS PER TRIP	INCREASE ELDERLY & HANDICAPPED ACCESSIBILITY	INCREASE BUS SCHEDULE RELIABILITY	INCREASE AUTOMOBILE DRIVERS SHIFTED TO TRANSIT	REDUCE WAITING TIME
Railroad Crossing at NE 3rd Street	Traffic Control Improvement	$25,500	+	NI	NI	NI	NI	NI	NI	NI	NI	NI
Railroad Crossing at SE 44th Avenue	Traffic Control Improvement	$25,500	+	NI	NI	NI	NI	NI	NI	NI	NI	NI

LIST OF STRATEGIES

a. Improve Total Vehicular Traffic Flow

b. Increase Car/Van Occupancy

c. Increase Transit Patronage

d. Increase Use of Bicycle/Pedestrian Facilities

e. Institute Work Hour Changes

f. Improve Management and Coordination of Existing Paratransit Fixed Route Transportation Systems

g. Reduce VMT

h. Reduce Vehicle Trips

TSM PROJECT	TSM ACTION	PROJECT COST	REDUCTION OF INJURIES, DEATHS AND PROPERTY DAMAGE RESULTING FROM TRAFFIC ACCIDENTS	OPTIMIZE THE PERSON AND GOODS MOVEMENT CAPACITY OF EXISTING TRANSPORTATION FACILITIES	REDUCE FUEL CONSUMED IN URBAN TRAVEL	ENCOURAGE ALTERNATIVES TO DRIVING PRIVATE AUTOMOBILES	PROVIDE GOOD QUALITY AFFORDABLE TRANSPORTATION TO THE DISADVANTAGED	REDUCE AUTOMOBILE EMISSIONS	STRATEGIES AFFECTED
Paving Modification - Intersection of 35th and NW 100th Streets with University	Intersection Improvement	$34,500	X	X	X			X	a
Intersection of 35th and NW 100th Streets with University	Traffic Control Improvement	$30,000	X	X	X			X	a
Intersection of Hickman and NW 86th Street	Traffic Control Improvement, Intersection Widening	$85,000	X	X	X			X	a
Intersection of Harbach and NW 86th Street	Traffic Control Improvement	$27,000	X	X	X			X	a

TSM PROJECT	TSM ACTION	PROJECT COST	REDUCTION OF INJURIES, DEATHS AND PROPERTY DAMAGE RESULTING FROM TRAFFIC ACCIDENTS	OPTIMIZE THE PERSON AND GOODS MOVEMENT CAPACITY OF EXISTING TRANSPORTATION FACILITIES	REDUCE FUEL CONSUMED IN URBAN TRAVEL	ENCOURAGE ALTERNATIVES TO DRIVING PRIVATE AUTOMOBILES	PROVIDE GOOD QUALITY AFFORDABLE TRANSPORTATION TO THE DISADVANTAGED	REDUCE AUTOMOBILE EMISSIONS	STRATEGIES AFFECTED
Intersection of 35th Street and NW 100th Street with University	Traffic Control Improvement	$30,000	X	X	X			X	a

TSM PROJECT	TSM ACTION	PROJECT COST	REDUCTION OF INJURIES, DEATHS AND PROPERTY DAMAGE RESULTING FROM TRAFFIC ACCIDENTS	OPTIMIZE THE PERSON AND GOODS MOVEMENT CAPACITY OF EXISTING TRANSPORTATION FACILITIES	REDUCE FUEL CONSUMED IN URBAN TRAVEL	ENCOURAGE ALTERNATIVES TO DRIVING PRIVATE AUTOMOBILES	PROVIDE GOOD QUALITY AFFORDABLE TRANSPORTATION TO THE DISADVANTAGED	REDUCE AUTOMOBILE EMISSIONS	STRADEGIES AFFECTED
Intersection of Hickman and NW 86th Street	Traffic Control Improvement Intersection Widening	$85,000	X	X	X			X	a

