prototype planning study portland

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16. Abstract

This report is one of a series documenting the results of the TSM Planning Prototype Studies Program. The Program involved five localities - Portland (Oregon), Dallas/Ft. Worth, Kansas City, Seattle and Middlesex County (NJ) and was designed to demonstrate the capabilities of local agencies to undertake TSM planning in a systematic problem oriented manner. This report documents the project in Portland, Oregon and is designed to provide a summary of the procedures utilized in Portland to systematically develop a regionwide program for TSM delineated on a small area basis.

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TRANSPORTATION SYSTEM MANAGEMENT (TSM)

PROTOYPE STUDY

FINAL REPORT

November 1979

Metropolitan Service District
(formerly Columbia Region Association of Governments)
527 SW Hall Street
Portland, Oregon 97201
(503) 221-1646

for

Urban Mass Transportation Administration
Office of Planning Assistance
Planning Research and Evaluation Division

Transportation System Management (TSM) is by now well known as a concept which calls for the planning, programming and implementation of low-capital, short-range improvements designed to increase the efficiency of existing transportation systems. In addition to serving the goal of efficiency by providing alternatives to major capital investments and by reducing operating costs, TSM also may serve goals of energy conservation, environmental protection and urban revitalization. The Joint Planning Regulations published September 17, 1975 required a TSM element to be incorporated into the transportation planning and programming process in all urbanized areas. Specifically, the regulation requires that plans be developed addressing the short-range needs of the urbanized area by more efficient use of the existing transportation system. Typical examples of actions related to TSM are traffic operations improvements, preferential treatment for high occupancy vehicles, parking management, transit fare changes, paratransit and service coordination.

When published, the requirement for a TSM plan represented a change in the direction of transportation planning. Prior to this time, the urban transportation planning process focused on the development of long-range plans which were often capital intensive. The technical tools available to planners were designed to analyze long-range capital intensive projects. These factors combined to make it difficult to meet the requirement for short-range, low capital planning. In order to address these problems, the UMTA Office of Planning Assistance initiated five speical studies on TSM planning.

The key objectives of these studies include 1) the identification of institutional arrangements which facilitate effective TSM planning and programming, 2) the identification of factors important in the implementation of TSM projects, and 3) the development of technical tools for use in TSM planning. The study reported on here, from Portland, Oregon, was designed primarily to address the first two of these objectives.

The Portland study had as its purpose the formulation, application and evaluation of procedures for systematic TSM planning in the urbanized area that would provide the basis for an ongoing process. Specifically, the TSM process was to include a clear statement of goals and objectives, evaluation of existing conditions, a set of proposed actions and justification for inclusion of those actions in the area's Transportation Improvement Program. The process used was designed to balance the planning effort with the scope of the problems to be assessed. Finally, the project was designed to broaden the familarity and experience of major jurisdictions in the area with TSM planning. We believe that the project succeeded in meeting these goals. The process described here represents a good model for the way in which comprehensive, systematic TSM planning can be carried out. The approach described should be adaptable without major change to many other urban areas.

The agency which undertook this study was the Columbia Region Association of Governments (CRAG). Since the time when the report was completed, a reorganization has replaced CRAG with a new agency, the Metropolitan Service District.

Additional copies of this report may be obtained through the National Technical Information Service (NTIS), Springfield, Virginia. Please reference report UMTA-IT-09-0068-79-1 on your request.

CH Graves

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PREFACE

This is the final report on the CRAG Transportation System Management (TSM) Prototype Study. It is a comprehensive presentation of the planning process followed throughout the study including technical analysis, agency coordination and study management. The following technical reports which were produced during the study process are available:

- Staff Report No. 4: Status of TSM Prototype Study and TSM Reserve, July 27, 1977.

- Staff Report No. 11: TSM Prototype Study: Problem Identification; Initial Screening; Candidate Problem List, October 10, 1977.

- Staff Report No. 15: TSM Prototype Study: Problem Quantification and Identification of Project Level TSM Alternatives, November 21, 1977.

- Staff Report No. 16: TSM Prototype Study: Status Report, December 9, 1977.

- Staff Report No. 17: TSM Prototype Study: Evaluation of the TSM Candidate Projects; Suggested TSM Strategies for Each of the Ten Problem Areas, January, 1978.

- Staff Report No. 19: Evaluation of TSM Candidate Projects and Suggested TSM Strategies, January 26, 1978.

- Staff Report No. 20 (Revised): Recommendations for Allocating Remaining Category V Monies, February 14, 1978.

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the population growth is occurring primarily in the suburbs. As of 1974, the US Census ranked the Portland SMSA 34th largest in the nation.

PURPOSE OF THE TSM STUDY

TSM stands for Transportation System Management and refers to a systematic approach to achieving more efficient use of existing transportation facilities and services. The objective of TSM is to respond to travel needs more quickly and at a lower cost as opposed to the more traditional capital intensive projects which involve the expansion of existing facilities or the addition of new ones.

The goal of the Study was to facilitate the increased use of the planning process in developing and programming TSM actions. The nature of the Study was to design and implement a TSM planning process at the regional level, recognizing that previously no such process existed. The Prototype Study was designed to test a practical analytical process for TSM planning at the regional level.

On May 3, 1976, the US Department of Transportation formally approved withdrawal of the Mt. Hood Freeway from the Interstate System, making approximately $203 million available to the urban area of the Portland-Vancouver metropolitan area for other transportation projects.

In June, 1977, the CRAG Board of Directors established a $5 million TSM Reserve Account from the Mt. Hood Transfer Funds. The CRAG Board also designated the TSM Prototype Study as the technical mechanism for developing project proposals for the TSM Reserve Account.

TSM PROTOTYPE PLANNING PROCESS

The focus of the Study was on identifying and implementing a TSM planning process. The process would have to be analytically sound, able to build broad concensus among a number of jurisdictions, and combine a number of evaluation procedures in a coherent and meaningful way.

The Prototype Study consisted of the following seven sequential steps:

- . PROBLEM IDENTIFICATION
- . INITIAL SCREENING
- . CANDIDATE PROBLEM LIST
- . PROBLEM QUANTIFICATION
- . IDENTIFY TSM ALTERNATIVES
- . EVALUATE TSM PROJECTS AND RECOMMEND TSM STRATEGIES FOR EACH PROBLEM AREA
- . FINAL RECOMMENDATIONS

A brief description of each step follows:

Problem Identification

The purpose of this phase of the Study was to identify an extensive list of problem locations with TSM potential. During this Study phase, some jurisdictions submitted project proposals rather than identifying problem locations. Efforts were then made to define the problem which the project was proposed to address. The phase was carried out as a joint effort between CRAG, its member jurisdictions, ODOT and Tri-Met.

During July, August and September 1977, nine TSM problem identification workshops were held in the region's counties and major cities. CRAG staff cooperated with county representatives in inviting city representatives to attend the workshops. ODOT and Tri-Met were involved in all these meetings. Normally a number of jurisdictions were represented at any one meeting. The workshops identified 55 different problem areas.

Initial Screening

The purpose of the initial screening was to establish a representative cross section of transportation problems for analysis using the TSM process and for funding from the TSM Reserve, to balance the number of transportation problems analyzed with the available resources; and to eliminate from consideration transportation problems that had marginal or no potential for a TSM solution.

Each problem area identified during the workshops was documented in a staff report. The documentation included the problem location, nature of the problem, problem impact, Interim Transportation Plan (ITP) designation, jurisdictions affected, ADT and VMT of the arterial, number of accidents, potential TSM opportunities, and recommendations on the best improvement strategy.

Each problem area was also evaluated based on the following criteria:

1. TSM Potential
2. Scale of the Problem
3. Jurisdictional Distribution
4. Regional Significance of the Problem
5. Local Jurisdictional Interest

CANDIDATE PROBLEM LIST

The purpose of the Candidate Problem List was to establish a representative cross section of priority transportation problems which lend themselves to solution through TSM strategies.

The initial screening process was the mechanism used to prioritize the 55 problem areas. Based on the initial screening, ten high priority problem areas were identified for further Study.

Problem Quantification

The purpose of this phase of the Study was to collect baseline data about the problem characteristics of the ten problem areas previously identified. The data was used as a basis for estimating problem severity, formulating potential TSM solutions and evaluating the anticipated effectiveness of TSM improvements.

During October and November, 1977, fourteen TSM Workshops were held with involved local jurisdictions, ODOT, Tri-Met and CRAG staff. The agenda of the workshops was:

1. Review of the candidate problems and finalization of a set of TSM improvement objectives for each of the ten problem areas.

2. Introduction of local jurisdictions to the criteria and performance measures which would be used for quantifying problems and for evaluating project level TSM alternatives.

3. Establishment of baseline data requirements needed for the evaluation process.

4. Identification and cost determination of project level TSM alternatives.

Baseline data requirements were determined at the workshops. It was recognized that staff resources and time were limited and that data would, for the most part, have to come from existing sources. It was also recognized that the local units of government in the region would not have a great deal of staff resources available to devote to the compilation of existing data. To ensure this minimum level of data, CRAG loaned staff to most jurisdictions to assist them in this phase.

Identify TSM Alternatives

The purpose of this phase was to identify a number of TSM alternatives for each of the ten problem areas based on the problem analysis carried out in the previous phase of the Study. The identification of TSM alternatives was completed during the second round of TSM Workshops.

CRAG staff working cooperatively with Tri-Met, ODOT and the jurisdictions identified a number of TSM project level alternatives for each of the ten problem areas. In identifying TSM projects both "supply optimizing techniques" and "demand management techniques" were considered for the degree to which they would solve the transportation problems of each area. Also emphasized were TSM projects whose impact would benefit more than one mode and which could be combined with other projects to produce a transportation solution with maximum effectiveness.

A set of TSM improvement objectives were also formulated during the second round of workshops and were extremely important in the planning process. The objectives served as a reference point for identifying TSM actions and encouraged actions which might normally not have been identified. The objectives also served as guides in the combination of project level TSM alternatives to produce TSM strategies and highlight the contradictory nature of certain objectives.

Evaluate TSM Projects and Recommend TSM Strategies for Each Problem Area

The purpose of this phase was to evaluate and determine the effectiveness of each of the candidate TSM projects. The projects were evaluated based on their effectiveness in solving the problems and meeting the TSM improvement objectives.

The objective of this phase was to recommend for each problem area a TSM strategy which was composed of the most effective and complementary set of TSM projects.

The evaluation concentrated on describing the advantages and disadvantages of the candidate projects. Candidate projects were evaluated as to which combination of projects were the most effective in solving the particular problems. Low-cost solutions which capitalized on the under-utilized potential of the corridors and the subarea were emphasized.

Corridor and subarea TSM strategies consisted of a set of integrated policy-related projects. Emphasis was on finding an integrated program of traffic and transit operation improvements recognizing that a project which would benefit more than one mode would have high TSM utility.

Interrelationships of candidate TSM projects were also emphasized, recognizing that maximum effectiveness could be achieved with a package of complementary and mutually supportive projects. The type and number of problems the candidate TSM projects would both solve and create were documented.

In emphasizing the "low-cost" nature of the TSM philosophy, the cost-effectiveness and scale of the candidate TSM projects were carefully evaluated. TSM recognizes that to solve a transportation problem, it is not necessary "to cut butter with a chain saw."

Final Recommendations

The purposes of the phase were to prepare final recommendations for allocating remaining TSM Reserve funds, to determine the extent of citizen interest in the projects recommended, and to document the willingness of local jurisdictions to pursue the local match on the projects.

In February, final staff recommendations on the allocation of the TSM Reserve were presented to TTAC and the CRAG Board.

TTAC and the CRAG board approved all staff recommendations and funds were reserved for TSM projects as follows:

Problem Area	Federal $ Share
. Canyon/TV Hwy	$ 275,641
. Farmington Rd	367,722
. Hall Blvd	229,930
. Cedar Hills Blvd & Walker Rd Intersection	53,955
. NW 18th & 19th; NW 14th & 16th Couplet	439,938
. Beaverton-Hillsdale Hwy	684,809
. Sandy Blvd	342,820
. State Street	669,038
. Gladstone-Milwaukie Subarea	1,215,640
TOTAL	$4,279,493

Summary of Findings

The Prototype Study developed a framework for determining the severity of existing transportation problems and for assessing the effectiveness TSM solutions would have in correcting the problems. The framework was analytically sound but yet the Study design was not too cumbersome to preclude local jurisdictional interest. The framework was comprehensive enough to incorporate trade-offs between a number of different modes and a number of different problem situations.

The emphasis throughout the Study was on agency coordination in finding the most effective low-cost TSM solutions. The Prototype Study framework enabled CRAG staff to take a relatively small sum of money and recommend allocations which were based on need and opportunity.

The Prototype Study enabled CRAG to identify problems which crossed jurisdictional boundaries and involved more than one mode. The Study enabled CRAG to achieve a coordinated, site specific TSM project and some service-related strategies in nine problem areas and to allocate funds for the actual implementation of the strategies. It would have been difficult to achieve this coordination or analytical base without CRAG involvement.

The Study also provided CRAG staff an analytical base with which to make recommendations altering initial "wish lists" of transportation problem areas and projects. Problem areas were reduced from over 55 to ten high priority areas. Initially $9 million in projects were identified for the ten areas. After the analysis, project recommendations of only $4.3 million were made to TTAC and the CRAG Board. The Board subsequently accepted all staff recommendations.

The Study enabled some TSM projects to be identified and funded which did not previously exist. This was especially true of some transit related projects.

The availability of funds was a significant factor in the level of interest and involvement of local jurisdictions in the TSM planning process. Competition among Oregon jurisdictions in the identification of problem areas and project submittal was at times fierce.

It should also be noted that there are a number of constraints attached to Interstate Withdrawal Funds which tended to direct the Prototype Study process. This type of funds is normally used for "on the ground" projects rather than more management oriented transportation strategies. These operational and management oriented strategies could have been addressed by the Study framework had time been available and had these types of strategies been eligible for funding.

Finally, it should be noted that the analytical procedures developed during the Prototype Study have been employed in two recent Study efforts by CRAG staff. CRAG is currently undertaking a special TSM study on a severely congested urban arterial in the region. A second effort involved a project analysis of six candidate signal projects which were competing for approximately $300,000 in FY 1979 unallocated Federal Aid Urban (FAU) funds.

I.
DESCRIPTION OF THE CRAG REGION

I. DESCRIPTION OF THE CRAG REGION

A. GEOGRAPHIC FEATURES

The Columbia Region Association of Governments (CRAG) is an association of governments composed of counties in the Portland, Oregon--Vancouver, Washington Metropolitan area and numerous cities within these counties as well as the Tri-County Metropolitan Transportation District (Tri-Met), the Port of Portland, the State of Oregon (ODOT) and the State of Washington (WDOT).

Portland is in northwestern Oregon (refer to Figure 1) and is located on the Willamette River just south of its confluence with the Columbia River. The Columbia River forms the boundary with Washington State. The City of Vancouver is located on the Columbia River to the north of Portland. The two cities are linked by one bridge over the Columbia River.

The Columbia and Willamette Rivers and their associated basins are the dominate features of the region's geography. The City of Portland is also bounded to the west by the Tualatin Mountains which rise over 1,000 feet. Land use patterns in the region are diverse, ranging from fully-developed urban use in the central city to rural non-farm and agricultural use in the outlying areas.

A majority of Portland's city arterial streets were planned and built during a period when public transportation dominated the Portland scene. These facilities tended to form the basis of Portland's land development and transportation patterns. Streetcar lines were later replaced by city buses and larger volumes of auto traffic but the majority of arterial streets retain the width and alignment characteristics of a previous era.

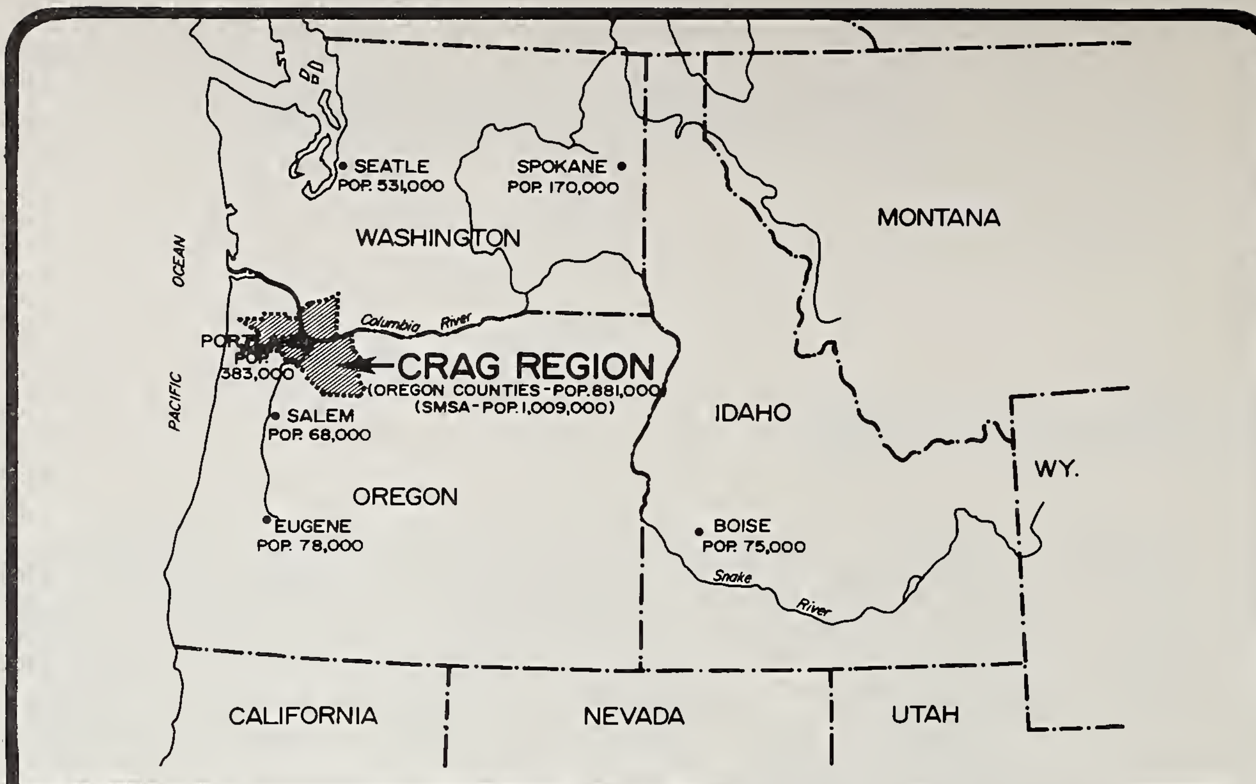

Figure 1 REGIONAL LOCATION MAP

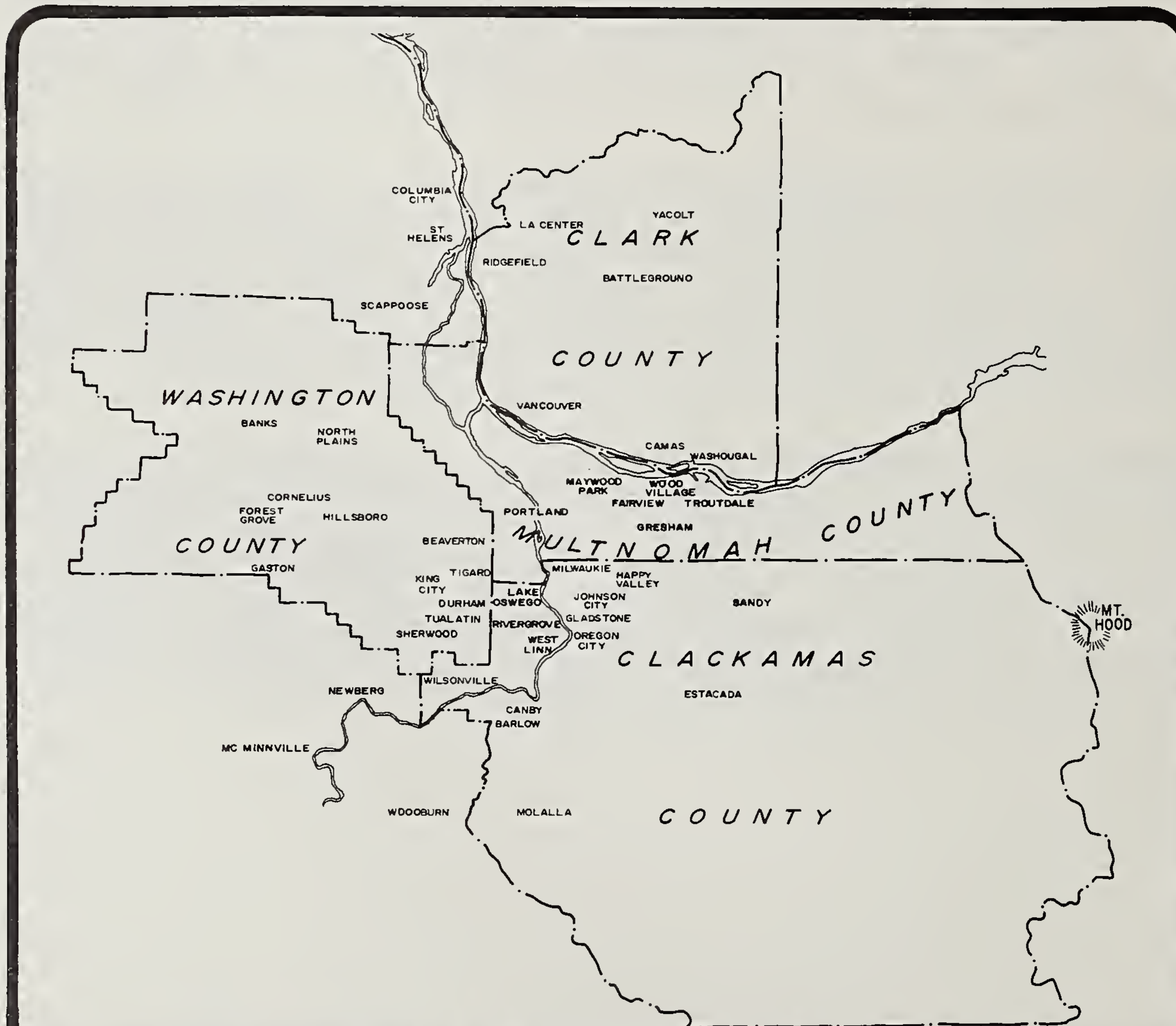

Figure 2 PORTLAND-VANCOUVER SMSA

As Portland's suburbs developed, streets were laid out to accommodate the private auto. Suburban growth has been rapid during the last two decades, but the implementation of adequate transportation facilities has not always kept pace with the residential and commercial growth.

The regional transportation pattern has as its backbone an inner-city freeway loop which encircles the Portland core area. A network of radial routes ties the city core with an outer belt of circumferential freeways. The major radials are the Sunset Highway, the Banfield Freeway and Interstate 5 (I-5) North and South. I-5 North joins the City of Vancouver and the City of Portland.

B. DEMOGRAPHIC CHARACTERISTICS

The 1975 population estimate for the CRAG region is approximately 1.1 million. Population growth averages 1.5 percent annually. The City of Portland and the City of Vancouver had 1975 population estimates of 375,000 and 47,000 respectively. In relation to transportation needs, the population growth is occurring primarily in the suburbs. As of 1974, the U.S. Census ranked the Portland SMSA 34th largest in the nation.

Major employment centers are primarily located in the center of the urbanized area. Other major employment concentrations are spotted in suburban industrial areas. Approximately 360,000 people comprised the region's work force in 1970, of which 55 percent (200,000) were employed within the city limits of Portland.

