Treasure Valley
Intelligent Transportation Systems (ITS) Strategic Plan

September 2006

Prepared By: McFarland Management, LLC

In Association With: ITERIS
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<td>ACHD</td>
<td>Ada County Highway District</td>
</tr>
<tr>
<td>AD</td>
<td>Advanced Data</td>
</tr>
<tr>
<td>ADT</td>
<td>Average Daily Traffic</td>
</tr>
<tr>
<td>AMBER</td>
<td>Name for Alert System for missing child</td>
</tr>
<tr>
<td>ANSI</td>
<td>American National Standards Institute</td>
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<tr>
<td>APS</td>
<td>Automatic Protection Switching</td>
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<tr>
<td>APTS</td>
<td>Advanced Public Transportation Systems</td>
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<tr>
<td>ATIS</td>
<td>Advanced Traveler Information System</td>
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<td>ATM</td>
<td>Asynchronous Transfer Mode</td>
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<td>ATMS</td>
<td>Advanced Traffic Management System</td>
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<td>Automatic Vehicle Identification</td>
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<td>Automatic Vehicle Location</td>
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<td>Advanced Vehicle Safety Systems</td>
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<td>Baggage Information Display System</td>
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<td>BSU</td>
<td>Boise State University</td>
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<td>CAD</td>
<td>Computer Aided Dispatch</td>
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<td>CBD</td>
<td>Central Business District</td>
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<td>CCDC</td>
<td>Capital City Development Corporation</td>
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<td>CCTV</td>
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<td>CLMATS</td>
<td>Closed Loop Traffic Management System</td>
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<td>CMS</td>
<td>Congestion Management System</td>
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<td>CODEC</td>
<td>Coder/Decoder</td>
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<td>COMPASS</td>
<td>Community Planning Association</td>
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<td>COTS</td>
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<td>Commercial Vehicle Information Systems and Networks</td>
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<td>DAB</td>
<td>Digital Audio Broadcasting</td>
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<td>Department of Transportation</td>
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<td>DSSD</td>
<td>Direct Sequence Spread Spectrum</td>
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<td>E-911</td>
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<td>Ethernet in the First Mile</td>
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<td>GPS</td>
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<td>HazMat</td>
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<td>High Density Polyethylene</td>
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<td>IDAS</td>
<td>ITS Deployment Analysis System</td>
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<td>IFS</td>
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<td>Internet Group Management Protocol</td>
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<td>Megabits per second</td>
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<td>Mega Hertz</td>
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<td>National Crime Information Center/</td>
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<td>QoS</td>
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<td>Redundant Array of Independent/Inexpensive Disks</td>
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<td>Sanderson Index (a ratio of Peak travel time to Ideal travel time)</td>
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<td>SIC</td>
<td>Standard Industrial Classification</td>
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<td>SMFO</td>
<td>Single Mode Fiber Optic</td>
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<td>Synchronous Optical Network</td>
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</table>
EXECUTIVE SUMMARY

Intelligent Transportation Systems (ITS) incorporate the use of electronics, communications, and computers to improve transportation efficiency and safety. ITS offers solutions to transportation challenges that may be cost effective alternatives or supplements to traditional approaches. Specific ITS applications include traffic management, traveler information, emergency management, commercial vehicle operations, transit systems management, and maintenance and construction. These technological solutions represent additional tools in the transportation professional's toolbox that have been shown to reduce travel time and delay, primary and secondary crashes, incident duration and response times, vehicular stops, and transit trip times. Additionally, studies indicate that ITS applications have positive benefit-to-cost ratios, ranging from 6:1 to 31:1.

The Treasure Valley encompasses the urbanized area within Ada and Canyon counties and includes the cities of Boise, Caldwell, Eagle, Garden City, Kuna, Meridian, Middleton, Nampa, and Star. An ITS plan was first prepared in 1999, prior to any deployment of field devices or organized communication system. Since then the Treasure Valley agencies, including emergency response providers, have made significant progress deploying ITS solutions and related infrastructure and have laid the foundation for further implementations. These accomplishments, in addition to continued urban development and resulting traffic growth, have resulted in a need to update the original plan.