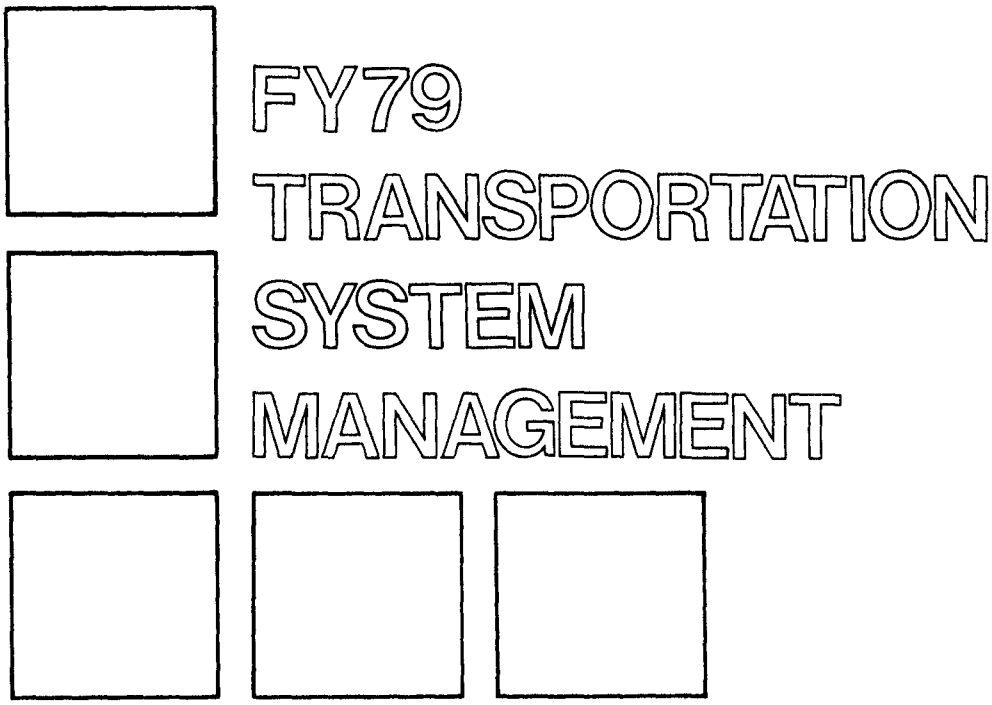
TSM PROJECT	TSM ACTION	PROJECT COST	REDUCTION OF INJURIES, DEATHS AND PROPERTY DAMAGE RESULTING FROM TRAFFIC ACCIDENTS	OPTIMIZE THE PERSON AND GOODS MOVEMENT CAPACITY OF EXISTING TRANSPORTATION FACILITIES	REDUCE FUEL CONSUMED IN URBAN TRAVEL	ENCOURAGE ALTERNATIVES TO DRIVING PRIVATE AUTOMOBILES	PROVIDE GOOD QUALITY AFFORDABLE TRANSPORTATION TO THE DISADVANTAGED	REDUCE AUTOMOBILE EMISSIONS	STRATEGIES AFFECTED
Park Accessibility for the Handicapped - Various Locations	Pedestrian-Walk and Pedestrian-Bicycle Safety Projects	$25,000	X						d
Bike Trails - between Gray's Lake and Hawthorne Park	Pedestrian-Walk and Pedestrian-Bicycle Safety Projects	$19,000	X						d
Bike Trail Rehabilitation between Ashworth and Water Works Parks	Pedestrian-Walk and Pedestrian-Bicycle Safety Projects	$15,000	X						d
Sidewalk Program - City Wide	Pedestrian-Walk and Pedestrian-Bicycle Safety Projects	$150,000	X			X			d
Downtown Skywalk System	Pedestrian-Walk and Pedestrian-Bicycle Safety Projects	$100,000	X		X	X			a,d
Des Moines City Wide Traffic Signals, Channelization and School Crossing Protection Programming	Traffic Control Improvement	$461,000	X		X	X			a,g

TSM PROJECT	TSM ACTION	PROJECT COST	REDUCTION OF INJURIES, DEATHS AND PROPERTY DAMAGE RESULTING FROM TRAFFIC ACCIDENTS	OPTIMIZE THE PERSON AND GOODS MOVEMENT CAPACITY OF EXISTING TRANSPORTATION FACILITIES	REDUCE FUEL CONSUMED IN URBAN TRAVEL	ENCOURAGE ALTERNATIVES TO DRIVING PRIVATE AUTOMOBILES	PROVIDE GOOD QUALITY AFFORDABLE TRANSPORTATION TO THE DISADVANTAGED	REDUCE AUTOMOBILE EMISSIONS	STRATEGIES AFFECTED
I-35 Interchange with I-80 from CRI R.R. to CNW R.R.	Intersection Improvements	$500,000	X	X					a
US 6 from E. 37th Street to E. 38th Street	Traffic Control Improvement, Intersection Improvement	$640,000	X	X	X			X	a
US 69 from Park Avenue to King Avenue	Right of Way Acquisition	$275,000	X	X	X			X	a
Intersection of US 69 with Euclid	Right of Way Acquisition (Intersection Improvement)	$326,000	X	X	X			X	a
Intersection of Iowa 163 with Iowa 46	Right of Way Acquisition (Intersection Improvement)	$500,000	X	X	X			X	a