C. INSTITUTIONAL ARRANGEMENTS

CRAG is the designated MPO for the region and has 41 member jurisdictions and associate members, representing the cities and counties within the Portland-Vancouver metropolitan planning area. The CRAG Board of Directors consists of a representative member for each county and the City of Portland, a member representing all the cities in each county, the State of Oregon, Tri-Met, and the Port of

Portland. The State of Washington is an ex-officio member. Votes of the city and county representatives are weighted according to population; other representatives have one vote each.

The CRAG decision-making structure for transportation policies consists of the Board of Directors which is technically advised by the Transportation Technical Advisory Committee (TTAC) and its working subcommittees and task forces. TTAC recommends policies, plans and programs to the CRAG Board for adoption.

TTAC coordinates and guides the regional transportation planning program in accordance with the policy of the Board of Directors. TTAC is comprised of a counterpart representative for each Board member. TTAC members are drawn from the technical transportation staff of jurisdictions. TTAC also forms subcommittees and task forces to deal with specific tasks such as TSM.

II.

OVERVIEW OF THE CRAG TSM PROTOTYPE STUDY

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A. AWARD OF THE GRANT

In 1976, the Urban Mass Transportation Authority (UMTA) awarded CRAG a special planning grant to undertake a Transportation System Management (TSM) Prototype Study. The goal of the study was to facilitate the increased use of the planning process in developing and programming TSM actions. The study was one of five such UMTA grants awarded around the country.

TSM stands for Transportation System Management and refers to a systematic approach to achieving more efficient use of existing transportation facilities and services. The objective of TSM is to respond to travel needs more quickly and at a lower cost as opposed to the more traditional capital intensive projects which involve the expansion of existing facilities or the addition of new ones. TSM actions can include traffic engineering improvements, such as signalization, left turn bays, traffic signal interties, paratransit programs; public transportation, regulatory pricing, management or operational improvements; or actions involving other surface transportation modes such as taxis, bicycles or walking.

TSM is not just a new name for a group of existing activities, but rather TSM is significant because:

1. TSM actions can be combined to treat regional problems.

2. TSM treats all modes and services in an integrated and consistent manner rather than as a number of isolated actions.

Due to escalating costs and intense competition for scarce resources, it is necessary for urban areas to improve the efficiency and utilization of their existing transportation facilities. To focus attention on this need, the Federal Highway Administration (FHWA) and UMTA promulgated the requirement for a short range transportation plan.

To improve the "body of knowledge" regarding TSM planning and to develop local capabilities regarding TSM, UMTA awarded a number of TSM Prototype Studies.

In July, 1976, CRAG staff prepared a proposed work program for a TSM Prototype Study and submitted it to UMTA for review.

The original work program identified the following overall objectives:

1. To formulate, apply and evaluate procedures for systematic TSM planning in the Portland-Vancouver metropolitan area that will provide the basis for a beneficial, on-going process.

2. To establish a TSM planning process that includes:

    A. A clear statement of goals and objectives.
    B. An evaluation of existing conditions.
    C. An adequate set of proposed actions.
    D. Justification of actions recommended for inclusion in the TIP.
    E. Adequate and timely funding.
    F. A balance of the level of planning effort with the scope of problem solution.

3. To broaden familiarity and experience of major jurisdictions with TSM planning addressing a cross-section of transportation problems.

The essential nature of the study was to design and implement a TSM planning process at the regional level, recognizing that previously no such process existed. The need for such a process was a function of the 1975 FHWA/UMTA joint regulation which established a short range transportation (TSM) element as part of the Regional Transportation Plan. The regulations also assigned responsibility for the preparation of the TSM element to the MPO. The Prototype Study was designed to test a practical analytical process for TSM planning at the regional level.

B. HISTORY OF THE $5 MILLION TSM RESERVE ACCOUNT AND THE MT. HOOD TRANSFER FUNDS

On May 3, 1976, the U.S. Department of Transportation formally approved withdrawal of the Mt. Hood Freeway from the Interstate System, making approximately $203 million available to the urban area of the Portland-Vancouver metropolitan area for other transportation projects. On May 10, 1976, the Governor of Oregon sent a letter to the CRAG Board chairman requesting the Board's assistance in allocating these funds and specifying the priorities for which the money should be used.

In July, 1976, the CRAG Board approved a project solicitation letter to be sent to local governments which emphasized the following three categories of priority:

1. Southeast Portland/Multnomah County projects
2. Transit Corridor Projects
3. Other Major and Minor Projects

In August, 1976, the CRAG Board adopted policies, factors and process recommendations for the distribution and use of Transfer funds and firmly established the three categories of priority.

In November, 1976, the Board set aside $152,750,000 for use on the Transit Corridor Projects (Category I), and $16,004,600 for Southeast Portland Projects (Category II). In both cases, specific projects with corresponding dollar amounts were identified.

In March, 1977, the CRAG Board established a set of management strategies and policies for use in allocating the Mt. Hood Freeway Transfer Funds. The strategies and policies are contained in Appendix A.

The management investment strategies emphasized TSM both as a concept in a policy context and as a tool in an implementation context. These intentions are expressed in the following excerpts from the management strategies:

> "Favors TSM where it will significantly address problems and favors capital intensive projects where TSM will not significantly address problems."

"Supports an investment strategy which will achieve regionwide momentum by early implementation of projects which address corridor and subarea problems."

In April, 1977, the CRAG Executive Director sent out a request to member jurisdictions requesting project proposals for Category III (the CRAG Board established five categories) Mt. Hood Transfer Funds.

As a result of this request, ODOT requested the CRAG Board of Directors establish and fund a regionwide $5 million TSM reserve from the Mt. Hood Transfer Funds. ODOT also suggested that a procedural and organizational framework be developed by CRAG staff to expedite TSM project identification and implementation on a continuing basis throughout the region.

In June, 1977, the CRAG Board established a $5 million TSM Reserve Account from the Mt. Hood Transfer Funds . The $5 million TSM Reserve Account was established to fund the federal share of TSM projects in the region, exclusive of the Southeast Portland Reserve Area and the East Multnomah County Reserve Area (refer to Figure 3).

The Southeast Portland Reserve was originally set up to fund a series of minor roadway and TSM improvements designed to improve transit operations and traffic circulation in the SE Portland area. The East Multnomah County Reserve was established to solve circulation problems in the Gresham area through the implementation of TSM alternatives and other roadway projects.

It should be noted that the original TSM work program submitted to UMTA did not envision the establishment of a project implementation fund such as the $5 million TSM Reserve Account.

Also in June, 1977, the CRAG Board established procedures and a process to fund projects from the TSM Reserve Account. On the recommendation of the CRAG Transportation Director, the Board designated the UMTA TSM Prototype Study as the technical mechanism for developing project proposals for the Reserve Account .

The Board also established a TSM Task Force: for monitoring and reviewing the technical work to be undertaken in the TSM Prototype Study; to review critical corridors and subareas and identify potential TSM project applications;

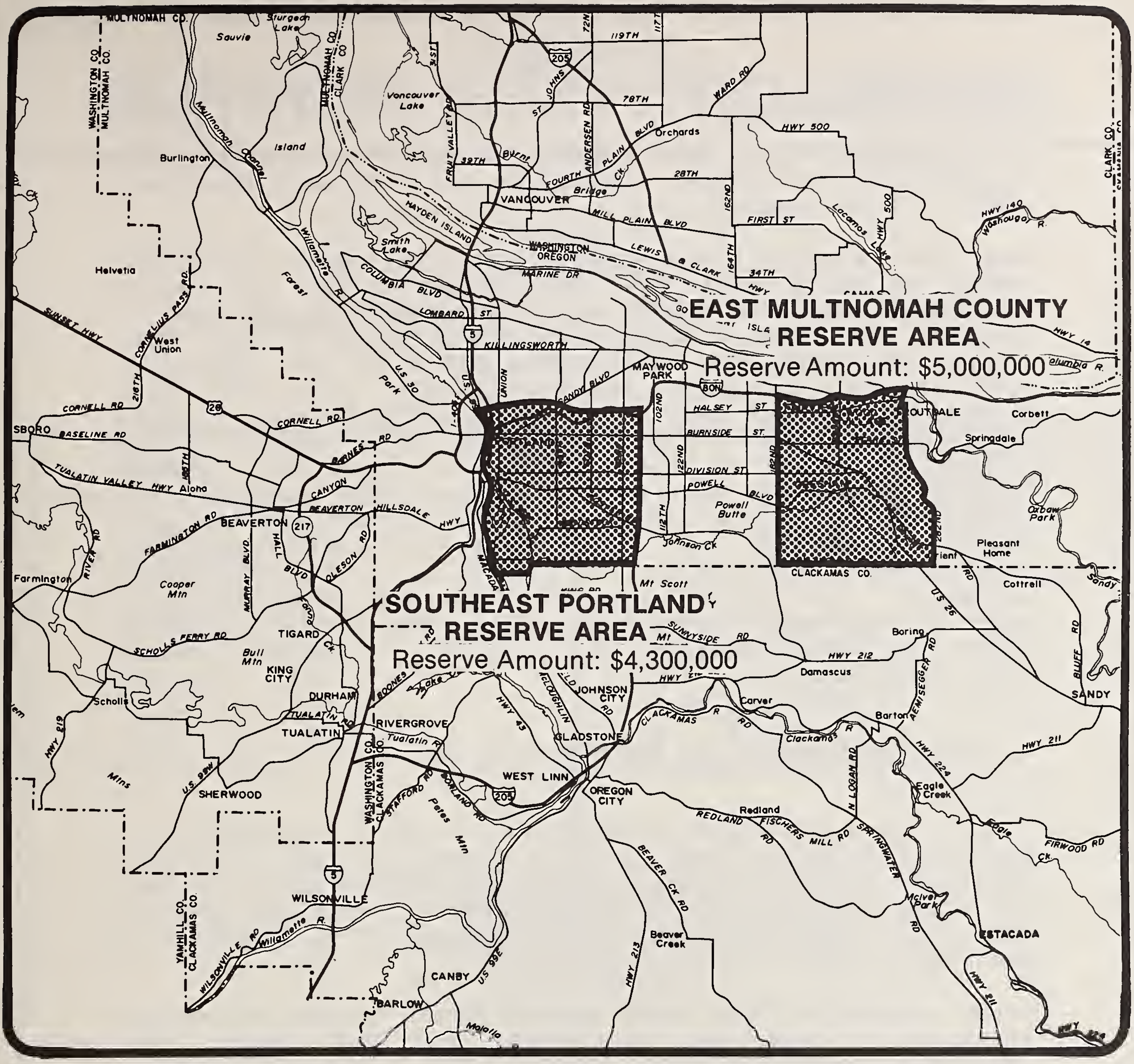

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Figure 3
OTHER RESERVE AREAS WITH SEPARATE FUNDING ALLOCATIONS

and to review candidate projects for their potential effectiveness.

The TSM Task Force was composed of members from the City of Portland, Multnomah, Washington and Clackamas Counties, ODOT, Tri-Met and CRAG.

When the Category V TSM Reserve was established, the Board asked the staff to report back if any of the previously submitted projects would constitute appropriate use of some of the reserve fund. The staff reported back that one of the projects along 99W represented an integrated and effective project. In August, 1977, the CRAG Board allocated $731,000 of the $5 million TSM Reserve to the 99W project. The project consisted of a series of TSM actions designed to both facilitate peak hour through movement along the arterial and allow access to the arterial from local cross streets. Included were new signalization, a computerized signal intertie, left turn bays, bus turnouts and a median barrier to control left-turning movements. The project allocation was not formulated as a part of the TSM Prototype Process. The allocation meant there was approximately $4.3 million in federal funds still available.

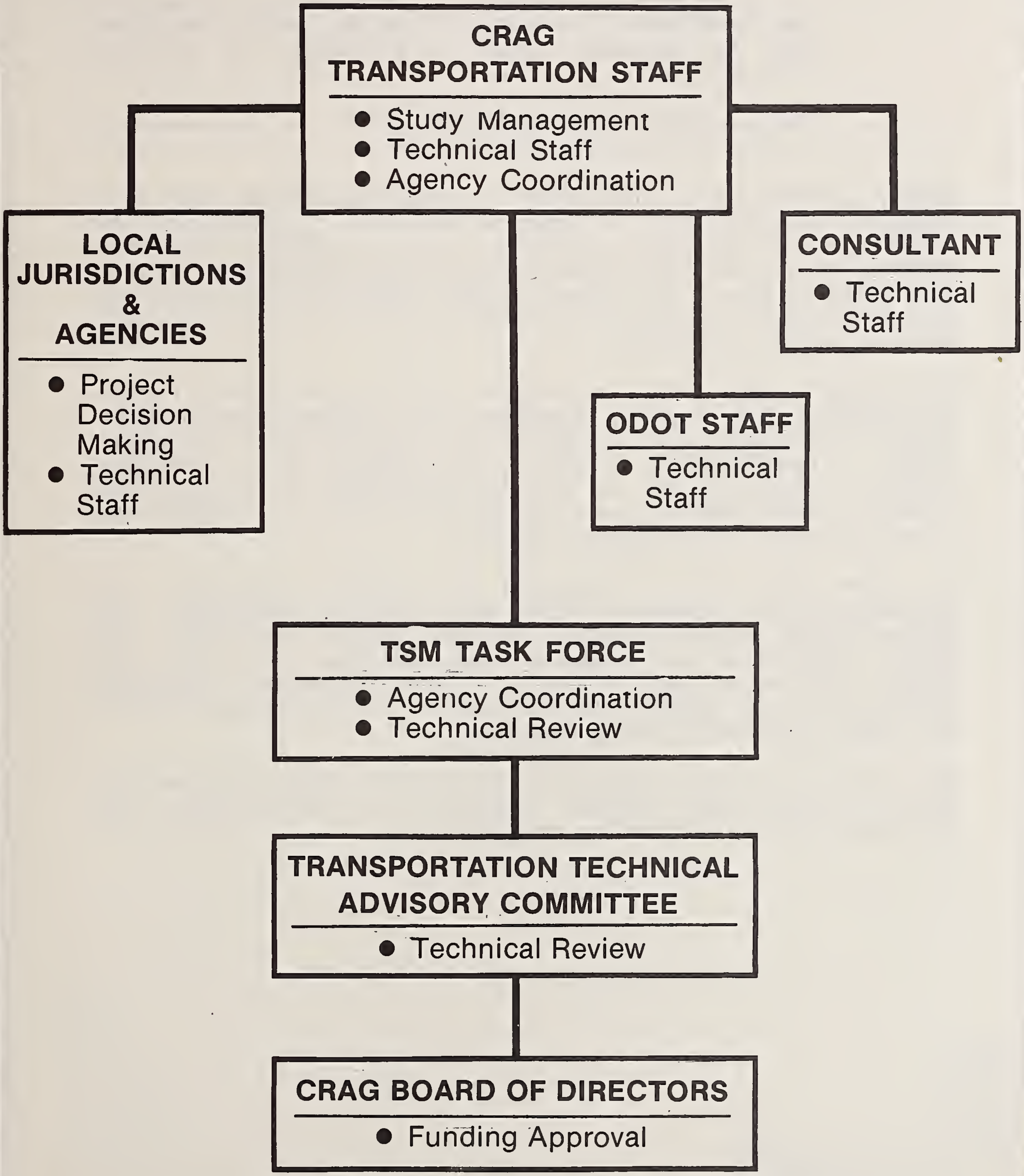
C. ORGANIZATION OF THE PROTOTYPE STUDY

CRAG's Transportation Division had primary responsibility for conducting all aspects of the study. These responsibilities included technical analysis, agency coordination, and study management. Acting as team leader, CRAG coordinated the efforts of the team members as illustrated in the organization chart (Figure 4).

Other members of the team included local jurisdictions and agencies, a technical consultant, and ODOT staff. The consultant and ODOT staff augmented the technical capabilities of the CRAG staff. The consultant was retained on a personal services contract to provide assistance on an as-needed basis.

Transportation Development Associates (TDA) was employed as the technical consultant. TDA input into the Prototype Study consisted of the following:

Figure 4
PROTOTYPE STUDY ORGANIZATION



1. Working with CRAG staff, TDA developed a set of evaluation criteria and corresponding performance measures. The criteria were used for reviewing problem areas and alternative TSM solutions.

2. TDA developed a handbook of analytical techniques and references for each criterion which could be used to estimate baseline problems and project effectiveness.

3. TDA assisted CRAG and ODOT staff in the evaluation of alternative TSM projects.

Local jurisdictions and agencies also provided technical support in assisting in data collection. Likewise, CRAG loaned staff to local jurisdictions to develop the data needed for documenting problems and evaluating the various TSM alternatives. The loan of CRAG staff to jurisdictions was critical as local jurisdictions did not have a great deal of staff resources.

To augment CRAG staff expertise in the area of traffic engineering the Oregon Department of Transportation provided technical staff support throughout the Prototype Study. Specifically ODOT staff undertook a volume-capacity analysis and an accident analysis of the problem areas. CRAG staff also had ready access to ODOT data resources for the Prototype Study.

The TSM Task Force consisted of traffic engineers and transportation planners from the City of Portland, the three Oregon counties, ODOT, Tri-Met, WDOT, and CRAG. The CRAG Transportation Director was Chairman of the Task Force. The essential role of the Task Force was technical review of work completed throughout the Prototype Study. The Task Force held three meetings .

The results of the Prototype Study was also reviewed by TTAC and the CRAG Board. Details of the meetings are discussed in the following chapter.

III. TSM PROTOTYPE PLANNING PROCESS

III. TSM PROTOTYPE PLANNING PROCESS

A. WORK PROGRAM

The work program was designed to fulfill the overall study goal of facilitating the increased use of the planning process in developing and programming TSM actions. The focus of the study was on identifying a process and testing its effectiveness. The process would have to be analytically sound, able to build broad concensus among a number of jurisdictions, and combine a number of evaluation procedures in a coherent and meaningful way. Perhaps the most important consideration was the development of regional concensus on the allocation of funds to projects identified in the study as priorities.

Based on this goal CRAG staff identified the following specific objectives for the study:

1. Identify problems that can be significantly affected by the TSM technique.

2. Substantially improve the TSM Element by expanding its scope to cover a more complete TSM systems approach.

3. Substantially improve the TSM Element by upgrading the planning and analysis that leads to project selection.

4. Strengthen the relationship between TSM planning and project programmimg and implementation.

5. Broaden familiarity and experience of major jurisdictions with TSM planning addressing a cross section of transportation problems.

The work program actually followed throughout the study differed from the original work program in the following manner:

> Originally it was proposed that potential problems and TSM alternatives would for the most part be identified by CRAG staff. It was also theorized that problems and TSM alternatives would be generally identified at the same time.

The need for <u>broad local jurisdictional involvement</u> in the identification of problems and TSM alternatives was necessary to ensure TTAC and CRAG Board support of staff recommendations. A sequential process of <u>initially identifying, prioritizing and quantifying problems prior to the identification of alternatives</u> was also emphasized in the study.

Figure 5 indicates the process followed throughout the study. Each of the steps in the process is explained in detail in the remainder of this section.

B. PROBLEM IDENTIFICATION

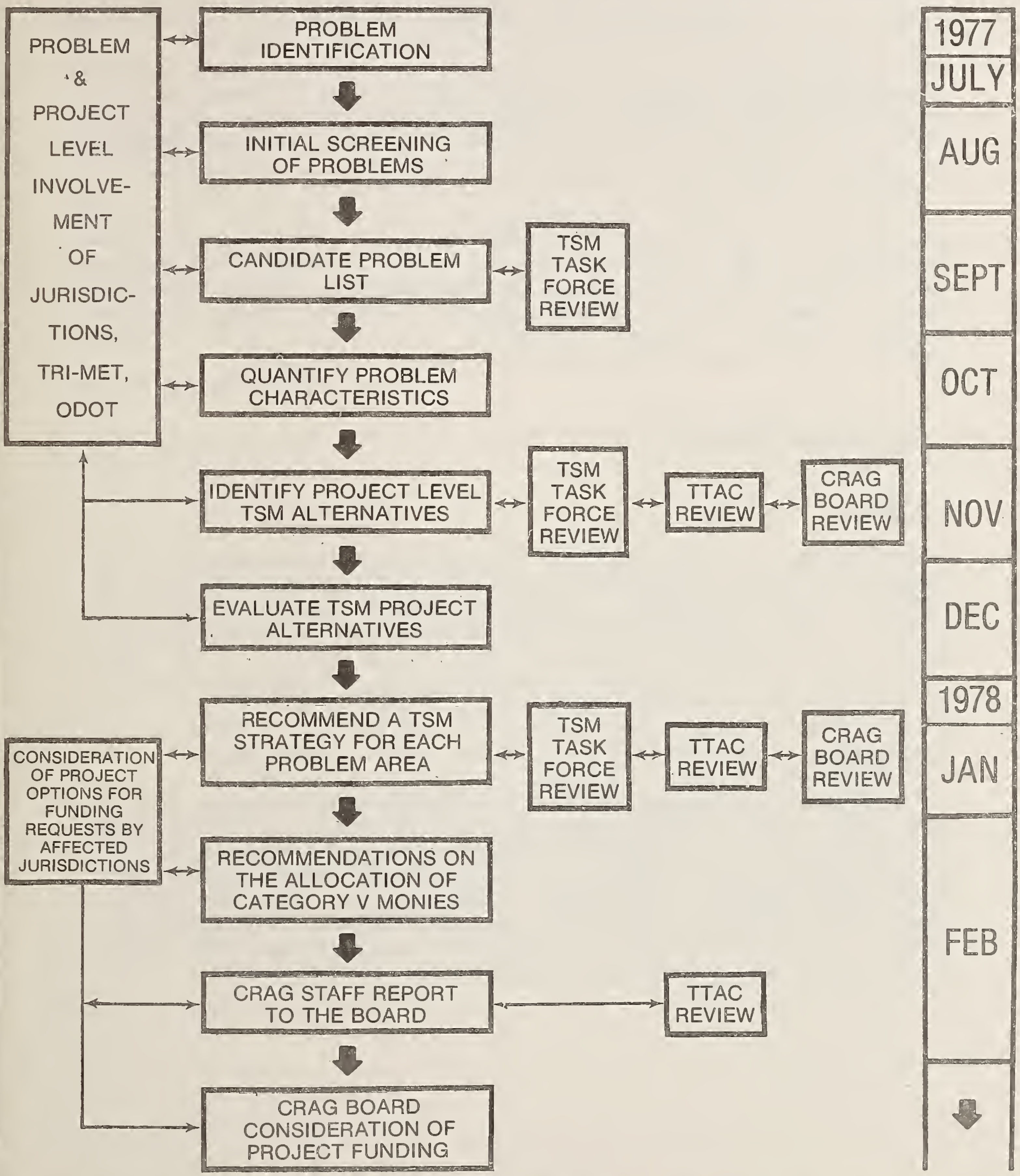
Purpose

The purpose of this phase of the study was to identify an extensive list of problem locations with TSM potential. During this study phase, some jurisdictions submitted project proposals rather than identifying problem locations. Efforts were then made to define the problem which the project was proposed to address. The phase was carried out as a joint effort between CRAG, its member jurisdictions, ODOT and Tri-Met.

Procedure

During July, August and September 1977, nine problem identification workshops were held in the region's counties and major cities. CRAG staff cooperated with county representatives in inviting city representatives to attend the workshops. ODOT and Tri-Met were involved in all these meetings. Normally, a number of jurisdictions were represented at any one meeting. All meetings were actually held outside CRAG offices at the appropriate jurisdictional offices.

Figure 5
PROTOTYPE STUDY PROCESS



The workshops were initiated with an explanation of the TSM concept and philosophy outlined by a CRAG planner. It was primarily emphasized that TSM is not a new name for a group of traffic engineering activities but rather a regional approach to solving transportation problems and an attempt to consider all transportation modes and services in an integrated and consistent manner.