The purpose of this report is to replace the 1999 Treasure Valley ITS Strategic Plan in its entirety. Therefore, this document replaces the original plan with every aspect updated. It is important to note that this is a strategic level plan and therefore it is not constrained by real-world challenges such as availability of funding and other programmatic issues. It also does not provide design detail for suggested future projects. Additional efforts to address these issues are critical and will need to be initiated in conjunction with implementing the recommended projects in this plan.

This plan defines the framework and specific deployments to most effectively implement the Treasure Valley ITS program through a cooperative effort by multiple agencies. The plan also provides an approach that leverages these deployments to maximize the benefits of systems integration and the utility of shared resources, particularly communications infrastructure.

Strong agency participation has been essential in developing an updated Treasure Valley ITS Strategic Plan that is informative and meaningful. It will also be critical in facilitating the use of the plan toward coordinated and supported future ITS deployments. This project has demonstrated the extensive and important participation needed to achieve this goal. Transportation management agencies and emergency service providers in Ada and Canyon Counties have participated in the process to develop this updated plan.
Significant Changes Since 1999 Affected Every Aspect Of The ITS Plan

Since the original Treasure Valley ITS Plan was completed, the growth in the Treasure Valley has had a significant impact on the transportation system and operations management strategies. Additionally, significant progress has been made to implement the recommendations in the original plan and consequently several projects have been successfully accomplished to deploy equipment, systems, and operations approaches to better manage the transportation network in the region.

Section 2.0 provides the existing conditions in the Treasure Valley, as well as an historical perspective that illustrates the significant changes and accomplishments since the original ITS plan was prepared. A few of the key areas that illustrate the magnitude of change include:

- Significant traffic volume growth has increased congestion levels, travel delays and corresponding time to reach destinations, and generally made commuting more difficult.
- Number of signalized intersections have grown from 411 to 535 (a 30% increase)
- ITS projects have installed 63 CCTV cameras, 33 freeway speed monitoring stations, and 7 dynamic message signs.
- Nearly 100 miles of fiber optic cable has been installed providing communications to field devices.
- Valley Regional Transit, a regional transit authority, has been established and served to focus management efforts and lay the foundation for true regional transit services linking major population and business areas.
- ACHD Commuteride has expanded van pool service from 30 to 70 vans operating.

The extent of change required that the Treasure Valley ITS Plan be updated. Every aspect of the planning process was impacted including entire re-documentation of existing conditions, extensive updates to area-wide needs, significant revisions to ITS priority corridors, completely new ITS Architecture to reflect and be consistent with the National ITS Architecture and market package list, broad expansion of communication system infrastructure, and a considerable update to future ITS projects and programs.

Updated Priority Corridors Provide Foundation For Future ITS Deployments

ITS priority corridors, originally established during the 1999 ITS planning efforts, were revisited and revised to reflect growth in the community and changes in the traffic patterns. These are typically routes that are experiencing significant traffic and growth and are frequently the primary commuter corridors in the valley. The process for development of these corridors is described in Section 3.2.

In summary, the process for revising the corridors included reviewing the priority corridors from the 1999 plan and comparing them with improvements implemented since that time, changes in land use and traffic growth, current
transportation construction projects, as well as planning efforts currently being conducted. In addition, important input from several of the stakeholders contributed to the development of the recommended ITS priority corridors.

The concept of priority corridors is intended to provide an overview of the network where ITS deployments are likely to have the greatest beneficial impact. Identification of a route as a priority corridor is not an indication of any specific planned deployment but rather is a means of setting the stage for consideration of technologies as the planning process progresses.

**A New Regional ITS Architecture Will Ensure Effective Integration**

An ITS architecture guides the efficient integration of ITS. It reflects the contributions of a broad cross-section of the transportation community (transportation practitioners, systems engineers, system developers, technology specialists, consultants, etc.). The architecture defines:

- The functions to be performed by ITS;
- The physical entities where the functions will be deployed;
- The information flows and data flows that connect the functions and physical subsystems together into an integrated system.
- The roles and responsibilities of the ITS stakeholders;
- The technical goals to avoid duplication of investments in infrastructure; and
- The opportunities for integration and data sharing.

The Architecture also provides a means for tracking the progress of ITS development in the region. The completion of this planning effort is not the end of the architecture development; the architecture is flexible and meant to continue to adapt to reflect the ITS deployments and plans in the Treasure Valley.

