1991

An Evaluation of the Missoula Urban Transportation Plan 1985 Update

Hong Fu
The University of Montana

Let us know how access to this document benefits you.
Follow this and additional works at: https://scholarworks.umt.edu/etd

Recommended Citation
https://scholarworks.umt.edu/etd/9291

This Thesis is brought to you for free and open access by the Graduate School at ScholarWorks at University of Montana. It has been accepted for inclusion in Graduate Student Theses, Dissertations, & Professional Papers by an authorized administrator of ScholarWorks at University of Montana. For more information, please contact scholarworks@mail.lib.umt.edu.
AN EVALUATION OF THE MISSOULA URBAN TRANSPORTATION PLAN
1985, UPDATE

by

Hong Fu
B. S., Northern Jiaotong University
Beijing, China, 1983

Presented in partial fulfillment of the requirements
for the degree of
Master of Science
University of Montana
1991

Approved by:

Chairman, Board of Examiners

Dean, Graduate School

Date
Dec. 18, 1991
ACKNOWLEDGMENTS

I wish to thank Professor Darshan S. Kang and Professor Paul Miller who kindly helped and patiently corrected me in writing this paper. In particular, my thanks go to Professor Evan Denney and Mike Kress, Director of Missoula Office of Community Development, for their good advice and generous help.

I also wish to express gratitude to my uncles, Mian Wu and Hanming Wu, my sisters, Ning and Ming, and my darling friend, Eping, for their love, encouragement, and generous support. And last I dedicate this work to my dearest Dad and Mom for their everlasting love, support and encouragement.
TABLE OF CONTENTS

ACKNOWLEDGMENT ..................................... ii
LIST OF ILLUSTRATIONS ............................... iv
LIST OF TABLES ....................................... v

Chapter

I. INTRODUCTION ................................. 1
   Problem Statement
   Study Area
   Research Methodology

II. A REVIEW OF THE HISTORY OF TRANSPORTATION PLANNING ................. 5
   Metropolitan Transportation Planning
   Transportation Planning Process
   Evaluation Techniques

III. MISSOULA TRANSPORTATION PLAN ANALYSIS .......... 15
   Transportation Plan's Goals and Objectives
   Projections

IV. CURRENT FACTOR EVALUATIONS .......................24
   Traffic Counts
   Populations
   Funding Sources

V. SUMMARY ........................................... 41
   Traffic Counts
   Population
   Funding Sources

SELECTED BIBLIOGRAPHY ................................. 43
# LIST OF ILLUSTRATION

<table>
<thead>
<tr>
<th>Figure</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Missoula Urban Transportation Study Area</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>Scope of Evaluation Process</td>
<td>13</td>
</tr>
<tr>
<td>3</td>
<td>Conceptual Framework for Evaluation</td>
<td>14</td>
</tr>
<tr>
<td>4</td>
<td>Missoula Traffic Analysis Zones</td>
<td>19</td>
</tr>
<tr>
<td>5</td>
<td>Missoula Future Traffic Volumes in Year 2000</td>
<td>23</td>
</tr>
<tr>
<td>6</td>
<td>Annual Average Daily Traffic and Percent Change from Previous Year (on Orange Street, Southwest of the Orange Street Bridge)</td>
<td>28</td>
</tr>
<tr>
<td>7</td>
<td>Missoula County Population, 1930 - 2010</td>
<td>33</td>
</tr>
</tbody>
</table>
# LIST OF TABLES

<table>
<thead>
<tr>
<th>Table</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Missoula Population and Employment Projections</td>
<td>21</td>
</tr>
<tr>
<td>2. Missoula Traffic Counts Comparison at Studied Stations</td>
<td>30</td>
</tr>
<tr>
<td>3. Missoula Population Comparison</td>
<td>32</td>
</tr>
<tr>
<td>4. Missoula Available Funds through Federal Aid Program</td>
<td>36</td>
</tr>
</tbody>
</table>
CHAPTER 1
INTRODUCTION

Transportation systems that provide access to employment, labor, goods, and services are crucial to the economic and social well-being of a community. Transportation planning today is a blending of technology and social science that occurs within a highly political environment and is shaped by the formal planning process.

All transportation planning activities are determined by the relationship between transportation and land use. This land use-transportation relationship is complex and changes to meet the political, social, environmental, and ethical requirements.

"The Federal Aid Highway Act of 1962 called for comprehensive, continuous, and cooperative urban transportation planning."¹ This "3C" process led to comprehensive long-range transportation plans in urban areas with populations exceeding 50,000 in United States. Changing economic, social, and environmental conditions during the last three decades influenced developing urban transportation systems and planning, rendering many plans obsolete.

Consistent with the Highway Act of 1962, Missoula

created its first transportation plan, the Missoula Urban Transportation Plan, in 1967. Updates of this plan occurred in 1974 and 1985. The 1985 update focused on "providing necessary, immediate and long-range improvements to Missoula's major street network," as well as updating community transportation needs, in general.

Problem Statement

This paper evaluates the Missoula Urban Transportation Plan, 1985 Update in terms of its ability to meet current transportation goals and objectives. It assesses Missoula's current traffic volumes, pertinent socio-economic factors, and funding level to determine how the 1985 update should be revised.

Study Area

Missoula is the primary regional trade center in western Montana and is where the University of Montana is located. Missoula's developed urban area exists adjacent to the Clark Fork River and extends west and southwest to the Bitterroot River. The study area of this paper is the Missoula Transportation Study Area, encompassing the entire Missoula urban area and a small portion of Missoula County. This study area covers approximately 46.5 square miles. Figure 1 shows the study area boundary and major street

---

network.

**Research Methodology**

Abundant literature exists on the subject of transportation planning and evaluation. Accordingly, a literature search regarding urban transportation planning processes and evaluation techniques appears in Chapter II.