TSM PROJECT	TSM ACTION	PROJECT COST	REDUCTION OF INJURIES, DEATHS AND PROPERTY DAMAGE RESULTING FROM TRAFFIC ACCIDENTS	OPTIMIZE THE PERSON AND GOODS MOVEMENT CAPACITY OF EXISTING TRANSPORTATION FACILITIES	REDUCE FUEL CONSUMED IN URBAN TRAVEL	ENCOURAGE ALTERNATIVES TO DRIVING PRIVATE AUTOMOBILES	PROVIDE GOOD QUALITY AFFORDABLE TRANSPORTATION TO THE DISADVANTAGED	REDUCE AUTOMOBILE EMISSIONS	STRATEGIES AFFECTED
10 Transit Coaches	Transit Marketing	$990,000				X			c,g,h
Accessory & Miscellaneous Equipment	Integration of Transit Services	$92,000				X			-
Maintenance of Existing Operations	Transit Route Improvement	$2,322,248		X	X	X			c
Management Training	Transit Route Improvement	$6,000		X		X			c

TSM PROJECT	TSM ACTION	PROJECT COST	REDUCTION OF INJURIES, DEATHS AND PROPERTY DAMAGE RESULTING FROM TRAFFIC ACCIDENTS	OPTIMIZE THE PERSON AND GOODS MOVEMENT CAPACITY OF EXISTING TRANSPORTATION FACILITIES	REDUCE FUEL CONSUMED IN URBAN TRAVEL	ENCOURAGE ALTERNATIVES TO DRIVING PRIVATE AUTOMOBILES	PROVIDE GOOD QUALITY AFFORDABLE TRANSPORTATION TO THE DISADVANTAGED	REDUCE AUTOMOBILE EMISSIONS	STRATEGIES AFFECTED
Iowa 46 (E. 30th) south of Dean Avenue Pedestrian Underpass	Pedestrian-Walk and Pedestrian-Bicycle Safety Project	$89,000	X		X				d
Intersection of US 6 with 86th Street	Traffic Control Improvement	$85,000	X	X	X			X	a
Intersection of US 6 with 63rd Street	Traffic Control Improvement	$69,000	X	X	X			X	a
Intersection of Iowa 401 with Madison Avenue	Signal Visibility Upgrading	$35,000	X						a
Intersection of Iowa 401 with NW 62nd and NW 59th in Johnston	Intersection Widening	$75,000	X	X	X			X	a
Intersection of Iowa 5 with SW 9th Street	Right of Way Acquisition (Intersection Improvement)	$234,000	X	X	X			X	a

TSM PROJECT	TSM ACTION	PROJECT COST	REDUCTION OF INJURIES, DEATHS AND PROPERTY DAMAGE RESULTING FROM TRAFFIC ACCIDENTS	OPTIMIZE THE PERSON AND GOODS MOVEMENT CAPACITY OF EXISTING TRANSPORTATION FACILITIES	REDUCE FUEL CONSUMED IN URBAN TRAVEL	ENCOURAGE ALTERNATIVES TO DRIVING PRIVATE AUTOMOBILES	PROVIDE GOOD QUALITY AFFORDABLE TRANSPORTATION TO THE DISADVANTAGED	REDUCE AUTOMOBILE EMISSIONS	STRADEGIES AFFECTED
Railroad Crossing at NE 3rd St.	Traffic Control Improvement	$25,500	X	X	X			X	a
Railroad Crossing at SE 44th Avenue	Traffic Control Improvement	$25,500	X	X	X			X	a



Chapter 5 •
Monitoring and Evaluation

CHAPTER V. MONITORING AND EVALUATION

The development of a Transportation System Management Element (TSME) to manage and efficiently utilize existing transportation resources requires the development of a sound data base and evaluation methodology. Such a monitoring and evaluation system makes it possible to assess the effectiveness of implemented TSM projects (e.g. how well do they help achieve TSM strategies and related objectives) and to indicate future TSM actions which should be considered for implementation.

Highway Monitoring Activities

A variety of highway surveillance activities are being conducted or are programmed for the Des Moines Urbanized Area. The following highway surveillance activities will provide the information needed to determine critical areas in terms of average travel speed, delay, capacity, safety, air pollution and energy consumption.

