EXECUTIVE SUMMARY

INTRODUCTION

The Portland Regionwide Advanced Traffic Management System Plan prepared in 1993 for ODOT, identified Gresham and the surrounding area in East Multnomah County in need of traffic signal system improvements. A Traffic Signal System and Communications Master Plan was completed in October, 1995 which developed a phased improvement plan to improve traffic flow in the Gresham area. The Master Plan recommended that the City of Gresham and Multnomah County improve their existing traffic management and monitoring capabilities by implementing a traffic signal control and communications system. The phased improvement plan included three phases:

- Phase 1: Interconnect and Coordinate 32 study area intersections
- Phase 2: Interconnect and Coordinate the remaining intersections in East Multnomah County (separated into Phase 2A and Phase 2B)
- Phase 3: Implement Advanced Traffic Management Devices including cameras and variable message signs.

Phase 1 of the Master Plan was completed in 1998 and Phase 2 is currently underway. As part of the Phase 2 task, the original master plan has been updated to clearly define the Phase 2 and Phase 3 projects and to lay out future traffic management improvements beyond the original master plan. This report provides the results of the *Gresham/East Multnomah County Traffic Signal System and Communications Master Plan Update*.

CHALLENGES OF THE FUTURE

Faced with increasing traffic congestion in the rapidly growing urban area of East Multnomah County, agencies responsible for the operation of the region's public transportation facilities[1] have recognized the need to improve the quality of transportation services with a coordinated, multi-jurisdictional and multi-modal approach. The agencies in this region have demonstrated a high level of cooperation through the implementation, operation and maintenance of the current traffic signal system and participation in the regional ATMS (Advanced Transportation Management System) meetings led by ODOT.

The continued growth in East Multnomah County will continue to strain the existing transportation infrastructure. Maximizing the performance of the transportation infrastructure in the future will require more advanced systems. These future systems will need to respond immediately, in real time to transportation operational problems. This will mandate that systems communicate with one another without waiting for someone to call or

[1] Agencies responsible for the operation of the Gresham/East Multnomah County public transportation facilities include: City of Gresham, Multnomah County, ODOT, City of Troutdale, City of Fairview, City of Wood Village, and Tri-Met.

go out into the field. Without this ability in the future, response to incidents and events, which affect transportation operation, will become longer and longer as traffic in non-peak time periods grow. Growth in peak hour and non-peak hour traffic impacts the recovery time following incidents (the length of time between congested periods and normal operation). What were small incidents in the past will become major problems for passenger cars, on-schedule transit service and freight mobility. Addressing major emergencies in a congested environment will require more sophisticated communication, operating techniques and transportation systems that can react instantaneously rather than those used today.

In addition, as the transportation system becomes more congested, the need to share accurate, timely information with the public becomes essential for efficient travel behavior. A better-informed public makes better transportation choices. The *Gresham/East Multnomah County Traffic Signal System and Communications Master Plan* focuses on meeting these challenges.

WORK PROGRAM

Significant coordination, planning, analysis, research and agency review was conducted over a nine-month period to produce the *Gresham/East Multnomah County Traffic Signal System and Communications Master Plan Update.* Figure ES-1 provides an illustration of the Work Program and its key components. This Executive Summary describes the recommended deployment plan, coordination with other projects and ITS benefits. The body of this report describes existing conditions, the needs assessment, development of options and the deployment plan.

RECOMMENDED DEPLOYMENT PLAN

Phase 1 (completed in 1998) included the interconnection and coordination of 32 study area traffic signals along 181st Avenue, Burnside Street and Division Street. Phase 2A (completed in the Fall of 2000) included the interconnection and coordination of 26 additional traffic signals along Powell Boulevard, 181st Avenue, Burnside Street and Hogan Drive.

Master Deployment Plan

Figure ES-2 shows the proposed Master Deployment Plan for traffic signal system management and communications. The figures illustrate detailed locations and specific methods of communication for each proposed field device. *Table ES-1* details the estimated cost to fully implement the Master Deployment Plan. Consistent with the original master plan, traveler information and traffic control/management elements are recommended. The primary elements of the recommended deployment plan include:

- Completion of the East Multnomah County communication network including connections to the Tri-Met, City of Portland and ODOT fiber optic network for information sharing.
- Installation of Closed Circuit Television Cameras (CCTV) for monitoring, incident detection and traveler information.
- Installation of Changeable Message Signs (CMS) for traveler information.