The remainder of the workshop then focused on identifying transportation problems which might lend themselves to solution through TSM techniques. The workshop participants identified over 55 different problem areas ranging in scale from intersections to corridors, subareas, and areawide concerns.

Problems in all local jurisdictions in the region were considered with the exception of those located in the two geographical areas where the TSM Reserve could not be spent. These areas, the Southeast Portland area and the Gresham area, received separate allocations of similar amounts from the transfer funds (refer to Figure 3).

C. INITIAL SCREENING

Purpose

The purpose of the initial screening was to establish a representative cross section of priority transportation problems for analysis. This screening was necessary to balance the number of transportation problems analyzed with the available resources and to eliminate from consideration transportation problems that have marginal or no potential for a TSM solution.

Procedure

It was not possible to study in depth even a majority of the fifty problems because of limited staff resources and the complexity of some of the problems. Therefore, all problem areas identified were analyzed and categorized into one of the following categories: high priority, moderate priority, low priority, or dropped from consideration as they can best be solved through non-TSM solutions, such as a functional upgrade or replacement.

Each problem area identified during the workshops was documented in a staff report. The documentation included the problem location, nature of the problem, problem impact, Interim Transportation Plan (ITP) designation, jurisdictions affected, ADT and VMT, number of accidents, potential TSM opportunities, and recommendations on the best improvement strategy. Refer to Appendix C for an example of the documentation provided for each of the 55 problem areas. The results of the initial screening are documented in CRAG Transportation Division Staff Report #11: Problem Identification; Initial Screening; Candidate Problem List.

The results of the initial screening were used by CRAG staff to categorize the problems by priority and as a basis for defining broader problems on either a corridor or subarea level. A number of intersection problems were aggregated into a corridor problem and also a number of corridor problems were aggregated into a subarea for study.

Screening Criteria

The categorization of the problem areas was based on the following criteria:

1. TSM Potential

   Obviously not all the problems are best solved through TSM strategies; therefore, those problems that have marginal or no potential for a TSM solution were eliminated from consideration.

2. Scale of the Problem

   There are three scales at which problems may be identified and studied--intersection, corridor and subarea with the level of effort involved in studying the problem increasing as the geographic area increased. Thus the number and type of transportation problems studied had to be balanced with the supply of staff resources available to do the job. That is, a representative cross section of transportation problems had to be selected for analysis.

3. Jurisdictional Distribution

Recognizing that problems exist in all four counties and the City of Portland which could be solved through TSM strategies, it was necessary to have an equitable distribution of problem areas.

4. Regional Significance of the Problem

It was not within the range of CRAG staff resources to undertake a technical evaluation of all fifty problem areas. Therefore, the indirect measures of significant transportation problems, i.e., ADT and functional purpose of identified arterials, were a factor. That is, principal arterials tend to have more significant transportation problems than neighborhood collectors. Problem areas were also compared to a map of regional congestion areas, present and predicted for 1990.

5. Local Jurisdictional Interest

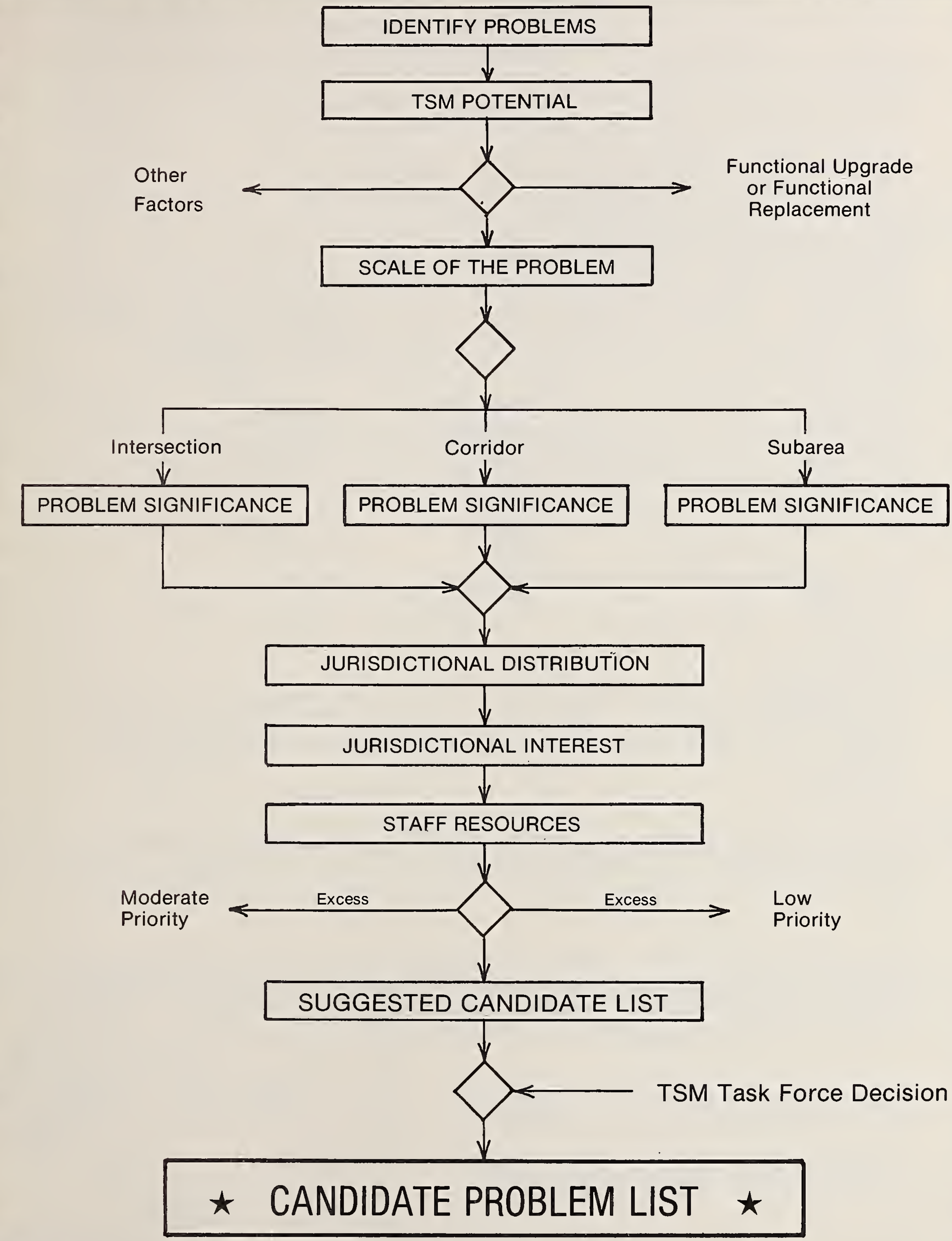
The counties and the cities all had varying perspectives and interests in the solution of one problem versus another. Therefore, local perceptions as to what were the worst problems were also a factor in the selection and, inevitably, such issues as availability of local match and state funding policies regarding transfer funds were considered.

Subsequently, a candidate problem list of ten high priority problem areas was formulated, recommended and accepted. The process followed through the initial screening is displayed in Figure 6.

Changes - Initial Screening

It was originally intended to emphasize problem severity to a greater extent in this phase of the study. However, existing data was sparse and, because of the variety of the types of problems identified, it would have been extremely difficult to use common measures to assess severity without spending considerable time compiling this data.

Figure 6 INITIAL SCREENING PROCESS



In applying the five criteria no particular weight was attached to any individual criterion. In making the selection of the candidate problem list, it was kept in mind that the study was designed to improve local capabilities in TSM planning by demonstrating that analytical TSM planning is possible. Therefore, the emphasis was on maintaining a geographical balance of problem areas which lend themselves to TSM solutions. Finally, because the study was the mechanism for identifying projects to be funded from the Category V TSM Reserve, there had to be local interest in the problem area. Otherwise, a local jurisdiction might be unwilling to provide local match funding for a project which would later be identified. The TSM Reserve also influenced the type of problems which were placed on the candidate problem list. Interstate Transfer Funds can only be used to fund on-the-ground projects and preclude a TSM solution such as a staggered work hours program from funding eligibility. Thus the Reserve somewhat restricted the range of potential TSM solutions.

Finally, many local jurisdictions at the problem workshops identified more than one problem intersection along a particular arterial. CRAG staff in many cases took the two or three intersections and redefined the problem in corridor terms.

D. APPROVE CANDIDATE PROBLEM LIST

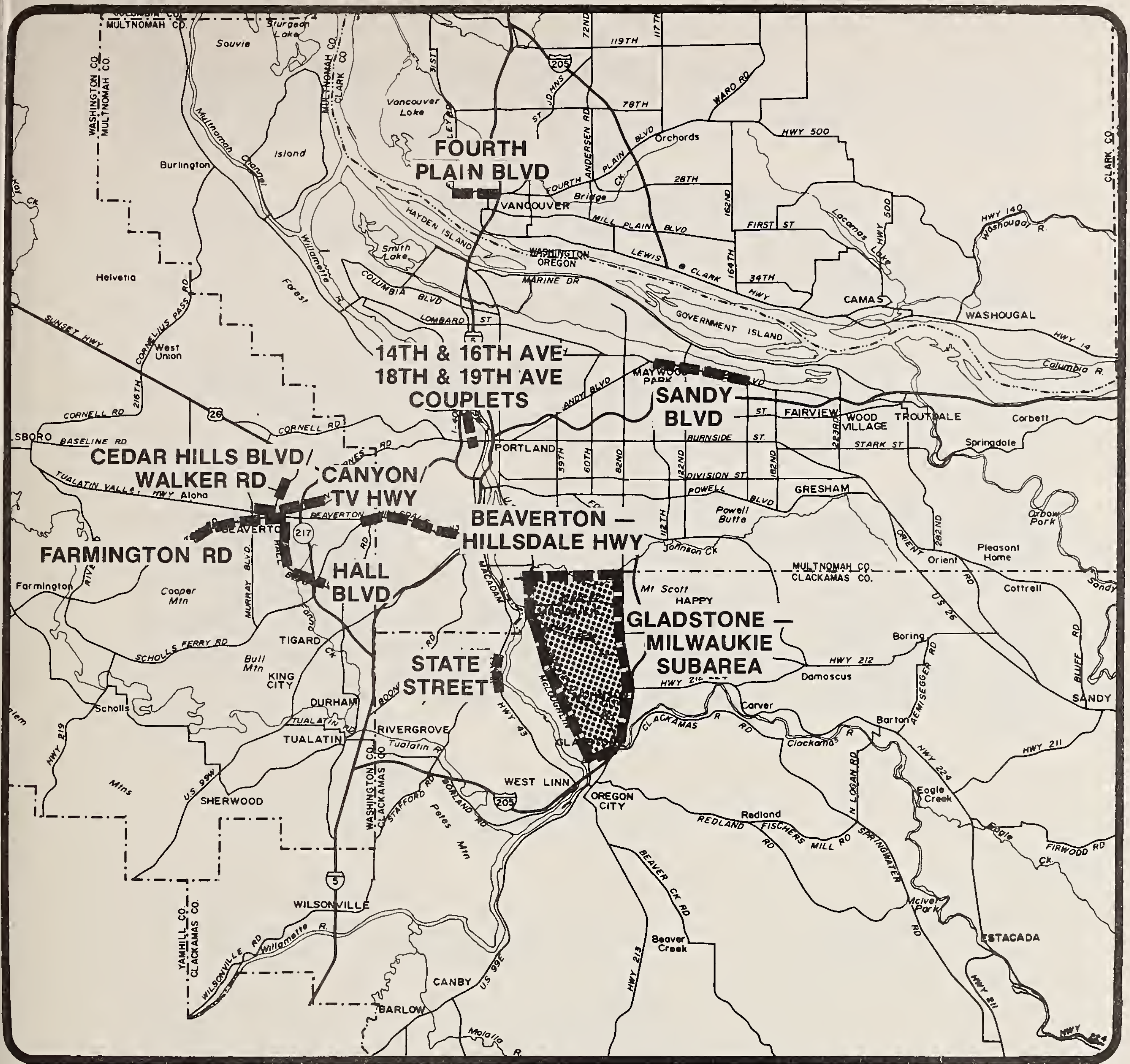
Purpose

The purpose of this phase was to establish a representative cross section of priority transportation problems which lend themselves to solution through TSM strategies.

Procedure

The initial screening process was the mechanism used to prioritize the 55 problem areas. Of the 55 problem areas there were ten selected as high priority (refer to Figure 7).

It was recommended that those problem areas designated high priority be placed on the candidate list for in-depth study and potential funding under the TSM Reserve. Those in the moderate priority category were retained for con-



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Miles

N

Figure 7

FINAL CANDIDATE PROBLEM AREAS

sideration and study at a future time. Those in the low priority category and those which can best be solved through non-TSM solutions were dropped from consideration.

CRAG staff identified ten high priority problem areas in the region and submitted them to the TSM Task Force for review and approval in October, 1977.

Changes in the Candidate Problem List

During the first TSM Task Force meeting, the City of Portland indicated City staff would submit a resolution to the City Council establishing five high priority problem areas for consideration of Category V funding.

Subsequent contact with the City of Portland resulted in the replacement of the Hollywood Subarea by the 14th/16th couplet. The major reason for the amendment is the inherent complexity involved in the Hollywood Subarea problem and the possibility that some of the improvements may fall into the Southeast Portland Reserve geographic area. Further, the 14th/16th couplet problem offered high TSM potential, would significantly benefit the Northwest residential area and would improve accessibility to I-405.

The recommendations are outlined in Table 1.

TABLE 1

CANDIDATE PROBLEM LIST

PROBLEM AREA	PROBLEM SCALE
Multnomah County:	
Sandy Blvd-99th Ave. to 162nd Ave.	Corridor
Washington County:	
Canyon/TV Hwy-Walker Rd to Murray Blvd	Corridor
Farmington Rd-185th Ave to Lombard Ave.	Corridor
Hall Blvd-TV Hwy to Scholls Ferry Rd	Corridor
Cedar Hills Blvd/Walker Rd	Intersection
City of Portland:	
Hollywood District	Subarea
Beaverton-Hillsdale Hwy-Capital Hwy to Scholls Ferry Rd	Corridor
Clackamas County:	
Milwaukie-Gladstone Subarea	Subarea
State Street Corridor	Corridor
Clark County (State of Washington):	
Fourth Plain-I-5 to Fruit Valley Rd	Corridor

E. PROBLEM QUANTIFICATION

Purpose

The purpose of this phase of the study was to collect baseline data about the problem characteristics of the ten problem areas previously identified. The data was used as a basis for estimating problem severity, formulating potential TSM solutions and estimating the anticipated effectiveness of candidate TSM improvements.

Procedure

Figure 8 documents the remainder of the process followed throughout the study.

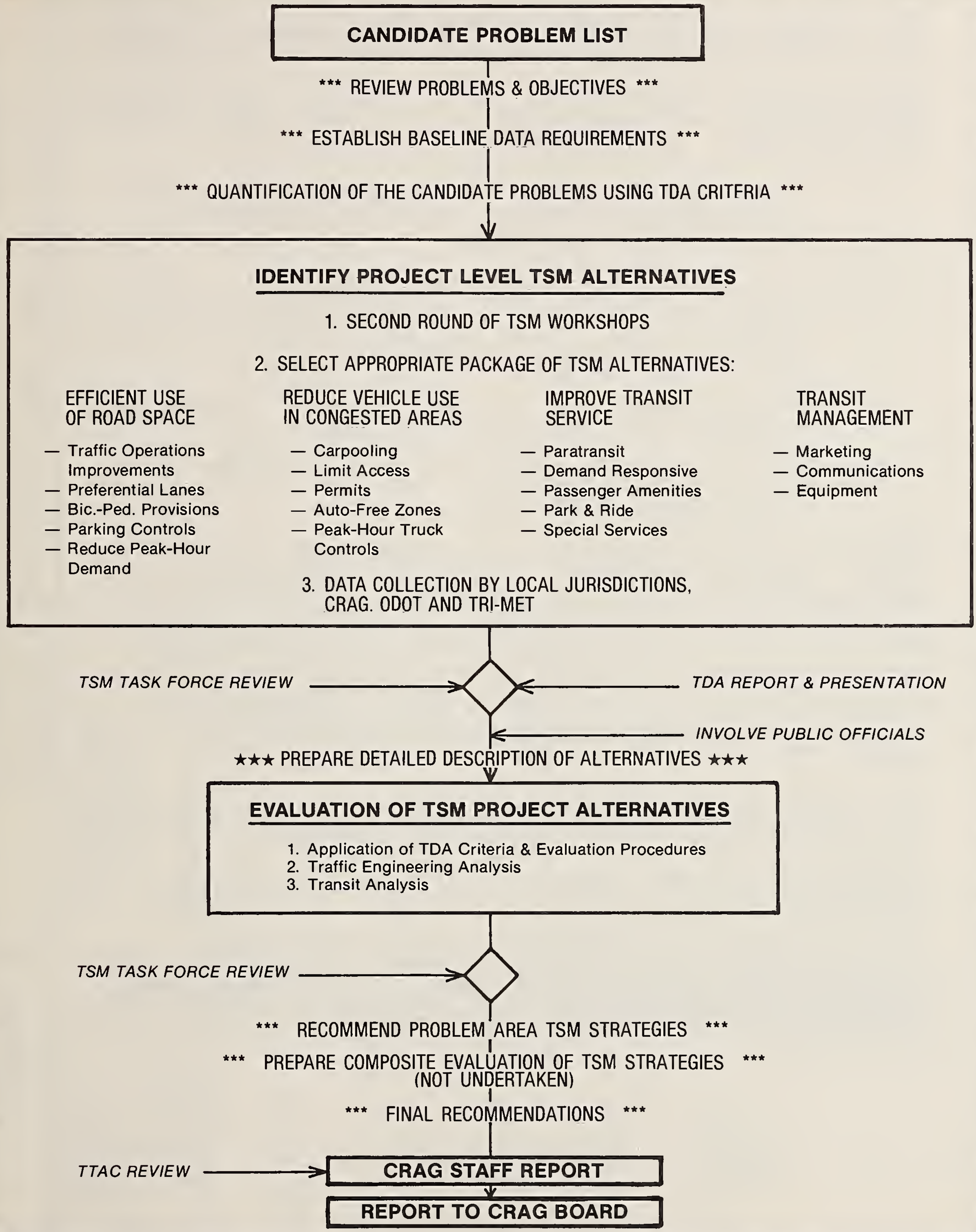
In collecting the baseline data strong reliance was made on existing data sources, completed studies, and on local staff participation in assisting CRAG staff to collect data.

In June, 1977, CRAG employed Transportation Development Associates (TDA) to act as a technical consultant on the TSM Prototype Study. The primary role of TDA was to establish a set of criteria and performance measures for use in dimensioning candidate problems and for evaluating TSM solutions.

TDA assisted CRAG staff in deriving a "Master List" of evaluation criteria from a set of management strategies and policies related to the use of Mt. Hood Freeway Transfer Funds. The management strategies and policies were adopted by the CRAG Board in March, 1977, and are consistent with the Regional Goals and Objectives previously adopted by the CRAG Board. The "Master List" of criteria is contained in Appendix B.

To assess the effectiveness of project level TSM strategies, performance measures were developed for each of the criteria. Recognizing that varying levels and sophistication of data would be available to evaluate TSM projects, a number of performance measures were developed for each criterion. Sources and availability of data were then documented for each criterion. Finally, to estimate baseline problems and project effectiveness as appropriate to each of the performance measures, a handbook of readily usable evaluation procedures, analytical techniques and references was compiled.

Figure 8 COMPLETION OF THE STUDY



The criteria were first used in the problem quantification phase. CRAG staff assessed each of the ten problem areas in terms of the criteria list.

The results of this exercise were the subject of discussion at the second round of TSM workshops.

During October and November, 1977, fourteen TSM Workshops were held with involved local jurisdictions, ODOT, Tri-Met and CRAG staff. The agenda of the workshops was:

1. Review of the candidate problems and finalization of a set of TSM improvement objectives for each of the ten problem areas.

2. Introduction of local jurisdictions to the criteria and performance measures which would be used for quantifying problems and for evaluating project level TSM alternatives.

3. Establishment of baseline data requirements needed for the evaluation process.

4. Identification and cost determination of project level TSM alternatives.

Baseline data requirements were determined at the workshops. It was recognized that staff resources and time were limited and that data would, for the most part, have to come from existing sources. It was also recognized that the local units of government in the region would not have a great deal of staff resources available to devote to the compilation of existing data. To ensure that at least a minimum level of data would be available, CRAG loaned staff to most jurisdictions to assist them in this phase.

An example of the "level of analysis" applied to each of the ten problem areas is contained in Appendix D.

A summary of this phase of the study is contained in Figure 9.

The results of the problem analysis are documented in <u>CRAG Transportation Division Staff Report #15: Problem Quantification; Identification of Project Level TSM Alternatives</u>.

Figure 9

SUMMARY OF THE PROBLEM QUANTIFICATION ANALYSIS

PROBLEM SEVERITY
● SEVERE
○ MODERATE
NO PROBLEM IDENTIFIED

PROBLEM AREAS / CRITERIA		CANYON/TV HWY.	HALL BLVD.	FARMINGTON HWY.	CEDAR HILLS BLVD/ WALKER ROAD	SANDY BLVD.	MILWAUKIE/ GLADSTONE SUBAREA	STATE STREET	18th & 19th 14th & 16th	BEAVERTON/ HILLSDALE HWY.	FOURTH PLAIN BLVD.
CORRIDOR MOBILITY	Transit Use	●	●	●		●/○	●	○	○	●	●
	Commercial Vehicle Trips	●	●	●		●		○	○		●
	Ped/Bike Trips					○	●	●	●		●
	Peak Period Trips	●	●	●	●	●	○	●		●/○	○
	Travel Time Delay	●	●	●	●	●	○	●		●/○	●
SAFETY	Accidents Total	●	●	●	○	●	●/○	●	●	○	●
	Accident Rate (per million vehicle miles traveled)	●	●	●	○	●	●/○	●	●	○	●
SOCIAL & ENVIRON-MENTAL	Air Quality	●	○			●	○	●		○	
	Energy Consumption	●	○			●		○		●	
	H & E Access						●				●
	Transit Rider Comfort/ Convenience	●	●	○		●	●	●		●	●
EXISTING LAND USE	Traffic Through Neighborhoods				●		●		●		○
	Noise Level within Neighborhoods								○		
	Local Access to & from Existing Neighborhoods			●		●	●			●	○
	Local Access to & from Adjacent Comm'l & Industrial Centers	●				●		●		●	
	Access to Centralized Comm'l & Industrial Centers	●	●					●			

F. IDENTIFY TSM ALTERNATIVES

Purpose

The purpose of this phase was to identify a number of TSM alternatives for each of the ten problem areas based on the problem analysis carried out in the previous phase of the study.

Procedure

The identification of TSM alternatives was completed during the second round of TSM Workshops.

CRAG staff, working cooperatively with Tri-Met, ODOT and the jurisdictions, identified a number of TSM project level alternatives for each of the ten problem areas. In identifying TSM projects both "supply optimizing techniques" and "demand management techniques" were considered for the degree to which they would solve the transportation problems of each area. Also emphasized were TSM projects whose impact would benefit more than one mode and which could be combined with other projects to produce a transportation solution with maximum effectiveness.

