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SYNTHESIS OF PRACTICE PLANNING FOR SMALL AND MEDIUM-SIZED COMMUNITIES

modes
1 highway transportation
2 public transit

subject area
12 planning

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PREFACE

In December of 1978, the First National Conference on Transportation Planning for Small and Medium Sized-Communities was held in Sarasota, Florida. The results of this conference have been reported in Transportation Research Board Special Report #187, entitled, "Transportation Planning for Small and Medium Sized-Communities." The conference at Sarasota represented the first major attempt to bring together professionals experienced and knowledgeable in transportation planning methodologies and techniques applicable to small and medium-sized communities. The objectives of the conference were to provide for the exchange of experience among a sample of practitioners engaged in transportation planning for cities of fewer than 200,000 people, to provide guidance for transportation policies and programs, to foster the development of future activities in this area, and lastly, to provide a document (SR #187) that would reflect the proceedings of the conference and serve as a basic resource for practitioners, administrators, and policy-makers.

The conference recognized the need for greater local understanding, participation, and use of technical expertise as a major objective of the emerging transportation planning era for small and medium-sized cities, and that this can no longer be accomplished by the use of overly complex and unrealistic long-range plans that, because of financial and other institutional problems, can be implemented only with difficulty. Other conference findings and recommendations were as follows:

- o Improve communication between the planner and the decision-maker;
- o Local determination of goals, problems, and planning processes;
- o Sharing of technical assistance among various public and private entities;
- o Sharing of techniques;
- o Reduction in the administrative burden inherent in the transportation planning process; and
- o Flexibility in the use of available financial-aid programs.

As a result of this first effort to focus attention on transportation planning for small communities, the Transportation Research Board's committee (ALD05) on Transportation Planning for Small and Medium-Sized Communities appointed in June, 1979, a taskforce to define the objectives, scope, and purposes of a follow-up project on this subject, recognizing the issues and problems that surfaced at the first conference. This Synthesis of Practice is the result of that effort and represents an objective of providing case studies on issues pertinent to the smaller urban areas. Implicit in this objective and this synthesis is the desire to foster periodic updates to reflect new experience and results.

This Synthesis of Practice represents an initial effort to identify and document a number of informative case studies surrounding four distinct topic areas of significant interest to the smaller urban areas:

- o Assessing growth effects
- o Data collection and management information systems
- o Public transportation services
- o Programming, financing, and communicating with decision-makers.

In the synthesis report are twenty-six (26) case studies representing issues and experience in these four topic areas. These case studies represent only a beginning in developing more complete coverage of the wide spectrum of issues, problems, approaches, and results of interest to potential users--the practicing professional. Although there are significant issues which were not addressed, it is the intent of this report to foster a momentum for future revisions and updates through the Synthesis of Practice series of the Transportation Research Board. Readers are encouraged to direct inquiries and case studies to the TRB standing committee on Transportation Planning for Small and Medium-Sized Communities (ALD05).

ACKNOWLEDGMENTS

Documentation for the case studies noted below was contributed by the following individuals:

Downtown Revitalization - James L. Youngquist,
Executive Director, Green River Area
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Determining Downtown Traffic Patterns - Charles W.
Manning, Vice President,
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Turning Movement Traffic Volume Data Collection
and Processing of Moving Vehicle License Tag
Origin-Destination Studies - Willis R. Deaton,
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Conducting a Community Transit Survey - David J.
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Joint Development Proposal Utilizing Public/
Private Funds - Montie G. Wade,
Study Director, Texarkana Urban Transportation
Study.

Utilization of a Road Impact Fee System -
Catherine L. Ross, Assistant Professor,
City Planning Program, Georgia Institute
of Technology.

Role of Functional Classification in Programming
Street Improvements - Michael T. Cousino,
Director of Public Works, City of Eau Claire.

Transit Operations - All case studies were derived
from Kirby, R. and G. Miller, A Casebook of
Short-Range Actions to Improve Public Trans-
portation.

INTRODUCTION

Transportation practitioners in small to medium-sized urban areas face a diversity of challenges in providing timely information to support local decisions concerning the scope, quality and magnitude of the local transportation system. Planners in these areas are becoming involved in a broad array of traffic, transit and street operational and management issues in addition to their traditional responsibilities for developing comprehensive transportation plans. The span of typical planning decisions can involve traffic operational improvements to enhance traffic efficiency and traffic safety at spot locations or along major corridors; development of plans for constructing new elements of the transportation system to divert traffic around congested areas or to enhance system continuity; assessment of the local traffic impacts resulting from new land use development; establishment of a priority program to correct the physical deterioration of the roadway system through implementation of a maintenance and reconstruction program; and financing transportation improvement programs.

All too frequently the planning resources and personnel available in smaller communities are limited, mandating development of a simplified planning approach oriented to specific problem issues. With the identification of 95 new urbanized areas by the Bureau of the Census, there are additional communities seeking the advantages of a formal transportation planning effort. With a limited number of professional planners and high turnover in local planning personnel, the planning process must be tailored to the specific characteristics of the urban area. The characteristics of each community in terms of transportation problems, issues, resources for planning, improvement possibility and growth prospects will help define the need for selected short and long range treatments as well as appropriate planning procedures. For example, in some situations, urban areas are being subjected to rapid development, placing pressure on the local planners' ability to provide timely information concerning modification of the transportation system to accommodate new land use development. Of particular concern are localized traffic impacts resulting from the development of new activity centers such as shopping centers, office parks, subdivisions, and apartment complexes. A rapidly growing population base then requires the transportation system to be modified to address the major issues of traffic congestion and safety. Some communities have participated in or completed a conventional "3-C" planning process with development of a localized planning resource base, while other communities have recently become urbanized and are without the benefit of a formalized transportation planning effort. For areas without a data resource base, simplified planning relationships and computational aids (field collection procedures) are available to permit quick assessment of alternative capital improvement and transportation management strategies. While main-frame computers and complex traffic models are beyond the resources of many planning agencies, simplified versions of these models oriented to micro-computers and manual procedures, relying on transferable parameters and secondary data sources, are available to address specific issues.

Stagnation or decline in the local economic base and population may be characteristics of other small and medium-sized urban area situations. Essential transportation services have to be provided but with

a declining resource base. In some communities, an aging population means increases in the non-auto-driving population and increases in those seeking to maintain essential mobility through public transportation. Here, planning requirements will differ from those applied in areas of rapid population growth and economic development. In other situations where predictable patterns in traffic growth are confined to well defined influence areas, local planning staffs may forecast future traffic volumes based on factors derived from the extrapolation of historical traffic data. Additionally, transportation represents only one element to be considered in a community's comprehensive development plan. Each community must exploit its own unique combination of transportation, commercial, and residential, etc. development opportunities into a mutually supportive planning effort.

The planning "level of effort" approach must be scaled to the nature of the problem, and finances for planning and implementation and technical assistance must be available from state and regional governments. Innovative efforts to implement a problem oriented planning approach in which the planning activities respond to problem definitions have met with success. Many of these applications utilize quick response/transferable parameters to avoid relying on large scale data collection and traditional modeling methods. Further, these procedures support the concept that maintaining the credibility of the planning process requires timely response to issues.

Public transit offers additional opportunities to implement a problem oriented approach to deliver cost-effective transportation services in small and medium-sized urban areas. Rather than relying on a single service concept to meet all needs, the services provided are tailored to the mobility needs of particular user groups. For example, fixed route service might be provided for commuters during the peak period; at the mid-day hours, route deviation or door-to-door services might be provided for the transportation disadvantaged. In areas without public transit services, emphasis can be placed on utilizing existing resources such as local taxi companies to offer shared-ride taxi service. A user-side subsidy program offers a simple means to administer a transit program, reimbursing the provider for only the trips delivered and providing a simple mechanism to discount fares for various transportation disadvantaged user groups.

For transportation programs to be implemented and information effectively communicated to decision makers, priorities need to be determined, project programs developed and innovative financial arrangements, including cooperative private and public contributions, defined. Planning is only as effective as it is able to provide meaningful information within a time frame to support decision making and also communicate findings in such a manner as to enhance public understanding of the consequences of alternative actions. Innovative examples of programming and creative financing also have met with success and have potential for transfer to other areas.

The basic premise of this synthesis report is that because of limited planning resources and staff, it is important that examples of planning techniques be disseminated to practitioners responsible for making transportation decisions in small and medium-sized communities. Frequently, ideas and techniques effectively utilized in one locality can be modified for transfer to another.

Objective

The objective of the synthesis report is to provide practitioners responsible for delivering transportation services and undertaking transportation planning decisions in small and medium-sized urban areas (less than 200,000 population) with case study examples of effective planning approaches towards solving local transportation problems. The synthesis will serve much as a technical directory by identifying contact individuals from whom users could obtain additional information and details.

The steering committee on transportation planning for small and mediumsized communities identified a selected sample of effective planning approaches used to address major transportation issues or problems encountered in small and medium-sized urban areas. Inclusion in the synthesis does not imply endorsement of any particular technique, but only attempts to stimulate thinking about a particular approach. Likewise, the committee understands there are additional approaches which, because of oversight, lack of suitable data, etc., could not be included in the document. It is anticipated that the synthesis will serve as a catalyst and encouragement to include these approaches in subsequent versions of the report.

Case Studies

In the synthesis of practice for small and medium-sized urban areas, twenty-six (26) case studies will be presented in four distinct topic areas:

1. Assessing growth effects
2. Data collection and management information systems
3. Public Transportation Services
4. Programming financing and communicating with decision makers.

A list of the case studies follows.

<u>Case Study</u>	<u>Problem Statement</u>
Downtown Revitalization	Use of "problem oriented" planning effort to suggest how a small community can best exploit the unique opportunities available for downtown revitalization. Reliance was placed on utilizing a volunteer design team approach.
Transportation System Management Corridor Improvement	Use of a simplified "problem oriented" approach to prepare a transportation system management plan for a corridor with low to moderate growth.
Assessing Traffic Impacts of a Land Use Change	Use of simplified traffic estimation procedures to determine the traffic impact of a major land use development on the street system in the immediate vicinity of the project.

Case StudyProblem Statement

Determining Downtown Traffic Patterns

Use of a simplified planning procedure to evaluate the impact of alternative downtown circulation patterns, downtown development and parking lot location.

Assessment of Impact of Zoning on Traffic Patterns

Use of simplified traffic forecasting methods to provide a quick assessment of localized transportation impacts resulting from the full development of a residential subdivision under current zoning regulations.

Assessing Needs for a Downtown Bypass

Use of simplified traffic estimation procedures to identify the need for and location of a cross-town arterial to divert traffic from a congested downtown area.

Determining Traffic Volumes for a Street System

Use of microcomputers in conjunction with simplified traffic estimation procedures to forecast traffic volumes on a community's street system.

Developing an Areawide Circulation Plan

Use of a comprehensive circulation plan to define future transportation needs for a small to medium-sized city.

Turning Movement Traffic Volume Data Collection

Use of a microcomputer to simplify turning movement traffic counts.

Collecting and Processing of Moving Vehicle License Tag Origin-Destination Studies

Use of microprocessors to summarize moving vehicle licenses tag multistation origin-destination studies.

Developing a Transit Management Information System

Use of microcomputer to simplify the processing and reporting of data concerning the utilization and performance of a transit system.

Conducting Community Transit Survey

Use of a citizen survey to increase public awareness of transit, measure willingness to pay a local tax to finance transit and determine the importance of various attitudes and personal characteristics to support transit.

<u>Case Study</u>	<u>Problem Statement</u>	<u>Case Study</u>	<u>Problem Statement</u>
Analysis of Alternative Fare and Service Proposals	Use of microcomputer to study the relationship between transit subsidy level, fare, ridership and service.	Transit Services (Special User Groups)	Establishment of a reduce taxi rate program to increase the mobility of elderly and handicapped residents. Ultimately transit service was extended to the general public through the provision of fixed route bus services using unique administrative procedures for involving private operators and reimbursement through a user-side subsidy program.
State/Local Bus Pooling Agreement	Establishment of a state-wide buspool purchase program to reduce the cost of purchasing bus vehicles.	Transit Services (Special User Groups)	Establishment of a user side subsidy to allow the mobility disadvantaged to use the taxi as a more preferred mode of travel. Shared ride taxi service was provided to eligible elderly and handicapped users at a fifty percent fare discount.
State/Local Cooperative Maintenance Agreements	Establishment of cooperative agreement between state and local governments for routine functions such as snow removal or maintenance in order to provide maximum services for the dollar.	Transit Services (Reduce Private Vehicle Use)	Development of a comprehensive employer-based rideshare program involving vanpools, carpools and express buses to reduce downtown parking needs and reduce vehicle miles to travel by private commuter vehicles.
Joint Development Proposal Utilizing Public/Private Funds	Use of creative financing to combine various public and private funding sources to implement a multi-purpose joint development project.	Transit Services (Reduce Private Vehicle Use)	Establishment of an auto management and pricing mechanism supplemented with shuttle transit service to limit non-resident on-street parking in a neighborhood adjacent to a popular beach area.
Utilization of a Road Impact Fee System	Implementation of a road impact fee paid by developers to compensate for expected traffic impacts on roads operating over capacity.	Growth Effects	
Role of Functional Classification in Programming Street Improvements	Use of functional classification as a tool to guide decisions concerning operation of the local street system.		
Street Maintenance Prioritization Program	Use of a preventive maintenance program to define needs and priorities, monitor programs and communicate street needs to the public.		
Transit Services (General Purpose Travel)	Operation of a flexible transit service in a high income suburban community in order to reduce reliance on private autos for commuting and also to increase the mobility of the transportation disadvantaged during off-peak hours.		
Transit Services (General Purpose Travel)	Operation of a shared-ride taxi service to increase the community-wide mobility of local residents living in a suburban community of a large metropolitan center.		
Transit Services (General Purpose Travel)	Operation of a general purpose public transportation system in two small towns responsive to the mobility needs of a number of different travel markets.		