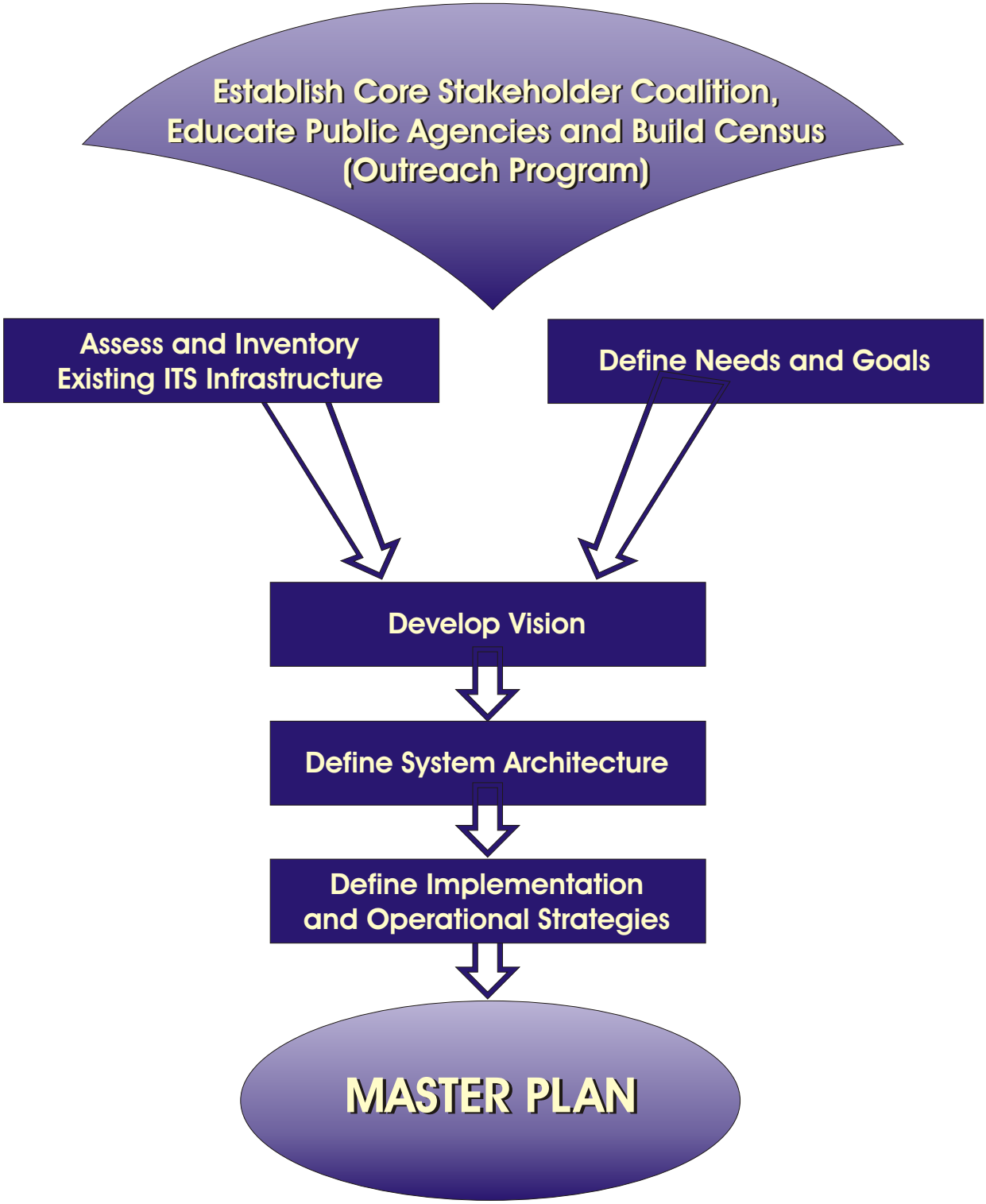