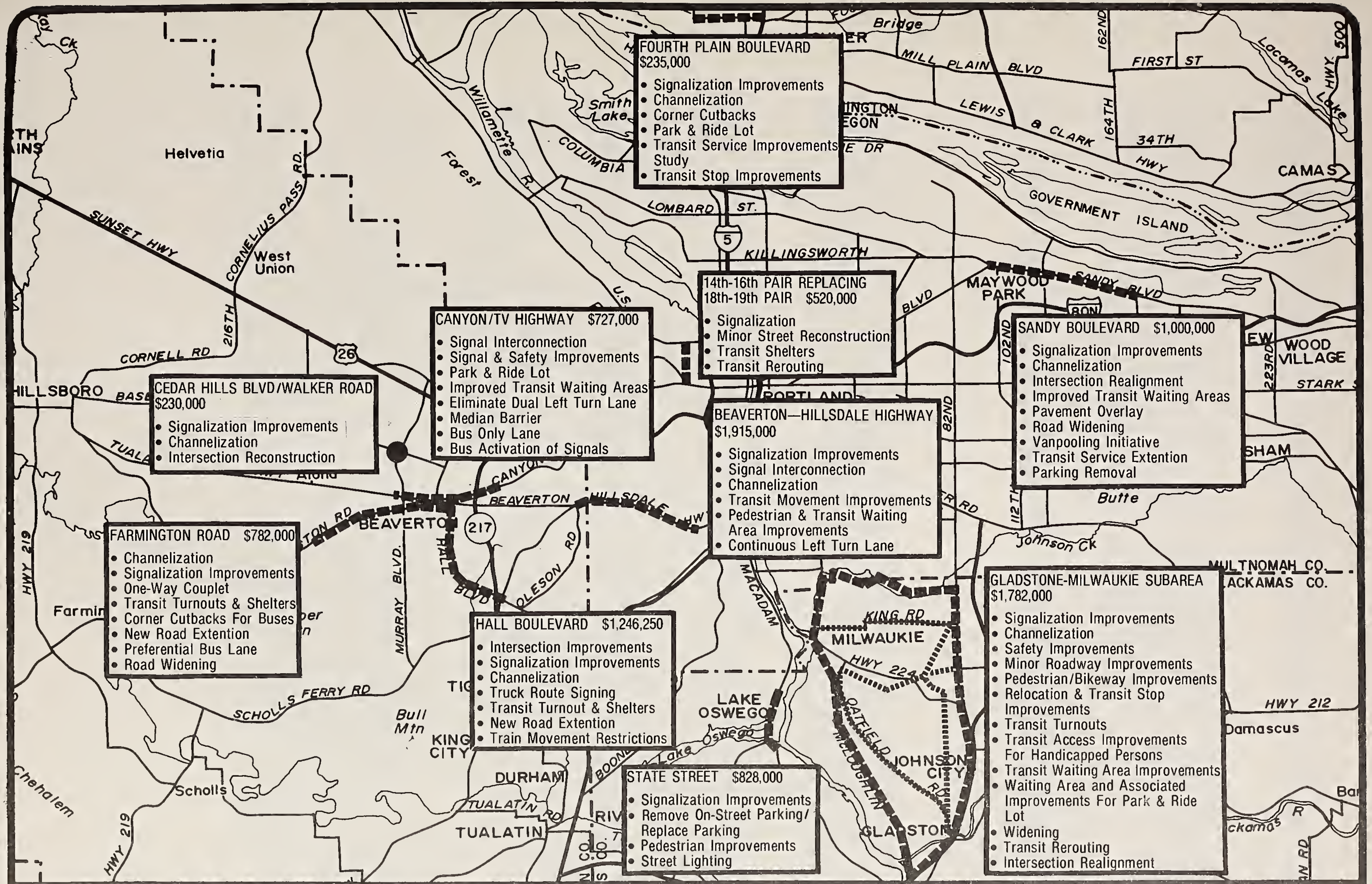
TSM projects identified consist of signalization improvements, channelization, safety overlays, Park and Ride lots, improved transit waiting areas, minor transit rerouting, parking removal, the substitution of off-street parking for on-street parking and pedestrian/bikeways.

The map in Figure 10 summarizes the candidate TSM projects which were identified and the project costs.

TSM Improvement Objectives

A set of TSM improvement objectives was also formulated for each problem area during the second round of workshops.

The setting of objectives in the TSM Prototype Planning Process was an extremely important step. The objectives served as a reference point for identifying TSM actions and encouraged actions which normally might not have been identified. For example, signalization was proposed at some intersections within the Gladstone-Milwaukie Subarea



CRAG

Figure 10

0 1 2 Miles

CANDIDATE TSM PROJECTS IDENTIFIED FOR THE TEN PROBLEM AREAS

as an action to reduce "non-local" through trips. However, some of the intersections did not meet signal warrants.

The objectives also served as guides in the combination of project level TSM alternatives to produce TSM strategies and highlight the contradictory nature of certain objectives. Finally, the individual problem area objectives were directly related to the criteria and performance measures which were used to evaluate the effectiveness of TSM projects.

G. EVALUATE TSM PROJECTS AND RECOMMEND TSM STRATEGIES FOR EACH PROBLEM AREA

Purpose

The purpose of this phase was to evaluate and determine the effectiveness of each of the candidate TSM projects. The projects were evaluated based on their potential effectiveness in solving the problems and meeting the TSM improvement objectives.

The objective of this phase was to recommend for each problem area a TSM strategy which was composed of the most effective and complementary set of TSM projects.

Procedure

The evaluation concentrated on describing the advantages and disadvantages of the candidate projects. Candidate projects were evaluated as to which combination of projects were the most effective in solving the particular problems and meeting the improvement objectives. Low-cost solutions which capitalized on the under-utilized potential of the corridors and the subarea were emphasized.

Corridor and subarea TSM strategies consisted of a set of integrated policy-related projects. Emphasis was on finding an integrated program of traffic and transit operational improvements recognizing that a project which would benefit more than one mode would have high TSM utility.

Interrelationships of candidate TSM projects were also emphasized, recognizing that maximum effectiveness could be achieved with a package of complimentary and mutually supportive projects. The type and number of problems the candidate TSM projects would both solve and create were documented.

In emphasizing the "low-cost" nature of the TSM philosophy, the cost-effectiveness and scale of the candidate TSM projects were carefully evaluated. TSM recognizes that to solve a transportation problem, it is not necessary "to cut butter with a chain saw."

Finally, a comparison of corridor and subarea strategies was undertaken and a recommendation as to how the remainder of the $5 million TSM Reserve should be allocated was made.

Figure 11 describes the process followed in evaluating the TSM projects.

The basis of the technical assessment of candidate projects relied on the criteria and performance measures developed earlier in the study. The assessment was carried out by CRAG staff with technical assistance from ODOT and TDA.

Refer to Appendix E for an example of the results of this evaluation for one of the problem areas. The complete evaluation of candidate projects is documented in <u>CRAG Transportation Division Staff Report #17: Evaluation of the TSM Candidate Projects; Suggested TSM Strategies for Each of the Ten Problem Areas</u> and <u>Staff Report #19: Evaluation of TSM Candidate Projects and Suggested TSM Strategies.</u>

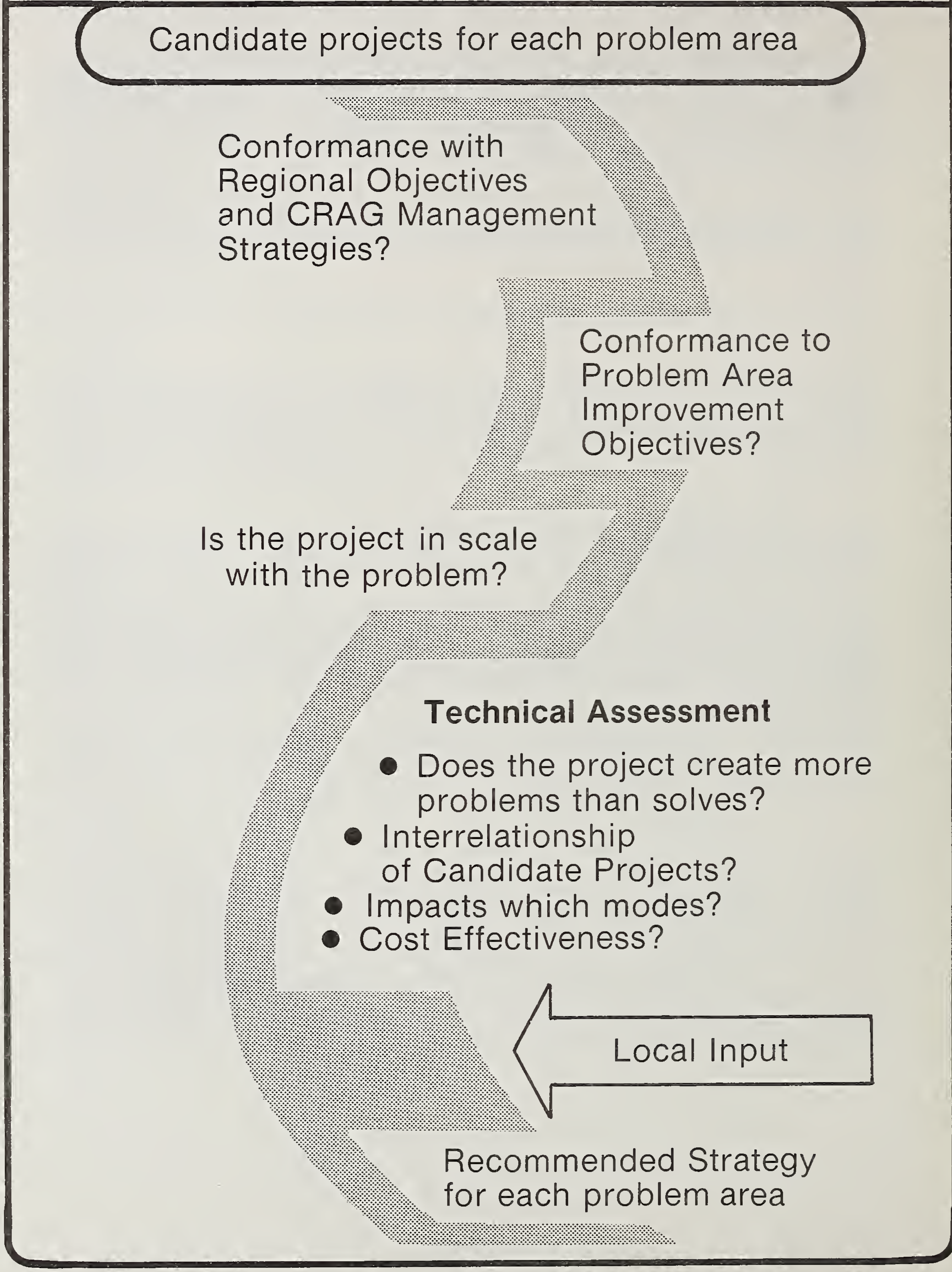
Basically, the evaluation focused on eliminating or downscoping those TSM projects which were:

1. Projects which were not considered TSM in spirit.

2. Projects which were identified where only a minimal problem existed.

3. Projects which were not on a scale in keeping with the severity of the problem identified.

Figure 11: PROJECT EVALUATION PROCESS



4. Projects which did not conform to the type of problem identified, the TSM improvement objectives, or projects which created more problems than they solved.

Also stressed in the evaluation was how the various projects interrelated with one another to produce the most effective package of projects to solve the problems identified.

The evaluation process eliminated $4 million in proposed projects.

Changes - Project Evaluation

Two major changes in the study process occurred at this point: an anticipated citizen involvement process was not undertaken; and an evaluation and prioritization of the ten strategies was not carried out.

The citizen involvement process was changed to account for restrictions on staff availability. Jurisdictions were requested to document their perception of whether or not individual projects had citizen support. In many cases, jurisdictions conducted their own citizen involvement process.

The prioritization of the ten strategies was unnecessary because the resulting TSM strategies essentially did not exceed the amount of unallocated funds remaining in the TSM Reserve Account. However, it should be noted that the process could have been used to undertake an evaluation between the different problem areas.

H. FINAL RECOMMENDATIONS

Purpose

The purposes of the final phase were to prepare final recommendations for allocating remaining TSM Reserve funds, to determine the extent of citizen interest in the projects recommended, and to document the willingness of local jurisdictions to pursue the local match on the projects.

Procedure

CRAG staff forwarded a memorandum to all involved jurisdictions and agencies asking them to document their perceptions of possible citizen reaction to the TSM projects and the willingness of the jurisdiction to provide the required local match.

Some of the projects were controversial in nature and it was expected the CRAG Board would desire some indication of public support for the projects before an allocation was made.

CRAG staff also felt the Board would desire assurances from local officials that a local match was available (local match was 14 percent of total costs and the federal share was 86 percent). Specifically requested was some form of written documentation of a jurisdiction's intention to secure local matching funds and the endorsement of the jurisdiction's city council or county commission. Final recommendations are described in Figure 12.

Changes - Washington State

Fourth Plain Boulevard, the corridor studied in the City of Vancouver (Washington) was dropped from funding consideration. Fourth Plain Boulevard was one of seven problem areas originally identified in Clark County. The corridor is a Washington State facility located entirely within the City of Vancouver and was originally selected by CRAG staff because it offered the highest TSM potential of the seven problems identified. The corridor had capacity problems in sections and very little potential for road widening solutions due to prohibitive right-of-way costs. Improved transit and para-transit service provided additional alternatives for TSM strategy.

The corridor does not show up as a particularly severe problem according to a Washington DOT needs analysis. Additionally, local city funds are tied up for the next several years on improvements necessary to complement the Interstate 5 widening. Based on these reasons, staff recommended this problem area be dropped from consideration regarding TSM Reserve funds.

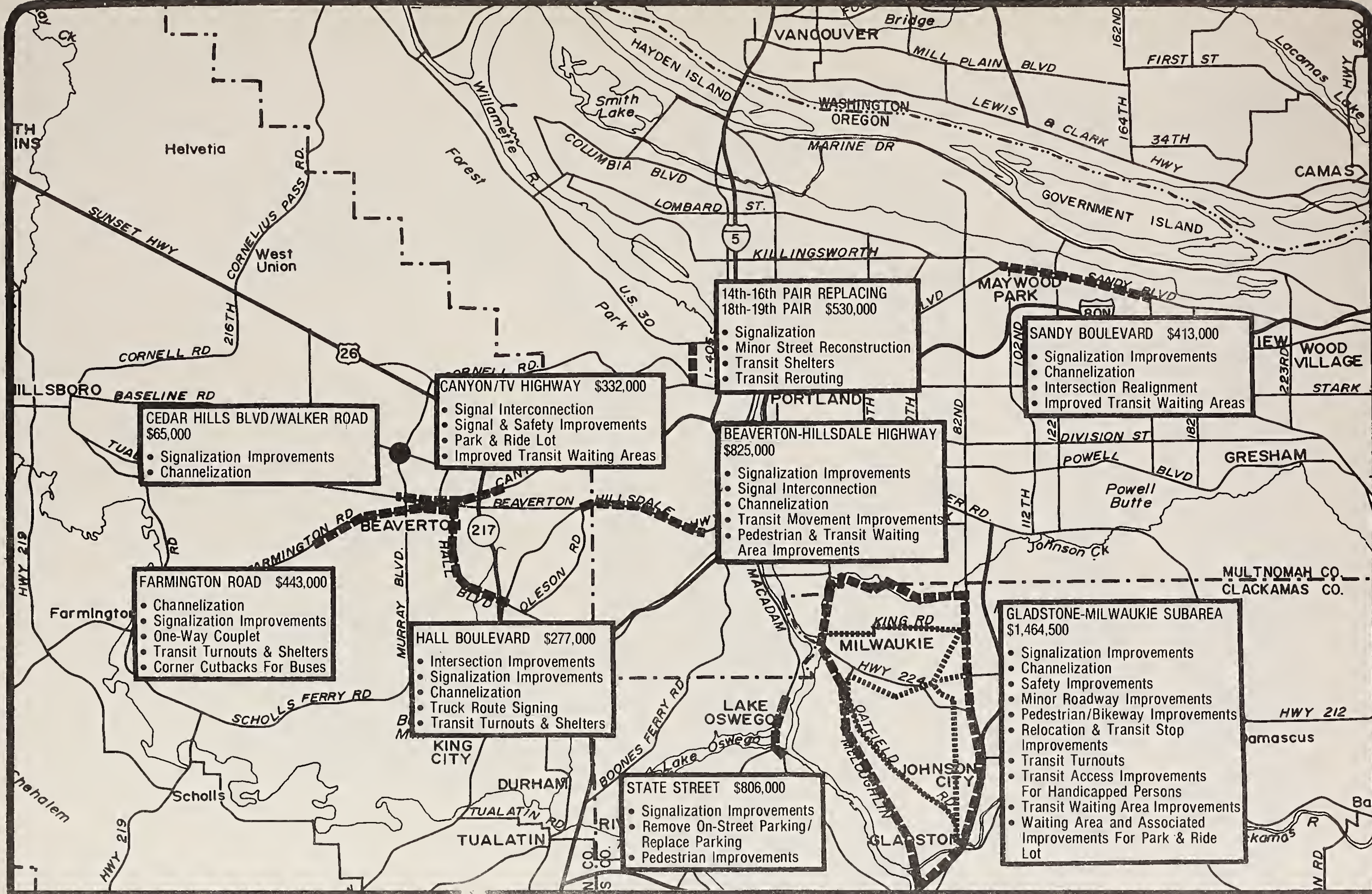


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Figure 12

0 1 2 Miles

N

RECOMMENDED TSM STRATEGIES

Board Action

Total project cost of the nine TSM strategies for the tri-county area was estimated to be $5,155,500. The project cost in federal dollars was estimated to be $4,433,730 which compared to remaining TSM funds of $4,279,493. Thus, a potential shortfall of $154,237 existed.

Interstate Transfer Funds continue to escalate according to the national construction price index. The funds escalate until monies are actually obligated so it was anticipated that the shortfall could well disappear by the time projects were actually constructed. Thus, all project costs were decreased 3.5 percent to bring costs in line with remaining revenues.

CRAG Board action regarding the Interstate Transfer Funds normally consists of two actions. First, funds are reserved for a project by the Board. The Board will also authorize preliminary engineering when a jurisdiction is ready to implement a project.

To ensure that federal monies were utilized in a timely fashion, staff recommended that implementing agencies be given until September, 1979, to obligate funds for preliminary engineering for the projects. Local jurisdictions would have approximately 14 months to request Board authorization for preliminary engineering.

TTAC and the CRAG Board approved all staff recommendations and funds were reserved for TSM projects as follows:

Problem Area	Federal $ Share
. Canyon/TV Hwy	$ 275,641
. Farmington Rd	367,722
. Hall Blvd	229,930
. Cedar Hills Blvd & Walker Rd Intersection	53,955
. NW 18th & 19th; NW 14th & 16th Couplet	439,938
. Beaverton-Hillsdale Hwy	684,809
. Sandy Blvd	342,820
. State Street	669,038
. Gladstone-Milwaukie Subarea	1,215,640
TOTAL	$4,279,493

It was recognized that the TSM strategies may involve more than one implementing agency, and that the possibility of actually getting a comprehensive package of actions implemented at the same time involving more than one implementing agency might be difficult. Not all implementing agencies would be able to provide a local match for some projects, and timing might also be an issue.

Therefore, it was recommended that those strategies, which have sub-components missing because of the inability of implementing agencies be re-evaluated prior to implementation to ensure overall effectiveness in solving the identified problems.

Finally, the responsibility of monitoring the progress of the projects was assigned to the Transportation Improvement Program (TIP) Subcommittee.

Subsequently, the TSM Task Force was disbanded. The Task Force was set up specifically to monitor and review the work undertaken in the Prototype Study and the allocation of the TSM Reserve Account.

In February, final staff recommendations on the allocation of the TSM Reserve were presented and approved by TTAC and the CRAG Board. Appendix F contains the final report presented to the Board and details the strategies of each of the problem areas.

Table 2 describes local jurisdictions and agencies involved in the actual implementation of the nine strategies.

TABLE 2

RANGE OF JURISDICTIONS AND AGENCIES INVOLVED IN THE IMPLEMENTATION OF THE TSM STRATEGIES

Problem Areas	Jurisdictions and Agencies
1. Canyon/TV Hwy	City of Beaverton Washington County ODOT Tri-Met
2. Farmington Rd	Washington County City of Beaverton Tri-Met ODOT
3. Hall Boulevard	Washington County City of Beaverton Tri-Met ODOT
4. Cedar Hills Boulevard/Walker Rd.	Washington County
5. Beaverton-Hillsdale Hwy	City of Portland Tri-Met ODOT
6. Sandy Boulevard	Multnomah County Tri-Met ODOT
7. 14th and 16th; 18th and 19th Couplet	City of Portland Tri-Met
8. State Street	Lake Oswego ODOT
9. Gladstone-Milwaukie Subarea	City of Gladstone City of Milwaukie Clackamas County Tri-Met

IV.
CONCLUSIONS

IV. CONCLUSIONS

The Prototype Study was a cooperative effort by CRAG staff and the staffs of its member jurisdictions in identifying existing transportation system deficiencies, prioritizing the deficiencies, identifying and evaluating a number of alternative TSM solutions and in allocating $4.3 million in federal funds.

The Prototype Study developed a framework for determining the severity of existing transportation problems and for assessing the effectiveness TSM solutions would have in correcting the problems. The framework was analytically sound but yet the study design was not too cumbersome to preclude local jurisdictional interest. The framework was comprehensive enough to incorporate trade-offs between a number of different modes and a number of different problem situations.

The emphasis throughout the study was on agency coordination in finding the most effective low-cost TSM solutions. The Prototype Study framework enabled CRAG staff, using a relatively small sum of money, to recommend allocations based on need and potential effectiveness.

The framework which was developed here enabled CRAG to identify problems which crossed jurisdictional boundaries and involved more than one mode. The Study enabled CRAG to achieve coordinated, site-specific TSM projects and some service-related strategies in nine problem areas and to allocate funds for the actual implementation of the strategies. It would have been difficult to achieve this coordination or analytical base without CRAG staff involvement.

The study also provided CRAG staff an analytical base with which to deal with initial "wish lists" of transportation problem areas and projects. Problem areas were reduced from over 55 to ten high priority areas. Initially, $9 million in projects were identified for the ten areas. After the analysis, project recommendations of only $4.3 million were made to TTAC and the CRAG Board. The Board subsequently accepted all staff recommendations.

The study enabled some TSM projects to be identified and funded which did not previously exist. This was especially true of some transit related projects. Examples include the park and ride lots associated with the Canyon-TV Highway Corridor and the Gladstone-Milwaukie Subarea; the transit rerouting to accompany the 18th Ave-19th Avenue Corridor improvements; and many of the transit waiting area "amenity improvements."

The availability of implementation funds was a significant factor in the level of interest and involvement of local jurisdictions in the TSM planning process. Competition among Oregon jurisdictions in the identification of problem areas and project submittal was at times fierce.

It should also be noted that there are a number of constraints attached to Interstate Withdrawal Funds which tended to direct the Prototype Study process. This type of fund is normally used only for "on the ground" projects excluding operational or policy oriented transportation projects, such as a staggered work hour incentive program or a vanpooling program. Thus the funding and its constraints tended to guide the Prototype planning process in certain directions.

These operational and management oriented TSM strategies could have been addressed by the Study framework had more time been available and had these types of strategies been eligible for funding.

Finally, it should be noted that the analytical procedures developed during the Prototype Study have already been employed in two recent study efforts by CRAG staff. CRAG is currently undertaking a special TSM study on a severely congested urban arterial in the region. The TSM criteria are being used to quantify existing problems and will be used in assessing the effectiveness of the TSM alternatives.

A second effort involved a project analysis of six candidate signal projects which were competing for approximately $300,000 in FY 1979 unallocated Federal Aid Urban (FAU) funds. In performing the project analysis, the problems were quantified. The project analysis consisted of quantifying the various problems and comparing them to one another. Based on the analysis, staff made recommendations to a CRAG Subcommittee on which projects should be funded. The recommendations were approved and the projects incorporated into the region's Transportation Improvement Program (TIP).