Traffic Counting Program

A traffic counting program will be conducted during FY 1978 on primary extensions by the Iowa DOT to obtain average daily traffic. A six block recorder count will also be conducted in the entire City of Des Moines. All traffic counts obtained in the Des Moines Urbanized Area will then be factored to vehicle miles of travel (VMT) and placed on maps to indicate traffic volume. The traffic counting program will gather the data needed for calculating volume/capacity ratios and for estimating fuel consumption.

Travel Time Studies:

Peak-hour travel time studies will be conducted every two years. Travel time along freeways and major arterials will be measured from 2nd and Grand. Average peak hour speed provides an indication of how efficiently traffic can

utilize a facility. The isochronal map of the 1977 peak-hour travel time survey is included in the analysis of highway facilities in Chapter three.

Highway Data Inventories:

CIRALG maintains a record of existing streets and highways according to their classification as interstates, freeways or expressways, principal arterials, minor arterials, collectors or local streets. The speed limits, cross sections and miles of roadway in each classification are shown in this data inventory.

Accident Studies:

The safety of highways will be evaluated by the number of accidents occurring at the top one hundred locations over a three year (1975-1977) period for the Des Moines Urbanized Area and one year for Polk County.

Capacity Studies:

The capacity of signalized intersections will also be analyzed since they, in effect, determine the capacity of a facility. Capacities will be calculated taking into consideration the factors (i.e. number of lanes, width or approach, presence or absence of on street parking, traffic signal timing, etc.) listed in the 1965 Highway Capacity Manual, Highway Research Board Special Report 87. The ratio of approach volume obtained from traffic counts-to-approach capacity (V/C) can then be used to estimate the level of service to each intersection. When this value exceeds the desired level of service, an intersection will be considered deficient in terms of capacity.

Air Quality:

CIRALG will assist the Iowa Department of Environmental Quality (IDEQ) in the preparation of the Revised State Implementation Plan. CIRALG will provide available data on population projections, emissions, transportation networks and

economic data. These data will be consistent, as much as possible, with current planning such as Transportation Planning and 208 Sewer Planning activities. The IDEQ and/or the U.S. Environmental Protection Agency's (EPA) technical consultants will provide alternatives for reduction of Photochemical Oxidants and particulates and management of an inspection maintenance program. The Iowa DOT will run the APRAC-IA diffusion model for Carbon Monoxide (CO) to determine if the Des Moines area can meet the national standards for CO.

Energy Consumption:

Fuel consumption estimates will be derived from vehicle miles of travel (VMT) data for the primary extensions and the freeway system by using national gas mileage standards.

Delay Data:

Time permitting, delay data will also be gathered to assist in the evaluation of TSM projects. Average peak hour stopped time delay measurements will be obtained at selected intersections before and after implementation of projects to assist in evaluating their effect on the transportation system.

Transit Monitoring Activities

As part of their surveillance program the MTA collects the following data: Ridership, operating and revenue data by route, by month; route data such as headway, average speed, length, location of bus stops; schedule characteristics by route; schedule adherence, miles, dead and driving time, overtime, fare schedules; and data on the number of buses by size, age, miles traveled and replacement schedule. This data will be used in the following studies:

MTA route Performance Studies:

A route subsidy analysis will be utilized to assess the productivity of existing and proposed routes. The level of service on these routes will be evaluated in terms of frequency of service, type of service offered (i.e., express, local, etc.) hours of operation (offpeak, peak hour) and the latent transit demand existing in each corridor served by a particular route.

MTA system Productivity Studies:

The productivity of the entire MTA operating system will be assessed in regard to the following elements:

1. Effect of fare changes on student ridership and system revenue.
2. Impact of marketing activities on ridership and revenue.
3. Identification of service deficiencies by comparisons of service characteristics to performance standards.
4. Transfer studies to identify schedule and route changes to accomodate transferring passengers.

Evaluation

The surveillance activities will provide the data necessary to evaluate the implemented TSM actions. Information collected through monitoring activities will provide the basis for a before and after evaluation of TSM projects implemented from the Annual Element of the Transportation Improvement Program (TIP). Improvements in highway and transit service can also be identified as a result of such an evaluation effort.

As part of the evaluation effort, 1976 Safety Projects are being analyzed in this TSM. This evaluation consists of before and after measurements of the number of accidents at each location where a safety project was implemented.