But, in a practical sense, many factors and criteria for evaluation are determined by local politics, economics, and community attitudes. Therefore, to determine the validity of the existing transportation plan, this paper (1) identifies the original goals and components of the 1985 plan update; (2) assesses the disparity between current traffic and population data and the 1985 plan projections; and (3) identifies funding sources for plan implementation.
Figure 1. MISSOULA URBAN TRANSPORTATION STUDY AREA

CHAPTER II

A REVIEW OF THE HISTORY OF TRANSPORTATION PLANNING

Metropolitan Transportation Planning

A fairly standardized metropolitan planning process that coordinates the plans of most transit and highway agencies has been structured by federal legislation and programs since the 1930s.

The Federal Aid Highway Act of 1934, which permitted a state to use up to 1.5% of construction funds for planning and economic evaluation, inaugurated highway planning at the state and local level.

The greatest impetus for transportation planning, as well as comprehensive regional land use planning, was the Interstate Highway System, launched by the Federal Highway Act of 1956. As cities and states began funding interstate highway links, there was the need to develop plans that were based on regionwide, comprehensive analyses of proposed projects and their costs and benefits.

The Federal-Aid Highway Act of 1962 provided major stimulus for a formal comprehensive process. The process required that "highway construction projects in urbanized areas of more than 50,000 population must be based on a continuing, comprehensive planning process carried out cooperatively (the "3-C" process) among states and local
communities." The "3-C" process had tremendous impact on the organizational arrangements developed at the local level to carry out highway and, ultimately, all transportation planning.

In 1975, the Federal Highway Administration (FHWA) and the Urban Mass Transportation Administration (UMTA) issued joint highway and planning regulations that empowered the governor to designate the Metropolitan Planning Organization (MPO) for each metropolitan area in the state.

From 1965 to 1983, MPOs' responsibilities and scope of their role grew substantially. MPOs were required to prepare three major documents: (1) a comprehensive long-range plan for transit and highway improvements; (2) a three- to five-year Transportation Improvement Program (TIP); and (3) an one-year program of activities. MPOs were required also to prepare Transportation System Management (TSM) plans to make better use of existing transit and highway facilities. As federal regulations became more stringent, MPOs began to develop comprehensive data bases and regional planning models on which other agencies came to rely.

In 1983, in response to criticism of the 1975 joint regulations for being too prescriptive and unresponsive to

---

local needs, the federal government issued new planning regulations that significantly relaxed the restrictions and requirements on states and MPOs. As a result of those regulations and lack of federal funding, there is strong pressure in some regions for decentralization or redistribution of the MPO function among smaller coordinating and planning units. As MPO obligations became less comprehensive, planners began to develop and rely on simplified and streamlined analytical approaches. Increasingly, they focus on single growth corridors or subregional areas and use less comprehensive and less complex methods in planning.

Transportation Planning Process

Technical Process

Large-scale transportation planning techniques and regional land use models were developed primarily to meet the new comprehensive planning requirements placed on MPOs by the "3-C" process. Three principle activities of the technical transportation planning process at the regional level are as follows: (1) gauging the demand for transportation services and facilities; (2) matching cost effective supply options to that demand; and (3) considering the impact of supply alternatives on the social, economic, and environmental characteristics of the community.

The process explains large-scale land use and
transportation patterns and social and commercial phenomena in a community. It also gives policy-makers comparable measures by which to judge alternative transportation strategies. Overall, the technical process has given U.S. transportation planners a good record in predicting future transportation needs.

Comprehensive Process

Though other components may vary, a regional transportation planning process must consist of the following elements:

1. Land use forecasting

2. Projecting population growth, economic activity, and travel demand

3. Matching predicted demand to possible supply options

4. Estimating costs and benefits of potential alternatives for the community.

New Approaches

As time progresses, many factors have created the need for new or modified approaches to regional transportation planning: (1) less available funds for needed transportation improvements; (2) growing complexity of regional supply and demand models; (3) pressure from political decision-makers; and (4) the need for immediate responses. Descriptions of new approaches are as follow.
Increasing System Efficiency

Because facilities are generally built to provide a high level of service during the peak period, the existing system is often inefficiently used during most of the time. There are a number of ways to make a better use of facilities by redirecting and redistributing travel demand. The methods, such as tolling on expressways during peak hours, offering reduced fares for carpool, and creating special bus and carpool lanes on freeways, have been the alternatives for that purpose. Transportation System Management (TSM) plans act to consider which of the possible methods could and should be used.

Paratransit Services

The traditional approach to regional transportation planning focused only on the public component of any transportation system that was directly supplied by the public sector. Paratransit services, a new approach with which planners are working today, combine public and private components. The services generally include carpooling, vanpooling, and subscription bus service, as well as taxis and demand-responsive transit services. In many cases, paratransit services are cheaper than comparable services provided by the public sector alone.

Streamlined Analytical Procedures

The traditional regional transportation planning
process described earlier was lengthy and complicated. It took from one to three years to provide answers to local policy-makers, which was too late to be of help in deciding pressing local policy issues.

The traditional four-step procedure includes: (1) trip generation—estimates the number of trips generated by different types of land use; (2) trip distribution—estimates where in the city the generated trips will go; (3) modal split—estimates which trips will use transit and which will use private auto; and (4) traffic assignment—assigns trips by each mode to actual or planned routes.

At the end of the 1970s, many metropolitan planning agencies began developing travel estimation procedures that could give analytical responses to important policy questions in a few months. These methods were the results of MPOs' emphasis shifting from long-range to short-range planning. The travel estimation methods generally supplement the traditional four-step procedure (trip generation, trip distribution, modal split, and traffic assignment).

The Local Transportation Planning Process

In many important ways local transportation planning processes are the same as those at the regional or metropolitan level. Local transportation planners estimate future demand or current travel need and match that need to cost-economical supply option. But the local projections
and activities are not always coordinated with the regional planning process.