APPENDIX A

CRAG BOARD MANAGEMENT STRATEGIES AND POLICIES TO BE USED IN THE ALLOCATION OF MT. HOOD FREEWAY TRANSFER FUNDS*

MANAGEMENT STRATEGIES

1. Favors TSM where it will significantly address problems and favors capital intensive projects where TSM will not significantly address problems.

2. Emphasizes measures which correct imbalances between regional and local systems.

3. Uses several funding sources for projects.

4. Supports an investment strategy which will achieve region-wide momentum by early implementation of projects which address corridor and sub-area problems.

POLICIES

1. Place the highest value on transportation investments which reinforce CRAG's containment land use objectives by facilitating better use of land in already developed areas.

2. Investments should reinforce environmental (clean air) and energy goals (reduced per capita consumption).

3. Investments should provide incentives for:

    a. Increased transit use
    b. Reduced trips taken
    c. Shortened trips
    d. Increased auto occupancy
    e. Maximized use of existing regional transportation investments (marine, air, railroad, highway and transit)

4. Weight should be given to investments which:

    a. Increase the efficiency of the existing commercial/industrial areas
    b. Enhance the livability of the existing neighborhoods

5. Investments should support and encourage concentration of job-sites and increased housing density.

*Adopted by the CRAG Board in March, 1977

APPENDIX B

TSM PROTOTYPE STUDY

PERFORMANCE MEASURES

A. CORRIDOR MOBILITY

CRITERIA	PERFORMANCE MEASURES	DATA SOURCES	COMMENTS
A.1 Auto Occupancy	o Average car occupancy o ADT or VMT o Auto driver trip ends o Van pools (number of pools and number of users)	o ODOT o Local Jurisdictions o CRAG (regional average) o Carpool Agency	Only limited occupancy study information available; may have to estimate based on values from other corridors or regional averages.
A.2 Transit Use	o Transit mode split o No. of transit person trips	o Tri-Met	
A.3 Commercial Vehicle Trips	o Number of trips affected o Specific constraints/problems	o ODOT o Local Jurisdictions	May have to be judgmental based on land use.
A.4 Pedestrian/Bicycle Trips	o Number of trips affected o Specific constraints/problems	o Local Jurisdictions	May have to be judgmental based on land use.
A.5 Peak Hour Trips	o Peak period V/C of overall corridor and key constraints o Corridor peaking characteristics o Transit facilities load factors o Transit passengers per bus mile o Average peak hour speeds o Person-trip capacity of overall corridor and key constraints	o ODOT o Tri-Met o Local Jurisdictions o CRAG (regional averages)	Factors used will vary depending on data available. CRAG speed/delay study available for selected corridors.
A.6 Off-Peak Trips	o Off-peak transit facilities load factors o Average off-peak hour speed o Off-peak transit passengers per bus mile	o ODOT o Tri-Met o Local Jurisdictions o CRAG	CRAG speed/delay study available for selected corridors.
A.7 Travel Time Delays	o Vehicle capacity of overall corridor and key corridor constraints o Average transit operating speed o Average peak hour speed	o ODOT o Tri-Met o Local Jurisdictions o CRAG	

TSM PROTOTYPE STUDY

PERFORMANCE MEASURES

B. SAFETY (ACCIDENTS)

CRITERIA	PERFORMANCE MEASURES	DATA SOURCES	COMMENTS
B.1 Accidents	o Number of accidents by type or total o Accident rate per million vehicle miles	o ODOT o Local Jurisdictions	The quality of this data is likely to vary from area to area.
B.2 Injuries	o Number of injury accidents o Injury accident rate per million vehicle miles	o ODOT o Local Jurisdictions	The quality of this data is likely to vary from area to area.
B.3 Fatalities	o Number of fatalities o Fatality rate per million vehicle miles	o ODOT o Local Jurisdictions	The quality of this data is likely to vary from area to area.
B.4 Pedestrian/Bicycle Accidents	o Number of accidents by type o Facility ADT and speed	o ODOT o Local Jurisdictions	The quality of this data is likely to vary from area to area.
B.5 Travel Delay Caused by Accidents	o Total annual hours of person delay attributable to accidents	o ODOT o Local Jurisdictions	The quality of this data is likely to vary from area to area.

TSM PROTOTYPE STUDY

PERFORMANCE MEASURES

C. COST

CRITERIA	PERFORMANCE MEASURES	DATA SOURCES	COMMENTS
C.1 Fiscal Considerations	o Local match available ? o Initial capital o Annual maintenance and operating cost	o Proposing Jurisdiction	M&O costs considered only if they are significant and related solely to the project.
C.2 Cost Effectiveness Measures	Examples: o Initial capital cost/transit passenger o Initial capital cost/trip served o Initial capital cost/accident eliminated o Annual maintenance and operating cost/passenger o Etc.	o Calculated from other performance measures	A number of cost effectiveness measures can be derived from the cost figures and performance measures (corridor capacity, safety, social/environmental, land use).

TSM PROTOTYPE STUDY

PERFORMANCE MEASURES

D. SOCIAL/ENVIRONMENTAL

CRITERIA	PERFORMANCE MEASURES	DATA SOURCES	COMMENTS
D.1 Air Quality	o Corridor air quality analysis o Daily vehicle delay in corridor o Average speed o VMT/ADT o V/C	o ODOT o Local Jurisdictions	Data for one or more of these measures will probably be available for each case.
D.2 Energy Consumption	o Daily vehicle delay in vehicle hours o VMT o V/C o Mode split o ACO	o ODOT o Local Jurisdictions o Tri-Met	Data for one or more of these measures will probably be available for each case.
D.3 Accessibility for Elderly and Handicapped	o Number of H&E users affected o Does project improve H&E accessibility	o Tri-Met o CRAG	
D.4 Rider Comfort and Convenience	o Number of people affected o Judgmental.	o Tri-Met	

TSM PROTOTYPE STUDY

PERFORMANCE MEASURES

E. EXISTING LAND USE

CRITERIA	PERFORMANCE MEASURES	DATA SOURCES	COMMENTS
E.1 Traffic Through Neighborhoods	o ADT's on neighborhood collectors and local traffic streets o Speeds on neighborhood collectors	o Local Jurisdictions	ADT's for neighborhood collectors and local traffic streets probably not available; may be subjective judgment.
E.2 Noise Levels Within Neighborhoods	o Corridor noise contours in relation to local neighborhoods o ADT's o Speed o V/C	o ODOT o Local Jurisdictions	Data will vary from area to area.
E.3 Local Access To/From Existing Neighborhoods	o Corridor residential population o Specific definition of the problem o Corridor mobility performance measures. (See Category A.)	o Local Jurisdictions o CRAG (Pop. Distr.)	Alternatively, the criteria may be whether the project improves residential accessibility (subjective) and the residential population affected:
E.4 Local Access to Adjacent Commercial and Industrial Centers	o Work trip travel in corridor o K factor o Corridor commercial and industrial activity (employment, square footage) o Specific definition of the problem o Corridor mobility performance measures. (See Category A.) o Parking o Commercial vehicle access	o ODOT o Local Jurisdictions	Alternatively, the criteria may be whether the project improves commercial accessibility (subjective) and the size of the development served.

TSM PROTOTYPE STUDY

PERFORMANCE MEASURES

E. EXISTING LAND USE (Cont'd)

CRITERIA	PERFORMANCE MEASURES	DATA SOURCES	COMMENTS
E.5 Access to Centralized Commercial and Industrial Centers	o Work trip travel in corridor o K factor o Corridor mobility performance measures. (See Category A.)	o ODOT o Local Jurisdictions o CRAG (Regional Data)	Requires the identification of affected activity centers.
E.6 Regional Land Use Objectives	o CRAG land use plan designation for areas within or contiguous to corridor	o CRAG	

APPENDIX C

CRAG - TSM PROTOTYPE STUDY

I. Problem Area Oatfield Road (Milwaukie-Gladstone Subarea)

1. Termini Lake Road to 82nd Drive

2. County Clackamas

II. Extent of the Problem and Objective of any Improvement Strategies as Suggested at the TSM Working Session:

Purpose

Maintain traffic flow along this minor arterial in order to prevent vehicular intrusion of through traffic into adjacent neighborhoods, but without significantly improving through capacity so as to provide an alternate route to 99E.

Problems

1. Oatfield functions as an overflow for McLoughlin, as the high number of signals along McLoughlin tend to restrict through movement. Thus, drivers are induced to choose Oatfield instead of McLoughlin for their north-south journey.

2. High Speed--Oatfield is signed at 35, but speeds usually average 45-50 mph.

3. Cross Circulation--Induced traffic on Oatfield tends to increase traffic volumes on local streets between 99E and Oatfield and Oatfield and I-205.

4. Local Access--Vehicles have difficulty entering Oatfield from side streets due to high ADT's and sight-distance problems.

5. Local Land Use--High ADT's conflict with the residential nature of adjacent land use.

6. Transit Problems--Buses have difficulty turning off Oatfield for passenger pickup due to "bikeway buttons" placed on the shoulder, and also making turns onto Oatfield.

7. Thiessen Road--Difficult access from Thiessen onto Oatfield causes traffic backup and accident problems.

8. Oatfield could provide a convenient link to the Oregon City Bypass, thereby creating an additional problem at some future time.

General Discussion. Potential TSM solutions should consider traffic restraint measures (mainly signalization) in order to maintain existing flow, facilitate access from local streets, and discourage induced traffic from McLoughlin. Tri-Met is currently negotiating the development of a new Park and Ride lot at the Oregon City Shopping Center.

III. Initial Screening

A. Improvement Strategy: _x_ TSM ____ Functional Upgrade ____ Functional Replacement

B. Jurisdictions Affected: City of Milwaukie, Clackamas County, City of Gladstone

C. ITP Designation: ______ Expressway ______ Principal Arterial

_x_ Minor Arterial ______ Collector

D. Problem Impact: _x_ Corridor ______ Intersection

E. Traffic Characteristics:

Corridor	Intersection
1. Length 4.82 miles	1. ADT ______
2. Average ADT 6,669 (1975)	2. ADT ______
3. Highest ADT 8,900	3. Number of Accidents ______
4. Lowest ADT 3,900	
5. Number of Accidents 4 (82nd to Glen Echo)	
6. VMT 32,145	

IV. Related Factors - Primarily residential use, however near Lake Road, Oatfield is a couple of blocks removed from 99E and the heavy commercial development virtually abuts Oatfield. Vertical and horizontal alignment problems. A signal is located at Concord and Oak Grove (4 lane intersections). Development of the Oregon City Bypass may increase the incidence of non-local traffic utilizing Oatfield. Addressing the problem now may well have substantial future benefits also. The road was recently overlayed. Oatfield also serves as a link between Gladstone & Milwaukie.

V. TSM Opportunities - In relation to the corridor objectives it appears the most obvious solutions will be signalization, bus turnouts, rerouting of through traffic, signing or traffic diversion. Also opportunities lie in intersection widening and channelization on side streets which flow into Oatfield. To increase mode split the provision of transit shelters and transit turnouts may offer potential.

VI. Recommendations - It is recommended that the problem be placed in the high priority category.

APPENDIX D

CANYON/TV HIGHWAY

The Corridor extends from Highway 217 to Murray Blvd. and affects the City of Beaverton.* Canyon/TV is a four lane facility with a dual left turn lane between Highway 217 and Cedar Hills Blvd. There is no on-street parking and adjacent land use is almost entirely commercial.

The facility is a primary State Highway and is designated a principal arterial in the ITP. The primary function of the facility is to serve major East-West through movements and provide high levels of regional through trips. The highway must also serve secondary purposes of accommodating a high amount of commercial access to adjoining properties in addition to through traffic. The highway also provides access to and through Downtown Beaverton.

Problems along the Corridor consist of peak hour congestion and low automobile occupancy. Linear commercial development creates continuous left turn conflict with oncoming traffic and accident hazards. Substandard signals and signal spacing create poor signal progression and uneven through traffic flow. Other problems include delays at signalized intersections. Downtown Beaverton is the indirect interchange of six directions of movement.

A. PROBLEM QUANTIFICATION

CORRIDOR MOBILITY

Auto Occupancy

Vehicle occupancy during peak hours on Canyon/TV is low. The regional average for work trips (A.M. & P.M.) is 1.2 persons per vehicle.

On November 1, 1977, an auto occupancy count was carried out by CRAG staff at the intersection of Hall & Canyon/TV during the hours of 4 - 6 P.M. in the westbound direction. Average auto occupancy recorded was 1.24 persons per auto.

*Based on an analysis of the problems and potential TSM solutions CRAG staff recommends that the corridor be extended to Walker Road so that the evaluation of a signal intertie can be considered.

Transit Use (For maps of transit movements, refer to end of this section.)

Buses experience delays at signalized intersections.

Number of Bus Movements by Intersection

Direction	Murray	Hocken	Cedar Hills	Hwy 217
Eastbound	71	101	117	105
Westbound	66	96	113	99

P.M. Peak Hour Intersectional Delays
Vs.
Number of Bus Movements

	Murray		Hocken		Cedar Hills		Hwy 217	
Direction	Int. Delay	# Buses	Int. Delay	# Buses	Int. Delay	# Buses	Int. Delay	# Buses
Eastbound	12	3	10	7	54	7	14	7
Westbound	36	6	38	10	71	10	16	10

Total travel time delay to bus movements at the four intersections is approximately 34 minutes during the P.M. peak hour.

Commercial Vehicle Trips

Canyon/TV facilitates a high amount of through truck traffic. However, due to intersection congestion between Hwy 217 and Murray, trucks are exiting Hwy 217 and Oregon 10, proceeding westbound on Broadway to Farmington and accessing Canyon/TV Hwy west of downtown Beaverton. The situation creates accident potential on Farmington and Broadway.

Currently, commercial vehicles account for three percent of traffic volumes. Thus, the corridor must accommodate approximately 810 commercial vehicles trips each day.

Peak Period Trips

Average speeds during the P.M. peak (westbound) average 10 mph between Hocken and 117th. Eastbound average speed during the P.M. peak also average 10 mph between Hocken and Hall.

Eastbound intersectional delays account for two minutes nine seconds and westbound a delay of four minutes two seconds. Multiplication of these delays with the peak hour volumes reveals that during each P.M. peak period approximately 235 vehicle hours is lost to intersectional delay.

Table I shows the existing traffic volumes and capacity (level of service "D") for the existing roadway.

TABLE I

Section	1976 AWD	1976 Pk Hr Vol	Capacity	V/C Ratio	L/S
Walker Rd to Beaverton-Tigard Highway	23,000	1,950	26,700	0.86	"D"
Beaverton-Tigard Hwy to Cedar Hills Blvd	29,000	2,450	28,800	1.01	"D"-"E"
Cedar Hills Blvd to Murray Road	25,000	2,000	27,900	0.89	"D"

Travel Time Delays

Travel time delays along the corridor are essentially concentrated at signalized intersections and affect both autos and transit vehicles.

Average Intersection Delay (P.M. Peak) in Seconds

Intersection	Eastbound	Westbound
Hwy 217 (E)	8	8
Hwy 217 (W)	6	8
Hall	39	91
Cedar Hills	54	71
Hocken	10	38
Murray	12	36

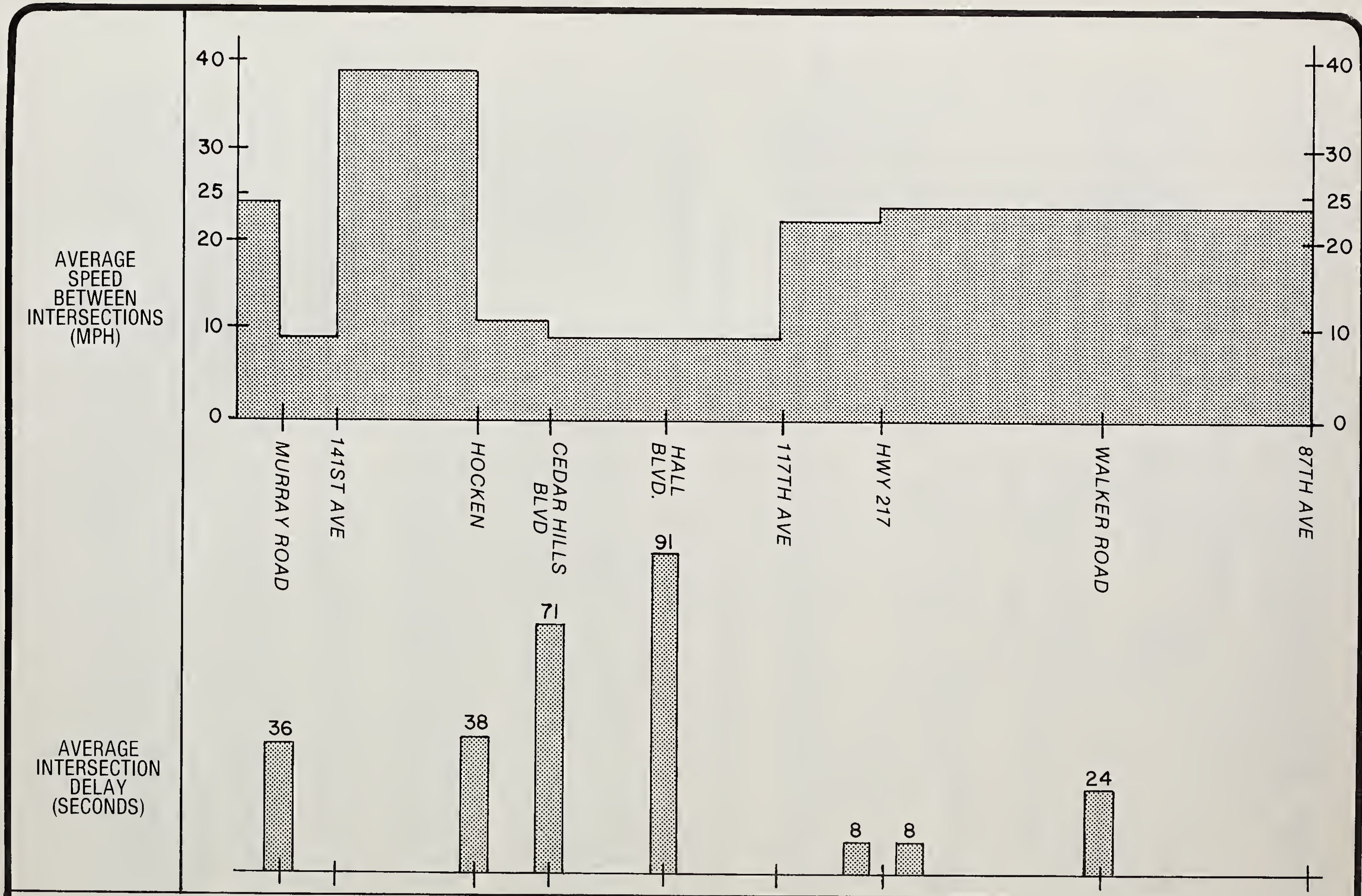
Delays are extremely high in the Hall to Murray section.

Average speeds in the Hall to Hocken section dip as low as 5 mph during peak periods.

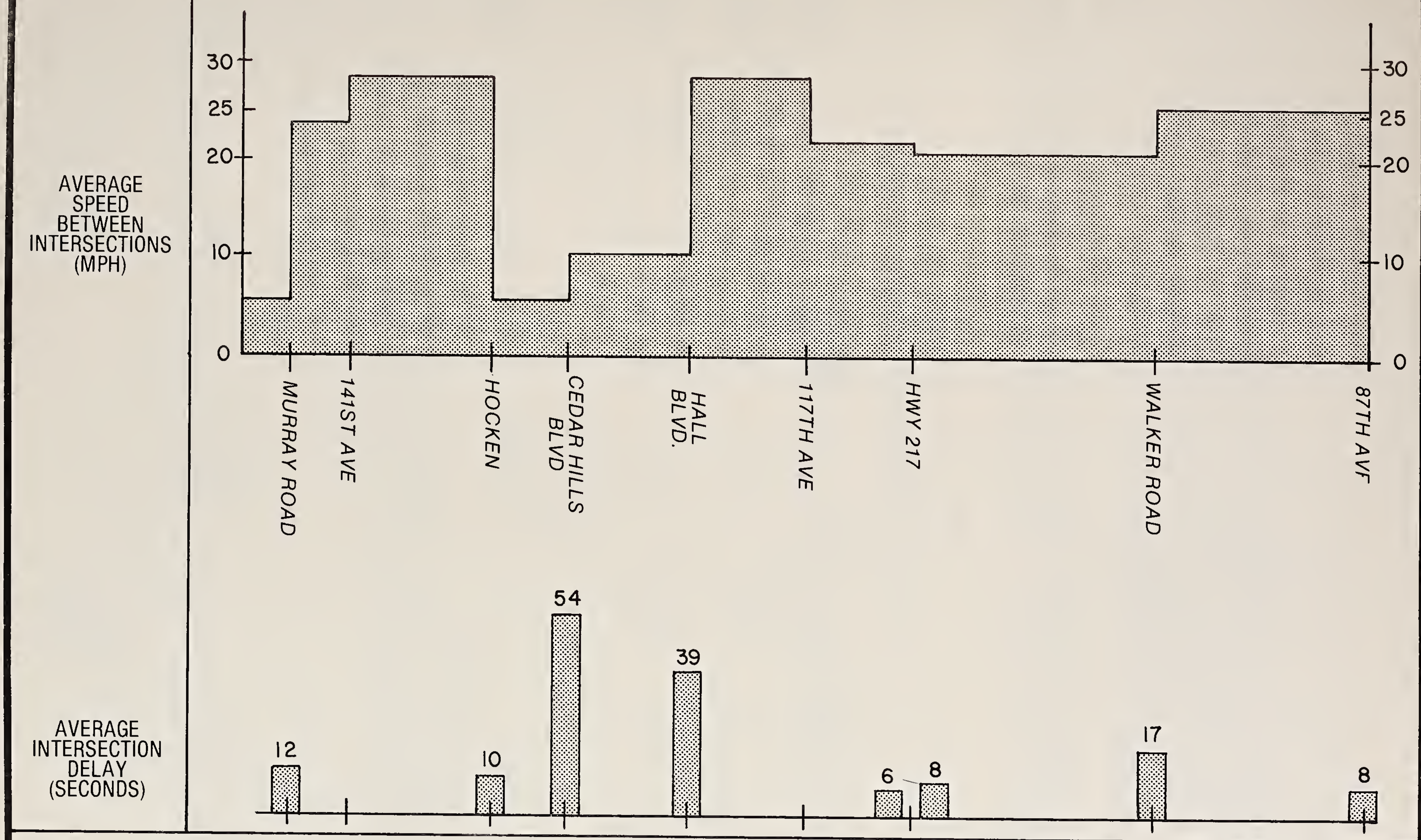
The speed and delay study was carried out by the City of Beaverton. The study concluded that delays to traffic caused by buses was non-existent.

Average speed for the entire corridor is as follows:

Time/Direction	Average Speed/mph
P.M. - Westbound	17
P.M. - Eastbound	21



TRAVEL TIME — SPEED & DELAY DIAGRAM
T-V HWY WESTBOUND ⟵ (PM PEAK)



TRAVEL TIME — SPEED & DELAY DIAGRAM
T-V HWY EASTBOUND ⟶ (PM PEAK)

SAFETY

Accidents

During 1976, 156 accidents were reported on the 2.4 mile section of the Tualatin Valley Highway from Walker Road to Murray Road. The accident rate for 1976 was 6.3 accidents per million vehicle miles. This compares to a statewide accident rate for similar highways of 5.2 accidents per million vehicle miles. Table II shows the type of accidents that occurred on this roadway and the five-year composite accidents.

Intersectional type accidents accounted for 59 percent of the total accidents in 1976. Table III shows the intersections which experienced a majority of these accidents during the years 1975 and 1976.