Section 4.0 describes the ITS Architecture developed during this study and provides the details associated with information flowing between agencies and systems. It represents a significant revision to the original architecture prepared in 1999 and includes the active agencies, current conditions in the region, and projections for transportation management in the future. Figure ES-1 illustrates the proposed Treasure Valley ITS Conceptual Architecture. This architecture will require updating following the conclusion of the Interagency Regional Operations Center (IROC) Phase 2 study and corresponding decisions regarding agency involvement in the new center.

**A Solid Communications System Is Needed To Facilitate Data Transfer**

A reliable communications system in the Treasure Valley is essential to support transportation management and operations. This communications network is necessary to ensure efficient data flow from monitoring devices to management centers, management centers to information dissemination equipment, and between management centers.
A Gigabit Ethernet (GigE) Communications Network is recommended for the Treasure Valley area. This network solution is the most cost effective communication technology that best meets the goals of all agency partners as well as the requirements of the ITS systems being deployed. This conclusion is further confirmed by the fact that regional agencies are already beginning to employ Ethernet for communications in current ITS deployments.

This solution represents a departure from previous practices and was not available when the original ITS Plan was prepared. It demonstrates the rapid technological change that has occurred in communication solutions. The communication system investments made to date by Treasure Valley agencies are incorporated into this solution in a contributory fashion. The nearly 100 miles of fiber optic cable installed will continue to serve as the backbone and be geographically expanded over time. The existing end equipment will function through its useful life and then be replaced by Gigabit Ethernet equipment as needed. It is recommended that as new ITS equipment is deployed that Gigabit Ethernet be used to facilitate communications. Section 5.0 of this report describes the communication system being recommended and defines the geographic layout of the communication rings and major trunk lines.
New List Of ITS Projects And Programs Will Help Guide Future Deployments

One of the primary outcomes of this study is a list of suggested projects and programs for future implementation. These projects are grouped into three timeframes: short term (within the next five years), medium term (six to ten years), and long term (beyond ten years). Additionally, the projects address all systems and roadways within the study area and within the ITS umbrella.

Section 6.0 defines the suggested Treasure Valley ITS projects and programs. There are 101 projects identified totaling nearly $102 million encompassing additional planning, system management enhancements, and corridor deployments. Tables ES-1 through ES-3 summarize the projects and provide planning level cost estimates and the major ITS categories being addressed. Potential opportunities for project funding sources are discussed in Section 7.2.

Recommendations Summary

Stakeholder support for this project and genuine interested in continued deployment of ITS throughout the Treasure Valley is exemplified in these six study recommendations, and discussed in greater detail in Section 7.1. The Study recommends that:

1. This plan be adopted by the participating Treasure Valley agencies and used to begin immediate implementation of future ITS projects identified herein.

2. This plan be updated approximately every 5 years. Additionally, portions of this plan be updated in 2 years to incorporate the new Interagency Regional Operations Center (IROC) Phase 2 Study results.

3. Agency stakeholders (established during this study) continue to meet at least twice a year to discuss and coordinate ITS implementations, potentials for increased data sharing, and ITS architecture updates.

4. The Community Planning Association of Southwest Idaho assume the responsibility for maintaining the ITS Architecture.

5. A regional, multi-agency operations center be established to enhance the level of agency coordination in the Treasure Valley.

6. Establish an initiative to develop a Treasure Valley ITS benefits database.

The Treasure Valley ITS Plan contained in this document provides a roadmap to further the ITS program in the region. The stakeholder agencies that contributed to the outcomes of this plan support its implementation and invite the reader to review the material presented and get involved in project initiation and deployment.
### Table ES-1
**Treasure Valley ITS Projects and Programs – Short Term**