Meeting high demand on local arterial is a frequent planning problem. The ultimate goal of local transportation planning is to make an uncongested network of highways and transit services that will link neighborhoods to other neighborhoods and commercial areas.

Local planners, like their regional counterparts, need to predict the number, kind, and distribution of trips associated with various land use patterns and building types. But local planners focused on individual parcels of land and specific land uses. Local planners can use empirical information as a guide to determine travel patterns. Ten major types of land uses that generate a number of trips are given by the Institute of Transportation Engineers (ITE): port and terminal, industrial and agricultural, residential, lodging, recreational, institutional, medical, office, retail, and services. Local planners can easily use the ITE Trip Generation Manual, with or without additional data from local studies, to determine the travel demand and then to match the demands to cost-effective supply options.

Urban road facilities are generally grouped into four categories according to level of service and function: expressway, arterial, collector, and local.
Evaluation Techniques

As part of the continuing transportation planning process, an evaluation is required to analyze data related to land use changes, traffic volumes and accidents and other socioeconomic factors describing conditions in the study area. By comparing current data with projection data, planners can assess the validity of the transportation plan.

Figure 2 presents the scope of the evaluation process, including procedures for developing an evaluation work plan, conducting technical analysis, and reporting the results of evaluation. The primary emphasis is on the integration of existing techniques into a comprehensive, operational framework for evaluation.

Figure 3 shows the conceptual framework for comprehensive evaluation of transportation plan. It includes key inputs, impact factors, and evaluation components.
Assess plan's validity

Developing an evaluation work plan
- Understanding of the information needs of the overall planning process (when and what)
- A plan for producing information

Technical analysis
- Detailed information about the evaluation factors

Reporting
- Presenting the findings

Fig. 2 Scope of Evaluation Process
OVERALL RESULTS

Key Inputs
- Plan's goals and objectives
- Concerns of decision-makers and others
- Legal and administrative requirements

Factor Collection
- Socioeconomic factors
- Land use
- Accident data
- Traffic volumes
- Funding and budgetary activities
- Environment and energy

Factor Evaluation
- Comparing and analyzing

Fig. 3 Conceptual Framework For Evaluation
CHAPTER III
MISSOULA TRANSPORTATION PLAN ANALYSIS

The Urban Transportation Plan for Missoula was originally completed in 1967, using 1964 data. In 1974, the traffic assignment model was updated and modified to the urban study area. Since then, changes have occurred in the development of the urban area, land use, major street network, and the travel demands. Certain elements of the original Transportation Plan are obsolete and no longer appropriate. In order to identify current transportation problems and improvements, the 1985 Update was made by a cooperative effort of the City of Missoula, Missoula County, the Missoula Office of Community Development, the Montana Department of Highways, and the Federal Highway Administration. This project was funded primarily with federal and state match planning funds with some contribution by the Missoula Redevelopment Agency.

The Missoula Urban Transportation Plan, 1985 Update was based on future land use and was intended to meet the transportation needs of Missoula as the community grows. It was an essential part of the overall comprehensive planning process and was intended to be a guide to provide necessary short- and long-range improvements to Missoula's major street network. This plan included two types of improvements: network improvements and transportation system management improvements. Network improvements
consisted of significant additions or modifications to the major street network and involved substantial construction and cost. Transportation system management improvements were designed to maximize the efficiency of the existing facilities and typically consisted of little or no construction and relatively low cost.

The Transportation Plan, 1985 Update developed the population and employment projections which were determined by Missoula Traffic Analysis Zones (TAZs). These parameters reflected the present conditions and future growth of Missoula and were used in the traffic assignment model. This plan also covered transportation problem identification, a central business district traffic circulation plan, and a financial plan. Some components of the plan are discussed more in later sections of this study.

**Transportation Plan's Goals and Objectives**

A public transportation system not only broadens the transportation alternatives available to a community, but also broadens the capability of a community to solve its social and economic problems and to seize opportunities. The Missoula Policy Guide for Urban Growth established the community's goals for the transportation system. The primary goals and objectives defined in the Transportation Plan, 1985 Update are as follows:

1. Reduce travel time
a) shorten travel distance
b) reduce congestion
c) separate incompatible traffic

2. Increase health and safety
   a) implement improvements and maintain mass transit system to reduce accidents
   b) provide safer pedestrian and bicycle travel facilities
c) maintain transport facilities for handicapped and elderly
d) design and maintain improvements to meet federal air quality standards

3. Lower traffic operating costs
   a) decrease the number of vehicles by improving carpool, mass transit, bicycle, and pedestrian travel system
   b) improve facility maintenance and adopt design life standards for new facilities and reconstruction

4. Reduce energy consumption
   a) make public transit system more efficiently
   b) update bikeway system periodically
   c) minimize congestion
d) develop a network of pedestrian travel ways

5. Promote better land development
a) design a transportation system to be coordinated with the land use plan.

Projections

Population and Employment Projections

Missoula County population and employment projections were developed during the Missoula Urban Transportation Plan. The geographic area covered is the Missoula Transportation Study area, which comprises 117 individual Traffic Analysis Zones (TAZs). Figure 4 shows the Missoula Traffic Analysis Zones.

The 117 TAZs are aggregated into 13 Census Tract equivalent zones which approximate the Study Area to obtain the information of analyzing past trends and the forecasts. The forecasts for the Tract equivalents are then disaggregated into the 117 TAZ's according to the share of each TAZ to the Census Tract equivalent. Therefore, the data of each TAZ can be achieved.

For each TAZ, population and employment data were developed using the 1980 block-level census data. By using historic growth patterns and a linear regression program, the population and employment conditions in future years were projected.