Simplified planning procedures that support issue oriented planning programs have emerged over the last decade to provide a flexible planning approach which is particularly responsive to the needs of small to medium-sized cities. Rather than strictly relying on the conventional "3-C" process to assign future traffic to a base year traffic network in order to define deficiencies, a problem oriented approach has been adopted. Problem identification, data availability and the decision making time frames then drive the technical analysis. In slow to moderate growth environments, simple growth factors might be utilized and the planning issues addressed without use of conventional traffic estimate procedures. In other situations, traffic volumes might be estimated at key intersections to test the integrity of suggested transportation management improvements over a 10 year period.

Rapid growth, however, may dictate the use of conventional traffic estimation procedures: trip generation, trip distribution and traffic assignment for forecasting future traffic volumes as a function of changes to the transportation network and/or alternative land use development scenarios.

Selection of the specific analysis method and area of analysis depends on the scale of the problem--a subarea undergoing rapid land use change; a traffic corridor being viewed as a bypass to a congested downtown area; or development of a comprehensive community-wide circulation plan.

Of particular attention is development of the "Quick Response Procedures" outlined in NCHRP 187. These techniques rely on the conventional modeling approaches of trip generation, trip distribution and traffic assignment with the presence of transferable parameters pooled from other areas. Although the quick response techniques were initially envisioned as manual procedures, much of the information is amenable to microcomputers and to main-frame computers, where planning staffs enjoy easy access to computer terminals. Where previous computer efforts relied on extensive network coding and primary data collected on an areawide level, the quick response approach can be mixed and matched with locally derived data. For example, previously calibrated trip generation relationships might be utilized in conjunction with friction factors scaled from nomographs presented in NCHRP 187. Planners are limited only by their creativity in interfacing local data resources and the transferable parameters presented in the NCHRP 187 document.

In addition, micro-computers offer advantages to local planning agencies in quickly testing a number of alternative socio-economic scenarios and transportation alternatives. The quick response planning techniques are easily adaptable to micro-computers, offering local planning bodies an effective means of implementing a problem oriented planning approach.

Table 1 reviews the major growth effect case studies presented in this synthesis of practice. For simplicity, the eight case studies are divided into two distinct groups: areas of slow to moderate growth and areas of rapid growth. Of interest with each case study is how the technical analysis was selected to respond to a community's unique problem issues. The case studies do not suggest that one approach should replace other approaches, but rather that each problem has its own application and based on the type of analysis being conducted the user should select the technique most applicable to the available technical and data resources available.

Data Collection and Management Information Systems

Transportation planners in small to medium-sized communities frequently must operate in an environment of limited resources and technical staff to collect, analyze and retrieve primary data. Procedures that can simplify data collection and analysis then can enhance the opportunities of planners to respond in a timely manner to a range of issues that decision makers might present. Innovative approaches have been developed to maximize the effectiveness of data collection, analysis and retrieval. Just as the microcomputer is serving to simplify traffic analysis in small to medium-sized cities, the technology of the microprocessors can be adapted to simplify the collection, analysis and reporting of primary data. Two case studies are presented to identify the application of micro-processor technology to simplifying the collection of intersection turning movements and license plate origin-destination surveys. The third case study presents an example of a transit management information system being developed on a micro-computer for a medium-sized transit operation.

Public Transportation Services

In small and medium-sized urban areas, public transportation services can be provided that are both cost-effective and responsive to local mobility needs. Whether fixed route, shared-ride taxi or commuter ridesharing services are provided, it is important that transit planners and operators select transit concepts that address specific mobility concerns and also maximize the communities' existing resources of public transportation services.

Seven case studies illustrate how flexible transit services have been developed to meet the mobility needs of the general public or special user groups such as the transportation disadvantaged. Rather than relying on a single service concept to address the needs of all market groups, success has been achieved by tailoring the service to the needs of specific markets.

In Westport, Connecticut, a flexible transit service has been developed to transport commuters to a rail station during the peak hours and to serve general community travel needs with route deviation services during the mid-day period. Fare discounts and door-to-door services (with advanced trip requests) are available for the elderly and handicapped, while package delivery services are also provided. In the suburban area of Hopkins, Minnesota, reliance was placed on taxi operators to provide, upon advance request, shared ride taxi service to residents for trips within the city boundaries. In addition, a user-side subsidy mechanism offered an efficient means of administering the program, achieving the benefits of reducing the provider's recordkeeping requirements, increasing the efficiency in providing shared-ride services and serving as a simple mechanism for charging reduced fares to mobility disadvantaged groups. In Winona and Goodview, Minnesota, a market oriented transit service has doubled transit ridership over the previous fixed route bus service. In peak periods, service was oriented to commuters with fixed route service between residential and work locations. During the midday, route deviations were permitted to meet the travel needs of the disadvantaged seeking door-to-door service. Weekend and evening subscription/charter service was provided for persons attending group functions.

In Danville, Illinois and Kinston, North Carolina, two communities without a public transit service, shared-ride taxi services were provided to increase the mobility of the elderly and handicapped. In order to assist disadvantaged groups in paying the cost of taxi service, a user-side subsidy program was provided with a 25 to 50 percent reduction in fares. These services were found to be of particular importance to a small segment of the mobility disadvantaged group--the elderly and low income who came to rely extensively on the program.

Auto pricing mechanisms and ridesharing programs are examples of programs that can be undertaken to reduce private automobile use. The Tennessee Valley Authority employer-based rideshare program in Knoxville, Tennessee and the Santa Cruz non-resident parking price program highlight local actions that can be taken to effectively reduce parking problems along with meeting other transportation objectives.

Programming, Financing and Communications with Decision Makers

For planning to be successful, recommended actions must be translated into specific programs

TABLE 1. GROWTH EFFECTS CASE STUDIES

COMMUNITY	AREA	PROBLEM	INNOVATION PLANNING APPROACH	TRAFFIC ESTIMATION APPROACH	COMPUTATIONAL TOOLS
Owensboro, Ky.	Downtown	Revitalization of downtown area	Use of volunteer design assistance team to prepare downtown revitalization plan	Historical trend data	-----
Lewiston, Maine	Corridor	TSM plan for slow growth traffic corridor	Simplified TSM Corridor study techniques	Growth factors	-----
Shreveport, La.	Subarea	Impact of site development on local street system	Simplified planning procedures-traffic estimation	NCHRP 187 Quick Response User's Guide	Manual/calculator
Glen Falls, N.Y.	Subarea	Evaluate the impact of downtown circulation patterns and downtown parking facilities	Simplified planning procedures-traffic estimation	Interactive route assignment process	Microcomputer
Brevard County, FL.	Subarea	Update 20 yr. transportation plan based on maximum growth of sub-area	Supplement areawide models with simplified planning procedures-traffic estimation	NCHRP 187 Quick Response User's Guide and previous areawide computer analysis	Manual/calculator
Hot Springs, Ark.	Corridor	Determine need for an arterial bypass to downtown area	Supplement local external O-D data with simplified traffic estimation procedures	NCHRP 187 Quick Response User's Guide and external O-D data	Manual/calculator Traffic assignment computerized
Central Massachusetts Regional Planning Council	Subarea and corridor	-Test TSM improvements for downtown area: Current and 10 yr. needs -Major arterial bypass to downtown area	Simplified planning procedures-traffic estimation Developed for a micro-computer	NCHRP 187 Quick Response User's Guide and local data	Microcomputer
Santa Maria, Calif.	Community circulation plan	Define future transportation needs	Simplified planning procedures-traffic estimation	NCHRP 187 Quick Response User's Guide and external O-D data	Manual/calculator (trip distribution computerized)

and projects that can be implemented. The implementation process usually involves programming, assessing programming priorities and then developing financial packages reflecting the available level and mixture of financial resources. Tight fiscal times have encouraged some small and medium-sized cities to develop innovative financial arrangements to maximize private sector involvement and effectively pool financial resources between public bodies. Ultimately, the entire implementation process relies on communicating transportation needs and programs to decision makers and the public in a logical and concise fashion.

This section presents eight case studies, six of which describe innovative approaches towards financing. In one community, a simplified transit service supply estimation technique has been adapted to a microcomputer to provide transit managers with a tool by which a number of alternative transit funding and service proposals can be studied, either separately or simultaneously. The ability to study a greater number of service and fare proposals enhances the opportunity to identify a fiscal plan which will be most effective in providing transit services for the levels of resources available. Prior to reaching financial decisions, citizen surveys can be conducted through relatively low cost telephone interviews. These surveys can be a useful tool to gauge public awareness of the issues and determine the public's willingness to increase their tax responsibility. Planners can communicate to the public a range of possible choices and the likely implications of these choices and receive timely feedback to guide financial decisions. Such a technique has been effectively utilized in Council Bluffs, Iowa.

Two case studies highlight approaches demonstrating how state and local governments can work cooperatively to achieve maximum use of transportation resources through establishment of a statewide buspool purchase program and cooperative maintenance agreements. Also, an example of a creative financing package utilized in Texarkana for the construction of the Four States Fair joint development project is presented.

In order to encourage private sector financial participation in transportation improvements, a Traffic Impact System (TRIPS) computerized traffic model is used in Broward County, Florida to predict the traffic consequences resulting from a specific development proposal. Developers are assessed a road impact fee to compensate for expected traffic impacts on roads operating in excess of capacity.

Overall planning, programming and financing are interrelated and rely on effective communications with decision makers and the public. In one small to medium-sized community, functional classification has been used as a tool to manage the community's street system by communicating to all interested parties a consistent set of policies concerning establishment of a street capital improvement program, establishment of street maintenance priorities, establishment of traffic control devices, and review of developers' proposals for land use changes on the location of public facilities. Functional classification then can become a means of communicating and coordinating policies concerning the operation and logical development of the street system between various city departments, decision makers and the public.

One community, Ft. Collins, Colorado, has developed an effective multi-year street maintenance program at substantially increased levels of funding by soliciting public support. Here the local street

system was communicated to local decision makers as a community investment requiring timely preventive maintenance to preserve its value. Communications became an integral aspect of the programming and financing arrangements comprising the street system maintenance program.

SUMMARY

Although each of the 26 case studies has been discussed under one of the four subject areas, there are obvious interactions between the subjects. Table 2 provides a primary and secondary classification for each of the case studies and also indicates functional elements of the transportation system under consideration and the potential users of the case studies.

References:

1. COMSIS Corporation, Quick-Response Urban Travel Estimation Manual Techniques and Transferable Parameters: Users Guide, National Cooperative Highway Research Program, Report 187, Washington, D.C., 1978.
2. Jones, K. and E. Philips, Interim Report, Fayetteville-Springdale, Arkansas Case Study in Transportation Planning. Paper presented at Transportation Research Board, January 1983.
3. Transportation Planning for Small and Medium-Sized Communities: Proceedings of a Workshop. National Cooperative Highway Research Board Special Report 187. 1980.

CASE STUDIES:

GROWTH EFFECTS

Topic Area: Growth Effects--Slow to Moderate Growth (Downtown Revitalization)

General Issue Being Addressed:

Development of a quick response "problem oriented" planning effort suggesting how a small community can best exploit the unique opportunities available for downtown revitalization. The planning approach reflects adopting a comprehensive approach utilizing the resources of a volunteer design assistance team to present recommendations on the interrelationships between commercial, economic, riverfront and residential developments and downtown transportation improvements.

Potential Users of Case Study:

Local decision makers, community leaders, downtown business leaders and planners in small to medium-sized cities.

Problem Statement:

Owensboro, Kentucky, is typical of many smaller communities where the major arterial street improvements completed in the 1960's resulted in the encouragement of suburban and strip development. With the completion of a new suburban mall and convention hotel, located just off the CBD core, the downtown area was put at an economic disadvantage. Owensboro, with a population of 55,000, serves as a regional trade center for central Western Kentucky. Yet the non-CBD location of the mall and convention center left the downtown area with a limited competitive commercial structure. Previous efforts focusing on "big project" revitalization in the downtown area failed due to a multiplicity of problems.

Approach:

The design team approach placed emphasis on revitalizing Owensboro's CBD, not just by building another shopping center, but rather by reflecting on the location's unique opportunities--its 19th Century Victorian commercial structures and waterfront location. Planning was conducted on a comprehensive basis with the realization that the downtown area might not emerge as the dominant retail center and the available resources should be used in whatever means could best serve to revitalize the CBD. A unique planning effort, relying on time volunteered by a team of professionals, was utilized to provide timely response. The design team was assembled through a joint effort of the Kentucky Society of Architects and the Department of Community and Regional Development (now the Department of Local Government) for the Commonwealth of Kentucky, calling itself the Kentucky Design Assistance Team (KyDAT). KyDAT was organized following the format of the highly successful Regional/Urban Design Assistance Teams Program of the American Institute of Architects.