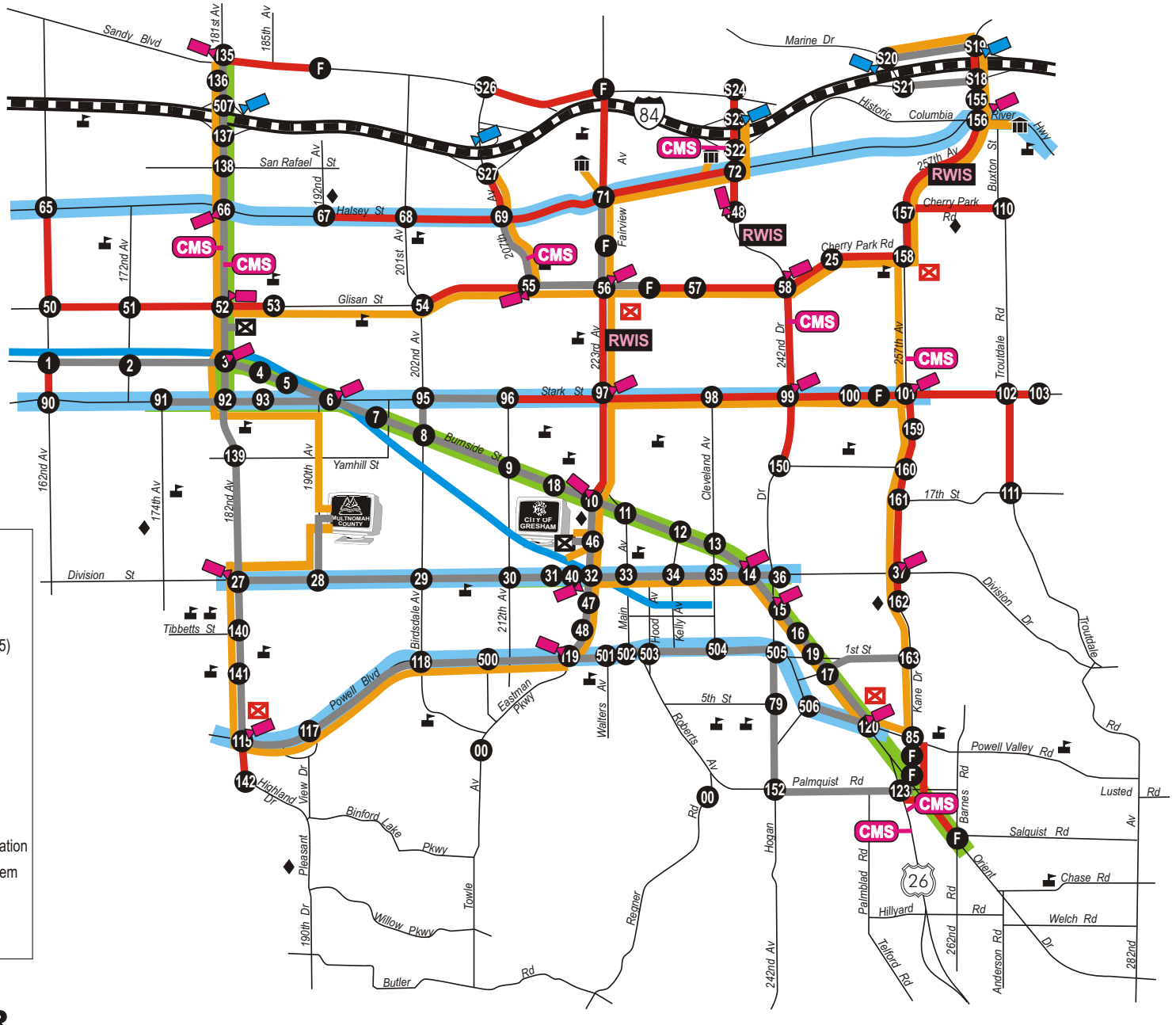