Missoula County population projections were obtained from the Research and Information Systems Division, Montana Department of Commerce (DOC). The 1980 census data indicated that about 80% of the County population resided in
Figure 4. MISSOULA TRAFFIC ANALYSIS ZONES

the Transportation Study Area, and that percentage was used to estimate future populations.

Missoula employment data for TAZs was mainly obtained from the Department of Labor and Industry, Research and Analysis Bureau according to the records of all employers in Missoula County who paid unemployment insurance during that year. Additional information was obtained by telephoning employers not covered in the Department of Labor records.

The employment/population ratios are the key assumptions used to forecast employment for the Transportation Study area, which was developed by the Office of Business and Economic Research Services (OBERS). Table 1 gives the Missoula population and employment projections for the future years, including the estimates of Missoula County population and employment, the Study Area population and employment, the employment/population ratio, and the Study Area/County population ratio.

Urban Traffic Projections

Because of the complexities of the major street network and travel demands, future traffic volumes can not be estimated by simply applying historical growth factors to existing traffic counts. Urban traffic projections are commonly developed through the use of computerized traffic assignment models. The model utilized to assess future traffic conditions in urban areas of Montana is called
<table>
<thead>
<tr>
<th>Year</th>
<th>MSLA County POP</th>
<th>% change</th>
<th>Study Area POP</th>
<th>SAP/CP</th>
<th>MSLA County EMT</th>
<th>Study Area EMT</th>
<th>EMT/POP Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>1980</td>
<td>76,016</td>
<td>29.67%</td>
<td>61,630</td>
<td>81.08%</td>
<td>33,103</td>
<td>0.44</td>
<td></td>
</tr>
<tr>
<td>1985</td>
<td>77,000</td>
<td></td>
<td>62,370</td>
<td>81.00%</td>
<td></td>
<td>30,329</td>
<td>0.49</td>
</tr>
<tr>
<td>1990</td>
<td>84,800</td>
<td>11.56%</td>
<td>67,840</td>
<td>80.00%</td>
<td>33,920</td>
<td>0.50</td>
<td></td>
</tr>
<tr>
<td>1995</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.50</td>
</tr>
<tr>
<td>2000</td>
<td>96,800</td>
<td>14.15%</td>
<td>77,440</td>
<td>80.00%</td>
<td>39,494</td>
<td>0.51</td>
<td></td>
</tr>
<tr>
<td>2005</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2010</td>
<td>110,497</td>
<td>14.15%</td>
<td>88,401</td>
<td>80.00%</td>
<td>45,004</td>
<td>0.51</td>
<td></td>
</tr>
</tbody>
</table>


1Missoula.
2Population.
3Compared to previous year.
4Study Area Population/County Population.
5Employment.

"PLANPAC/BACKPAK", which is developed by the Federal Highway Administration. During the process of estimating traffic volumes on the major street network, this model combines traffic generation parameters such as population and employment with travel characteristics in a number of traffic zones within the study area. The projections of...
future socio-economic conditions and the traffic data which describes operational characteristics of the study area are primary model inputs necessary to estimate future traffic volumes.

The 1985 transportation plan traffic volumes predictions were developed from this model to represent the anticipated traffic loadings on street network within the Study Area in the years 2000 and 2010. Figure 5 shows annual average daily traffic volumes of the year 2000. These projected volumes are used to assess the ability of Missoula major street network to meet the needs of future traffic demands.

An interpolation method is used to yield the estimated traffic information of the years between 1985 and 2000 by applying the actual data of previous year and the predicted data of 2000. More details about this method will be discussed in a later section.
Figure 5. MISSOULA FUTURE TRAFFIC VOLUMES IN YEAR 2000

CHAPTER IV
CURRENT FACTOR EVALUATIONS

Three key factors have the most impact on transportation system. These three factors are traffic counts, population, and funding sources. By comparing the data for current conditions with the projections used in the Transportation Plan, 1985 Update, we can tell whether urban change is indeed occurring as forecasted, and thus, assess the validity of the plan. The evaluation factors are discussed in the following sections.

Traffic Counts

Missoula Traffic Counting Program

Traffic counts are an essential part of the overall transportation planning process. The counts not only provide the basic data for designing and implementing traffic improvements, but also provide valuable information for modifying traffic plans, developing street network improvement programs, and establishing priorities.

The Missoula Traffic Counting Program was prepared by the Missoula Office of Community Development in cooperation with state, city, and county agencies. This program was established for the Missoula Urban Transportation Study Area to provide basic traffic volumes which can be used in making objective highway and transportation related decisions.
This program basically involves four types of traffic counts distinguished by their intended uses: (1) surveillance or coverage counts; (2) continuous count locations; (3) control counts; and (4) special counts.

Surveillance counts, also referred to as coverage counts, are obtained with portable traffic recorders, usually during a period of 24 to 48 consecutive hours depending on unique characteristics of the facility being counted. These counts are generally taken at major intersections or major traffic generators in the street network.

Surveillance counts can be used to provide traffic volume information for the urban planning process which deal with the verification and/or development of transportation models. They are valuable for estimating vehicle miles traveled (VMT), average annual daily traffic (AADT), and peak directional hourly traffic volumes (PDHV).

Continuous count locations, generally referred to as Automatic Traffic Recorders (ATRs), are obtained from permanently installed traffic recorders. These ATRs are located at strategic locations on the street network and provide long-term and continuous traffic measurements.

The ATR continuously provides a source of key traffic data information for making daily, weekly and seasonal adjustments to raw traffic count data such as surveillance counts. These continuous counts are also used to determine
traffic trends. There is one ATR in operation in the Missoula Urban Area on a principal arterial (at south end of the Orange Street Bridge), which is operated by the Montana Department of Highways.

Control counts or seasonal counts are taken for a period of one week from four to twelve times a year. Control counts are mainly used to provide a seasonal assignment linkage for factoring surveillance counts to average annual daily traffic data.