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### Table ES-2

Treasure Valley ITS Projects and Programs – Medium Term

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<td>Middleton Road</td>
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<td>Corridor Management Systems*</td>
</tr>
<tr>
<td>L-27</td>
<td>I-84 Corridor</td>
<td>$30K</td>
<td>Corridor Management Systems*</td>
</tr>
<tr>
<td>L-28</td>
<td>Nampa Boulevard</td>
<td>$20K</td>
<td>Corridor Management Systems*</td>
</tr>
<tr>
<td>L-29</td>
<td>Highway 44 Corridor</td>
<td>$300K</td>
<td>Corridor Management Systems*</td>
</tr>
<tr>
<td>L-30</td>
<td>Highway 55 Corridor</td>
<td>$75K</td>
<td>Corridor Management Systems*</td>
</tr>
<tr>
<td>L-31</td>
<td>Franklin Road</td>
<td>$225K</td>
<td>Corridor Management Systems*</td>
</tr>
<tr>
<td>L-32</td>
<td>Overland Road</td>
<td>$150K</td>
<td>Corridor Management Systems*</td>
</tr>
<tr>
<td>L-33</td>
<td>Happy Valley Road</td>
<td>$30K</td>
<td>Corridor Management Systems*</td>
</tr>
<tr>
<td></td>
<td><strong>TOTAL</strong></td>
<td><strong>$30,590K</strong></td>
<td></td>
</tr>
</tbody>
</table>

SECTION 1.0
INTRODUCTION

1.1 Background

The Treasure Valley encompasses the urbanized area within Ada and Canyon counties and includes the cities of Boise, Caldwell, Eagle, Garden City, Kuna, Meridian, Middleton, Nampa, and Star. The 2006 population estimate for the project study area is approximately 500,000\(^1\). The Treasure Valley ITS planning study area is illustrated in Figure 1-1. The tremendous growth seen in recent years has emphasized the need for transportation planning with a focus on making the most of the Valley’s existing resources. Interagency cooperation has been key to this effort’s continuing success.

In 1998-1999 the Treasure Valley transportation agencies commissioned the preparation of an Intelligent Transportation System (ITS) Strategic Deployment Plan. At that time, the region was in its infancy regarding the use of technology applications to address transportation needs, and demonstrated very little experience with system oriented solutions. The planning process focused on educating participants about the potentials of ITS to increase safety and reduce congestion, documenting the transportation conditions and related needs in the region, preparing a communications plan, identifying future deployment projects, and developing an initial regional ITS architecture. In 1999, the Treasure Valley had been experiencing tremendous population growth that was stressing the transportation system. These conditions resulted in a plan that outlined several important projects, most of which were prioritized as needing implementation in the near term (within 5 years). The population growth in the valley has continued at a blistering pace and the stress on the transportation system has only worsened.

During the past seven years these same Treasure Valley agencies, including emergency response providers, have made significant progress deploying ITS solutions and related infrastructure and have laid the foundation for further implementations. Some of the major accomplishments include:

- Expansion of the ACHD Transportation Management Center, including software to manage ITS assets and providing a regional Internet webpage with comprehensive traveler information
- Significant growth in the traffic signal network, centralized control, and management sophistication
- Deployment of Closed Circuit Television (CCTV) cameras, Dynamic Message Signs (DMS), traffic monitoring and other field devices
- Strengthening of the link between transportation agencies and emergency responders, including the sharing of CCTV camera images used to enhance incident management activities
- Deployment of communications infrastructure supporting data transmissions and operations
- Formation of Valley Regional Transit (VRT), the regional transit authority, who is focusing management efforts and laying the foundation for true regional transit services linking major population and business areas
- Planning for a regional center to enhance the coordination and collaboration of transportation and emergency response operations

---

\(^1\) Source: COMPASS 2006-1990 Population Estimates by City Limit Boundaries, Excel Spreadsheet
Figure 1-1 Treasure Valley ITS Planning Study Area
The details associated with these accomplishments and current conditions are documented in the next section. Although much has been achieved in a relatively short period of time, the Treasure Valley agencies recognize the need for further expansion of the ITS program. The area growth, changed transportation conditions, significant ITS deployments, focus on enhanced multi-agency coordinated operations, and the outdated ITS project list has dictated the need to update the original ITS plan.

1.2 Purpose

The purpose of this report is to update the original Treasure Valley ITS Strategic Plan in its entirety. Therefore, this report replaces the original strategic plan with every aspect updated. Specific revisions include updating the:

- Existing conditions
- Needs and priority corridors
- Regional ITS architecture
- Communications system plan
- ITS projects and programs
- Recommendations, procurement options, and funding opportunities

It is important to note that this is a strategic level plan and therefore it is not constrained by real-world challenges such as availability of funding and other programmatic issues. It also does not provide design detail for suggested future projects. Additional efforts to address these issues are critical and will need to be initiated in conjunction with implementing the recommended projects in this plan.