TABLE II

Type of Accident

	Rear End	Turning	Angle	Fixed Object	Ped.	Misc	Total
1976							
% of Total	54	60	26	2	1	13	156
	35%	38%	17%	1%	1%	8%	100%
1972-1976 5-yr composit	227	250	115	12	7	45	706
% of Total	39%	35%	16%	2%	1%	7%	100%

TABLE III

Intersection	1975	1976	Total
Beaverton-Tigard Hwy East Signal	10	12	22
Beaverton-Tigard Hwy West Signal	4	10	14
Hall Blvd	10	11	21
Cedar Hills Blvd	7	9	16
Hocken Road	9	4	13
SW Murray Road	20	18	38
Total	60	64	124

Collision diagrams are attached for Murray (the highest number of accidents); Broadway; and Cedar Hills Boulevard. Analysis of the diagram for Murray indicates that left-turning and rear-end accidents accounted for most of the accidents. The high number of rear-end accidents at Murray indicates the intersection has poor skid resistance; an overlay should be considered. A high number of "overtaking turn" accidents occurred at Cedar Hills Blvd. indicating a need for better lane control signing. Finally, examination of the Broadway intersection indicates a number of rear-end accidents. The Broadway intersection is utilized by a number of Tri-Met buses after they have accessed the Beaverton Park and Ride lot.

An analysis of accidents between the major intersections was also made and is contained in Table IV.

TABLE IV

Accidents Between Intersections (1976)

Location	# of Accidents	Rear End	Turning	Other
West of Murray	10	7	2	3
Murray to 144th	9	5	2	2
144th to Hocken	8	5	2	1
Hocken to Cedar Hills	6	3	3	
Cedar Hills to Hall	7	1	4	2
Hall to Broadway	6	3		3 (1 Ped Acc)
Broadway to Hwy 217	11			

Table IV indicates that a relatively small number of accidents are caused by turning movements associated with either the existing linear commercial development or the dual left turn lane. Most appear to be rear-end accidents.

SOCIAL/ENVIRONMENTAL

Air Quality

A 1977 CRAG air quality study indicates that the range of the amount of carbon monoxide exceeding the 10 mg/cu meter standard along the corridor is as follows:

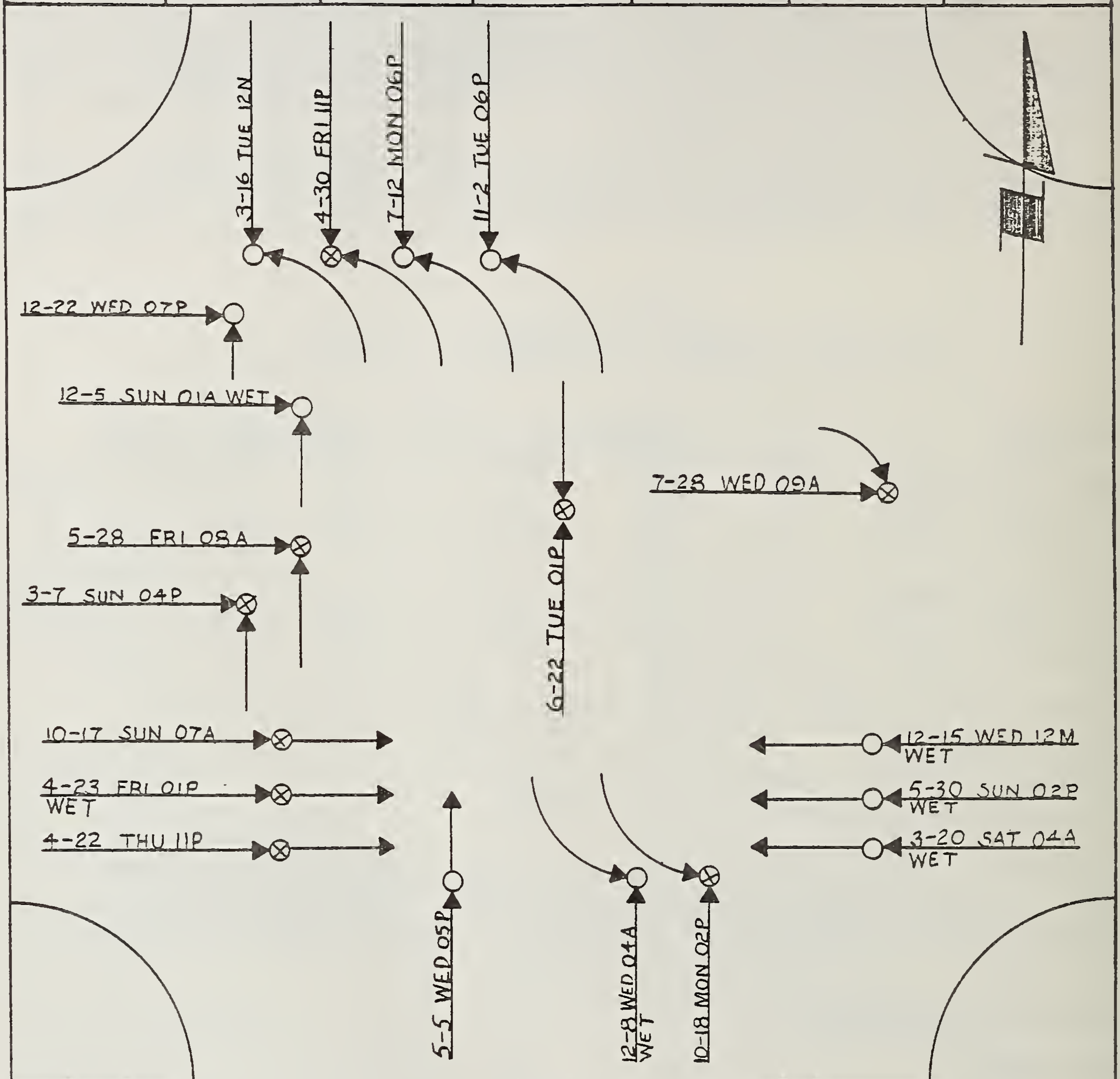
Section	% Exceeding Standard
Hwy 217 to Broadway	100
Broadway to Cedar Hills	26-35
Cedar Hills to Murray	51-100

COLLISION DIAGRAM

CITY OF BEAVERTON, OREGON
ENGINEERING DEPARTMENT
TRANSPORTATION & TRAFFIC ENGINEERING

LOCATION		
MURRAY AND T-V HWY		
DATE	DRAWN BY	PERIOD
	THOMPSON	JAN 76 — DEC 76

NO. ACCIDENTS BY TYPE						
TOTAL	PROP. DAMAGE	INJURY	FATAL	LIGHT	DARK	WET
19	11	8	0	13	6	6



LEGEND

VEH. MOVING AHEAD	HEAD-ON	DPD DRIVER PHYSICAL DEFECT
VEH. BACKING UP	HEAD-ON SIDE-SWIPE	DV DEFECTIVE VEHICLE
PEDESTRIAN	REAR END	ES EXCESSIVE SPEED
TRAIN	OVERTAKING SIDESWIPE	FTC FOLLOWING TOO CLOSE
PARKED VEHICLE	RIGHT ANGLE	HBD HAD BEEN DRINKING
FIXED OBJECT	APPROACH TURN	H.R. HIT & RUN
PROPERTY DAMAGE ONLY	OVERTAKING TURN	ILC IMPROPER LANE CHANGE
INJURY ACCIDENT	OUT OF CONTROL	IP IMPROPER PASSING
FATAL ACCIDENT	VEH. TURNED OVER	IT IMPROPER TURN
		RSS RAN STOP OR SIGNAL
		VRW VIOLATED RIGHT OF WAY
		WS WRONG SIDE OF ROAD
		INATT INATTENTION
		CONS CONSTRUCTION

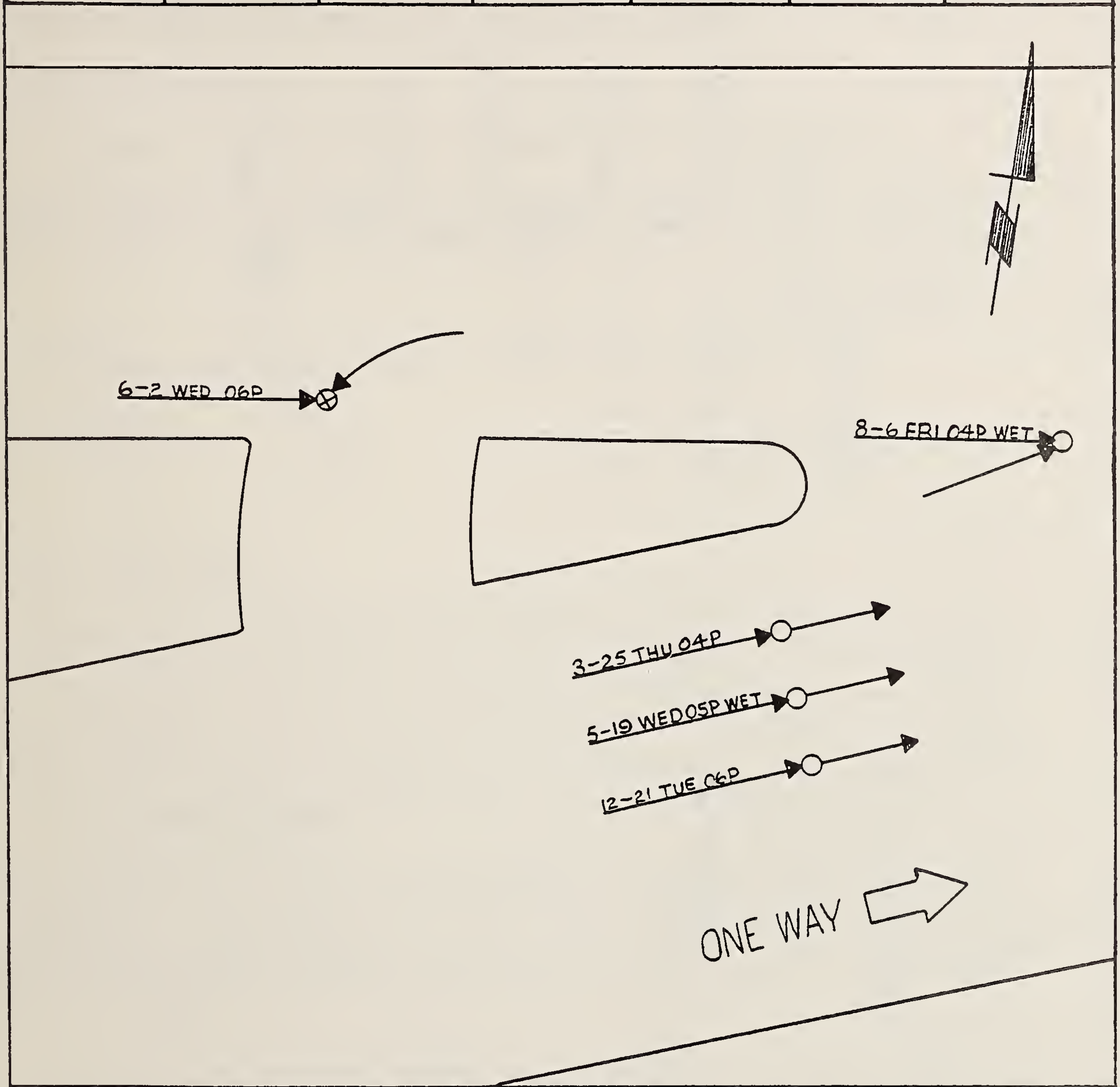
COLLISION DIAGRAM

CITY OF BEAVERTON, OREGON
ENGINEERING DEPARTMENT
TRANSPORTATION & TRAFFIC ENGINEERING

LOCATION		
T-V HWY AND BROADWAY, E.		
DATE	DRAWN BY	PERIOD
	THOMPSON	JAN 76 – DEC 76

NO. ACCIDENTS BY TYPE

TOTAL	PROP. DAMAGE	INJURY	FATAL	LIGHT	DARK	WET
5	4	1	0	4	1	2



LEGEND

VEH. MOVING AHEAD
VEH. BACKING UP
PEDESTRIAN
TRAIN
PARKED VEHICLE
FIXED OBJECT
PROPERTY DAMAGE ONLY
INJURY ACCIDENT
FATAL ACCIDENT

HEAD-ON
HEAD-ON SIDE-SWIPE
REAR END
OVERTAKING SIDESWIPE
RIGHT ANGLE
APPROACH TURN
OVERTAKING TURN
OUT OF CONTROL
VEH. TURNED OVER

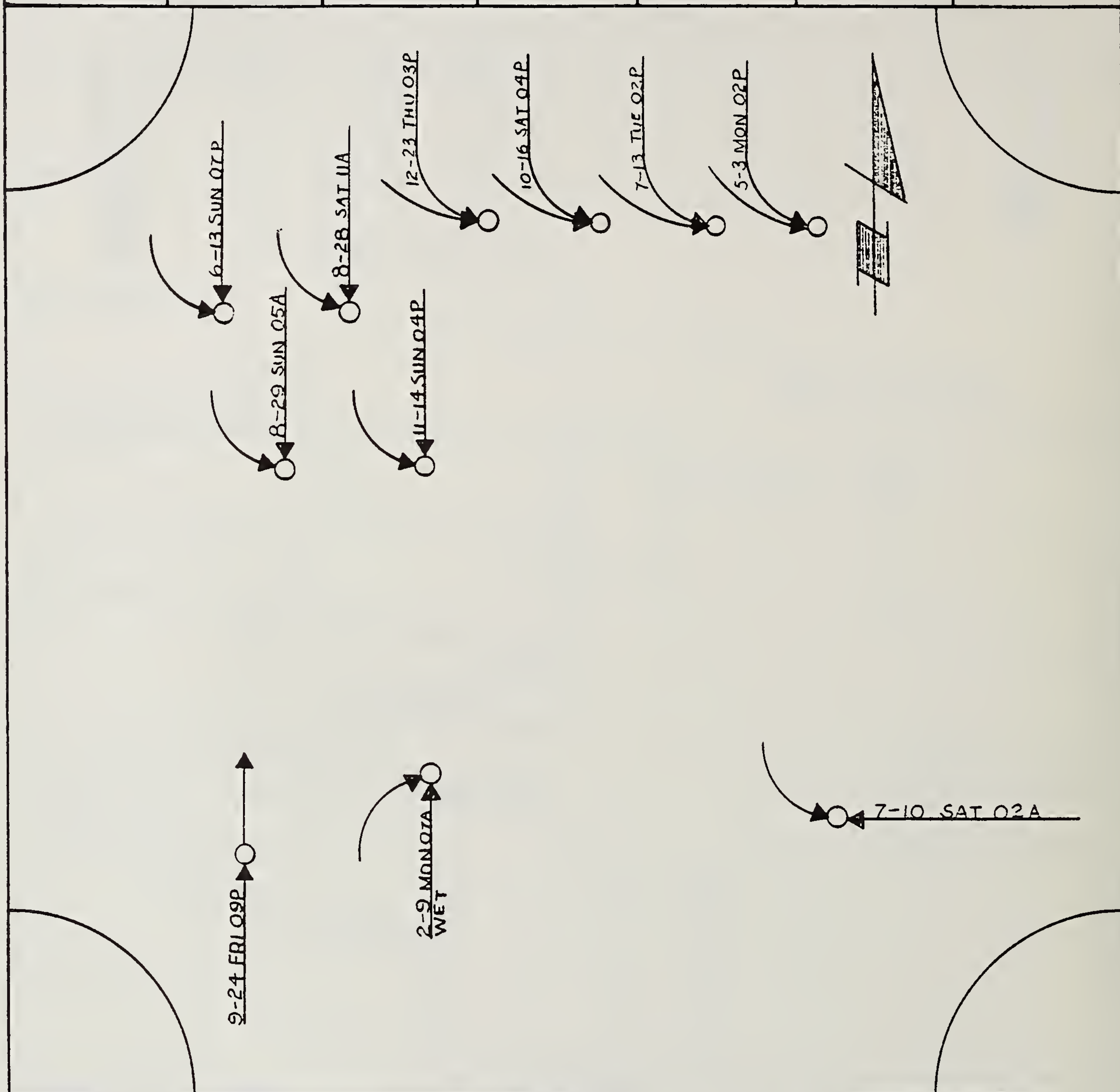
DPD DRIVER PHYSICAL DEFECT
DV DEFECTIVE VEHICLE
ES EXCESSIVE SPEED
FTC FOLLOWING TOO CLOSE
HBD HAD BEEN DRINKING
H.R. HIT & RUN
ILC IMPROPER LANE CHANGE
IP IMPROPER PASSING
IT IMPROPER TURN
RSS RAN STOP OR SIGNAL
VRW VIOLATED RIGHT OF WAY
WS WRONG SIDE OF ROAD
INATT INATTENTION
CONS CONSTRUCTION

COLLISION DIAGRAM

CITY OF BEAVERTON, OREGON
ENGINEERING DEPARTMENT
TRANSPORTATION & TRAFFIC ENGINEERING

LOCATION	CEDAR HILLS AND T-V HWY	
DATE	DRAWN BY THOMPSON	PERIOD JAN 76 – DEC 76

NO. ACCIDENTS BY TYPE						
TOTAL	PROP. DAMAGE	INJURY	FATAL	LIGHT	DARK	WET
11	11	0	0	10	1	2



LEGEND

VEH. MOVING AHEAD	HEAD-ON
VEH. BACKING UP	HEAD-ON SIDE-SWIPE
PEDESTRIAN	REAR END
TRAIN	OVERTAKING SIDESWIPE
PARKED VEHICLE	RIGHT ANGLE
FIXED OBJECT	APPROACH TURN
PROPERTY DAMAGE ONLY	OVERTAKING TURN
INJURY ACCIDENT	OUT OF CONTROL
FATAL ACCIDENT	VEH. TURNED OVER

DPD DRIVER PHYSICAL DEFECT
DV DEFECTIVE VEHICLE
ES EXCESSIVE SPEED
FTC FOLLOWING TOO CLOSE
HBD HAD BEEN DRINKING
H.R. HIT & RUN
ILC IMPROPER LANE CHANGE
IP IMPROPER PASSING
IT IMPROPER TURN
RSS RAN STOP OR SIGNAL
VRW VIOLATED RIGHT OF WAY
WS WRONG SIDE OF ROAD
INATT INATTENTION
CONS CONSTRUCTION

Transit Rider Comfort and Convenience

Lack of adequate waiting areas at transit stops and pedestrian access facilities.

Energy Consumption

VMT in the corridor is calculated to be 46,822.

Existing Land Use

Local Access to/from Adjacent Commercial and Industrial

Linear commercial development creates continuous conflict with through traffic from Hwy 217 to Murray. There are 45 curb cuts on the south side and 73 curb cuts on the north side of the highway.

Intersection	Total Vehicles Entering Intch	Ent. From North&South	Ent. From East&West
107th Avenue	24,078	976(s)	23,102
110th Avenue	22,021	1,581	20,440
145th Avenue	41,863	15,616	26,247

Unusual Conditions

The corridor is affected by the Beaverton Park & Ride lot which is currently the most popular lot in the Region. According to a Tri-Met survey 289 spaces out of 300 are utilized on an average day. The Park & Ride lot is currently adjacent to a site which will be developed beginning this summer by Fred Meyer. It is unclear whether the lot will be maintained as a lot or developed. In the event the lot is abandoned, it can be assumed that a majority of the present users will not have an alternate lot.

Approximately 20 to 30 autos are parked on the frontage road near 198th Avenue and TV Hwy for purposes of transit usage. Current usage plus latent demand for additional Park & Ride lots may be substantial. Development of a lot to the West of Beaverton would positively affect corridor mobility and could serve a catchment point for East-West peak hour traffic movements.

B. TSM IMPROVEMENT OBJECTIVES

1. To improve regional traffic handling capacity of Canyon/TV Highway.

2. To improve local circulation utilizing Canyon/TV Hwy and reduce conflicts between local access vehicles and through vehicles.

3. Reduce the occurrence of traffic accidents.

4. Increase modal split in the corridor through transit service and facility improvements and also improve ride sharing provisions.

5. Enhance air quality in the corridor.

C. PROJECT LEVEL TSM ALTERNATIVES IDENTIFIED

TSM projects identified include signalization improvements, elimination of the dual left turn lane on Canyon/TV and construction of a median barrier, bus pull-outs, a bus only lane and bus actuated signal between the Beaverton Park & Ride lot along Broadway to the Canyon/TV intersection, concrete pads for transit stop waiting areas and bus shelters, development of a new Park & Ride lot, and other minor traffic engineering improvements.

Stragegy #1
Eliminate the existing dual left turn lane on Canyon/TV Highway from Murray Blvd. to Highway 217 and create a median barrier except at intersections where left turn bays would be striped. The project would decrease the number of conflicts between left turning vehicles and oncoming traffic. The cost of the project is approximately $250,000.

Strategy #2
Presently there are signals at Hwy. 217 (both sides), Hall Blvd., Cedar Hills Blvd., Hocken Road, Murray Blvd, and Walker Road. Intertie the signals between Walker and Murray and upgrade them as necessary. The intertie will insure proper signal progression and improve flow for both autos and buses. The cost of the project is $150,000 . ODOT plans to install a signal at 110th in the near future. The Corridor termini should be extended to Walker Road to insure proper signal progression and spacing of signals.

Strategy #3
Reduce the number of curb cuts between Hwy. 217 and Murray Blvd. Presently there are 96 curb cuts on the North side and 76 curb cuts on the South side. Where off-street parking lots are attached, one or more of the curb cuts providing ingress/egress should be eliminated. The project would reduce the number of conflicts between local access traffic and through traffic. The approximate cost is $66,000 to remove ten curb cuts.

Strategy #4

Upgrade the existing signals at Hocken and Murray Blvd. to include additional phasing. Both intersections presently have left turn bays but no left turn phase. The projects would reduce conflicts between left turning vehicles and oncoming traffic. The cost of the strategy is $65,000. Additionally the intersection of Cedar Hills Blvd. and Canyon/TV Hwy. has a high number of left turn accidents which may be reduced if additional lane signing and buttons were installed to direct movements. The cost of the project is $5,000. Additionally, an overlay for the Murray/TV intersection could reduce the accident problem. The cost is approximately $10,000.

Strategy #5

The Corridor is presently served by 3 bus routes. There are also 18 bus stops located between Hwy. 217 and Murray. A number of transit turnouts have been suggested along Canyon/TV Highway. The turnouts would increase safety for deboarding/boarding passengers and decrease vehicle delay to through traffic. Average cost per turnout is $5,000-7,000. Six turnouts would cost $36,000.

Strategy #6

A combination bus actuated traffic signal at the intersection of Canyon/TV Highway and Broadway, and a transit lane between Beaverton Park & Ride and Canyon. The transit turnout would provide additional safety for boarding/deboarding passengers and decrease travel times. Additionally the bus actuated signal could be timed to operate during peak hours only. No cost has been determined for the strategy.