Special counts are supplemental to a regular counting program and can be provided by machine or manually. They are usually taken as required for collecting specific traffic information for highway design purposes and special traffic studies, and for assessing various impacts on the street network imposed by special traffic generators.

Missoula Traffic Counting Program uses one automatic traffic recorder (ATR) and 256 portable traffic counters to obtain routine surveillance traffic information. This program is primarily designed to collect region-wide traffic volume data for calculating vehicle miles of travel (VMT), link volumes, cordon and screenline counts, and Highway Performance Monitoring System sample sections.

In the Missoula Urban Area, 257 count station locations were selected for base Traffic Counting Program by Montana Department of Highways, Missoula County Surveyor, and Missoula City Engineer based on certain criteria. 54 of the
257 count stations form part of the Highway Performance Monitoring System (HPMS), a Federal Highway Administration Program. These counts are adjusted to an Average Daily Traffic (ADT) by applying seasonal and daily adjustment factors. These factors are developed from Automatic Traffic Recorder data by Montana Department of Highways as follows:

\[
\text{Daily Factor} = \frac{\text{7 day average 24 hour volume}}{\text{daily 24 hour volume}}
\]

\[
\text{Monthly Factor} = \frac{\text{12 month average 24 hour volume}}{\text{monthly 24 hour volume}}^*\]

(* = after adjustment by daily factor)

Figure 6 presents the annual average daily traffic and percent change from previous year at the Automatic Traffic Recorder on Orange Street, southwest of the Orange Street Bridge. The traffic volumes do not change following a straight line trend.

Traffic Count Comparisons

The method used here to evaluate the validity of the Transportation Plan is simply comparing 1990 actual annual average daily traffic (AADT) to projected 1990 volumes. The projected data of 1990 can be obtained from a straight line interpolation between the 1985 and 2000 assignments assuming a constant rate for any change between 1985 and 2000. The formula of interpolation is as follow:
Figure 6. ANNUAL AVERAGE DAILY TRAFFIC AND PERCENT CHANGE FROM PREVIOUS YEAR (On Orange Street, Southwest of the Orange Street Bridge)

\[ 1990 I^1 = 1985 A^2 + \frac{1}{3}(2000 A - 1985 A) \]

or

\[ 1990 I = 2000 A - \frac{2}{3}(2000 A - 1985 A) \]

Interpolation.

Projected data

For this evaluation, thirty-five major traffic count locations were selected to represent the overall street network. Table 2 presents the thirty-five selected station number, the 1985 and 2000 assignment volume, the 1990 interpolation volume, the 1990 actual volume, and percentage difference between 1990 interpolation data and actual data. The first four locations are located on major bridges which are cutlines in the Missoula Urban Study Area. The remaining locations are on I-90, and East/West and North/South arterial and collectors.

The comparisons show that the disparities between the assigned volumes and actual counts are all less than 20%, except for Station 192 which is 38%. Station 192 locates on South Avenue, between Thames and Park. The overall disparity between the interpolation volumes and the actual counts is 7%.

Population

Missoula Population Projections

Another key factor affecting the transportation system is population information. Missoula population projections
TABLE 2
MISSOULA TRAFFIC COUNTS COMPARISON AT STUDIED STATIONS