"The program was developed as a public service program to assist Kentucky communities with their urban design problems. In each instance, a highly motivated team of volunteer professionals such as architects, planners, engineers, attorneys, developers, sociologists and financial advisors, visit a community with the intent of preparing a report on that community, with recommendations dealing with the city's history, its aims and intentions for the future, its physical structure, its traffic patterns, its demographic characteristics, its economic well being, and other factors which may be identified as being appropriately studied. The program encourages a city to take advantage of existing assets and potential opportunities, while dramatizing the importance of good urban design."¹

Before the entire KyDAT team came to Owensboro, a reconnaissance team came to the City first to talk with citizens, businessmen and government officials about their impressions of the Owensboro CBD. The emphasis from public officials was that the KyDAT team could be most beneficial to the City if they came up with some financial guidance and a feel for what buildings in the CBD it would be economically feasible to rehabilitate. During one weekend, the entire KyDAT team worked with the public and private sector to prepare a comprehensive and complete direction for the revitalization of the CBD. Before the work sessions began, the team outlined six different stages of effort which would lead to the completed plan on the final day of the exercise. The six stages were:

1. General overview and scrutiny of the City of Owensboro. This included surface and airborne explorations for familiarization.
2. Explicit examination of previous plans, economic trends, etc. to identify factors influencing CBD development potential. This effort included extensive interviews with as many concerned parties as possible as well as

investigation of previous planning efforts.

3. Specific evaluation of cause and effect relationships affecting the CBD and the identification of past to conceptual recommendations.
4. Subteams were staffed according to members' expertise to develop conceptual recommendations.
5. Team critique of concepts leading to final consensus.
6. Some restatement preparation. The intention of the summary statement was to present conceptual recommendations for revitalization of the Owensboro CBD.²

Results Achieved:

Recommendations which resulted from the KyDAT visit focused on the areas of commercial development, transportation and parking, residential development, riverfront development and economic development.

Six major recommendations were made by the KyDAT Transportation "Subteam" which pertain to transportation and parking in the revitalization effort. They were as follows: First, the City should consider an ordinance preserving the status quo of off-street parking and another requiring new businesses to provide off-street parking for their employees. Second, the City should remove parking meters, allowing free two-hour parking which would be enforced by marking tires and pavement. Third, North/South streets should be changed to one-way in couplets to provide increased on-street parking spaces. Fourth, the City should make an effort to acquire substandard and nonhistorically significant buildings adjacent to the proposed historic district that could be razed for municipal parking lots. Fifth, parking for the state office building should be relocated to the proposed county/state parking structure on the south side of Second Street. Last, a professional traffic engineer should be hired on a consultant basis to develop a parking and traffic plan for the downtown.

As a result of the six recommendations, the City did adopt an ordinance removing parking meters and allowing two hour free parking on streets. The City is experimenting with one North/South couplet and has provided angle parking which has increased parking on those two streets. Thus far, the response to the one-way couplet and the additional parking has been favorable. These changes in turn have addressed one of the concerns of the merchants and the public in their discussions with the KyDAT team, that being the noncontinuity and quick flow of the traffic through the downtown which was perceived as a detriment to shoppers when walking from one shop to another. In addition, there have been improvements made to street markings, particularly the marking of pedestrian crosswalks to provide a more cohesive atmosphere for the pedestrian.

Potential Transferability:

The Owensboro case study highlights the utilization of a unique resource, a design assistance team of multi-disciplinary professionals who help assess a community's potential for development. Further, the case study identifies

that revitalization plans must consider the unique resources of a particular community and the interrelationships of urban functions including transportation.

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References:

1. Kentucky Design Team Program Informational Brochure of Kentucky Society of Architects, AIA.
2. Downtown Owensboro. Kentucky Design Assistance Team, Downtown Owensboro, Inc., and Owensboro Metropolitan Planning Commission, March 1982.

Topic Area: Growth Effects--Slow to Moderate Growth (Transportation Systems Management Corridor Improvements)

General Issue Being Addressed:

Use of a simplified "problem-oriented" approach to preparing a Transportation Systems Management improvement plan for a corridor with low to moderate traffic growth potential.

Potential Users of Case Study:

Planners working in small to medium-sized communities with low to moderate growth potential, but traffic operational problems along a major corridor.

Problem Statement:

The Lisbon Street corridor in Lewiston, Maine, population 60,000, is 2.4 miles long and runs from the CBD area to the outer boundary of the urban area. The corridor is dominated by Lisbon Street and has a mature land use pattern with historically low to moderate rate of travel demand growth. No significant actions are expected to dramatically alter travel patterns, nor are there any system improvements expected to alter travel characteristics within the corridor.

Approach:

A simplified Transportation Systems Management planning approach was developed to plan for a corridor dominated by a single major arterial with low to moderate growth potential. The planning approach systematically structured traditional traffic and highway engineering, planning, and evaluation techniques into a series of independent, simplified corridor studies. Maximum emphasis is placed on utilizing commonly available transit and highway data and simplified techniques to estimate travel demand changes. The example is one of a "problem-oriented" planning approach.

Results Achieved:

The major steps involved in conducting the arterial study included:

Problem Definition - used factual information, perceived problems or issues, legislative and regulatory requirements and/or achievement of policy objectives to define the key traffic

issues affecting the corridor. In many cases, the problems related to perceived unacceptable levels of accidents, congestion or physical deterioration.

Study Area Definition - based on identification of the problems, the study area is defined to bound the improvement actions and the extent of impacts.

Select Planning Approach - based on definition of the problems, an appropriate planning strategy was selected, including type of analysis, data resources and identification of specific technique. With land use stability and slow growth, it becomes appropriate to emphasize immediate actions to satisfy existing conditions.

Existing Condition Appraisal - use field observations and secondary data sources to define the extent and magnitude of perceived problems, identify other deficiencies and seek out the causal factors contributing to the deficiencies. A systematic evaluation framework with standards and threshold levels can be used to evaluate the operational performance and physical integrity of the transportation system.

Future Conditions - utilize historical traffic growth trends to estimate future traffic volumes, to define additional deficiencies that might arise during the planning period and to insure improvements will be adequate for future periods. Because of the stable traffic patterns, simple growth factors were applied as traffic estimation procedures.

Develop and Evaluate Improvements - suggest specific improvements to overcome deficiencies and make sure "system effects" are duly recognized. Deficient locations are typically grouped into common sections for analysis.

Design - develop specific improvement proposals using standard traffic engineering and highway engineering improvements. It is important that projects be conducted in the corridor so that actions taken at one location are compatible with those taken at adjacent locations.

Implementation and Programming - individual actions are grouped into program packages and priorities established by a technical and policy committee through a series of formal ranking procedures.

The Lisbon Street Corridor Study shortened the time required for implementation and also served as a management tool for continued short range improvements.

Potential Transferability:

Has high transferability to other slow to moderate growth corridors.

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Topic Area: Growth Effects--Rapid Growth (Subarea Analysis)

General Issue Being Addressed:

Use simplified traffic estimation procedures to determine the traffic impact of a major land use development on the street system in the immediate vicinity of the project.

Potential Users of Case Study:

Transportation engineers and urban planners in small to medium-sized cities concerned with a site impact analysis.

Problem Statement:

A 78 acre shopping mall employing over 1000 individuals and requiring about 4000 parking spaces was scheduled for construction in an area of Shreveport, Louisiana, experiencing rapid growth. Local officials were concerned about the short-term traffic impacts resulting from the mall and desired to receive recommendations on remedial actions that could be taken to reduce congestion.

Approach:

The planning approach utilized the conventional three step traffic forecasting process of trip generation, trip distribution and traffic assignment. First, the street system surrounding the mall was identified and the key intersections were designated for a level of service determination. Fourteen analysis districts were defined in terms of the area potentially to be exchanging work and shopping trips with the mall.

Second, traffic counts were obtained for the major intersections surrounding the mall in order to obtain base ground count data.

Third, home based work trips attracted to the mall were estimated by the estimated total number of employees at the mall divided by average auto occupancy. Shopping trips were estimated based on leasable floor space at the mall. All trips were factored to a PM peak hour time period prior to use of a manual gravity model to distribute the trips attracted by the mall to the fourteen analysis districts. Travel time contour information was already available for use in estimating friction factors from the nomographs outlined in NCHRP 187 Quick Response User's Guide.

An all-or-nothing assignment was conducted to determine the number of peak hour trips attributed to the mall. Local knowledge was utilized to define the minimum path routes. Forecasted traffic loads on the key intersections were obtained by adding mall oriented work and shopping trips to existing ground counts. A level of service analysis was then conducted, using the critical movement summation technique to define intersection level of service.

Results Achieved:

Given the level of service that key intersections will operate at when the mall opens, a series of improvements were considered including:

1. Improved or new transit service
2. Ridesharing
3. Construction of new turning lanes
4. Traffic signalization at points of ingress/egress to the mall

Potential Transferability:

Local planners concerned with determining the short-term transportation impacts resulting from the construction of a new activity center such as a shopping center, office park, industrial park, etc. Limited amounts of primary data need to be collected; only current turning movements at key

intersections and characteristics of the development such as floor area, employment, etc. The analysis period is approximately two weeks.

Contact:

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(318) 226-6488

Resource:

Bossier Pierre Mall Subarea Analysis, Shreve Area Council of Governments, Shreveport, Louisiana, February 1982.

Reference:

1. COMSIS Corporation, Quick-Response Urban Travel Estimation Manual Techniques and Transferable Parameters: Users Guide, National Cooperative Highway Research Program, Report 187, Washington, D. C., 1978.

Topic Area: Growth Effects--Rapid Growth (Subarea Analysis)

General Issue Being Addressed:

Application of simplified planning procedures to evaluate the impact of alternative downtown circulation patterns (one and two-way streets and street-closings); increased downtown development (more floor space) by type; and altered locations of parking lots. A background problem is that traditional transportation planning processes require relatively large-scale, time-consuming computer models with all-or-nothing trip assignment to minimum paths; these models inhibit the user from dealing with numbers of alternatives.

Potential Users of Case Study:

Transportation engineers and urban planners concerned with planning transportation facilities in the CBD's of small or mid-sized cities, campuses, industrial districts, regional shopping centers and outlying business districts.

Problem Statement.

Frustrations with time-consuming and error-prone hand methods and with clumsy inputs to expensive main-frame computer programs led to the development of the interactive route assignment program (IRAP), which has been applied in corridor, industrial park and sports-events situations.

In the subject case study, IRAP 3.0 was applied to the Glens Falls, New York CBD, an area of approximately 0.15 square miles with over 700,000 square feet of building space used for retail, service, office, institutional and residential purposes. Existing highways converge upon a five-way intersection at the core of the CBD. Various circulation patterns and improvements have been made in the past, but the public is dissatisfied with the present system. Parking supply is insufficient at the core, and proposed new developments require even more space to be provided. These problems can only be addressed by evaluating a series of alternatives and being able to demonstrate to officials that an optimum plan has been achieved.

Approach:

The planning procedures are based upon use of the Interactive Route Assignment Process (IRAP 3.0), a software program for microcomputer. This program accepts a trip table (discussed in the following) that can be modified to represent (a) increased generation resulting from new buildings, and (b)

changed locations of parking lots. Assignments can be made to multiple paths (up to four) between origin-destination pairs. Changing circulation patterns to evaluate alternatives is easily done by the operator. Computer costs are minimal.

Results Achieved:

Initially, surveys were taken to measure traffic volumes, turning movements at key intersections, and to count through traffic (license plate survey). Geometrics at all intersections were noted for use in an in-house capacity calculation microcomputer program. Parking lots were counted and exiting peak hour volumes/turning movements were counted. Floor space in the core of the CBD was measured from an insurance atlas; uses were identified by survey.

With these data, a trip table was developed (with both through and external-to-internal components) and stored using generic "spread-sheet" software. The trip table was verified by comparing it with manual turning movement counts. The 1982 trip table was then expanded to a 1985-1987 trip table on the basis of new floor space assumptions approved by the community.

The future traffic will be assigned to a maximum of four circulation patterns, each approved by the local community. Once a workable solution to present problems has been achieved, the final plan will be "fine-tuned" with TSM-type improvements.

Potential Transferability:

The project is expected to be completed by April 30, 1983. Cost is approximately 2/3 of a person-year for all aspects of the study. The software has application to problems encountered in a variety of sub-areas. Software is proprietary.

Contact:

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Resources:

Information on software is available.

Topic Area: Growth Effects--Rapid Growth (Subarea Analysis)

General Issue Being Addressed:

Use of simplified traffic forecasting methodology to provide a quick assessment of localized transportation impacts resulting from the potential development of a residential subarea under current zoning regulations.

Potential Users of Case Study:

Transportation engineers and urban planners in small to medium-sized urban areas concerned with defining twenty year traffic demands stemming from the rapid development of a subarea. Quick response traffic forecast techniques are used to test alternative transportation facility improvements. To simplify the analysis, planners have access to previously developed area-wide transportation models.