Strategy #7

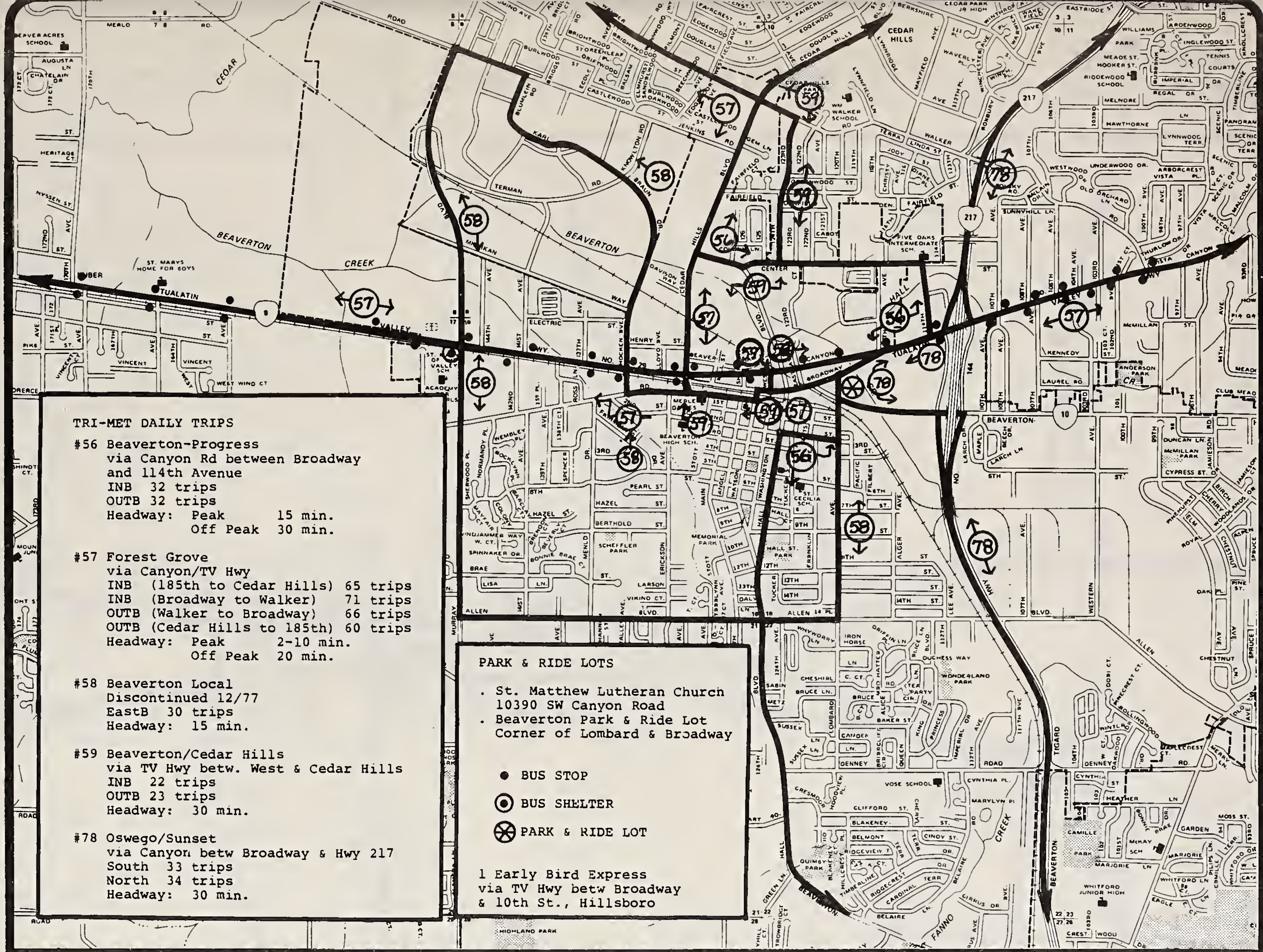
Either purchase land or existing developed site for a new Park and Ride lot West of 185th Avenue. Presently there are a number of autos parking in the vicinity of TV Hwy. and the Frontage Road at 198th Ave. and utilizing route #57. Further the Beaverton Lot has the highest utilization rate of all lots (96%). Additional Park & Ride lot space in this area would be aimed at capturing work trips. The lot would increase transit ridership and decrease peak hour traffic congestion in the Corridor. Cost of the strategy would be approximatley $100,000 for a one acre site.

Strategy #8

Northbound Ore. 217 Frontage Road and TV Hwy. is signalized and has 3 lanes in the approach. One lane is a left turn only lane and the other a through option left or right. Widening, channelization and lane control signing could reduce delay and accidents. The cost of the strategy is $7,000. Also more visible signal heads at the intersection may reduce the number of accidents. Possibly an adjustment in signal timing may alleviate the problem. Finally the same type of improvements should be considered at Canyon and the West ramp of Hwy 217. Cost is $20,000 including widening and signs for all improvements.

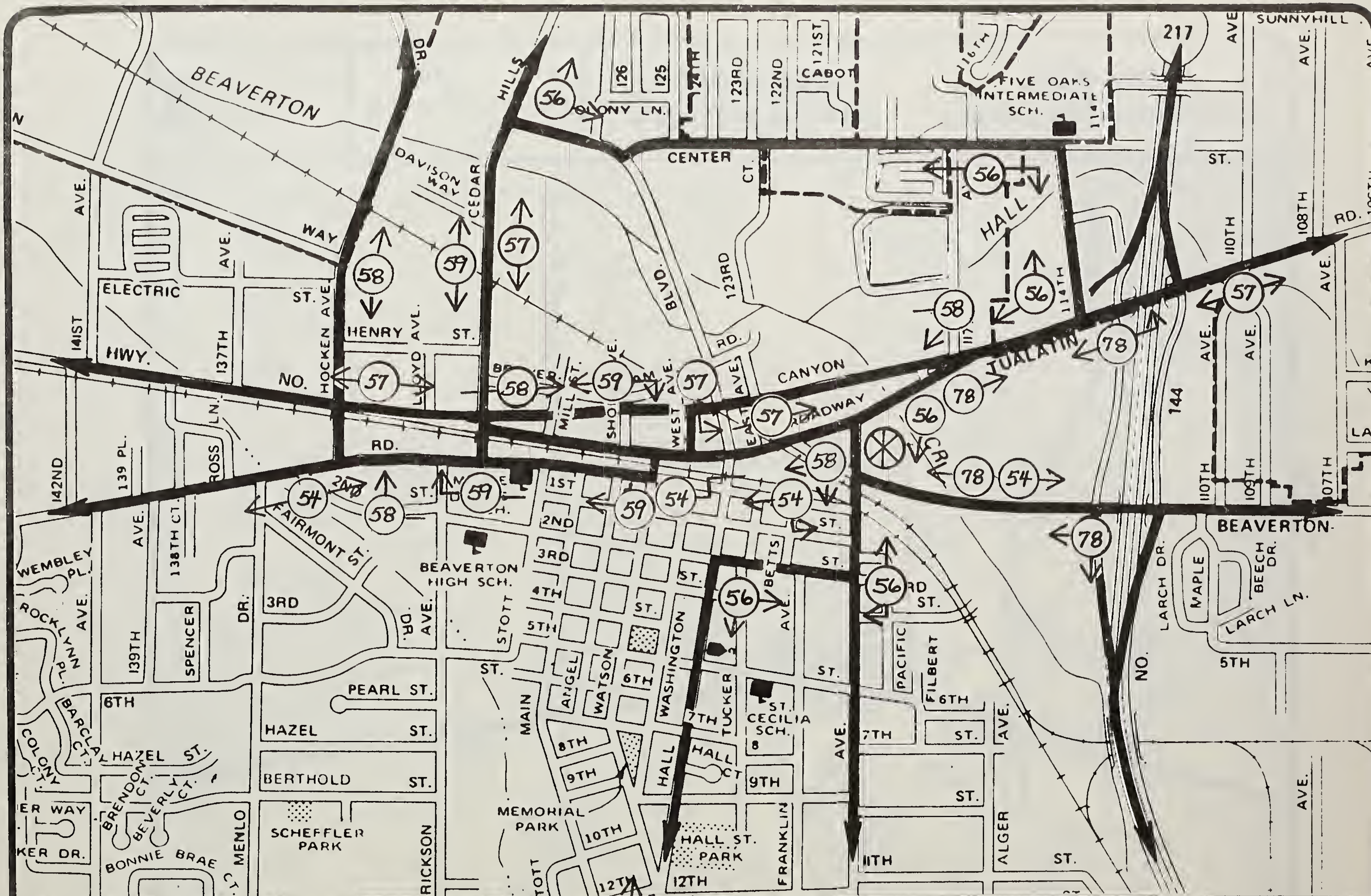
Strategy #9

Sidewalks or concrete pads for bus passengers on the South side of Canyon/TV Highway between Walker and Murray. If combined with strategy #5, $15,000 for six locations.



CRAG

CANYON ROAD/ TV HIGHWAY : EXISTING TRANSIT SERVICE



DOWNTOWN BEAVERTON: EXISTING TRANSIT SERVICE

APPENDIX E

III. INDIVIDUAL PROBLEM AREA EVALUATIONS

A. CANYON/TV HIGHWAY CORRIDOR

1. INTRODUCTION

The Corridor extends from Walker Road to Murray Boulevard. Canyon/TV is a four lane facility with a dual left turn lane between Highway 217 and Cedar Hills Boulevard. There is no on-street parking and adjacent land use is almost entirely commercial.

The facility is a primary state highway and is designated a principal arterial in the ITP. The Corridor serves major east-west through movements, provides high levels of regional through trips, provides access to and through downtown Beaverton and also accommodates a high number of local commercial access trips to adjoining properties.

Severe peak hour travel time delays are experienced by both autos and buses at signalized intersections along the Corridor. Other problems include a high accident rate, poor transit waiting areas, difficult access to downtown Beaverton and to adjacent commercial use and air quality problems.

2. TSM IMPROVEMENT OBJECTIVES

During the project identification workshops, the following improvement objectives were identified:

- Improve the regional traffic handling capacity of Canyon/TV Highway.
- Improve local circulation utilizing Canyon/TV Highway and reduce conflicts between local access vehicles and through vehicles.
- Reduce the occurrence of traffic accidents.
- Increase modal split in the Corridor through transit service and facility improvements and also improve ride sharing provisions.
- Enhance air quality in the Corridor.

3. TSM PROJECT EVALUATIONS

Nine TSM candidate projects have been suggested as solutions to one or more of the problems identified along the Corridor. Some of the projects are not mutually supportive. Some projects solve most of the problems identified while other projects solve only a few of the problems.

Chart 1 details the interrelationships among TSM actions and which types of problems the candidate project solves.

The individual project evaluations are as follows:

Remove Two Way Left Turn Lane (2WLTL) and Create a Median Barrier

Removal of the 2WLTL and its replacement with a median barrier and selected left turn pockets may increase around-the-block movements and, hence, traffic intrusion on local streets. In some locations, around-the-block movements may not be possible (lack of adjacent local streets). U-turn problems may also occur. The overall impact of this measure will depend upon current 2WLTL useage volumes and where the proposed left turn pockets will be located.

Apart from the above, a median barrier interrupted by striped left turn bays may present severe hazards for head-on collisions with the barrier ends. For the given volume, speed and street character, an ordinary curbed median island without a barrier would probably be safer overall and better for pedestrian crossing at minor streets (refuge, no barrier-climbing, etc.).

The median barrier would not reduce the total number of conflicts substantially but would concentrate them in space (at the proposed left turn bays).

The project is not recommended for inclusion into the Corridor strategy.

Signal Interconnect ($150,000)

The project would correct the problem of poor signal progression and uneven through traffic flow. The project would also address the problem of severe peak hour intersectional congestion which results in reduced travel times for both autos and buses.

The project positively impacts nine of the eleven problems identified in the Corridor. Additionally, it would decrease travel time delays for both autos and buses, maximize use of existing facilities and meet three of the five improvement objectives.

The project is recommended for inclusion into the Corridor strategy.

Eliminate Ten Curb Cuts ($66,000)

The project would reduce the number of curb cuts between Highway 217 and Murray Boulevard. Presently, there are 96 curb cuts on the north side and 76 curb cuts on the south side. Where off-street parking lots are attached, one or more of the curb cuts providing ingress/egress should be eliminated. The project seeks to reduce the number of conflicts between local access traffic and through traffic.

The project would solve three of the eleven problems identified and would negatively impact three of the eleven problems. The primary impact of the project would be to reduce the number of accidents and to facilitate through traffic flow along the Corridor. The project, however, would negatively impact an already severe local access problem and conflict with one of the TSM improvement objectives. It is also anticipated the project may be controversial and difficult to implement.

The project is not recommended as part of the Corridor strategy.

<u>Upgrade Signals and Safety Improvements ($30,000)</u>

The projects would upgrade the existing signals at Hocken and Murray Boulevard to include additional phasing to reduce conflicts between left turning vehicles and oncoming traffic. The signal at Murray and Canyon/TV Highway is being upgraded from five phase to eight phase by ODOT. The upgrading should be included as part of the Corridor strategy although the project is already funded. An overlay for the Murray/TV intersection has also been identified to reduce the rear-end accident problem along with additional lane signing and buttons at the Cedar Hills Boulevard intersection to reduce turning accidents.

The primary impact of the improvements is on safety. The additional left turn phasing will increase access to/from side streets and reduce the number of intersection accidents but would also reduce travel time during peak hours on Canyon/TV.

The project encourages local access at major side streets and will reduce the number of accidents at major intersections. Because of the relatively high number of accidents and high side street ADT, it is recommended the projects be considered as part of the Corridor strategy.

<u>Transit Turnouts ($36,000)</u>

The Corridor is served by three bus routes. There are also 28 bus stops located between Murray Boulevard and Walker Road. It is anticipated the turnouts (six have been suggested) would increase safety for deboarding/boarding passengers and decrease vehicle delay to through traffic.

The Corridor has four lanes allowing traffic an opportunity to flow around the buses. A recently completed speed and delay study indicated that stopped buses did not make a significant contribution to travel time delays experienced by through traffic. Further, the transit turnouts could increase bus travel times, especially during peak hours when buses would have difficulty re-entering Canyon/TV.

It is recommended the project not be included as part of the Corridor TSM strategy.

Bus Actuated Signal and Transit Lane Along Broadway (No Cost Determined)

The candidate project is to develop a transit lane between the Beaverton Park and Ride and Canyon/TV and to provide a transit turn-out and bus actuated traffic signal at the Canyon/TV Highway and Broadway intersection. The project would provide additional safety for boarding/deboarding passengers, decrease transit travel times, and, additionally, the bus actuated signal could be timed to operate during peak hours only.

The project would decrease transit travel times, support the Beaverton Park and Ride lots which has the highest utilization rate of all Park and Ride lots (289 out of 300 spaces), increase transit rider comfort and convenience and increase transit ridership.

It is not clear how much longer the Beaverton Park and Ride lot will be in existence because of the Fred Meyer development. Therefore, the project is not recommended for inclusion into the Corridor strategy.

Park and Ride Lot ($100,000)

Presently there are a number of autos parking in the vicinity of 198th Avenue and TV Highway and utilizing Route #57. The Corridor is also impacted by the Beaverton Park and Ride lot, one of the most successful lots in the region indicating that a high demand for adequate Park and Ride facilities exists along TV Highway.

The Park and Ride lot would increase transit ridership and decrease peak hour congestion in the Corridor. The lot could serve as a partial alternative to the Beaverton Park and Ride lot at a future time.

It is recommended the project be included as part of the Corridor strategy and the specific location be selected so as to decrease VMT in the Canyon/TV Highway Corridor.

Ramp Widening and Safety Improvements ($27,000)

Northbound Oregon 217 Frontage Road and TV Highway is signalized and has three lanes in the approach. One lane is a left turn only lane and the others a through option or a right. Widening, channelization and lane control signing would reduce delay and accidents. Also, more visible signal heads at the intersection may reduce the number of accidents. Possibly, an adjustment in signal timing may alleviate the problem. Similar improvements including widening and signing should be considered for the west ramp of Highway 217.

The project positively affects eight of the eleven problems identified and it is recommended that it be included as part of the Corridor strategy.

Improved Transit Waiting Areas ($25,000)

Sidewalk and/or paved transit passenger waiting areas, sidewalks would improve non-transit rider safety and comfort (pedestrians, bicyclists) as well as help transit riders. Sidewalks in suburban locations can function as a waiting area as well. Small paved walk stubs linking the curb to the parallel sidewalk would be needed where the sidewalk is separated from the curb by a planting strip.

With only one existing bus shelter, there would seem to be a great need for bus shelters at all major intersections and at other important traffic generators along the Corridor. They can help increase transit patronage in the Corridor, encourage concentration of passengers and, hence, reduce the average number of stops made and improve overall transit speed.

4. CORRIDOR STRATEGY

It is recommended the following candidate TSM projects be implemented as a package and that they form the basis of the Corridor strategy:

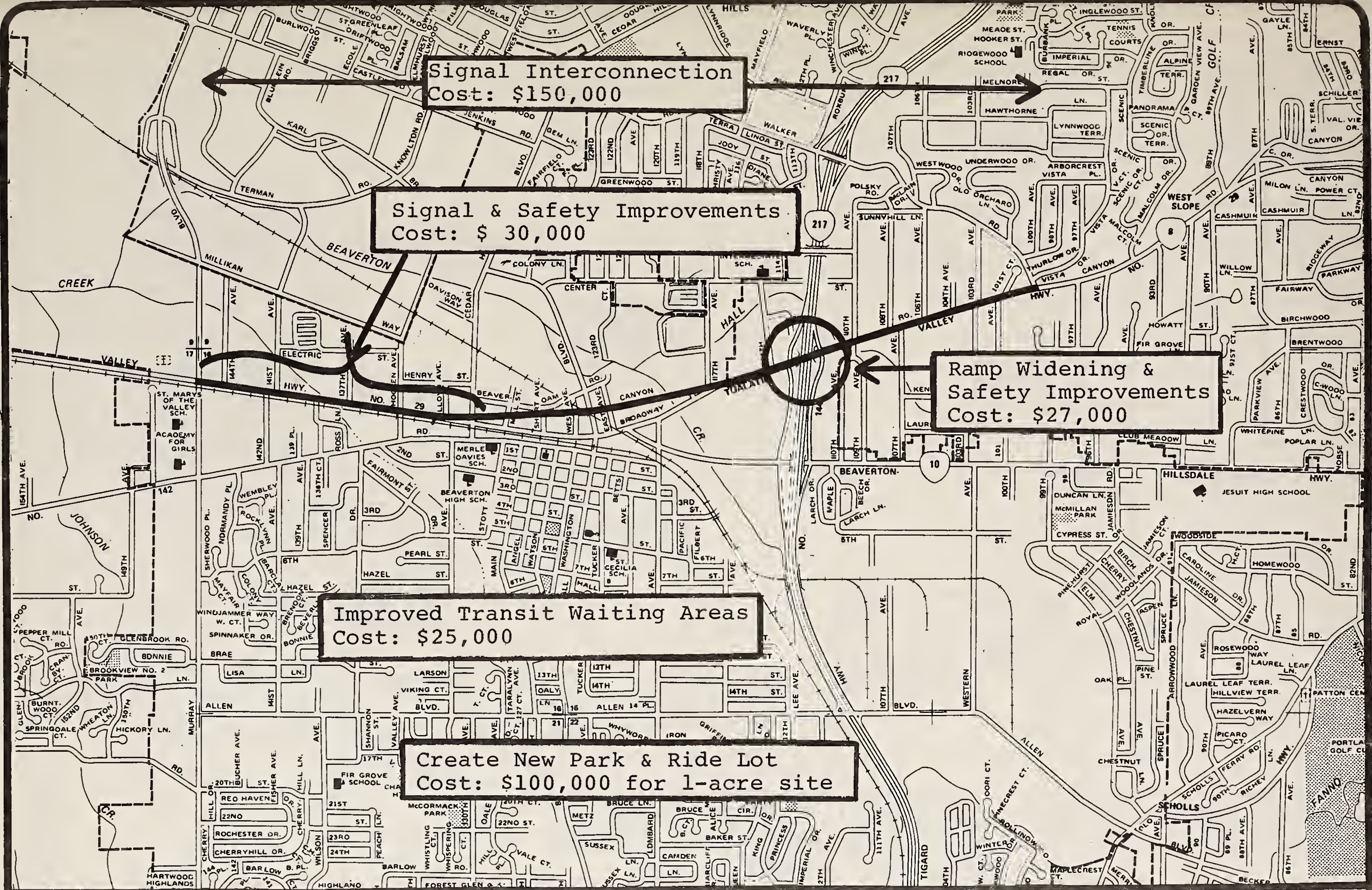
TSM Project	Cost
. Signal Interconnection	$150,000
. Signal and Safety Improvements (ODOT is upgrading a signal at Murray and Canyon/TV, the signal should be included as part of the strategy although it is already funded).	30,000
. Park and Ride Lot	100,000
. Ramp Widening and Safety Improvements	27,000
. Improved Transit Waiting Areas	25,000
Total Cost	$332,000

The computerized signal intertie will facilitate optimum directional flow during peak hours. Adjusted timing to facilitate local movement during the off-peak will benefit both auto and bus movements.

The ramp widening, signal and safety improvements will facilitate local access and interchange of trips to/from downtown Beaverton.

The Park and Ride lot and improved transit waiting areas will encourage transit ridership and offer an increased opportunity for through drivers to utilize the existing bus service, thereby reducing peak period traffic through the Corridor.

Implementation of the package will result in improved through traffic flow with reduced delays at signalized intersections, improved local access to and from the Corridor, improved safety and the potential for improved transit use. The individual actions are supportive of one another and address the essential problems identified in the Corridor.



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CANYON / TV HIGHWAY CORRIDOR

TERMINI: MURRAY ROAD TO WALKER ROAD   LENGTH: 2.4 MILES

TOTAL COST OF TSM STRATEGY: $332,000

LEGEND
+ Positive Impact
0 No Effect
− Negative Impact

Chart 1

CRAG Prototype Study — Evaluation of Candidate TSM Projects

Problem Area: Canyon/TV Hwy. Corridor

Termini: Murray Road to Walker Road **Length:** 2.4 miles

	Criteria	Problem Quantification (S: Severe M: Moderate)		Candidate TSM Projects: Remove 2-Way Left Turn Lane (Murray to Hwy 217) Create median barrier	Signal Inter-connect	Eliminate 10 Curb-cuts	Improve signals at Hocken & Murray to incl. left turn phasing; Safety improvements at Murray, Cedar Hills Blvd.	Transit Turnouts	Bus Activated Signal and Transit lane along Broadway	Park & Ride Lot Expansion	Ramp Widening & Safety Impr.	Improved Transit Waiting Areas
Corridor Mobility	Transit Use	Approx. Daily Ridership is 2440 persons	S	0	+	0	+	0	+	+	+	+
	Comm'l Veh. Trips	810 comm'l vehicles	S	− Reduce ease of delivery	+	−	0	0	0	0	+	0
	Ped./Bike Trips											
	Peak Per. Trips	V/C = .86 to 1.01 Level of Service: D to E	S	0	+	+	Positive for Hocken & Murray; Negative for Canyon/TV Hwy	0 Buses don't cause delays	+ Buses / − Autos	+	+	+
	Travel Time Delay	PM (W) = 17 mph PM (E) = 21 mph 235 hrs lost to intersectional delay	S	−	+	+	Positive for Hocken & Murray; Negative for Canyon/TV Hwy.	0 Buses don't cause delays	+ Buses / − Autos	+	+	+
Safety	Accident Rate (MVM)	6.3 vs. state avg. of 5.2	S	0 May increase intersection accidents but decrease mid-block accidents	+	+	+	+	0		+	Pedestrian Safety +
Social / Environ.	Air Quality	61,440 VMT	S	− More around-the-block movement	+	0	+	+	+ Depends on new transit riders	+	+ decreases stop delay	+
	Energy Consumption	61,440 VMT	S	−	+	0	+		+	+	+	+
	H & E Access											
	Transit Rider Comf. & Conven.	28 bus stops 2.4 mile corridor	S	0	0	0	0	−/+ May incr. bus travel time	+	+	0	+
Existing Land Use	Traffic Thru Neigh.			Removal of the 2-way Left turn lane will increase around-the-block movements as access will be restricted.								
	Noise Level in Neigh.											
	Local Acc. To/From Neigh.											
	Local Acc. Local Comm'l/Ind. Centers	High side street ADT 118 curb cuts / 25,000 ADT	S	−	+	−	+ Would improve access to/from side streets	0		0	0	0
	Access Centralized Comm'l/Ind. Centers	Downtown Beaverton	S	−	+	−	+	0	+	+	+	0
	Unusual Conditions											
	Cost			$250,000	$150,000	$66,000	$30,000	$36,000	No Cost Determined	$100,000	$27,000	$15,000 sidewalks $10,000 shelters
	Overall Recommendation			Not Recommended	Rec.	Not Rec.	Recommended	Not Rec.	Not Rec.	Rec.	Rec.	Rec.