Figure ES-1
ITS PLANNING PROCESS

ITS (Intelligent Transportation Systems)

NOT TO SCALE

Gresham/East Multnomah County Traffic Signal and Communications Master Plan



LEGEND

- Existing Tri-Met Fiber
- Proposed Fiber Optic Cable
- Existing Twisted Wire Pair
- Proposed Twisted Wire Pair
- Proposed ODOT Fiber (Planned Year 2005)
- Transit Priority Routes
- Adaptive Signal Control Routes
- 00 - Existing Signalized Intersection
- F - Future Signalized Intersection
- Existing Communication Hub
- Proposed Communication Hub
- Proposed ODOT CCTV Location
- Proposed CCTV Location
- CMS - Proposed Changeable Message Sign Location
- RWIS - Proposed Road Weather Information System
- School
- Firestation
- City Hall
- Operations Center

Figure ES-2
PROPOSED MASTER DEPLOYMENT PLAN

Table ES-1
Gresham/East Multnomah County Master Plan Update
Master Plan Cost Estimate

Item No.	Item Description	Cost	Cumulative Total
PROJECT ITEMS			
Communications			
1	Furnish and Install Aerial Fiber Optic Cable and Twisted Pair Wiring	$ 230,000.00	
2	Furnish and Install Twisted Pair And Fiber Optic Cable in Existing Conduit	$ 65,000.00	
3	Furnish and Install Twisted Pair And Fiber Optic Cable in New Conduit	$ 900,000.00	
4	Install Fiber Optic Cable From City Hall to the Light Rail Station	$ 30,000.00	
5	Install Conduit to Access City Hall	$ 10,000.00	
6	Install Aerial Fiber Optic Cable from Multnomah County to the Light Rail Station on 190th Avenue	$ 40,000.00	
7	Install Combination Aerial and Underground Fiber Optic Cable From City Hall to the City of Portland border on Powell Boulevard	$ 240,000.00	
8	Install Aerial Fiber Optic Cable From City Hall to Burnside/Powell	$ 70,000.00	
9	Install Wireless Interconnect (Radio)	$ 25,000.00	
10	Install Communications Hub	$ 60,000.00	
	Subtotal	$1,670,000.00	**$ 1,670,000.00**
Traffic Signal System/Transit Priority			
11	Install new Central Software and Adaptive Algorithms	$ 325,000.00	
12	Furnish and Install new ATC Controllers	$ 375,000.00	
13	Install Additional Vehicle Detection	$ 600,000.00	
14	Upgrade Opticom	$ 65,000.00	
15	Update Existing Signal Timings	$ 75,000.00	
	Subtotal	$1,440,000.00	**$ 3,110,000.00**
Motorist Information and Traffic Control			
16	CCTV Video Camera	$ 550,000.00	
17	Install Roadside Message Sign	$ 480,000.00	
18	Install Roadside Weather Information System (RWIS)	$ 75,000.00	
	Subtotal	$1,105,000.00	**$ 4,215,000.00**

Contingency (20%)	**$ 843,000.00**
Engineering (25%)	**$ 1,053,750.00**
TOTAL	**$ 6,111,750.00**

Current Secured Funding **$950,000**

- Installation of Roadway Weather Information Systems for weather and roadway condition monitoring
- Adaptive Signal Control
- Transit Priority

The master deployment plan has been separated into two initial phases; Phase 2B and Phase 3. These initial phases do not cover all the elements of the master deployment plan, but provide phases associated with current funding. Additional phases for implementation are identified in Chapter 4 of this report.

Phase 2B Deployment Plan

The Phase 2B deployment plan focuses primarily on expanding the existing traffic signal system and continuing the installation of system detectors. In addition, Phase 2B includes a major change to the trunkline communications between the City of Portland and East Multnomah County. As part of Phase 2B, a fiber optic backbone will be established for communications between the City of Portland, Multnomah County and the City of Gresham. The fiber optic connection will replace the current INET infrastructure for backbone communications, which has been unreliable since implementation in 1997.

Figure ES-3 shows the proposed twisted pair and fiber optic cable installations for the proposed Phase 2B project.

Phase 3 Deployment Plan

Figure ES-4 shows the proposed Phase 3A project. The Phase 3A deployment plan continues the installation of communications infrastructure to the signalized intersections in East Multnomah County. It takes steps to redundancy to the communications network and at the same time builds towards implementing adaptive signal control on 181st Avenue.