Problem Statement:

An attractive residential beach area (a twelve mile section of the Atlantic barrier island) in Brevard County, Florida, is expected to increase in population from 7800 residents in 1980 to over 70,000 residents by the year 2000. Decision makers wish to determine highway improvements required to

accommodate the population increase. Under investigation were proposals to construct:

1. a new river crossing
2. two additional river crossings
3. additional capacity on the major arterials linking the bridge to the regional transportation system.

Approach:

In order to provide timely response to public officials, it was felt impractical to recalibrate the regional computer models to test changes to the localized transportation system stemming from the rapid growth of a subarea representing only three traffic zones. Rather, a quick response approach was utilized interfacing transferable parameters defined in NCHRP 187, Quick Response User's Guide, with data available from the areawide computer models.

A traditional traffic estimation process of trip generation, trip distribution and traffic assignment was adopted as follows:

1. The zonal structure was redefined from three zones, as used in the areawide analysis, to twelve zones in order to detail the local travel patterns likely to utilize a new bridge crossing.
2. Current zoning regulations were used to define the maximum number of dwelling units permitted in the subarea. Estimates of zonal population and employment were developed for the "full development" scenario.
3. Population threshold levels were applied to define the number of acres of land required for shopping, medical, and social-recreational activities.
4. Home based work trips were analyzed, and regression equations developed in the Brevard Area Transportation Study were used to estimate subarea zonal trip productions and attractions.
5. External zone productions and attractions were totaled for the trip generation models.
6. It was assumed that all trip productions not satisfied in the subarea would be attracted to new developments occurring in other parts of Brevard County. A balanced trip table was then prepared for the twelve subarea zones and nine external zones representing all other areas of Brevard County.
7. Two iterations of the gravity model for HBW trips using manual procedures and transferable parameters outlined in NCHRP 187, Quick Response User's Guide, were performed.

8. Conversion factors presented in NCHRP 187 were utilized to convert home based work trips to total trips and PM peak-hour trips.
9. Use of logical minimum travel time routes, based on local knowledge, provided estimates of current year and year 2000 trips likely to utilize a new river crossing and an upgraded four lane major arterial linking the bridges with the residential subarea. Both PM peak hour and total trips were assigned.
10. Volume to capacity ratios were plotted for major intersections and a facility stress diagram was prepared for the major arterial route linking the beach area with the river crossings. Traffic improvements were then developed to accommodate future year traffic.

Results Achieved:

The ADT and peak hour traffic volumes, combined with level of service information, provided information to evaluate the traffic impacts of the full development scenario. Adoption of a quick response traffic forecasting methodology allowed timely response to questions posed by decision makers. Use of the conventional areawide computerized modeling system would have required over a month to respond. The simplified approach yielded results in a week, thereby adding credibility to the transportation planning effort.

Potential Transferability:

The methodology utilized in this case study can be applied to estimating the traffic impacts resulting from the rapid development of a sub-area within a study area. Although areawide traffic forecasting models and zonal/network structures were available from a previous areawide study, the analysis could not have been completed in a timely manner without use of the quick response planning techniques. Interfacing the areawide network structure and calibrated models with transferable parameters enhanced the timely response of the analysis.

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Resources:

South Beaches Traffic Assessment, Full Development Scenario. Brevard County Planning and Zoning Department and Brevard Metropolitan Planning Organization, Merritt Island, Florida, December 1981.

Reference:

1. COMSIS Corporation, Quick-Response Urban Travel Estimation Manual Techniques and Users Guide, National Cooperative Highway Research Program, Report 187, Washington, D.C., 1978.

Topic Area: Growth Effects--Rapid Growth (Corridor Analysis)

General Issue Being Addressed:

Application of simplified traffic estimation procedures to identify the need for and possible location of a crosstown arterial to divert traffic from the congested downtown area. Quick response travel estimation procedures were utilized to simulate internal travel patterns as a supplement to a recently completed external O-D study in order to estimate traffic volumes with and without the bypass.

Potential Users of Case Study:

Transportation engineers and urban planners in small and medium-sized cities concerned with corridor location and design. As part of the data base, a recent external O-D study may be available, but internal trip data is lacking, requiring simulation with simplified traffic estimation techniques.

Problem Statement:

Hot Springs, Arkansas had a 1970 population of 35,000 with a projected increase to 61,000 by the year 2000. Due to the attraction of regional recreational facilities, the weekend population currently may swell to in excess of 50,000 population. Historically, due to topography, a radial highway system developed, channeling all east-west traffic through the downtown area. With increases in the community's population and the presence of tourists, traffic problems have been compounded in the downtown area. Suggestions have been made to construct a four lane east-west southern cross-town arterial that could remove traffic passing through the CBD and also provide roadway capacity to facilitate future growth in an area prime for development and expansion.

Approach:

Simulated internal travel patterns were combined with external O-D data available from a recent corridor survey to forecast traffic volumes on a major corridor serving as a bypass to the downtown area. An internal trip table was developed by the quick response trip generation and trip distribution procedures outlined in NCHRP 187. In order to reduce the time and complexity of assigning trips by manual approaches, the trip table was loaded on to a network coded specifically for this analysis.

Results Achieved:

Hot Springs was subdivided into ten internal districts and each district's population and employment were projected to the year 2000. Generalized trip generation relationships as presented in the Quick Response Planning User's Guide were used for a three purpose stratification of trips--HBW, HBNW and NHB. District trip productions were estimated as a function of household income and number of dwelling units, while attractions were based on retail and non-retail employment. Due to the unique nature of two districts which represent entrances to a national park, special modifications were made to the productions and attractions based on local knowledge. Internal trip distributions were estimated for the year 2000 with a manual gravity model. Area to area impedances were determined by using an existing computer network available for the community. Year 2000 trips were assigned to the network with and without the east-west arterial bypass. Added to the internal trip structure was external

traffic for the year 2000 simulated for a recent external O-D survey expanded with growth factors developed from historical traffic trends at ten stations. Using the traffic estimation procedures, year 2000 traffic loads were forecasted to the Hot Springs network with and without the proposed bypass.

Potential Transferability:

The planning methodology has application to other communities desiring an analysis of a major corridor. Without recent home interview O-D data, internal movement can be simulated through transferable parameters as outlined in the Quick Response User's Guide. With the availability of external O-D data, future year traffic movements can then be estimated.

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Resource:

Hot Springs East-West Arterial Study. Statewide Planning Section, Arkansas State Highway and Transportation Department, Little Rock, Arkansas. December 1979.

Reference:

1. COMSIS Corporation, Quick-Response Urban Travel Estimation Manual Techniques and Transferable Parameters: Users Guide, National Cooperative Highway Research Program, Report 187, Washington, D.C., 1978.

Topic Area: Growth Effects--Rapid Growth (Corridor Analysis-Subarea Analysis)

General Issue Being Addressed:

Use of microcomputers in conjunction with simplified traffic estimation procedures to forecast traffic volumes for a small community's street system.

Potential Users of Case Study:

Planners in small to medium-sized cities with access to a microcomputer who need to simulate traffic patterns with simplified traffic estimation models.

Problem Statement:

Northborough, Massachusetts, located twelve miles east of Worcester, is served by a number of major highways, including Interstate 290 crossing the town in an east-west direction. Although the town is primarily residential, there are commercial, manufacturing and agricultural centers in the town of 10,500 population. Major traffic problems are encountered during the peak hours in the downtown area due to a lack of signalization, confusing geometrics and lack of pavement markings. Prior to developing a traffic improvement program, future traffic volumes were estimated to ensure that the recommended TSM improvements would satisfy future as well as current needs.

Approach:

Staff planners at the Central Massachusetts Regional Planning Commission applied the quick response planning techniques and transferable parameters similar to those developed in NCHRP 187, Quick Response User's Guide, to a 48K Radio Shack

Model I microcomputer. The software is able to handle a maximum of 60 zones and 160 nodes.

The microcomputer modeling process consists of five subprograms:

1. Program origination includes establishing base data for each network link:
 - a. length of link
 - b. link speed
 - c. facility type
 - d. K-factor
 - e. added delay due to traffic controls, interchanges, etc.
 - f. lane width
 - g. lateral clearance
2. Determine the path of least resistance between zone pairs using Moore's algorithm.
3. Manually create zonal productions and attractions through use of NCHRP 187, Quick Response Trip Generation Procedures.
4. Using transferable parameters from NCHRP 187, conduct a gravity model trip distribution.
5. Conduct an all-or-nothing traffic assignment. Output of the traffic assignment represents volume to capacity ratios and levels of service for major roadway sections.

Northborough was divided into eleven internal zones and ten external zones, which facilitated determining the impact of development in abutting communities. The external zones were defined by links in the highway network which extend beyond the study boundary and were represented as a centroid. The data inputs for each zone included:

1. number of households by income range
2. retail employment
3. non-retail employment

In preparing zonal estimates for 1990, a high and low forecast was used to bracket actual 1990 conditions. A three purpose trip stratification was utilized of home based work, home based non-work, and non-home based trips. Distribution was based on a gravity model for 21 zones. Travel impedances were determined by actual travel times based on observed speeds and estimated speeds for the 1990 network. Assignment was conducted with an all-or-nothing assignment using minimum travel paths between zones calculated with the microcomputer.

Results Achieved:

It was concluded that the model provided a good reflection of 1980 ground counts and could be used to forecast 1990 traffic volumes. The difference between the high and low growth scenarios was used to determine the impact of growth on future traffic patterns. With the use of a microcomputer, it became possible to easily replicate the analysis using different socio-economic inputs. The advantages to using this microcomputer approach over larger modeling programs are given below.

"Minimal data requirements - Types of data needed include population or number of households, retail and non-retail employment, household

income, traffic volumes and roadway geometrics. Much of this data is available at the local level. Traffic volumes and roadway geometrics are usually the most time consuming to collect.

Simple approach - The simplicity of the approach, which uses worksheets to calculate data inputs, allows easy understanding and use of the computerized models.

Quick setup and application - With the computer and models in place, a region can be modeled in a very short time. In cases where a limited budget would not allow the traditional modeling approach, this microcomputer package becomes a viable study direction.

Easy to change inputs - Once the model is running, various socio-economic growth scenarios can be reviewed with a range of alternate highway networks. The time frame for doing different scenarios is approximately two per day."¹

Potential Transferability:

In a related application by the Central Massachusetts Regional Planning Commission, a microcomputer model was used to forecast 1990 traffic volumes as part of a study to determine the location of a major arterial bypass to the city center of Westborough, Massachusetts. In Westborough, heavy traffic volumes on major roads leading into the town center caused local officials to explore the feasibility of a town center bypass facility. Two socio-economic growth scenarios were developed and traffic volumes for 1990 were estimated for the Federal-Aid highway system. Five alternate highway alignments were analyzed for a total of twelve scenarios run in a two week period. This type of analysis greatly enhanced the transportation planning capabilities of the regional planning group and facilitated the establishment of credibility between planners and local decision makers.

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Resources:

Westborough Corridor Planning Study.
Transportation Staff of the Central Massachusetts
Regional Planning Commission, Worcester,
Massachusetts, March 1982.

Northborough Center Traffic Study--Working
Paper. Transportation Staff of the Central
Massachusetts Regional Planning Commission,
Worcester, Massachusetts, October 1982.

Microcomputer software is written in BASIC.
Documentation is presented in: Microcomputer
Traffic Simulation Model--A Case Study.
Transportation Staff of the Central Massachusetts
Regional Planning Commission, Worcester,
Massachusetts, October 1982.

References:

1. Microcomputer Traffic Simulation Model--A
Case Study. Transportation Staff of the Central
Massachusetts Regional Planning Commission,
Worcester, Massachusetts, October 1982.

2. COMSIS Corporation, Quick-Response Urban
Travel Estimation Manual Techniques and Users Guide,
National Cooperative Highway Research Program,
Report 187, Washington, D.C., 1978.

Topic Area: Growth Effects--Rapid Growth
(Circulation Plan)

General Issue Being Addressed:

Use of a comprehensive circulation plan to define future transportation needs in small to medium-sized communities undergoing rapid growth. Definition of future transportation needs helps develop specific plans and programs and preserves land for the future construction of major transportation facilities. The case study highlights preparation of a circulation plan relying on simplified traffic estimation techniques.

Potential Users of Case Study:

Transportation engineers and urban planners in small to medium-sized communities wishing to conduct a comprehensive traffic circulation plan without the need to collect internal O-D data.

Problem Statement:

The Santa Maria-Orcutt urban area in California recently reached the 50,000 population threshold and has been designated as an urbanized area. Because of the community's rapid population growth, local planners decided it was timely to undertake a continuing, cooperative, comprehensive transportation plan. Specific attention was focused on analyzing the ability of the transportation system to support future land use growth. The circulation plan then would represent a major revision to earlier transportation plans and would identify problems and suggest recommendations for improvements.

Approach:

The case study highlights the application of simplified traffic estimation procedures, relying on quick response planning methodologies and transferable parameters to forecast 1990 traffic volumes on the community's freeway and arterial street system.