<table>
<thead>
<tr>
<th>Sta No.</th>
<th>Location</th>
<th>1985 E + C</th>
<th>2000 E + C</th>
<th>Inter^2</th>
<th>Most Recent Count</th>
<th>% Diff</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>On Madison Ave (FAP 7) Bridge</td>
<td>16,140</td>
<td>27,200</td>
<td>19,827</td>
<td>23,350</td>
<td>15%</td>
</tr>
<tr>
<td>2</td>
<td>Just S. of Orange St. Bridge</td>
<td>16,520</td>
<td>19,900</td>
<td>17,647</td>
<td>16,570</td>
<td>-6%</td>
</tr>
<tr>
<td>3</td>
<td>Just S. of Russell St. Bridge</td>
<td>18,600</td>
<td>19,600</td>
<td>18,933</td>
<td>20,220</td>
<td>6%</td>
</tr>
<tr>
<td>4</td>
<td>Just W. of Reserve St. Bridge</td>
<td>13,150</td>
<td>19,200</td>
<td>15,167</td>
<td>14,520</td>
<td>-4%</td>
</tr>
<tr>
<td>5</td>
<td>1-90, btwn Reserve &amp; DeSmet</td>
<td>8,260</td>
<td>12,300</td>
<td>9,607</td>
<td>11,990</td>
<td>20%</td>
</tr>
<tr>
<td>6</td>
<td>1-90, btwn Reserve &amp; Orange</td>
<td>9,250</td>
<td>10,000</td>
<td>8,533</td>
<td>12,000</td>
<td>12%</td>
</tr>
<tr>
<td>7</td>
<td>19-90, btwn Orange &amp; VanBuren</td>
<td>11,800</td>
<td>14,000</td>
<td>12,533</td>
<td>14,400</td>
<td>13%</td>
</tr>
<tr>
<td>8</td>
<td>I-90, btwn VanBuren &amp; E. Msla</td>
<td>13,640</td>
<td>23,200</td>
<td>16,827</td>
<td>14,180</td>
<td>-19%</td>
</tr>
<tr>
<td>9</td>
<td>Orange, W. of MRL Overpass</td>
<td>12,280</td>
<td>12,500</td>
<td>12,353</td>
<td>13,510</td>
<td>9%</td>
</tr>
<tr>
<td>10</td>
<td>Stephens, btwn Beckwith &amp; Florence</td>
<td>12,970</td>
<td>16,500</td>
<td>13,979</td>
<td>13,910</td>
<td>-6%</td>
</tr>
<tr>
<td>11</td>
<td>Stephens, btwn Burlington &amp; Strand</td>
<td>11,380</td>
<td>11,200</td>
<td>11,877</td>
<td>13,320</td>
<td>11%</td>
</tr>
<tr>
<td>12</td>
<td>Brooks, S.W. of Higgins</td>
<td>10,070</td>
<td>15,600</td>
<td>11,913</td>
<td>13,620</td>
<td>13%</td>
</tr>
<tr>
<td>13</td>
<td>Brooks, N.E. of Reserve</td>
<td>16,140</td>
<td>17,800</td>
<td>16,727</td>
<td>19,870</td>
<td>16%</td>
</tr>
<tr>
<td>14</td>
<td>Reserve, 0.3mi. N. of Mullan Rd.</td>
<td>10,230</td>
<td>16,800</td>
<td>12,420</td>
<td>13,930</td>
<td>11%</td>
</tr>
<tr>
<td>15</td>
<td>Reserve, btwn Olafson &amp; S. 3rd W</td>
<td>13,850</td>
<td>22,000</td>
<td>16,179</td>
<td>16,630</td>
<td>3%</td>
</tr>
<tr>
<td>16</td>
<td>Reserve, btwn South &amp; Central</td>
<td>13,330</td>
<td>17,400</td>
<td>14,779</td>
<td>17,720</td>
<td>17%</td>
</tr>
<tr>
<td>17</td>
<td>Russell, btwn S. 2nd &amp; S. 3rd</td>
<td>17,250</td>
<td>22,000</td>
<td>18,833</td>
<td>19,710</td>
<td>4%</td>
</tr>
<tr>
<td>18</td>
<td>Russell, just W. of Lawrence</td>
<td>15,440</td>
<td>19,300</td>
<td>15,566</td>
<td>17,840</td>
<td>7%</td>
</tr>
<tr>
<td>19</td>
<td>Russell, btwn Fairview &amp; Benton</td>
<td>9,360</td>
<td>10,480</td>
<td>9,733</td>
<td>10,510</td>
<td>7%</td>
</tr>
<tr>
<td>20</td>
<td>Russell, just S. of 34th</td>
<td>7,320</td>
<td>8,100</td>
<td>7,847</td>
<td>7,710</td>
<td>-2%</td>
</tr>
<tr>
<td>21</td>
<td>Higgins, btwn Agnes &amp; Mary</td>
<td>9,530</td>
<td>12,300</td>
<td>10,321</td>
<td>10,710</td>
<td>4%</td>
</tr>
<tr>
<td>22</td>
<td>Broadway, btwn Monroe &amp; Jackson</td>
<td>17,830</td>
<td>24,400</td>
<td>20,127</td>
<td>20,360</td>
<td>-1%</td>
</tr>
<tr>
<td>23</td>
<td>Broadway, btwn Washington &amp; Adams</td>
<td>10,230</td>
<td>14,400</td>
<td>11,620</td>
<td>12,120</td>
<td>4%</td>
</tr>
<tr>
<td>24</td>
<td>Broadway, btwn Rymann &amp; Higgins</td>
<td>10,480</td>
<td>11,700</td>
<td>10,807</td>
<td>12,160</td>
<td>10%</td>
</tr>
<tr>
<td>25</td>
<td>Broadway, btwn Reserve &amp; Great Northern Rd.</td>
<td>8,600</td>
<td>10,600</td>
<td>9,267</td>
<td>10,990</td>
<td>16%</td>
</tr>
<tr>
<td>26</td>
<td>S. 3rd W., W. of Russell</td>
<td>9,500</td>
<td>16,200</td>
<td>11,733</td>
<td>12,900</td>
<td>9%</td>
</tr>
<tr>
<td>27</td>
<td>S. 3rd W., just E. of Reserve</td>
<td>9,100</td>
<td>11,300</td>
<td>9,833</td>
<td>9,950</td>
<td>1%</td>
</tr>
<tr>
<td>28</td>
<td>S. 3rd W., just W. of Reserve</td>
<td>4,820</td>
<td>8,400</td>
<td>6,013</td>
<td>5,170</td>
<td>-16%</td>
</tr>
<tr>
<td>29</td>
<td>South Ave., btwn Hilda &amp; Helen</td>
<td>6,120</td>
<td>10,300</td>
<td>7,513</td>
<td>8,810</td>
<td>15%</td>
</tr>
<tr>
<td>30</td>
<td>South Ave., btwn Thrones &amp; Park</td>
<td>4,400</td>
<td>7,400</td>
<td>5,400</td>
<td>8,770</td>
<td>38%</td>
</tr>
<tr>
<td>31</td>
<td>South Ave., btwn Catlin &amp; Washburn</td>
<td>11,300</td>
<td>18,200</td>
<td>15,397</td>
<td>12,190</td>
<td>-2%</td>
</tr>
<tr>
<td>32</td>
<td>South Ave., btwn Clark &amp; Reserve</td>
<td>10,380</td>
<td>11,500</td>
<td>10,760</td>
<td>12,490</td>
<td>14%</td>
</tr>
<tr>
<td>33</td>
<td>South Ave., btwn Reserve &amp; 26th</td>
<td>7,160</td>
<td>12,200</td>
<td>8,040</td>
<td>10,320</td>
<td>14%</td>
</tr>
<tr>
<td>34</td>
<td>S.W. Higgins, S.W. of Pattee Canyon</td>
<td>7,100</td>
<td>8,300</td>
<td>7,443</td>
<td>8,400</td>
<td>11%</td>
</tr>
<tr>
<td>35</td>
<td>S.W. Higgins, S.W. of Pattee Canyon</td>
<td>9,360</td>
<td>11,800</td>
<td>10,343</td>
<td>10,390</td>
<td>0%</td>
</tr>
</tbody>
</table>

Total Overall Difference | 438545 | 473520 | 7% |


1Missoula traffic assignments.
2Interpolation

a1988
b1989.
future years were developed through the use of historic growth patterns for each Traffic Analysis Zone and a linear regression program.