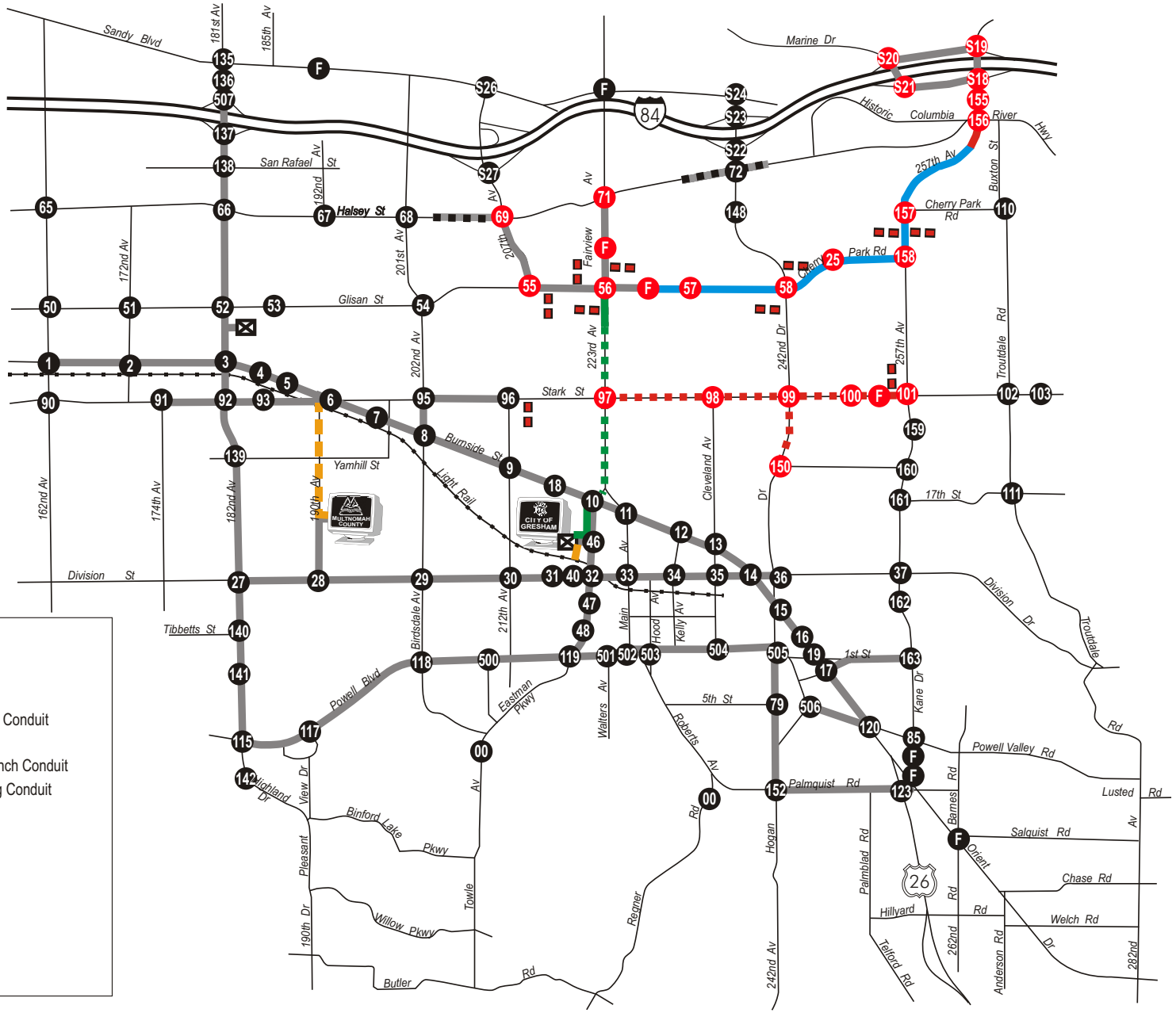
The backbone of ITS equipment is the communication system. Sharing of data is made possible through the communications network, allowing the goals of this project to be met. A communications network will benefit the public in the long term by establishing a trunkline of communications that future ITS projects in the region can utilize. Phase 3A will expand the fiber optic infrastructure further heading towards a fault tolerant communications network, i.e. if one communications cable is broken there is an alternate path available so communications is maintained.

Phase 3 is consistent with the original master plan and the benefits provided are consistent with phase 1 and phase 2. With this project, coordinated signal progression will be expanded on the major north-south routes and updated on Burnside Road and Division Street.

In addition, Phase 3 will provide a solid foundation for the installation of future ITS field equipment, connections between all agencies in the region and allow for future signal coordination on arterials in Fairview, Wood Village and Troutdale. The major benefit to constructing a complete communications backbone at this stage is future ITS equipment could easily be connected to the system. All ITS implementations require some form of collecting, analyzing and distributing information, and the communications backbone provides this base.