The major steps in the simplified approach involved:

1. Assignment of 1980 trips to the street system using quick response trip generation, trip distribution and traffic assignment models.
2. Check of 1980 traffic volumes to calibrate the trip generation, distribution and assignment procedures in preparation for the 1990 modeling. Some trip generation rates were recalibrated where local knowledge indicated the trip rates were not representative.
3. Recomputation of travel on the existing network for the 1990 target year.

A conventional application of trip generation, trip distribution and traffic assignment was

applied utilizing a three purpose trip stratification of home based work, home based non-work and non-home based trips, following the general provisions of the Quick Response Users Guide. Zonal trip productions and attractions were estimated with the relationships presented in NCHRP 187 for 41 zones based on the variables: income, auto ownership and employment. Trip distribution was calculated utilizing a computerized version of the gravity model procedure outlined in NCHRP 187. The FHWA computer version was utilized because the staff had access to an IBM-370. External trips were obtained from a previous O-D study and were added to the internal trips calculated for the gravity model. Traffic assignment was completed with the selection of minimum path routes obtained from travel time runs on the major street system. Trips were assigned to the best path on an all-or-nothing basis, utilizing local knowledge.

Results Achieved:

The results of the 1980 network calibration revealed good checks with ground counts. The highest link error was 22 percent while the highest cordon error was 12 percent. Prior to predicting traffic, some modifications were made to the trip generation relationships and trip paths to better reflect local conditions. The results of the calibration indicated that the deviation between assigned trips and ground count was considered acceptable and the same basic approach was applied to model 1990 traffic.

The 1990 traffic forecast provided inputs into the critical movement analysis to evaluate the performance of critical intersections, thereby highlighting capacity problems requiring further analysis. Suggested intersection improvements were presented as well as proposals to increase corridor capacity through selected widening of existing roads or adding new facilities.

Potential Transferability:

The planning approach utilized has application to other communities desiring a comprehensive analysis of future traffic volumes on the major street system. External O-D survey data should be available. The analysis required about three weeks or a quarter of the time required to complete the analysis with a conventional main-frame traffic modeling effort.

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Resource:

Santa Maria Area Circulation Study. Santa Barbara County-Cities Area Planning Council, Santa Barbara, California, January 1982.

Reference:

1. COMSIS Corporation, Quick-Response Urban Travel Estimation Manual Techniques and Transferable Parameters: Users Guide, National Cooperative Highway Research Program, Report 187, Washington, D.C. 1978.

CASE STUDIES:
DATA COLLECTION AND MANAGEMENT
INFORMATION SYSTEMS

Topic Area: Traffic Data Collection (Intersection Turning Counts)

General Issue Being Addressed:

Accuracy and completeness of various traffic count data have always been a problem since employees in the field are working without direct supervision. Adoption of microprocessor technology offers an opportunity to simplify data collection procedures.

Potential Users of Case Study:

Transportation engineers and urban planners responsible for collecting turning movement counts, pedestrian counts, etc.

Problem Statement:

Charlotte, North Carolina, counts fifty percent of all signalized intersections each year, which means over one hundred locations are counted each year to monitor traffic volumes for transportation planning purposes. In addition, ten permanent count stations are maintained to monitor annual traffic flow and special counts are conducted for other events such as pedestrian movement, classification studies, and school zone studies.

Approach:

Turning count procedures have progressed from a total manual approach to microprocessors which not only capture information at the site, but also serve as a supervisor by monitoring activity every five minutes.

Results Achieved:

A Portable Electronic Event Recorder (PEER) was developed as a microprocessor based collection device. The unit was developed to give the appearance of a briefcase. The unit has a capacity for all vehicle and pedestrian movements that occur in an intersection to be recorded for more than a twelve hour period. Extremely busy intersections can be counted by two different individuals, then merged for a summary. Real time clocks in the unit permit storage of data in five minute increments, thus serving as a supervisor because once a five minute increment has passed, the operator cannot alter the information.

In application, experience has shown that the device is popular with field crews. Also, accuracy and data completeness have improved, and supervision of the count program is less demanding. A maximum of fifteen minutes is required to summarize the data, which includes connecting the unit to a host computer, initializing computer software, printing turning movement summaries, performing calculations to assist employees with capacity analysis and disconnecting the unit.

Potential Transferability:

The city of Charlotte patented the Portable Electronic Event Recorder (PEER) and has licensed a local manufacturer, Computer Technology Corporation, to manufacture the unit for sale.

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Resource:

Product information is available from Computer Technology Corporation, 1132 Commercial Avenue, Charlotte, North Carolina 28205

Topic Area: Traffic Data Collection and Processing (Moving Vehicle License Tag Origin-Destination Studies)

General Issue Being Addressed:

Speed and accuracy in summarizing moving vehicle license tag surveys for multi-station origin-destination studies.

Potential Users of Case Study:

Planners studying neighborhoods, shopping centers, or other small areas where moving vehicle license tag surveys are appropriate.

Problem Statement:

In 1977, the City of Charlotte began a neighborhood "through-traffic program". In order to determine the amount of traffic traveling through neighborhoods, it was necessary to conduct moving vehicle license tag surveys. Because of extensive time required to conduct manual matching, software was written for an in-house microprocessor system to enter and edit the data files and to process the data to develop origin-destination tables.

Approach:

Uses interactive, on-line computer software to enter and match license tags. It includes a feature to specify the number of character errors allowed in the tag number before a match is judged invalid.

Data collection personnel use a microphone to record license tag numbers on audio tape recorders. In the office, data collection personnel play back the tapes and write the tag numbers on a standard form. Next, data processing personnel enter data for each data collection station including the tag number, time, and whether the vehicle is entering or exiting the study area.

Once the data has been checked and edited where necessary, the data processing personnel enter parameters to be used in matching including: start time, stop time, time interval allowed for vehicle to travel through the study area, and the number of character errors allowed for a valid match.

The software creates two basic files: one file is of entering tags in time order; the other file is of exiting tags in time order. For each entering tag, the software searches the specified allowable time interval to determine if the vehicle left the study area during the interval. Running totals are kept on a station basis for tags which enter and do not leave, and an origin-destination table is developed for all through trips. At the end, totals are developed on a station basis for tags which exited but did not enter.

Results Achieved:

The software has been found to be valuable in determining the actual extent of neighborhood through traffic and has also been used to analyze proposed detours and to evaluate the actual benefit of offset intersection realignments.

Potential Transferability:

The software is written in ALPHABASIC; however, the match search routine is written in Alpha Micro machine language in order to decrease run time. Use of the software on another system would require some rewriting by the user.

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Topic Area: Transit Management Information System

General Issue Being Addressed:

Use of microcomputers to simplify the processing and reporting of data concerning the utilization and performance of a small to medium-sized community transit system.

Potential Users of Case Study:

Transit operators and planners in small to medium-sized cities having access to a microcomputer.

Problem Statement:

During times of financial uncertainty, with potentially declining subsidy levels, transit managers need to develop timely decisions on fares, schedules and routes to overcome potential shortfalls in transit system financial resources. In order to achieve the best balance between resources and service levels, management requires current data on ridership by route, daily revenue-miles and hours of service, etc.

The Brockton Area Transit Authority operates fifty-nine buses on eighteen routes, carrying approximately three million yearly riders. Data collected to monitor system performance and evaluate service were only available to management through manual procedures approximately two months after collection.

Approach:

The Old Colony Planning Council has developed a microcomputer software package for transit operations with little or no familiarity with computer programming. The software was written for a Commodore CBM-8032 microcomputer with 32K memory.

The microcomputer was utilized to support a management information system to provide current operational data and simplify the preparation of annual reports. Large amounts of field data can be processed and analyzed in a short time period, thereby providing managers with access to current performance standards and allowing more service and fare alternatives to be considered. The computer software includes the following programs:

1. A fare program to analyze the merits of various fare proposals to raise revenue, while minimizing loss in passengers. The "VISI-CALC" software package was utilized to prepare a "spread sheet" identifying the impact of fare changes on ridership levels, assuming use of the traditional Simpson Curtin relationship between fare and ridership. Given the need to generate a predetermined level of farebox revenue, alternative fare policies can be studied.
2. A program has been developed to provide timely reports on ridership by route. Driver counts are used as basic inputs and, through storage of the bus schedule in computer memory, ridership and

revenue reports by route and by time of day can be prepared.

3. UMTA Section 15 reporting requirements have been simplified through a program which summarizes field survey trip sheets, monthly ridership reports and vehicle inventories to prepare an annual report suitable for reporting requirements.
4. Calculating the amount of service delivered is simplified through storing a bus schedule in a computer file. The microcomputer then easily calculates daily service--mileage, hours, number of trips, etc., by route and system.

Results Achieved:

Through an investment of \$4000 in computer hardware and programming assistance contributed by the Old Colony Planning Council, the Brockton Area Transit Authority has developed a management information system to support short range transit planning. Information is now available in a timely manner to support management decisions. For example, prior to the computerized management systems, manual procedures were employed which required two man-weeks of effort to report four days of ridership per month. Typically, there was a two month delay in reporting this data. Currently, one day's data can be entered on the microcomputer in one man-hour and results are available within a few hours. Timely data is now available to management to monitor system performance and quickly evaluate service changes.

Potential Transferability:

The microcomputer software is written in BASIC and can be transferred to other machines. The software logic is user friendly and can be applied to other transit properties.

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Resources:

The Brockton Area Transit Service Evaluation Study--Conclusions and Recommendations. Old Colony Planning Council, Brockton, Massachusetts, July 1982.

Software documentation available in Development and Application of Microcomputer Programs for BAT. Old Colony Planning Council, Brockton, Massachusetts, October 1981.

CASE STUDIES:
PUBLIC TRANSPORTATION SERVICES

Topic Area: Transit Services (General Purpose Travel)

General Issue Being Addressed:

Development of a flexible transit service in a high income suburban community in order to reduce reliance on private autos for commuting and also to increase the mobility of the transportation disadvantaged during off-peak hours.

Potential Users of Case Study:

Transit operators and planners in suburban areas interested in increasing the mobility of local residents.

Problem Statement and Approach

Westport, Connecticut, is a suburban area of 28,000 population with a residential density of 1300 persons per square mile and an average annual household income of \$26,000 (1976 dollars). Local officials were concerned about reducing dependence on the private auto and instituted a community-wide transit service.

During commuter hours, a fixed route minibus service focussed on the downtown rail station, while during off-peak hours the minibuses serve general community travel needs with limited route deviation service provided on seven loops. Each 35 minutes, a time transfer was provided between all vehicles. In order to serve a range of mobility needs, the elderly received a 25 percent fare discount and specialized door-to-door service was provided to the elderly and handicapped with advanced trip requests (maxytaxi). Package delivery service was also provided.

Results Achieved:

The system was effective in addressing the mobility of different market segments and served about 39,000 daytime and 11,000 commuter boardings per day. The dial-a-ride service handled 13,000 passengers per month in addition to transporting 1,000 packages per month. The services appealed to very different markets. For example, young persons without access to an auto used the daytime service for social-recreational trips. The commuter service attracted work trips and the maxytaxi served adult work and social-recreational trips. In general, the transit service accommodated many trips which would not have been made otherwise. Only the commuter service diverted trips from the private auto, thereby reducing traffic congestion and parking demands in the vicinity of the railroad station. In addition, sixty percent of the commuters riding transit left their vehicles at home for use by other family members. Maxytaxi costs \$3.36 per passenger trip and the minibus costs \$.95 per passenger trip, all expressed in 1980 dollars.

Potential Transferability:

A suburban transit service can serve many travel markets even in high income, high automobile ownership areas if the services are tailored to the mobility needs of the different user groups. Transit services will be well received and can divert commuters from private autos while also increasing the mobility of transit's traditional market segment--the young and elderly.

Source:

Kirby, R., and G. Miller. A Casebook of Short-Range Actions to Improve Public Transportation. The Urban Institute, Washington, D.C., February 1983.

Topic Area: Transit Services (General Purpose Travel)

General Issue Being Addressed:

Operation of a shared-ride taxi service to increase the community-wide mobility of local residents living in a suburban community of a large metropolitan center.

Potential Users of Case Study:

Taxi operators and planners in suburban areas wishing to increase the mobility of local residents.

Problem Statement and Approach:

"Hop-a-Ride" was a shared-ride taxi service available to the residents of Hopkins, Minnesota, a suburban area of Minneapolis. The community's 13,500 residents are concentrated in a four square mile area with the regional transit authority operating a fixed route bus service through the community. In addition, three local taxi services are available for 24 hour service. In order to increase the mobility for short trips made within the community (average trip length about 1.5 miles), "Hop-a-Ride" was available to those residents requesting travel 24 hours in advance. In addition, subscription service was encouraged for repetitive trips. Payment was made mostly through ten ride ticket books purchased from the city. Designated low income individuals were eligible to purchase the books at half price. An average fare was forty cents. The provider redeemed a used ticket for a specified amount as established by the city. Thus, the provider receives a subsidy only for the trips served. Previously, the provider was paid based on the hours of service, regardless of utilization levels.