1.3 Potential Benefits of Intelligent Transportation Systems

Intelligent Transportation Systems, in a variety of forms, have been deployed in large, medium, and small cities across the nation for several years. Only recently has there been a comprehensive focus on the benefits of these deployments, large and small. The published benefits vary widely and are primarily dependent on the benefits of the different ITS applications deployed, the extent of the applications, and the level of systems integration. One thing is clear: ITS deployments can have significant benefits in a region the size of the Treasure Valley. Some typical benefits (and measurement ranges) found in studies across the nation include:

<table>
<thead>
<tr>
<th>Potential Benefit</th>
<th>Measurement Range</th>
<th>Involved Jurisdictions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduction in travel time</td>
<td>4% - 18%</td>
<td>Seattle, Cincinnati, Boise, Fargo</td>
</tr>
<tr>
<td>Reduction in delay time</td>
<td>4% - 17%</td>
<td>Seattle, Tucson, Cincinnati, Boise</td>
</tr>
<tr>
<td>Reduction in incident response times</td>
<td>20%</td>
<td>San Antonio</td>
</tr>
<tr>
<td>Reduction in crashes</td>
<td>3% - 41%</td>
<td>Seattle, Tucson, Cincinnati, San Antonio</td>
</tr>
<tr>
<td>Reduction in incident duration time</td>
<td>12% - 36%</td>
<td>Fort Lauderdale, Salt Lake City</td>
</tr>
<tr>
<td>Reduction in vehicular stops</td>
<td>6% - 27%</td>
<td>Boise, California</td>
</tr>
<tr>
<td>Reduction in transit trip time</td>
<td>24% - 30%</td>
<td>Seattle, Tucson</td>
</tr>
<tr>
<td>Benefit-cost ratio</td>
<td>6:1 – 31:1</td>
<td>Seattle, Tucson, Cincinnati, Boise, Houston, Fort Lauderdale, California</td>
</tr>
</tbody>
</table>

Sources: Various studies conducted by the jurisdictions listed encompassing partial and full ITS deployments. Data includes actual before and after evaluations, as well as model forecasts using the ITS Deployment Analysis System (IDAS) software.
The potential benefits of implementing the suggested projects in this plan are not known at this time and will be dependent on the type and extent of ITS deployments achieved and the level of integration of the various systems. However, the data points above suggest that the potential to realize significant benefits to the transportation system and the public in the Treasure Valley is real.

1.4 Participants

Strong agency participation has been essential in developing an updated Treasure Valley ITS Strategic Plan that is informative and meaningful. It will also be critical in facilitating the use of the plan toward coordinated and supported future ITS deployments. This project has demonstrated the extensive and important participation needed to achieve this goal. Table 1-1 identifies the agencies and participants that have contributed to the information documented in this report.