NOT TO SCALE

Gresham/East Multnomah County Traffic Signal and Communications Master Plan



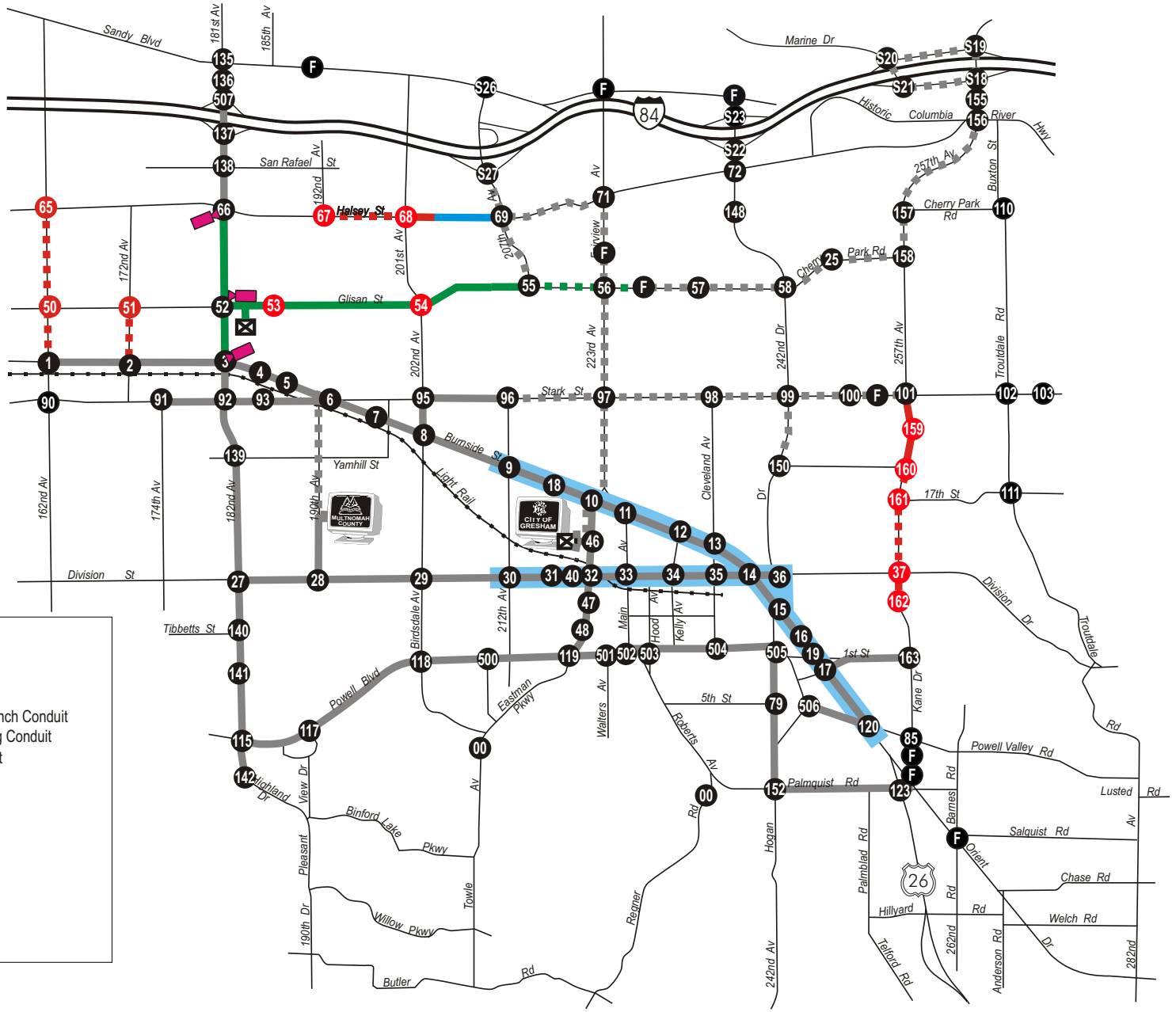
LEGEND

- Existing Twisted Pair Interconnect
- Existing 3-Inch Conduit
- New Aerial Twisted Pair/Fiber Cable
- New Twisted Pair/Fiber Cable in Existing Conduit
- New Aerial 12-Pair Interconnect
- New Twisted Pair Interconnect in New 3-inch Conduit
- New Twisted Pair Interconnect in Existing Conduit
- New Aerial Fiber Optic Cable
- New Fiber Optic Cable in New Conduit
- Proposed System Detectors
- Existing Communication Hub
- 00 - Existing Signalized Intersection
- F - Future Signalized Intersection
- Operations Center