Results Achieved:

Ridership grew to about 28,200 passengers per year with almost half of the "Hop-a-Ride" users traveling to/from work. Less than ten percent of the users were making new trips, with 4.9 percent being diverted from private autos either as auto driver or auto passenger and 26 percent were diverted from bus transit. Only five percent of the users previously rode on a local taxi service. The user-side subsidy program cost was nine percent lower than the previously operated contracted service. Besides a lower cost per passenger, the taxi operators have an incentive to maximize vehicle occupancy. Rather than dispatching a new cab and increasing vehicle hours of service, it became more cost-effective to arrange shared rides. Also, the operator avoided the need to devote 8-10 hours per week to calculating service hours from the dispatch records. Given an annual ridership of 28,200, the program would cost \$2.35 per trip in 1980 dollars with a \$1.95 subsidy and \$.40 fare.

Potential Transferability:

An advanced request shared-ride taxi program can serve as an efficient means for increasing the mobility of local residents living in a suburban area. A user-side subsidy mechanism becomes an efficient means of administering the program, helping to reduce provider recordkeeping requirements, encouraging the provision of more efficient services, and providing a simple means of charging reduced fares to mobility disadvantaged groups.

Source:

Kirby, R., and G. Miller. A Casebook of Short-Range Actions to Improve Public Transportation. The Urban Institute, Washington, D.C., February 1983.

Topic Area: Transit Services (General Purpose Travel)

General Issue Being Addressed:

Provision of a general purpose public transportation program responsive to the mobility needs of a number of different travel markets.

Potential Users of Case Study:

Transit operators and planners in small and medium-sized urban areas wishing to increase the mobility of different travel markets such as the transportation disadvantaged and commuters.

Problem Statement and Approach:

Winona and Goodview, Minnesota, with a combined population of 28,400, tailored the local bus service to meet the mobility needs of three distinct transit market segments. In the peak periods, service was oriented to commuters with fixed route service between residential and work locations. During the mid-day, route deviations were permitted to meet the travel needs of the disadvantaged seeking door-to-door service. Weekends and evening subscription/charter service was provided for persons attending group functions. All residents can use the service for thirty cents, with a route deviation costing an additional ten cents.

Results Achieved:

The introduction of the market oriented transit services doubled annual ridership over the previous fixed route service, reaching 120,000 trips per year. The route deviation option was used only by four to six percent of the riders, mainly the elderly. Users tended to be individuals with an income of less than 5000 dollars per year and without access to a private vehicle. The service has been more successful than the previous bus service in attracting younger riders, riders with autos and home-to-work travelers. New markets for transit have been developed with 37 percent of the users previously traveling as auto drivers or auto passengers. Twelve percent of the users made new trips. At an annual ridership of 180,000, the average cost per trip would be \$1.31 in 1980 dollars. The use of prepaid passes, marketing, promotion and system expansion all were judged to aid in building ridership.

Potential Transferability:

Provision of flexible market oriented transit service has application to other communities wishing to increase the mobility of local residents.

Source:

Kirby, R., and G. Miller. A Casebook of Short-Range Actions to Improve Public Transportation. The Urban Institute, Washington, D.C., February 1983.

Topic Area: Transit Services (Special User Groups)

General Issue Being Addressed:

Establishment of a reduced taxi rate program to increase the mobility of elderly and handicapped residents. Ultimately transit service was extended to the general public through the provision of fixed route bus services using unique administrative procedures for involving private operators and reimbursement through a user-side subsidy program.

Potential Users of Case Study:

Transit and taxi operators and planners in small and medium-sized communities with/without a public transit service wishing to increase the mobility of all local residents.

Problem Statement and Approach:

Danville, Illinois, has a population of 43,000 and a higher than average percentage of elderly persons. With the availability of three taxi companies and no public bus service, it was decided to provide shared-ride taxi service with a 25 to 40

percent reduction in taxi fares for elderly and handicapped residents. User subsidies were limited to \$20 per month per individual and payments were disbursed through a charge slip scheme. At the completion of a trip, users paid a portion of the fare in cash and signed a slip for the remaining portion of the fare. Subsequently, the slips were submitted by the taxi companies to the city for reimbursement.

Twenty-five months into the study period, a modification was made with the introduction of scheduled and on-call fixed route bus service, called "runaround," being operated for the general public. Runaround service was provided by two private operators on a four month renewable contract. Fares and service levels were negotiated. Ultimately, twelve hours of daily service were offered on eleven routes. Riders pre-purchased tickets and providers were reimbursed through submission of used tickets to the city.

Results Achieved:

The shared-ride taxi service was found to be of major benefit to a subgroup of the eligible population, and it was the subgroup with the greatest mobility needs--the low income and handicapped. Even though 85 percent of trips would have been made without the benefits of a user-side subsidy, it was felt the program was able to facilitate those trips highly valued by travelers. At 8500 trips/month, the average cost in 1980 dollars was assumed to be \$1.88 per trip (\$.43 user payment, \$1.16 fare subsidy and \$.29 administrative costs).

The "runaround" ridership reached 22,000 trips per month. Trips were mostly taken for the purposes of work, school and medical trips, with most trips previously being made as an auto passenger or driver (36 percent) or by shared-ride taxi service (33 percent). At an estimated 24,000 rides per month, "runaround" was estimated to cost \$2.14 per trip in 1980 dollars (\$.34 user payment, \$1.49 subsidy and \$.31 administrative costs).

Potential Transferability:

Danville's experience with two transit delivery systems indicated that a shared-ride taxi utilizing reduced rates for the transportation disadvantaged is cost competitive with public dial-a-ride services. However, the fixed route bus was relatively more expensive with the total cost per passenger trip being close to the average shared-taxi fare for the same trips.

Source:

Kirby, R., and G. Miller. A Casebook of Short-Range Actions to Improve Public Transportation. The Urban Institute, Washington, D.C., February 1983.

Topic Area: Transit Services (Special User Groups)

General Issue Being Addressed:

Application of a user-side subsidy to allow the mobility disadvantaged to use the taxi as a more preferred mode of travel. Shared ride taxi service was provided to eligible elderly and handicapped users at a fifty percent fare discount.

Potential Users of Case Study:

Taxi operators and planners in small and medium-sized urban areas without public transit service wishing to increase the mobility of the elderly and handicapped special user groups.

Problem Statement and Approach:

Kinston, North Carolina, is a small community of 25,000 population with incomes and auto ownership rates below the national average. No public bus service was provided in the community and only limited services were provided by social service agencies. Taxicabs were used as the primary means of local public travel with eight firms operating in excess of forty vehicles. In order to increase individual mobility, reduced taxi rates were made available to all elderly and handicapped citizens. Each registered participant was entitled to \$25.00 worth of subsidized taxi travel per month. Users selected the taxi company of their choice and paid the fare in tickets purchased from the city.

Results Achieved:

A small subgroup made extensive use of the program with only eighteen percent of all eligible users registering for the program. Travel records revealed that fifty percent of all program trips were made by three percent of the eligible users, mostly low income and handicapped individuals not owning an automobile. Over 84 percent of the trips would have been made by taxi at full fare without the subsidy program. However, only nine percent of the trips would have been made as auto driver or auto passenger. Service was provided at a cost of \$2.36 per trip (\$.86 user payment, \$.86 subsidy and \$.64 administration) for 3000 trips per month. In addition, the subsidy program encouraged two new taxi companies to join the market.

Potential Transferability:

A shared-ride taxi user-side subsidy program has application to small and medium-sized urban areas without bus service where there is concern about increasing the mobility of transportation disadvantaged groups. Competition between taxi operators can keep service levels high as participants select the operator of their choice.

Source:

Kirby, R., and G. Miller. A Casebook of Short-Range Actions to Improve Public Transportation. The Urban Institute, Washington, D.C., February 1983.

Topic Area: Transit Services (Reduce Private Vehicle Use)

General Issue Being Addressed:

Development of a comprehensive employer-based rideshare program involving vanpools, carpools and express buses to reduce downtown parking needs and reduce vehicle miles of travel (VMT) by private commuter vehicles.

Potential Users of Case Study:

Transit operators, urban planners, community decision makers and major employers concerned with a declining inventory of parking spaces and desiring to reduce VMT by private commuter vehicles through a shift to higher occupancy vehicles.

Problem Statement and Approach:

The Tennessee Valley Authority is a major employer located in downtown Knoxville, employing over 3,400 personnel. In response to the elimination of 1,300 parking spaces due to the construction of a new office complex, a ridesharing solution was sought as an alternative to constructing a downtown parking garage. A mass transit incentive plan was negotiated with employees and included parking discounts for carpools, a 1/3

discounted fare on local and express buses, a subsidized vanpool program and the establishment of a full time transportation coordinator.

Results Achieved:

With the establishment of over 95 vans and 25 express buses tailored to the travel desires of TVA employees, a major shift in employee travel patterns resulted. Prior to initiation of the program, 65 percent of the work force drove to work alone in a private vehicle. Over a three year period, the size of this group was reduced to eighteen percent. Express bus and vanpools evolved as the primary means of commuting for 35 percent of the employees, resulting in a substantial reduction in VMT. The annual program costs to TVA were about \$125,000 (1977 dollars) for the employee incentive, bus guarantees and administrative charges, resulting in a reduced cost of 2.7 cents per VMT. Besides employees reducing their commuting costs, TVA benefited by enhancing its energy conservation image and avoided the cost of building a downtown parking structure.

Potential Transferability:

Applicable to other areas where a major employer is willing to undertake responsibility for altering employees' commuter mode choice decision. Employer benefits must be present where the employer can justify costs involved.

Source:

Kirby, R., and G. Miller. A Casebook of Short-Range Actions to Improve Public Transportation. The Urban Institute, Washington, D.C., February 1983.

Topic Area: Transit Services (Reduce Private Vehicle Use)

General Issue Being Addressed:

Establishment of an auto management and pricing mechanism supplemented with shuttle transit service to limit non-resident on-street parking in a neighborhood adjacent to a popular beach area.

Potential Users of Case Study:

Transit operators, city officials and planners concerned with limiting non-resident parking in a neighborhood in order to reduce congestion, littering and a severe on-street parking shortage.

Problem Statement and Approach:

Santa Cruz has extensive non-resident visitation to a seaside recreational area during the summer months. A two square mile beach area with 4500 residents has approximately 1000 vehicles parked in this zone during peak days, with over 600 of these vehicles belonging to non-residents. Through a parking price mechanism, non-residents were required to purchase and display a \$5.00 daily permit while residents, guests and employees of local businesses were allowed to park either free or at nominal charge by displaying a yearly windshield permit. In order to encourage use of a newly constructed 600 space remote parking area, free shuttle bus service was provided to the beach and business area.

Results Achieved:

Non-resident parking was reduced by forty to sixty percent for a net daily reduction of 500 non-resident parkers. Daily revenue amounted to \$1750 of which \$500 was generated by the sale of daily permits and \$1250 from citations. Yet, use of the shuttle bus was a disappointment, with only 100

vehicles parking at the remote lot on a typical weekend. An average shuttle bus trip carried only three passengers. Evidence suggests that many former non-resident beach users now traveled to other beach areas.

The continuing annual cost of the program is in the range of \$230,000 or \$1910 per day for a 120 day season. With elimination of the shuttle bus, the daily cost could be reduced to a level for the program to be self supporting. The initial costs were in the magnitude of \$875 per day for a 120 day season.

Potential Transferability:

An auto parking management and pricing mechanism was identified as a successful means of controlling non-resident parking in a neighborhood adjacent to a major seasonal traffic generator. Shuttle bus service from a remote lot was judged not to be a good substitute for private auto use.

Source:

Kirby, R., and G. Miller. A Casebook of Short-Range Actions to Improve Public Transportation. The Urban Institute, Washington, D.C., February 1983.

CASE STUDIES:

PROGRAMMING, FINANCING AND COMMUNICATION WITH DECISION MAKERS

Topic Area: Financing (Local Transit)

General Issue Being Addressed:

Use of a citizen survey to: 1) increase public awareness of transit's possible social contributions, 2) measure the public's willingness to pay a local tax to finance transit, and 3) determine the importance of various attitudes and personal characteristics in support for transit.

Potential Users of Case Study:

Local decision makers (mayors, council members, transit authority board members), managers (city and transit), and planners in small to medium-sized cities.

Problem Statement:

Council Bluffs, Iowa, purchases transit service from nearby Omaha, Nebraska. Each month, the transit authority, Metro Area Transit (MAT), bills Council Bluffs for the number of bus hours operated. As MAT's operating costs increased in the late 1970's, Council Bluffs purchased fewer and fewer hours of service. Faced with service that had been pared to the bone and the specter of diminished federal operating subsidies, the mayor and city council formed a committee to evaluate alternative courses of action for the city. These alternatives included: 1) termination of service, 2) a local tax earmarked for transit along with higher fares, or 3) an alternative form of service, such as demand responsive transit or subsidized taxis.

It was decided by the committee to conduct a detailed household survey to determine the importance of having a fixed route transit system within the community and the level of support for an earmarked property tax assessment to finance transit. Iowa law allows up to a two mill property tax levy for specific services like transit, but no other types of local option taxes are enabled.

Approach:

A random digit telephone number selection procedure was used to select a sample of households

to be contacted. Because there were several telephone exchanges, it was necessary to generate telephone number prefixes proportionally to the relative sizes of these exchanges. The last four digits were randomly generated by a computer. Within each household, a randomized selection table was used to identify the actual respondent. The person answering the telephone was asked to list all persons in the household aged eighteen years or more by relation to this person. The selection table told the interviewer which person to interview (e.g., if there were five adults, the table may say to interview the third person listed). The result was a sample that was nearly random at the household level.