BEFORE AND AFTER ANALYSIS OF 1976 SAFETY PROJECTS

By means of this analysis the number of accidents at a particular location, before and after implementation of a safety project, can be evaluated. Before and after comparisons are made in terms of accidents per million vehicles. One year time periods before and after the 1976 safety project implementation were used. The accident rates at each location are calculated as follows:

$$\text{Accidents per million vehicles} = \frac{\text{Number of Accidents}}{\text{MEV}}$$

An accident rate which would indicate significant improvement is then calculated by:

$$Rs = Rb - K\sqrt{\frac{Rb}{M} + \frac{1}{2M}}$$

where: Rs = accident rate which would indicate significant improvement

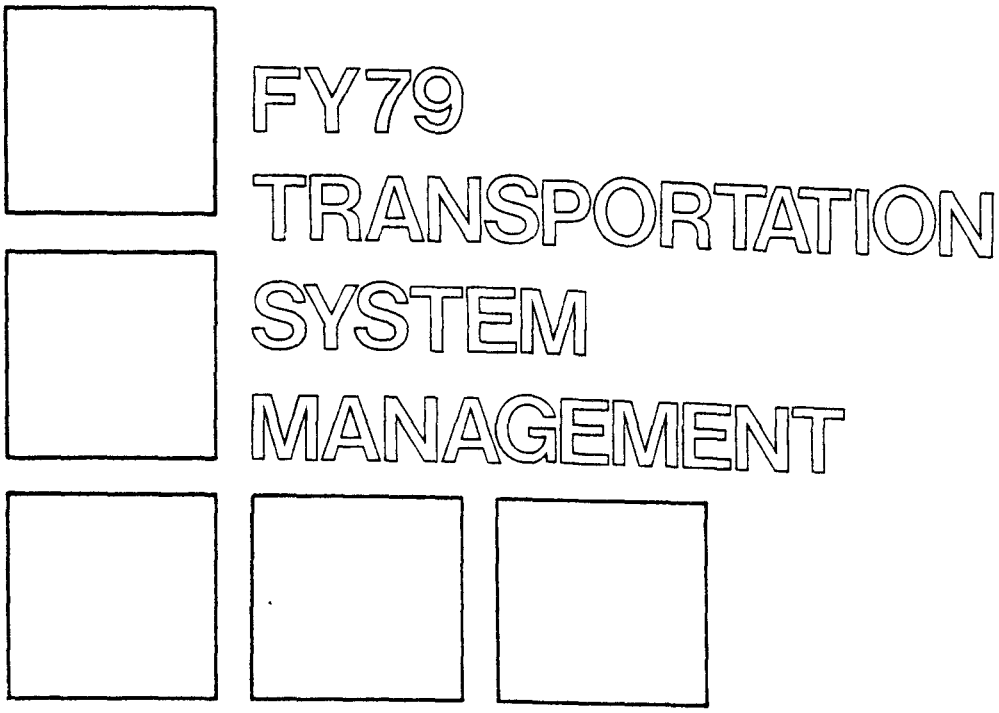
Rb = accident rate before improvement

K = Constant which corresponds to a desired level of probability. (A value of 1.5 is used, which corresponds with a confidence level of 93.3 percent)

M = Exposure at the given location in accidents per million entering vehicles.

If the Rs value is larger than the total on the right side, the improvement had a "significant" impact on the safety of the intersection. Locations with a significant change are marked with "X".

Location	Number of Accidents 1975	1976	1977	Accidents MeV 1975	1976	1977	Rs		Improvements
Keosauqua Way & Crocker Oakridge	9	3	4	1.31	0.43	0.56	0.73	X	(1/5/76) Islands and Turn Lanes were constructed
Grand Ave. & 28th, 31st, 35th & 42nd Sts.	26	20	26	1.91	1.41	1.77	1.47		(12/13/76) Existing Pre-timed Signals interconnected
Grand Ave. & 56th St.	3	0	1	0.63	0	0.20	0.19		(6/10/76) New Solid State Semi-actuated Controller installed
Keosauqua Way & 9th St.	5	1	7	0.68	0.13	0.90	0.30		(1/5/76) Island and right turn lane constructed
Guthrie Ave. & East 14th St.	8	3	5	1.01	0.38	0.61	0.53		(11/3/76) Unwarranted Traffic Signal removed
Maple St. & East 15th	16	23	15	2.41	3.32	2.08	1.83		(5/24/76) All red clear-ance Interval installed
McKinley Ave. & S.W. 9th St.	26	26	21	4.68	4.49	3.50	4.01	X	(5/13/76) Oversized signal and All red clearance interval installed
University Ave. & East 33rd St.	10	12	4	1.55	1.81	0.58	1.21	X	(6/29/76) New fully actuated signals installed
Washington Ave. & East 14th St.	11	9	5	1.34	1.07	0.59	1.08	X	(12/2/76) Temporary Signal installed



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