Figure ES-3
PHASE 2B PREFERRED EXPANSION PLAN

NOT TO SCALE

Gresham/East Multnomah County Traffic Signal and Communications Master Plan



LEGEND

- Existing Twisted Pair Interconnect
- Phase 2B Interconnect
- New Aerial 12-Pair Interconnect
- New Twisted Pair Interconnect in New 3-inch Conduit
- New Twisted Pair Interconnect in Existing Conduit
- New Fiber Optic Cable in Existing Conduit
- New Fiber Optic Cable
- Update Coordinated Signal Timings
- Existing Communication Hub
- 00 - Existing Signalized Intersection
- F - Future Signalized Intersection
- 00 - Phase 3 Intersection
- Operations Center

FIGURE ES-4
PHASE 3A DEPLOYMENT PLAN

COORDINATION WITH OTHER PROJECTS

In developing the project deployment plan, other projects in the Portland region were considered. ODOT, City of Portland and Tri-Met all have plans to expand their existing ITS infrastructure. Linking the Gresham/East Multnomah County Master Plan with other transportation management improvements and programs can take advantage of cost sharing and joint development opportunities as well as the benefits of integrated systems and strategies. Table ES-2 lists projects currently being considered with which Gresham and Multnomah County should coordinate.

Table ES-2
Proposed ITS Projects

Owner	Planned Project Description	Estimated Construction Time Frame
ODOT	Installation of CCTV and ramp meters on I-84	5 years
Tri-Met/ City of Portland	Transit Priority at traffic signals on Division Street and Powell Boulevard	1 year
City of Portland	Installation of Fiber Optic Cable on Powell Boulevard to Portland City Limits	1-2 years
All Phase	Installation of Conduit on Powell Blvd and Hogan Rd	1 year

OPERATIONS AND MAINTENANCE

To maximize the benefits of the proposed ITS systems an on-going commitment to maintenance and operation of the sophisticated ITS equipment and software will be required. The ITS elements required with this plan require trained staff to ensure the existing system continuously accomplishes the goals and objectives for which it was designed and to respond to changing technologies and transportation system demands.

The keys to ensuring the ITS systems described in this plan provide a reduction in delays, emissions, fuel consumption and improved safety including:

- Provide adequate resources (staff and equipment) to support the ITS infrastructure. The level of staffing should be increased in incremental steps, as system needs grow in the future.
- Specify "easy to operate" and "low maintenance" equipment.
- Work closely with other agencies in the region (i.e. Portland, ODOT, Tri-Met)

Efficient operation of the existing and future transportation systems will be necessary to retain the region's quality of life. Well trained and motivated professionals to support the operations and maintenance requirements of the ITS plan are critical to the success of these systems.

FUNDING

The implementation of the ITS program described in this master plan will depend upon the availability of funds. Beyond the initial funding for program planning and development of this master plan, a critical factor to the success of ITS in the Gresham area will be the continued funding for project implementation, operations and maintenance.

There are several possible strategies for pursuing ITS funding. It is recommended that

due to the complexity of funding issues, funding be pursued along multiple tracks. Possible sources of funding are listed below:

- Federal funding sources, including Congestion Mitigation and Air Quality (CMAQ), National Highway System (NHS), and Surface Transportation Program (STP)
- Develop a program to fund ITS projects from the local agency budgets.
- Public/private sector partnerships. One method of partnering with the private sector is considered shared-resource partnering, in exchange for using public right-of-way for telecommunications conduit, the private sector installs conduit for the public agencies.
- Transportation Improvement Program. This includes all federal and state transportation funds that are distributed.