APPENDIX F

STAFF
REPORT

number: 20

RECOMMENDATIONS FOR ALLOCATING REMAINING
CATEGORY V MONIES

SUBMITTED TO: TTAC

BY: GARY SPANOVICH, PROJECT MANAGER
C. WILLIAM OCKERT, TRANSPORTATION DIRECTOR

TRANSPORTATION DIVISION

COLUMBIA REGION ASSOCIATION
OF GOVERNMENTS

CRAG TRANSPORTATION DIVISION STAFF REPORT

RECOMMENDATIONS OF THE
TSM PROTOTYPE STUDY

I. SUMMARY OF THE TSM PROTOTYPE STUDY PROCESS

1. The CRAG Board on June 2, 1977 established a $5,000,000 TSM Reserve Account (Category V) for Interstate Transfer funds (BD 770505).

2. The CRAG Board on June 2, 1977 established procedures and a process to fund Category V projects (BD 770508) and established a TSM Task Force to review staff technical work.

3. The CRAG Board designated the TSM Prototype Study previously funded in the UWP as the technical mechanism for formulating TSM project proposals.

4. The CRAG Board allocated $731,000 (BD 770707) from the Category V Reserve to the Highway 99W project leaving $4,269,000 of the Reserve unallocated.

5. CRAG staff held nine TSM problem identification workshops with ODOT, Tri-Met, the four counties and the various cities in the region and identified over 50 problem areas on an intersection, corridor and subarea basis.

6. Staff performed an initial screening of the problem areas and produced a high priority list of ten problem areas. The TSM Task Force met on October 13, 1977 and reviewed the staff analysis and problem area recommendations. These problem areas have been reviewed with the CRAG Board.

7. Subsequently, staff held 14 TSM project identification and problem quantification workshops with ODOT, Tri-Met and involved local jurisdictions concerning the ten problem areas. The workshops documented the severity of the problems and identified over $9 million (approximately $7.7 million federal share) in candidate TSM projects which are eligible for the remaining $4,269,000 (federal share) Category V Reserve. CRAG staff work was reviewed by a second TSM Task Force session on November 28, 1977 and by TTAC and the Board in December.

8. Staff performed a rigorous technical evaluation of the candidate TSM projects within each of the ten problem areas. Based on the technical evaluations, staff recommended a TSM strategy for each of the ten problem areas. The technical analysis was reviewed by a third TSM Task Force session on January 9, 1978 and by TTAC and the Board in January.

9. Staff has documented the willingness of local agencies to pursue local matching funds for nine of the TSM strategies and has received this information from the involved agencies.*

10. One of the problem areas (Fourth Plain Boulevard) is a Washington State facility located entirely within the City of Vancouver. Presently the problem area does not show up as a particularly severe problem according to a Washington DOT needs analysis. Additionally, local city funds are tied up for the next several years on improvements necessary to complement the I-5 widening. Staff recommends this problem area be dropped from consideration regarding Category V monies.

11. Remaining Category V Reserve monies stand at $4,269,000 (federal dollars). As of September 30, 1977, this figure has been escalated approximately $10,493 to $4,279,493.

12. Total project cost of the nine TSM strategies for the tri-county area is estimated to be $5,155,500. The project cost in federal dollars is estimated to be $4,433,730 which compares to remaining Category V monies of $4,279,493. Thus, a shortfall of $154,237 exists.

13. Since the Reserve will continue to escalate until the monies are actually obligated and also because it is difficult to determine project costs until PE, TTAC recommended at their February 10, 1978 meeting that all project costs be decreased 3.48 percent to bring costs in line with remaining revenues. TTAC approved staff recommendations with the above change.

14. As of September 30, 1977, the Category V Reserve stood at $4,279,493. Staff recommends these funds be reserved for TSM projects as follows:

Problem Area	Cost
. Canyon/TV Hwy.	$ 275,641
. Farmington Rd.	367,722
. Hall Blvd.	229,930
. Cedar Hills Blvd & Walker Rd. Intersection	53,955
. N.W. 18th & 19th; N.W. 14th & 16th Couplet	439,938
. Beaverton-Hillsdale Hwy.	684,809
. Sandy Blvd.	342,820
. State Street	669,038
. Gladstone-Milwaukie Subarea	1,215,640
Total	$4,279,493

*Currently, documentation has not been received from Tri-Met.

15. It is also recommended that local agencies be given until September 30, 1979 to obligate funds for preliminary engineering for the projects. This would allow the local jurisdictions approximately 14 months to request Board authorization for preliminary engineering.

16. Finally, staff recommends that the TIP Subcommittee monitor the progress of the projects and that the TSM Task Force be disbanded.

II. FINAL RECOMMENDATIONS

1. CANYON/TV HIGHWAY CORRIDOR

INTRODUCTION

The Corridor extends from Walker Road to Murray Boulevard. The facility is a primary state highway and is designated a principal arterial in the ITP. The Corridor serves major east-west through movements, provides high levels of regional through trips, provides access to and through downtown Beaverton and accommodates a high number of local commercial access trips to adjoining properties.

Severe peak hour travel time delays are experienced by both autos and buses at signalized intersections along the Corridor. Other problems include a high accident rate, poor transit waiting areas, difficult access to downtown Beaverton and to adjacent commercial use, and air quality problems.

CORRIDOR STRATEGY

It is recommended the following candidate TSM projects be implemented as a package:

TSM Project	Cost
. Signal Interconnection	$150,000
. Signal and Safety Improvements	30,000
. Park and Ride Lot	100,000
. Ramp Widening and Safety Improvements	27,000
. Improved Transit Waiting Areas	25,000
Total Cost	$332,000

The signal intertie will facilitate optimum directional flow during peak hours. Adjusted timing to facilitate local movement during the off-peak will benefit both auto and bus movements.

The ramp widening, signal and safety improvements will facilitate local access and interchange of trips to/from downtown Beaverton.

The Park and Ride lot and improved transit waiting areas will encourage transit ridership and offer an increased opportunity for through drivers to utilize the existing bus service, thereby reducing peak period traffic through the Corridor.

Implementation of the package will result in improved through traffic flow with reduced delays at signalized intersections, improved local access to and from the Corridor, improved safety and the potential for improved transit use. The individual actions are supportive of one another and address the essential problems identified in the Corridor.

2. FARMINGTON ROAD CORRIDOR

INTRODUCTION

The Corridor extends from 185th Avenue to Lombard Avenue and affects Washington County and the City of Beaverton. Farmington Road is designated a minor arterial in the ITP. It is a high volume road with no real through linkage to another arterial. The arterial ends in downtown Beaverton at a stop sign, and traffic flows essentially drain out into smaller side streets causing capacity and safety problems. Intersections along the Corridor have heavy left turn movements for vehicles accessing residential areas from the narrow two lane roadway. Lack of transit turn-outs cause lane blockages and safety problems. The rapidly developing adjacent residential area has created high volumes on an arterial not designed to handle them.

CORRIDOR STRATEGY

The following candidate projects are recommended as the corridor strategy:

TSM Project	Cost
. Signalization of 160th, 170th (to be funded) and 185th	$ 80,000
. Channelize Farmington and Murray	85,000
. Transit Turn-Outs and Shelters	23,000
. Corner Cutbacks for Buses	5,000
. Farmington-Second Street One Way Couplet (Signalization)	250,000
Total Cost	$443,000

The Farmington-Second couplet would create a one way couplet between Main and Lombard along Farmington and Second. The couplet would move traffic more efficiently through downtown Beaverton. The couplet would also serve as the first phase of a major capital construction project to connect both Farmington and Second to Beaverton-Hillsdale Highway. The project also relates to a one way couplet northbound on Hall and southbound on Watson. The Hall and Watson couplet involves minor road construction between Canyon and Broadway and will be financed with URA monies.

Thus, four of the five signals to be implemented in the Farmington-Second couplet will also be utilized by the Hall-Watson couplet. It is recommended the Hall-Watson couplet be implemented at the same time as the signals for the Farmington-Second couplet are installed.

The signalization improvements will facilitate local access to/from the corridor, ensure proper platooning of traffic, decrease auto/bus conflicts and facilitate pedestrian movement across the Corridor. The turn-outs and shelters, corner cutbacks, and channelization of the Farmington and Murray intersection will ease restricted bus movements, reduce travel time delays, facilitate access to bus stops and have the potential to increase transit ridership.

The overall strategy addresses the major problems of the Corridor and is composed of mutually supportive components.

3. HALL BOULEVARD CORRIDOR

INTRODUCTION

The Corridor extends from Canyon/TV Highway to Scholls Ferry Road and affects the City of Beaverton and Washington County. Major problems consist of peak hour traffic congestion at intersections which results in travel time delays to both autos and buses, substandard facility design, high accident rates, poor transit waiting areas, difficult access to downtown Beaverton and blockages to through traffic caused by stopped buses.

CORRIDOR STRATEGY

The following candidate TSM projects are recommended for implementation as a package:

TSM Project	Cost
. Broadway and Canyon/TV Highway Intersection Improvements	$ 20,000
. Truck Route Signing	5,000
. Highway 217 On/Off Ramps Channelization	Presently Funded
. Transit Shelters and Turn-Outs	76,000
. Various Left Turn Refuges and Signalization Improvements	85,000
. Restrict Train Movements During Peak Hours	No Cost Determined
. Reconstruct Scholls Ferry Intersection	91,000
Total Cost	$277,000

The strategy maximizes the existing highway facilities through traffic engineering capacity optimization actions. Also included are a number of transit stop amenities and turn-outs which will reduce travel time delays to through traffic caused by stopped buses.

The strategy addresses the major problems identified in the Corridor and represents a comprehensive TSM solution.

4. CEDAR HILLS BOULEVARD/WALKER ROAD INTERSECTION

INTRODUCTION

Cedar Hills Boulevard, a four lane arterial, crosses Walker Road, a two lane arterial, in an area of dense linear commercial development.

Problems at the intersection include a high number of turning movements which cause accident potential and peak hour traffic congestion which causes queuing that extends some distance from the intersection and also diverts traffic through local neighborhood streets.

RECOMMENDED STRATEGY

The recommended TSM improvement strategy is as follows:

TSM Project	Cost
. Improved Signalization	$50,000
. Channelization (East and West Legs Only)	15,000
Total Cost	$65,000

The two projects will reduce the occurrence of accidents at the intersection, improve the capacity of the intersection and reduce traffic now being diverted through residential neighborhoods by peak hour congestion.

5. N.W. 18th AND 19th; N.W. 14th AND 16th COUPLET

INTRODUCTION

The Corridor extends along N.W. 14th, 16th, 18th and 19th between I-405 and Burnside. Eighteenth and 19th presently operate as a north/south one-way couplet with on-street parking on both sides and two travel lanes. The couplet is adjacent to a dense residential neighborhood interspaced with some commercial use, schools and a hospital. The N.W. 14th and 16th couplet is presently a northbound and southbound couplet with on-street parking on both sides of 14th but only on the west side of 16th.

Problems in the area are centered in the 18th and 19th couplet. Heavy traffic volumes on the couplet create accidents and intrude (noise and vibration) into the adjacent high density residential neighborhood. Problems on the 14th and 16th couplet involve constricted movements for commercial vehicles at certain locations and difficulty for through movement to 13th and 14th to the south of Burnside.

CORRIDOR STRATEGY

The following project package is recommended as the TSM strategy:

TSM Project	Cost
. 14th-16th Avenue Pair Replacing the 18th-19th Avenue Pair	$530,000
. Transit Rerouting (To Be Determined by Tri-Met)	No Cost Determined
Total Cost	$530,000

The project recommended is to convert the 18th and 19th Avenue one way couplet back to two way streets and upgrade the 14th and 16th Avenue couplet to handle an increased traffic load.

The strategy meets the TSM improvement objectives and addresses the major problems identified. The strategy addresses a number of different problems and would encourage transit ridership in an area where approximately one quarter of the residents presently depend on Tri-Met.

The strategy has citizen support and is consistent with the City of Portland's policy of routing non-local traffic around residential areas.

6. BEAVERTON-HILLSDALE HIGHWAY CORRIDOR

INTRODUCTION

The Corridor extends from Capitol Highway to Scholls Ferry Road and affects the City of Portland and Washington County. Problems along the Corridor consist of conflicting roadway use between through and local traffic. Linear commercial and residential development creates continuous left turn conflicts with on-coming traffic and accident hazards. Too few signalized intersections and signals spaced at inadequate intervals cause poor signal progression and uneven traffic flow. Transit passengers have difficulty accessing bus stops; there are inadequate passenger waiting facilities; pedestrian movement in general is limited; and there are transit movement problems at certain locations.

CORRIDOR STRATEGY

The following candidate TSM projects are recommended for implementation:

TSM Project	Cost
. Signalization Improvements	$232,000
. Signal System Interconnect	70,000
. Street Lighting Improvements	40,000
. Transit Movement Improvements	200,000
. Left Turn Refuges; Pedestrian and Transit Waiting Area Improvements	283,000
Total Cost	$825,000

The projects are mutually supportive, positively impact more than one mode and address the major problems identified in the Corridor.

The signalization improvements, signal interconnect and left turn refuges will insure proper platooning of vehicles, thereby facilitating local access to and from existing neighborhoods and to and from adjacent commercial land use. The signalization improvements will also facilitate pedestrian movement and access to/from bus stops. The left turn refuges will also reduce accident potential for left turning vehicles.

The transit movement improvement will decrease transit travel times and improve transfer capabilities, thereby encouraging transit ridership in the Corridor.

The pedestrian and transit waiting area improvements will facilitate pedestrian movement and transit access, thereby offering the potential of increasing transit ridership in the Corridor and decreasing VMT. The improvements, when combined with the signalization improvements, will greatly improve pedestrian flows across the arterial to/from adjacent multi-family dwellings and bus stop waiting areas.

The strategy conforms to all five of the improvement objectives identified for the Corridor and has citizen support as indicated in documentation provided by the City of Portland.

7. SANDY BOULEVARD CORRIDOR

INTRODUCTION

The Corridor extends from 99th Avenue to 162nd Avenue. Adjacent commercial and nearby residential and industrial development create left turn conflicts with oncoming traffic and accident hazards at intersections and driveways. The situation creates lane blockages, delays to through traffic and causes potential left turn accidents. Autos and buses have difficulty entering Sandy from side streets because of inadequate spacing of signals. High auto occupancy occurs due to inadequate ride sharing and transit service in the Corridor.

CORRIDOR STRATEGY

The recommended TSM strategy for the Corridor is as follows:

TSM Project	Cost
. Signalization and Channelization Improvements	$339,000
. Tri-Met Market Research Study	No Cost Determined
. Intersection Realignment	50,000
. Improved Transit Waiting Areas	24,000
Total Cost	$413,000

The strategy is composed of mutually supporting actions which, for the most part, address the major problems identified along the Corridor.

The signalization and channelization improvements both support each other to address the problem of difficult local access to/from residential neighborhoods and adjacent commercial land use. Improving transit waiting areas offer the potential of increased transit ridership. The recommended Tri-Met market research study offers the potential of suggesting transit/ride sharing opportunities in a Corridor which is presently not well served by existing transit service.

8. STATE STREET CORRIDOR

INTRODUCTION

The State Street Corridor extends from Terwilliger to McVey and affects the City of Lake Oswego. Highway 43 facilitates major north-south traffic movements between the City of Portland and West Linn/Oregon City. The State Street Corridor is part of a primary state highway providing a high level of regional through trips in addition to providing access to adjacent commercial development.

Problems identified along the Corridor include high traffic volumes and peak hour congestion, local access/through traffic conflicts, auto/transit conflicts due to narrow lane width and conflicts between train movements/auto traffic.

CORRIDOR STRATEGY

The TSM strategy recommended for the State Street Corridor is as follows:

TSM Project	Cost
"B" Avenue to North Shore	
. Signalization Improvements	$450,000
. Remove On-Street Parking and Replace On A One-For-One Basis With Off-Street Parking	200,000
. Signing and Striping	20,000
. Lighting and Sidewalks	28,000
. Engineering	108,000
Total Cost	$806,000

The strategy will reduce travel time delays during peak hours for both autos and buses, reduce local access and through traffic conflicts, reduce the occurrence of accidents, improve access to downtown Lake Oswego and improve air quality in the Corridor through the reduction of congestion.

The strategy has the support of the Lake Oswego Chamber of Commerce, and the Lake Oswego City Council recently passed a resolution requesting ODOT to consider the strategy as part of their improvement program.

9. GLADSTONE-MILWAUKIE SUBAREA

INTRODUCTION

The Subarea is bounded by McLoughlin Boulevard, Johnson Creek Boulevard and I-205/82nd Avenue. Specific problem areas which will be addressed by the Prototype Study within the Subarea include Oatfield Road, Webster Road, Lake/Harmony Road, Harrison/King Road and the transit related problems in downtown Milwaukie and downtown Gladstone.

Specific problems in the Subarea include heavy traffic volumes and fast moving traffic on the minor arterials which conflict with the adjacent residential nature; too few signalized intersections to allow easy local access to/from the minor arterials; auto/transit conflicts resulting in safety problems and travel time delays; auto/pedestrian conflicts caused by the lack of pedestrian/bicycle connectors; safety problems associated with poor alignment, sight distance, and narrow no-shoulder roadway; lack of sufficient Park and Ride facilities and adequate transit stop amenities; and circuitous bus routing in downtown Milwaukie.

SUBAREA STRATEGY

The recommended strategy for the Subarea is as follows:

TSM Project	Cost
Oatfield Road	
. Signalization Improvements	$ 220,000
. Widening, Channelization, Relocation and Improvement of Bus Stops	260,000
. Pedestrian Improvements	90,000
Subtotal Cost	$ 570,000
Webster Road	
. Safety Improvements	$ 64,500
. Pedestrian/Bikeway Improvements	80,000
. Transit Access Improvements For Handicapped Persons	10,000
. Widening and Bus Stop Improvements	20,000
Subtotal Cost	$ 174,500

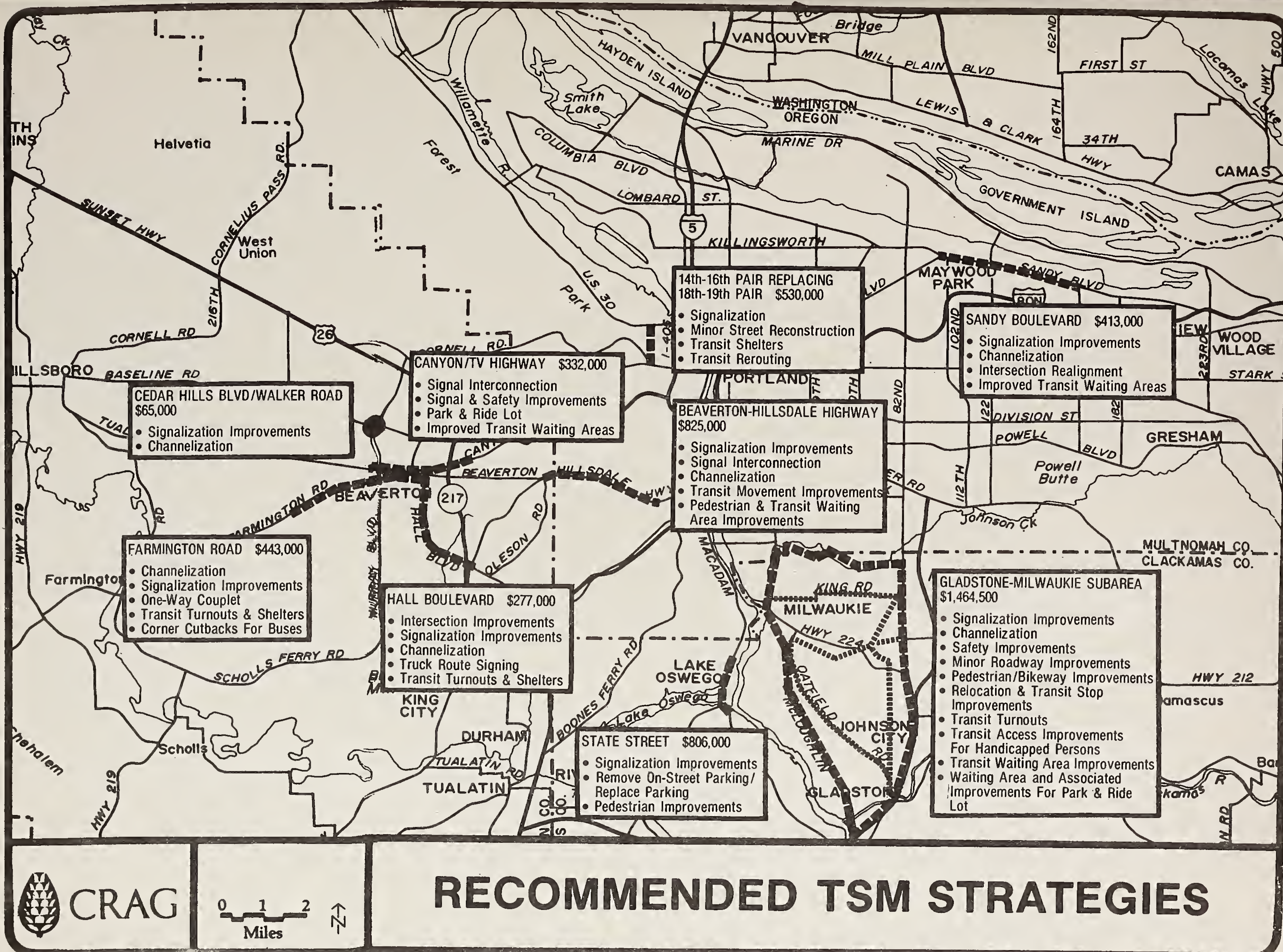
TSM Project	Cost
Lake/Harmony Road	
. Pedestrian/Bikeway Improvements	$ 180,000
. Signalization Improvements	100,000
. Bus Pullouts	40,000
Subtotal Cost	$ 320,000
Harrison/King	
. Channelization, Signalization and Minor Roadway Improvements	$ 215,000
. Pedestrian and Transit Waiting Area Improvements	70,000
Subtotal Cost	$ 285,000
Portland Avenue	
. Channelization and Intersection Realignment	$ 20,000
Price Fuller Road	
. Pedestrian/Bikeway Improvements	$ 65,000
Downtown Milwaukie	
. Transit Waiting Area Improvements	$ 20,000
Downtown Gladstone	
. Waiting Area and Associated Improvements for a Park and Ride Facility	$ 10,000
TOTAL COST FOR THE SUBAREA STRATEGY	$1,464,500

The Subarea strategy is composed of mutually supporting actions which address the major problems identified in the Subarea. The Subarea strategy is aimed at managing (reducing non-local traffic on residential arterials) and maximizing existing transportation facilities in order to meet the identified TSM improvement objectives. The strategy is a comprehensive one which is problem-related and seeks to minimize the contradictions caused by actions aimed at conflicting objectives.

The strategy is multi-modal in approach and has the potential of increasing transit ridership to/from/within the Subarea and, thereby decreasing VMT.

One important issue which should be addressed is the extent the reduction of non-local traffic on Oatfield will have on McLoughlin

Boulevard. To the extent the Oatfield sub-strategy reduces traffic diversion from McLoughlin, then congestion and air quality will worsen on McLoughlin. It is suggested the effect on McLoughlin be examined in the McLoughlin Corridor Study.



RECOMMENDED TSM STRATEGIES

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