Population Comparisons

The population factor will be evaluated by comparing 1990 census data with estimated data developed in the Technical Memorandum, Population and Employment Projections for the Missoula Urban Transportation Plan.

According to the Population and Employment Projections, the population ratio between Missoula Transportation Study Area and Missoula County in 1990 is 0.8. Therefore, the census information of the Study Area can be obtained by multiplying Missoula County census data by 80%. Table 3 shows both actual and estimated population data of Missoula County and the Transportation Study Area, and the percentage difference between these two volumes.

The 1990 data comparing results indicate that the County population projection is about 7.77% above the actual population, and same, the Study Area projection is about 7.77% above the actual population. It appears that the projections will overstate actual population growth during the planning period. Figure 7 represents the divergence between projections and actual data. It graphically depicts the trend of this divergence that will increase toward the latter 10 years of the planning period (2000-2010).
### TABLE 3

MISSOULA POPULATION COMPARISON

<table>
<thead>
<tr>
<th>Year</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Missoula County Pop. (Actual)</td>
<td>% Change&lt;sup&gt;2&lt;/sup&gt;</td>
<td>Missoula County Pop. (Est)</td>
<td>% Diff. (C-A)/A</td>
<td>Study A&lt;sup&gt;4&lt;/sup&gt; Pop. (Est)</td>
<td>% Study A/County (E-A)/A</td>
<td>Study A Pop. (Actual) (E X F)</td>
<td>% Diff. (E-G)/G</td>
</tr>
<tr>
<td>1980</td>
<td>76,016</td>
<td>29.67%</td>
<td>77,000</td>
<td>60,630</td>
<td>81.08%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1985</td>
<td></td>
<td></td>
<td>62,370</td>
<td>81.00%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1990</td>
<td>78,687</td>
<td>3.51%</td>
<td>84,800</td>
<td>7.77%</td>
<td>67,840</td>
<td>80.00%</td>
<td>62,950</td>
<td>7.77%</td>
</tr>
<tr>
<td>1995</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2000</td>
<td></td>
<td>14.15%</td>
<td>96,800</td>
<td>77,440</td>
<td>80.00%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2005</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2010</td>
<td></td>
<td>14.15%</td>
<td>110,497</td>
<td>88,401</td>
<td>80.00%</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


<sup>1</sup>Population<br>
<sup>2</sup>Compared to previous year<br>
<sup>3</sup>Difference<br>
<sup>4</sup>Area

---

#### Funding Sources

Capital is a primary element to maintain, improve, and construct transportation facilities. As funding status changes in terms of source and level, the question, "How can we pay for the needed improvements?" shows perhaps the greatest transportation problem affecting the Missoula community.
Figure 7. MISSOULA COUNTY POPULATION, 1930 - 2010

This section discusses Missoula's traditional funding sources, funding needs, and current funding status.

Traditional Funding Sources

Funding sources for highway transportation system and bridges improvements include federal, state, local, and private funds. Traditionally, the majority of financing came from federal and state governments. In recent years, however, there have been significant cutbacks in federal aids. This trend has resulted in an increasing financial burden for transportation system improvements on local governments.

Federal

All highway transportation improvements funded through the Federal Highway Administration (FHWA) and administered by the Montana Department of Highways (MDOH) are under the Federal Aid Highway Program. The funding resources for this aid program come from the "Highway Trust Fund" which is a user-supported fund including federal tax revenues.

The Surface Transportation and Uniform Relocation Assistance Act of 1987 is the most recent amendment of the Federal Aid Highway Program which is modified periodically through a Congressional procedure. This Highway Act defines the amount of financial aid available to each state through more than 20 different Federal Aid Highway Programs. Following programs are those for which Missoula may be
eligible:

1. Interstate 4-R
2. Primary System
3. Secondary System
4. Urban System
5. Hazard Elimination and Safety Program
6. Rail-Highway Crossing Program
7. Highway Bridge Rehabilitation and Replacement Program
8. Urban Mass Transit Assistance Program

The current federal highway act will expire in September of 1991, and major changes in the programs made by Congress are expected. In the study of the Missoula Urban Transportation Plan, 1985 Update, it was assumed that all current federal programs would remain constant through the year 2010.

The Montana Department of Highways Program Development Division made funding estimates according to financial categories. These estimates were based on the assumption that the projected 1988 funding amounts by category would remain constant till year 2010.

Table 4 shows these estimated funding levels for the Federal Aid Highway Programs that can be available for highway transportation improvements and that annually allocate funds for use in the Missoula area. Two facts should be noted. First, the primary funds includes nine
TABLE 4
AVAILABLE FUNDS THROUGH FEDERAL AID HIGHWAY PROGRAMS

<table>
<thead>
<tr>
<th></th>
<th>Primary(^1) (FD No. 1)</th>
<th>Rural Secondary (MSLA Co.)(^2)</th>
<th>Urban System (Missoula)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unobligated Balance (11/1/86)</td>
<td>$6,827,000</td>
<td>$798,000</td>
<td>$2,765,000</td>
</tr>
<tr>
<td>Includes 1986 Allocation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Projected Annual Allocations:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1987</td>
<td>$11,600,000</td>
<td>$383,000</td>
<td>$742,000</td>
</tr>
<tr>
<td>1988</td>
<td>$16,200,000</td>
<td>$383,000</td>
<td>$742,000</td>
</tr>
<tr>
<td>1989 - 2010</td>
<td>$16,200,000</td>
<td>$383,000</td>
<td>$742,000</td>
</tr>
<tr>
<td>Total: 1986 - 2010</td>
<td>$391,027,000</td>
<td>$8,394,000</td>
<td>$20,573,000</td>
</tr>
<tr>
<td>Total Available to Missoula Study Area</td>
<td>?</td>
<td>?</td>
<td>$20,573,000</td>
</tr>
</tbody>
</table>


\(^1\)Funding District No. 1 includes Missoula, Flathead, Granite, Lake, Lincoln, Mineral, Ravalli, and Sanders Counties. The portion of funds to be available for use by the Missoula urban area is difficult to estimate.