ITS BENEFITS

The ability to measure the benefits of ITS technologies is important to making decisions regarding their implementation. The benefits of ITS projects are best evaluated through their positive impact on the travelling public. Evaluation factors include:

- Reduction in travel delay
- Reduction of collisions
- Reduction in fuel consumption
- Improvement in air quality

State-of-the-art traffic signal systems, with communication to a central computer and coordinated signal timing plans have proven to produce substantial benefits to the public. Examples in Gresham include 181st Avenue, Burnside Street and Division Street where improved signal timing reduced travel times on these arterials by 10 to 25 percent during peak periods[2]. Figure ES-5 illustrates the benefits from signal timing in Gresham. The recent traffic signal timing project in the City of Gresham reported a benefit to cost ratio of 30 to 1. Other parts of the country, such as Orange County, Washington, Texas, Chicago, Las Vegas, and Los Angeles have also documented similar benefits of traffic signal timing including[3]:

- In Los Angeles, a new traffic control system reduced travel time by 18%, signal delays by 44%, vehicle stops by 41%, fuel consumption by 13%, and air pollutants by 14%.
- In Washington, recent signal timing projects have resulted in annual fuel reductions of 295,500 gallons and annual reductions in vehicle delays of 145,000 vehicle hours.
- A recent signal timing project in Virginia resulted in a 25% reduction in delays and stops, a 10% reduction in travel time, a 4% reduction in fuel consumption and a 16% reduction in air pollutants.

Field studies have indicated that various real-time traffic adaptive control systems are capable of attaining reductions in the range of 10 percent in the network travel time compared with conventional time-of-day signal control.[4]

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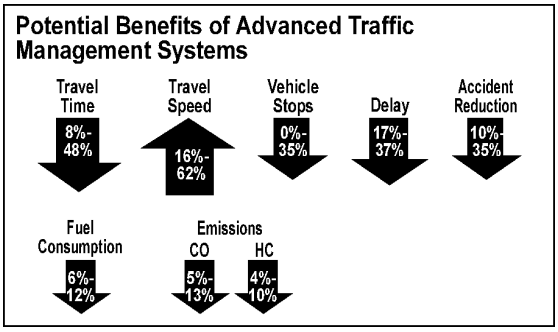
[2] Based on actual before and after travel surveys conducted by Traffic Smithy, 1997 and 1998.

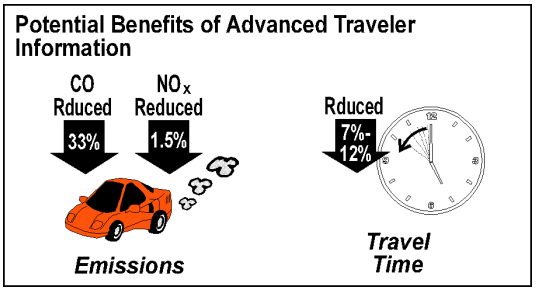
[3] Transportation Infrastructure – Benefits of Traffic Control Signal Systems Are Not Being Fully Realized, US General Accounting Office, 1994.

[4] Rahka, H., and Aerde, M. Van, REALTRAN: An Off-line Emulator for Estimating the Effects of SCOOT, Transportation Research Record 1494, 1996.

Potential benefits of Advanced Transportation Management Systems go beyond just improved signal timing. When coordinated with freeway management, these systems can deliver improved incident management, which can have the benefits shown below:



These benefits could be converted into direct cost savings using vehicle-miles of travel (VMT). The percentage increase benefit is provided here to demonstrate the positive impact to the travelling public.



Additional benefits include the collection and dissemination of information. While this information is useful for planning purposes, the information has a real-time use by travelers to make intelligent travel choices, which could even include the decision to not make a trip during certain periods.

The benefits of ITS reach all travel modes. ITS technologies can help to reduce overall corridor transit travel times. This can be accomplished using the GPS system and devices at traffic signals that allow transit vehicles to proceed through the signal by providing an early green or green extension. In a test by the City of Portland on SE Powell Boulevard, travel times were reduced by 5 to 10% during the peak hours.

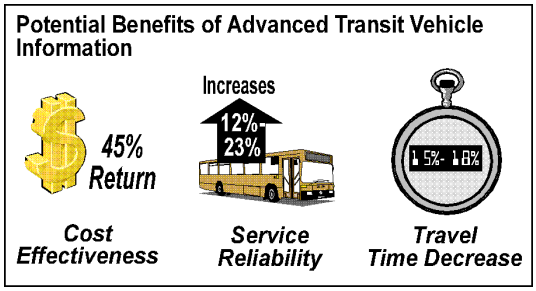


Figure ES-5
Signal Timing Benefits