Table 1-1
Treasure Valley ITS Strategic Plan Participants

<table>
<thead>
<tr>
<th>Organization</th>
<th>Representative</th>
<th>Organization</th>
<th>Representative</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACHD</td>
<td>Jim Larsen</td>
<td>Canyon Highway District</td>
<td>Tim Richard</td>
</tr>
<tr>
<td></td>
<td>Mike Boydstun</td>
<td>Nampa Highway District</td>
<td>Jim Buffington</td>
</tr>
<tr>
<td></td>
<td>Shawn Martin</td>
<td>Ada Disaster Services</td>
<td>Doug Hardman</td>
</tr>
<tr>
<td>Idaho Transportation Dept-Hdqtrs</td>
<td>Bob Koeberlein</td>
<td>State Bureau of Homeland Security</td>
<td>Bill Bishop</td>
</tr>
<tr>
<td></td>
<td>Carl Main</td>
<td>Emergency Medical Services</td>
<td>Dia Gainor</td>
</tr>
<tr>
<td></td>
<td>Steve Steiner</td>
<td>State EMS Communications Center</td>
<td>Kathy Bessey</td>
</tr>
<tr>
<td></td>
<td>John Krause</td>
<td>National Weather Service</td>
<td>Michelle Carreras</td>
</tr>
<tr>
<td>Bryan Smith</td>
<td>Idaho Transportation Dept-Dist 3</td>
<td>Boise State University</td>
<td>Mandar Khanal</td>
</tr>
<tr>
<td></td>
<td>Kevin Sablan</td>
<td>Jon Ogden (traffic)</td>
<td>Brian McDivitt</td>
</tr>
<tr>
<td></td>
<td>Eric Shannon</td>
<td>University of Idaho</td>
<td>Mike Kyte</td>
</tr>
<tr>
<td></td>
<td>Scott Gurnsey</td>
<td>Boise City Planning</td>
<td>Kathleen Lacey</td>
</tr>
<tr>
<td></td>
<td>Merrill Sharp</td>
<td>Boise City - communications</td>
<td>Rob Bousfield</td>
</tr>
<tr>
<td></td>
<td>Sue Sullivan</td>
<td>CCDC</td>
<td>Pam Sheldon</td>
</tr>
<tr>
<td></td>
<td>Dave Kusil</td>
<td>Boise City Airport</td>
<td>John Anderson</td>
</tr>
<tr>
<td>FHWA</td>
<td>Lance Johnson</td>
<td>Boise Fire Department</td>
<td>George Webb</td>
</tr>
<tr>
<td>Idaho State Police</td>
<td>Stan Passey</td>
<td>Boise Police</td>
<td>Rich Fuhrman</td>
</tr>
<tr>
<td>COMPASS</td>
<td>Jay Witt</td>
<td>City of Meridian</td>
<td>Steve Siddoway</td>
</tr>
<tr>
<td></td>
<td>John Cunningham</td>
<td></td>
<td>John Overton (police)</td>
</tr>
<tr>
<td>LHTAC</td>
<td>Joe Haynes</td>
<td>City of Nampa</td>
<td>Paul Raymond</td>
</tr>
<tr>
<td>ValleyRide</td>
<td>Kevin Bittner</td>
<td>Nampa Police Dispatch Center</td>
<td>Craig Kingsbury</td>
</tr>
<tr>
<td>CommuteRide</td>
<td>Don Kostelec</td>
<td>Aess. Chief Tim Vincent</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Kirk Montgomery</td>
<td>City of Caldwell</td>
<td>Gordon Law</td>
</tr>
<tr>
<td>Ada County EMS</td>
<td>Darby Weston</td>
<td>Gem County</td>
<td>Brent Orton</td>
</tr>
<tr>
<td>Ada County Sheriff</td>
<td>Ron Freeman</td>
<td>Oregon DOT</td>
<td>Ric Young , District 14 Manager</td>
</tr>
<tr>
<td></td>
<td>Bart Hamilton</td>
<td></td>
<td>Len Smith</td>
</tr>
<tr>
<td>Canyon County</td>
<td>Donna West</td>
<td></td>
<td>Lisa D Resinkin (Sheriff’s office)</td>
</tr>
<tr>
<td>Canyon County Dispatch Center</td>
<td>Lorraine Elfering</td>
<td>Parametrix</td>
<td>Ev Olen</td>
</tr>
</tbody>
</table>

McFarland Management, LLC

~ Treasure Valley ITS Strategic Plan ~
1.5 Report Contents

This report contains the following sections:

- **Section 2: Existing Conditions** provides an historical perspective between the original plan and now, and documents the current existing conditions.

- **Section 3: Needs and Priority Corridors** updates the list of needs and functional requirements by major ITS category. Additionally, this section defines the priority corridor concept and illustrates the current priority corridors for ITS deployments throughout the Treasure Valley.

- **Section 4: Regional ITS Architecture** describes the current and future Treasure Valley ITS architecture. The result of this work is a completely new architecture that better reflects the current regional conditions and is consistent with the revisions made to the National ITS Architecture since 1999.

- **Section 5: Communication System** outlines a new strategy for communications based on the latest technology and defines the infrastructure required to meet future ITS project deployments.

- **Section 6: ITS Projects and Programs** identifies future ITS projects and programs necessary to meet the needs and architecture defined by the sections above. Projects are divided into short (within 5 years), medium (6 to 10 years), and long (beyond 10 years) term time frames, and are briefly described including rough cost estimates (in 2006 dollars).