The questionnaire covered four topical areas: 1) the individual's travel behavior in terms of mode used for various types of trips, 2) his or her economic and demographic circumstances, and 3) the person's attitudes toward transit and its financing. By using a series of skips designed to minimize the asking of redundant or irrelevant questions, interview time was kept below fifteen minutes. At the heart of the questionnaire was a series of statements regarding the role and possible benefits of transit to which the respondent could agree or disagree. The respondent was then asked whether he or she favored a two mill property tax for transit. As it was worded, the question first informed the respondent as to how much the millage would increase property taxes for each of several illustrative home values. If the respondent was a renter, an estimate of tax burden was provided as well. Those respondents who did not favor a two mill tax were asked if they would support a one mill tax.

Results Achieved:

A total of 770 interviews were completed, amounting to a 3.4 percent sample of all households with telephones (less than one percent have no telephone). Over two thirds of those interviewed (68.2 percent) favored a transit millage. The highest level of support for a transit tax came from women, those with higher incomes, the well educated, renters, and those who personally use transit. It should be stressed, however, that personal use was not a major factor in support for a property tax millage. Stimulation of business within the city and helping the poor find or keep jobs were strong factors in transit support. The attitudinal measure having the strongest relationship with support was the degree to which the respondent felt that this mode helps keep the air clean. The perception that transit can help conserve fuel also is strongly tied to support for a transit tax.

Upon receiving these results, the city council voted four to one to institute a two mill transit tax. The tax generates approximately \$350,000 annually, which coupled with an increase in fares from \$.50 to \$.75 has enabled the city to avert further erosion of transit service. If federal funding cuts are deferred, a series of service improvements will become possible.

Potential Transferability:

The methodology used in this study is, of course, readily transferable. The total cost of the citizen survey and the analysis that followed was less than \$13,000. This sort of approach allows planners to act as facilitators, informing the public of possible choices and the likely implications of these choices. Considerable pressure is removed from both planners and decision makers, because they are carrying out the public's will.

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Topic Area: Financing (Transit Fare and Service Proposals)

General Issue Being Addressed:

Use of microcomputers to study the relationship between transit subsidy level, fare, ridership and service. Simplification of these relationships provides an opportunity for transit management to quickly process and analyze alternative fare and service policies.

Potential Users of Case Study:

Transit operators and planners in small to medium-sized cities having access to a microcomputer.

Problem Statement:

In times of actually or potentially declining subsidy levels, transit management must have the capability to quickly evaluate alternative proposals to alter fares and service levels to match estimated levels of available resources. A microcomputer program allows management to simply and quickly test a number of alternative service and fare policies.

Approach:

The Old Colony Planning Council developed a quick response service-supply model to estimate ridership, revenue and total miles of revenue service for different fare and subsidy levels. A microcomputer was used to simplify a complex mathematical relationship between demand for transit service and alternative service-fare policies. The model permitted transit managers to utilize simplified planning techniques by:

1. Relating demand for transit to revenue bus-miles operated in an area and the population residing within a 1/4 mile transit service area.
2. Relating revenue as a function of ridership (revenue-miles of service and routing), percent transfers and average fare.
3. Relating changes in fare on ridership reflecting traditional transit elasticities.
4. Relating transit operating costs as a function of revenue vehicle-miles of service, revenue vehicle hours of service and peak hour vehicles.
5. Relating operating budget to revenue and subsidy levels.

Through mathematical manipulation, it is possible to develop a complex relationship between the following variables:

1. number of peak period vehicles
2. unit cost per mile, per vehicle and per hour
3. service area population

4. average fare (new versus old)
5. operating subsidy (\$ annual)
6. average operating speed
7. transfer factor

By placing the complex mathematical relationship on a Commodore CBM-8032 microcomputer, transit managers can test alternative funding and fare proposals to determine impact on total revenue-miles of service. Adjustments can then be made individually or simultaneously to each fare and/or funding policy to determine how much service might be added or deleted.

Results Achieved:

The simplified service supply model has been tested for a number of small urban area transit systems with good results. The model has been utilized by the Brockton Transit Authority to test the impact on ridership, fare levels and service levels resulting from a twenty percent reduction in present subsidy levels.

Potential Transferability:

The service supply model is written in BASIC and can be transferred to other microcomputers. The model has been tested for a series of fare and service changes instituted by the Brockton Area Transit System in 1981 and the proximity of the estimates to the actual operating characteristics were within a few percent, supporting the suitability of the model for use as a forecasting tool. Also, the model has been replicated for a number of other small-to-medium sized agencies. The tests supported the prospects for applying the technique in other small-to-medium sized agencies. With access to a microcomputer, the service supply estimation technique is simply and easily applied.

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Resources:

Software documentation is available in A Service Supply Estimation Technique, Old Colony Planning Council, Brockton, MA, August 1982.

Topic Area: Financing (State/Local Bus Pooling Agreement)

General Issue Being Addressed:

Establishment of a statewide buspool purchase program to reduce the cost of purchasing bus vehicles in small to medium-sized communities.

Potential Users of Case Study:

Small to medium-sized urbanized and non-urbanized transit authorities.

Problem Statement:

A collective effort was established by the Pennsylvania Department of Transportation to buy new buses for sixteen transit authorities through a single multi-year procurement.

The pool was formed in 1979 during a period of increasing transit ridership, while transit systems were having difficulties replacing aging vehicles.

The pool was formed to:

1. ensure the timely replacement of worn out vehicles.
2. provide a reserve capacity of vehicles by stockpiling the replaced buses to meet increased ridership demand.
3. reduce the unit price of acquiring buses through a large scale purchase.
4. reduce the red tape and paperwork involved in procuring buses by having one federal capital grant application for sixteen transit authorities for vehicle replacement over a three year period (1981-83).

Approach:

The pool was formed in 1979 and will remain active until one thousand buses are delivered and accepted, estimated to be in 1985. Upon entering the pool, each transit system agreed to sign (1) the Technical Agreement agreeing to abide by decisions of the Technical Committee; (2) the Authority Agreement committing to pay the local share for their vehicles; (3) and the Supplier Agreement assuming responsibility for inspecting, taking title to and accepting warranty rights for their vehicles, and to pass a board resolution authorizing their participation in the project. In addition, each system agreed to assign a sufficient amount of Section 5, Tier IV funds to help cover the costs of their buses and provide the state with all necessary federal exhibits, assurances, and vehicle specification information to enable the Department to complete the required federal capital grant application and finalize bus specifications.

Collective decisions are made through a technical committee composed of one voting member from each of the seventeen participating agencies. Each agency has one vote, regardless of the number of vehicles purchased, and the Pennsylvania Department of Transportation also has one vote. All decisions are based on a majority vote.

Results Achieved:

The Buspool represents the largest single federally approved bus order, with one-hundred buses delivered in 1982, six hundred in 1983, one hundred fifty in 1984 and one hundred fifty in 1985. Neoplan-USA was the successful bidder at an average cost of \$157,000 for delivery costs and spare part assemblies. The acquisition was limited to thirty-five foot and forty foot Advance Design Buses. The greatest advantage will be a significant cost savings per vehicle from the collective procurement. Secondly, the amount of paperwork involved in capital grant applications was substantially reduced for the transit agencies and state government. Smaller transit systems benefited from the experience of larger agencies in writing specifications and inspecting buses. In addition, the smaller systems will be able to accrue benefits of the Safe Harbor Lease Tax Credit Program to be handled collectively by the Technical Committee and the Pennsylvania Department of Transportation. With small fleets, it would have been difficult for these systems to sell depreciated tax credits.

Potential Transferability:

The bus consortium concentrated on replacing the bus fleet operated by local transit authorities. Pooling of bus purchases has applicability to many states where smaller transit properties can benefit from the joint purchase and the expertise of larger transit systems.

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Resources:

Dockendorf, John, The Pennsylvania Statewide Bus Pool Purchase--Internal Memorandum. Pennsylvania Department of Transportation, Harrisburg, October 1982.

Topic Area: Financing (State/Local Cooperative Maintenance Agreements)

General Issue Being Addressed:

Cooperative agreements between state and local governments on routine functions such as snow removal or maintenance can help provide maximum services for the dollar. Pennsylvania provides an example of how mutually cooperative arrangements between state governments and local jurisdictions can provide more timely and efficient services to the citizens.

Potential Users of Case Study:

Small to medium-sized cities with maintenance capabilities willing to work with state governments to perform selected maintenance functions when the state's work load in an area exceeds capacity.

Problem Statement:

In routine maintenance functions such as snow removal, a cooperative agreement between states and local governments can provide efficiencies only where municipal personnel must travel over state highways to reach local roads. Cooperative agreements can be arranged where local governments have the available manpower and equipment to provide maintenance at lower cost or in a more timely manner, especially on roads where the state out of necessity must assign a low priority.

Approach:

The Pennsylvania Department of Transportation has made available to local governments a series of service agreements allowing these units to perform maintenance on state highways within their jurisdictional boundaries. The service agreement includes:

1. winter maintenance including snow and ice removal and control
2. pothole patching
3. comprehensive maintenance including shaping, patching, base repair, sealing, grading drainage systems, mowing, etc.

The pothole and comprehensive maintenance program depends on the establishment of unit costs for performing various items of work. Payment is made upon receipt of a certified invoice. All work must be conducted to state specifications, policies

and procedures. Reimbursement is negotiated based upon each municipality's estimated labor and equipment costs.

Winter maintenance contracts are determined by the number of miles of road by type, i.e., primary or secondary. A lump sum payment is provided. Once a reimbursement is established, no adjustments are made regardless of actual weather conditions.

Results Achieved:

The number of maintenance agreements varies from year to year, depending in part on previous experience with the program. The pothole patching program varied from eight to forty agreements between 1975 and 1982, representing a financial commitment of \$165,000 in 1982. Interest has expanded in the comprehensive maintenance program with nineteen agreements representing \$375,000 in 1982. Winter maintenance agreements have grown from 187 agreements in 1976 to 725 in 1982, at an estimated annual value of 5.4 million dollars.

Potential Transferability:

Small to medium-sized municipalities that have manpower and equipment that can be provided at lower or competitive cost to the state highway department on local streets and highways considered to be low priority by the state.

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Topic Area: Financing (Joint Development--Public/Private Funds)

General Issue Being Addressed:

Use of creative financing to combine various public and private funding sources to implement a multi-purpose joint development project.

Potential Users of Case Study:

Planners, local decision makers and city managers in small to medium-sized cities.

Problem Statement:

The Four States Fair, a major seasonal event held in Texarkana, population 70,000, attracts over 100,000 persons annually. Due to growing attendance, the Four States Fair Association sought a new fair site with adequate parking, expansion potential and joint development potential. In 1979, plans were developed for relocating the fair site to the Loop 245 Park, a 125 acre tract of land occupying the southeast corner of the intersection of Interstate Highway 30 (east-west four lane divided, controlled access freeway) and Loop 245 (a four lane divided, limited access expressway). The Loop 245 Park Project will include a convention center, hotel facilities, the Four States Fair, a regional recreational park complex and related access facilities.

Approach:

A joint development program was pursued based on a cooperative effort between public and private interests. The basic philosophy was to combine all potential sources of public and private financial assistance in order to encourage maximum development of the Loop 245 Park site.

Results Achieved:

The complete project envisions construction of the following elements:

1. Four States Fair - midway and livestock housing complex with parking for 2,000 autos.
2. Loop 245 Park - a passive leisure-arts recreational facility which links all the plan elements together. The park includes a picnic area, jogging trails, walking trails, benches, pavilions, rock gardens, amphitheater, fishing wharves and parking for 200 autos.
3. Access - approximately 1,000 feet of interstate frontage and 2,600 feet Loop frontage. Frontage roads are proposed on both sides of the complex with internal development roads. A full interchange at Loop 245 is proposed.
4. Convention Center - a 51,000 square foot building with a seating capacity of approximately 4,000 persons with 1,300 parking spaces. The complex includes plaza space for outdoor events including arts, crafts and farmers market.
5. Hilton Hotel - initial construction of 175 room hotel with future expansion to 300 rooms. A restaurant and meeting rooms will be provided.

Phase I construction is now in progress and includes items 1 and 2 and part of item 3. Phase II will complete items 3,4 and 5.

The various federal, state, local and private funds to be joined for development of the Loop 245 Park include:

1. Fair Grounds - \$5,000,000 private funds from the Four States Fair Association and \$500,000 from the Economic Development Administration.
2. Park Complex - \$1,200,000, with fifty percent from the Federal Land and Water Conservation Program and fifty percent from the local government.
3. Access - right-of-way for frontage roads funded by the private Four States Fair Association. Frontage road construction is 75 percent Federal Aid Urban and 25 percent local government through bond issues. The interchange is 75 percent Federal Aid Urban and 25 percent state. The total cost is \$3,000,000.
4. Convention Center - \$2,000,000 federal and local government funds.
5. Hotel - \$10,000,000 private funds.