\(^2\)Missoula County.

western Montana counties and only a portion of these funds will be used in the Missoula area. Second, the Missoula Transportation Study Area can only use part of the secondary fund allocation which is utilized for the entire Missoula County.

The federal funds to be available for the study area can't be determined because the portion of these funds that can be used in this area is difficult to estimate.
State

In the 1987 State Legislature, the revenues for the Reconstruction Trust Fund (RTF) come partly from user fees in the form of a state fuel tax. This fund also receives 12% of the state's coal severance tax. Since the Reconstruction Trust Fund was designed mainly to improve the rural primary road system, most of the transportation projects in the Missoula Urban Study Area are not eligible for this types of funds.

Local

Revenues generated by local governments are available for specific functions and particular services.

Funding sources from the City of Missoula include general fund, special revenue funds, capital improvements fund, and enterprise funds. Missoula County generates funds such as the road, bridge, rural special improvement district revolving, special bond, and capital improvements.

Several additional local funding alternatives were recommended in the 1985 plan to cope the reductions in federal aid programs: (1) local option gas tax; (2) transportation utility; (3) general obligation bond sale; (4) development exactions; (5) tax increment financing; (6) multi-jurisdictional service district; and (7) local improvement district. As these mechanisms are authorized for use in Montana, local governments can gain additional financial flexibility in meeting community needs.
Funding Needs

The Missoula Urban Transportation Plan, 1985 Update identified two types of needed improvements to the urban transportation study area: transportation system management (TSM) improvements and major network improvements.

A total of 83 TSM improvements were recommended in the 1985 Plan with a cost of approximately $3 million. These improvements consist of minor changes to the urban transportation system that are required to increase the effectiveness of the existing infrastructure. TSM improvements are anticipated to be implemented with local maintenance forces and financed by the conventional maintenance funding sources. The TSM programs are expected to be implemented over the next four or five years.

The 1985 Plan recommended nineteen major network improvements in addition to six committed major projects requiring an estimated total cost of approximately $78 million. All of these improvements are anticipated to be implemented by the year 2010. These major network improvements has been traditionally financed by the Federal Aid Urban (FAU) Fund. According to the funding projections in the 1985 Plan, the FAU Fund will generate approximately $20 million through the year 2010. It is apparent that the cost of the major network improvements far exceeds the limited financial resources available within the 20-year planning year. Therefore, a tentative prioritized order of
implementation was established by the Missoula Technical Advisory Committee. Also additional local funding will be required to close the gap between the cost of desired improvements and available funding.

Current Funding Status

Recently the reduction of federal aid funds has caused significant financial problems to local governments. Based on existing federal aid funding levels remaining constant, Missoula can only complete five committed projects and three recommended projects out of nineteen recommended major network improvements by the year 2010. The 1985 plan recommended that an additional $0.5 million per year in local funds be raised to help close the funding gap, with which another five recommended improvements could be accomplished within twenty years. However, no funding source has been developed.

Due to the shortcoming of the federal aids, it became necessary to rely on other local funding alternatives. Except for a decrease on Missoula County Bridge Fund from $686,000 to $460,000, there have been several slight increases on Missoula local funds between FY 1987 and FY 1990. Approximately $12.87 million has been budgeted in FY 1990 for Missoula City general fund that was approximately $9.3 million in FY 1987. A portion of this fund can be used in transportation programs. Missoula County road fund is financed through a county mill levy of 13.83 mills which
generates approximately $2.5 million in FY 1990 that is about $0.1 million higher than FY 1987.

Even with federal aid programs at the 1987 level, the transportation needs of the Missoula urban area far outstrip available funds. It is anticipated that the funding levels of these programs will be reduced. The first priority now is to maximize the use of federal and state programs by making matching funds available and applying for eligible grants. Local funding is also essential to complete the transportation system management improvements, as well as many of the major network improvements.
CHAPTER V

SUMMARY

This evaluation has attempted to assess the validity of the Missoula Transportation Plan, 1985 Update. The procedures have been to evaluate the Plan in terms of its ability to meet the community's goals and objectives, the basic projections made for the Plan's initial preparation, and its funding status. Following are brief synopses of this evaluation.

Traffic Counts

Traffic counts continue to be relatively stable with minor increases and decreases at most stations selected. The overall comparisons between ground counts and projections indicate that ground counts exceed projected volumes by about 7%. This disparity occurred less than 10% in 17 of the compared stations, and less than 20% in 34 of the 35 stations studied. According to Montana Highway Department, traffic estimates will be feasible if the disparities are less than 10% in major streets with annual average daily traffic (AADT) of 5000 or more, or less than 20% in minor streets with an AADT of lower than 5000. Therefore, the traffic count projection in the 1985 plan is now valid.

Population

The comparisons between actual and projected
populations show that actual population lags behind the population projections since 1985. It is primarily due to the nationwide substantial decrease in average number of people/occupied dwelling unit since 1970. The overall disparity in 1990 was 7.8%, which is acceptable for Missoula local governments. However, an increasing disparity appears within next few years.

Funding Sources

The funding aspects of the 1985 plan are difficult to project and compare, given the political uncertainties that apply to state and federal highway funding. The 1985 plan did define the funding problems and recommend local funding alternatives. It helped to reduce the gap between financial need and supply. Therefore, this plan appears now financially feasible.

Overall, Missoula Urban Transportation Plan, 1985 Update is still valid. However, it is important that the projections should be continuously assessed in the future.
SELECTED BIBLIOGRAPHY


Tripodi, T., P. Fellin, and H. J. Meyer. The Assessment of