Potential Transferability:

The joint development experience has been extended in Texarkana to an Airport Industrial Park which includes a 420 acre industrial park located adjacent to Loop 245, a four lane divided, limited controlled access facility and U.S. Highway 67. Transportation access facilities were funded from Federal Aid Primary Funds; right-of-way was provided by a private authority and the Texarkana Industrial Foundation. Internal streets and utilities were funded by EDA and HCD funds and from private sources: the Texarkana Industrial Foundation and Texarkana Chamber of Commerce. Local bond funds were used for construction of a fire station. Industries located at their own expense.

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Topic Area: Financing (Road Impact Fee System)

General Issue Being Addressed:

Estimation of the traffic impacts of proposed development and calculation of a road impact fee paid by developers to compensate for expected traffic impacts on roads operating over capacity.

Potential Users of Case Study:

Municipal and county governments.

Problem Statement:

Broward County is located along the southeast coast of Florida and covers 1,200 square miles. However, only 410 square miles are in the urban area of the county. During the 1960's, Broward was the fastest growing county in the United States. From a 1970 population of 620,000, the county has grown to over one million people. The county's 1981 land development code requires that proposed developments be serviced by adequate transportation facilities in order to be approved. When existing facilities are inadequate, the developer may construct the needed roads, or is assessed an impact fee to help pay for the needed improvements.

Approach:

Using the Traffic Impact System (TRIPS) computerized traffic model, Broward County planners calculate the impact fee through simulation of the expected traffic impacts of the proposed development. The case study illustrates the economic benefits gained by the community at large when developers underwrite some of the transportation costs.

TRIPS operates on a minicomputer with input via CRT terminal and output on printer and plotter. The following information must be supplied: name of proposed development, type and quantity of proposed land use, locations of loading into the highway network, and travel time to each loading location from the proposed site. The amount of the fee is based on: the cost of improving the impacted road segment, the additional capacity which the improvement will accommodate, and the number of trips placed on the segment by the proposed development. The model is very sensitive to location, thereby penalizing development near congested roads. For each segment, the model compares the roadway to the sum of existing traffic, traffic from approved plots, and traffic from the

proposed development. If the total exceeds capacity, then an impact fee is assessed. The fee for each segment is calculated by using the ratio of the number of generated over-capacity trips on the segment to the additional capacity accommodated by an improved roadway. This ratio is multiplied by the estimated cost of improving the segment.

Results Achieved:

During the period from April 1, 1982 to August 31, 1982, road impact fees assessed averaged approximately \$720,000 per month. This equals \$1,400 per acre of new development. A developer may hire a traffic consultant which results in precise capacity analyses and frequently in new proposals for improvements to relieve the over capacity conditions.

Potential Transferability:

Applicable to areas where a high demand for land exists. There must be a review process for all development proposals in the jurisdiction. Also, the legal basis for such a system varies from state to state.

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Resource:

Documentation of model to be available soon. Copies of Land Development Code available at nominal charge.

Topic Area: Programming and Communication with Decision Makers (Management of the Local Street System)

General Issue Being Addressed:

Application of functional classification as a tool to guide decisions concerning operation of the local highway and street system in a small community.

Potential Users of Case Study:

Planners and public works directors in small to medium-sized communities.

Problem Statement:

Eau Claire is a regional center located in West Central Wisconsin with a population of 52,000. In 1972, the City of Eau Claire was requested to prepare a functional classification plan in response to the 1968 Federal Highway Act mandate of preparing a 1990 Highway Need Study. A policy statement on the role of functional classification to guide street and highway policies, laws and ordinances was adopted by January 1974. In conjunction with adoption of the Street Functional Classification Plan, street operational and construction standards were also prepared.

Approach:

The case study highlights the use of functional classification in a community of 52,000 to serve as the foundation for planning and programming decisions concerning the operations of street and highway systems. The plan is updated periodically as an on-going commitment of the local government.

Results Achieved:

The City of Eau Claire's experience with the street functional classification system (SFCS) has

been very positive. The SFCS has proven to be a very effective tool in planning, programming capital improvement projects, setting maintenance priorities, and implementing a traffic management system on a city-wide level. Further, the SFCS serves as an effective means of communication and coordinating with other city agencies concerned with the operation and development of the street system.

The adoption of operational and construction standards associated with the classification system has been very helpful in reviewing developers' proposals and negotiating with the surrounding town governments over construction, maintenance, and jurisdictional matters. The classification system has been used in new developing areas with vacant land. Developers are required to dedicate the necessary right-of-way as part of the process of having plats approved. Additional right-of-way necessary for major arterial streets has not posed a problem to date. Using the operational standards, developers have a concept of what adjacent street pattern and use is planned. The City also has a site plan review committee that uses the classification system in determining land use controls.

Therefore, the transportation system becomes an integral part of the land use decisions rather than being a reaction after the fact. With a major change in land use such as a proposed regional shopping center, considerable effort was made in extending the classification system to an undeveloped area and projecting traffic volumes on the system. This was of great assistance to the decision makers in their deliberations on this major land-use change and was beneficial to the public in understanding the traffic impact on existing developed areas.

The classification system has also been used quite effectively in obtaining access controls on the major arterial routes. It has also been used by the area school district and the Parks and Recreation Department in discussing sites for proposed schools and parks.

In preparing the street capital improvement program, the classification system is a major element in establishing priorities. Following the adoption of the classification system by the Council, the Public Works Department has been programming a major portion of available street improvement funds to upgrade the arterial street system. Over the last eight years, significant improvements have been made to which the public has responded favorably. The emphasis has been getting the biggest "bang for the buck" versus spending a fixed amount of dollars per year on street paving projects.

The classification system has also been quite helpful in optimizing street maintenance programs and in establishing snowplowing priorities. Collectors and arterial streets receive higher priority and greater frequency of maintenance than local streets. The snow emergency route system has been developed for approximately 75 miles of the 260 miles of streets in the city. All city bus routes and arterial and collector streets are on the system. Under snowplowing conditions, these routes have a top priority and all are cleaned before plowing operations are started on the local street system. After many snowfalls, these are the only routes that are plowed. During a declared snow emergency, parking is prohibited on all snow emergency routes until the streets have been plowed from curb-to-curb.

Since the adoption of the SFCS, the proper use of traffic control devices has been very successful

in Eau Claire. The classification system has been used extensively to resist public demands for unwarranted traffic controls. The use of stop signs has been generally limited to only intersections with collector/arterial streets or sight obstructions. The city has been quite successful in removing a number of unwarranted stop signs on local streets and changing stop sign directions on a number of other locations, using the classification system as a major justification. As an example, stop signs on a collector street were located approximately midpoint of a one-mile segment. The local street was given priority because that is where the old street car tracks used to be. The tracks were removed well over 30 years ago, but the stop signs remained. Using the classification system, the stop signs were reversed over objections of the neighborhood.

The classification system has also been used quite successfully in several other areas affecting traffic operations:

- Parking restrictions
- Number of travel lanes
- Speed limits
- Designating truck routes
- Justifying high traffic volumes
- Controlling number and location of private driveways
- Street lighting standards
- Justification for sidewalks
- Using warrants for traffic signals
- Locating school crossings
- Channelization

The classification system has been used very effectively as a justification for requiring sidewalks on collector and arterial routes. Although recommended by the Public Works Department on most local streets, the success rate has not been as good. Generally, property owners oppose installing sidewalks primarily because they must pay for them (one hundred percent through special assessments) and must maintain them (shovel snow).

The functional classification system has also been used in developing the special assessment policy for street improvements. The city assesses local streets for one hundred percent cost of street improvements (i.e., grading and graveling, paving, curb and gutter, driveway approaches, and sidewalks). On collector and arterial routes, property owners are only assessed for property access, the same rate as the local street. The additional roadway width is funded as a general public benefit out of the general fund.

Potential Transferability:

Use of the functional classification plan as an effective tool in managing the street and highway system requires technical staff personnel and decision makers willing to represent overall community interests. Characteristically, this is found in a city-manager, council form of government with several representatives being elected at large.

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Topic Area: Street Maintenance Prioritization and Communication with Decision Makers

General Issue Being Addressed:

Public works officials need to communicate to the general public the advantages of performing timely maintenance on local streets and highways. Experience has shown that proper maintenance prolongs useful street life and a lack of maintenance leads towards large scale deterioration. Generally, corrective actions taken when streets are visually in bad condition will receive public support, but can cost four times as much to correct. Scarce funds can then be spent more effectively on preventive maintenance and it is important to develop a street maintenance program in such a manner as to define needs and priorities, monitor progress and communicate needs to the public.

Potential Users of Case Study:

Municipal and county public works officials, city engineers and street superintendents concerned with establishing a street maintenance program.

Problem Statement:

The winter of 1979-1980 had a particularly severe impact on the physical condition of the 252 miles of local streets in Ft. Collins, Colorado, population 70,000. With a limited budget for street maintenance, it became necessary to implement a strategic plan to establish priorities and also communicate the need to expand annual street maintenance funding from \$80,000 per year to \$800,000-900,000 per year. The local streets, over six million square yards of pavement, represent a capital investment of over \$66,000,000.

Approach:

The approach assumes that a square yard of pavement has a fixed life of twenty years and various techniques exist for extending life based on the concept of a "square-yard-year of pavement life." If no action is taken besides routine maintenance of patching and crack sealing, the road has one less year of useful life. Depending on a road's functional classification, an arterial overlay could potentially add five to ten years and a seal coat can add one to three years to pavement life. After the application of an overlay in year fifteen, the pavement is assumed to be as good as new and its life is extended ten years. Translating this to the 6,171,000 square yards of pavement in the city, the pavement loses 6,171,000 square-yard-years of life every year. In order to counter this loss, life must be added back to the system. This added life can be measured for comparison by the same approach, square-yard-years. For example, a project is planned for overlaying a section of street with 30,000 square yards of asphalt pavement. The overlay will add ten years of life to the street. The result is 300,000 square-yard-years of life added back to the street system. Given an estimate of ride quality deterioration with age (for example, it is assumed that without treatment the ride quality becomes unacceptable for the last twenty-five percent of the life cycle), appropriate maintenance actions can be taken at critical points during the life cycle to achieve gains in pavement life. In the aggregate, the performance of an effective maintenance program for the local street system can be depicted.

Development of the pavement maintenance management program relies on acquiring accurate data concerning the condition and performance of existing streets and selecting a method of establishing

priorities. As part of the maintenance program, a sufficiency study was conducted to identify the existing condition of pavements. City personnel were utilized to identify the following items:

Street Surface Study

1. Pavement cracks
 - a. Severity
 - b. Frequency
2. Deformations
3. Failure areas

Soil Borings

Traffic Information

1. Percentage of trucks
2. Average daily traffic

Physical Data

1. Curb and gutter
2. Sidewalks

Drainage Data

Corings were made through pavements on about twenty miles of the more critical arterial streets to determine thickness of the asphalt and base, and condition and type of subgrade soil. Benkelman beam deflection measurements were made on the same streets to ascertain traffic carrying capabilities of existing pavement sections. Average daily traffic counts for major streets from 1977 were projected to the year 2000 and used to determine needed design capacity values.

Structural adequacy of the pavement, ride quality and traffic volumes were used to establish a five year prioritization to establish total street repair needs. As traffic or weather conditions alter pavement conditions, priorities are updated on a continuing basis.

Results Achieved:

The sufficiency study determined that nearly 65 percent of the streets needed some reconstruction and asphalt overlays within the next five years. The worst 25 percent needed reconstruction during the current year. Using information from this sufficiency study, priorities were established on a project-by-project basis for development of a five year major street rehabilitation budget totaling about \$5,000,000. The budget need was estimated at \$15,000,000 over five years, but anticipated funding limited actual expenditures to about one-third of the program needs. Yet the prioritization program represents a fifteen fold increase in street maintenance over the previous four years. This is the direct result of the ability of public works officials to communicate effectively street maintenance needs to city administrators and local officials.

The sufficiency study and street maintenance programming effort gave public officials an opportunity to:

- Optimize maintenance fund utilization.
- Select various types of pavement repair.
- Determine priorities with respect to maintenance cost.
- Determine increased serviceability obtained for various types of corrective repair actions.
- Develop a prioritization map so repairs can be coordinated in various sections of the city.
- Allow utility companies to program their work so newly overlaid streets are not cut after overlay.¹

Potential Transferability:

The technique presented has application to communities interested in providing timely maintenance and seeking to achieve public support for routine street maintenance functions. Public works officials must work closely with elected officials and the public in communicating needs.

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Resources:

Krempel, Roger, "The Economics of Timely Street Maintenance." Paper presented at International Public Works Congress of the American Public Works Association, Kansas City, Missouri, September 1980.

Krempel, Roger, "Pavement Preservation Strategies and Economics." Paper presented to the Third Annual Road and Street Maintenance Conference, Fort Worth, Texas, April 1982.

Street Sufficiency Study--City of Fort Collins. Centennial Engineering, Inc., Arvada, Colorado, June 1980.

References:

1. Krempel, Roger. "The Economics of Timely Street Maintenance." Paper presented at International Public Works Congress of the American Public Works Association, Kansas City, Missouri, September 1980.

2. Krempel, Roger, "Pavement Preservation Strategies and Economics." Paper presented to the Third Annual Road and Street Maintenance Conference, Fort Worth, Texas, April 1982.