- **Section 7: Opportunities** provides specific recommendations to facilitate deployment of ITS projects in the Treasure Valley, addresses funding opportunities, and documents implementation considerations expressed by the stakeholders.
SECTION 2.0
EXISTING CONDITIONS

This section of the report documents the existing conditions pertinent to, and establishes the foundation for, updating the Treasure Valley Intelligent Transportation Systems Plan and Architecture. The existing conditions discussion provides an inventory of the transportation network, transit operations, monitoring and surveillance, control systems, communications, and traveler information related to the transportation management and emergency response operations in the region.

Additionally, this section provides a historical perspective and comparison to the original ITS plan (1999) for selected categories that best illustrates the considerable growth and change in the region. The following subsections are discussed separately in this section.

**Historical Perspective.** Provides a summary of how conditions have changed since the original Treasure Valley ITS Plan was completed, addressing several key determinants.

**Freeway and Arterial Network.** Provides the transportation network overview including interstates and major arterials, discusses the physical and operational characteristics of each, and highlights the established ITS priority corridors.

**Congestion Assessment.** Briefly describes the congestion levels throughout the Treasure Valley including existing and projected traffic volumes at key locations, high volume intersections, high accident locations, and the segments with the highest congestion index.

**Traffic Signal Systems.** Identifies existing number of traffic signal systems by jurisdiction, provides a graphical view of signal locations throughout the valley identifying the type of controller used at each location.

**ITS Implementations.** Identifies the existing ITS implementations throughout the Treasure Valley including traffic signal control systems, Advanced Traffic Management System (ATMS) software, closed circuit television cameras (CCTV), traffic monitoring devices, dynamic message signs (DMS), road weather information systems (RWIS), traffic count stations, and the incident response program.

**Public Transportation.** Describes the public transportation services and systems available in the region.

**Traveler Information.** Provides a description of the traveler information available, data collection and dissemination approaches used, and agencies involved in providing the information.

**Commercial Vehicle Operations.** Acknowledges the commercial vehicle operations as a statewide function.

**Airport Services.** Provides a brief description of the airport services in the region.

**Operations.** Provides a brief description of each of the pertinent operations centers in the Treasure Valley and specific operations plans. Additionally, this section addresses the impact these operations may have on the ITS architecture development.

**Communication Systems.** Provides the current communications infrastructure available to support intelligent transportation systems in the Treasure Valley.
2.1 Historical Perspective

The original Treasure Valley Intelligent Transportation Systems Plan was completed in 1999, with much of the work being accomplished in 1998. Since that time the growth in the Treasure Valley has had a significant impact on the transportation system and operations management strategies. Additionally, significant progress has been made to implement the recommendations in the Plan and consequently several projects have been successfully accomplished to deploy equipment, systems, and operations approaches to better manage the transportation network in the region.

These accomplishments have also had an impact on the architecture by which the region integrates data and shares information among the agencies and other organizations. The first Treasure Valley ITS architecture, developed in 1998, was based on a national ITS architecture that has also been significantly revised and updated. Section 4.0 of this report describes the effort to update the Treasure Valley ITS Architecture to include all pertinent elements in the national architecture, as well as reflect the current and future management strategies in the Treasure Valley.

The following paragraphs provide a summary level view of the ITS regional landscape and progress made since the original ITS Plan was prepared. Additional detail is provided in sections 2.2 through 2.11 for these and other existing conditions categories.

2.1.1 Traffic Conditions

In general, 2006 traffic volumes (in terms of average daily traffic at key locations in the study area) have kept pace with the projections made during the original study – which illustrates significant growth. However, in many instances growth has been (or is anticipated to be) much greater than originally projected in 1998. In these cases, the data suggests that growth is occurring in the western part of the Treasure Valley faster than originally thought. Projections for 2015 and 2030 continue to indicate steadily increasing traffic volumes throughout the region.

The significant traffic volume growth has increased congestion levels, travel delays and corresponding time to reach destinations, and generally made commuting more difficult. It has also contributed to an increase in frequency of incidents and complicated emergency response to traffic incidents and other emergencies. The growth has resulted in increased manpower and equipment to manage the transportation network and provide effective emergency response services. The need for deployment of intelligent transportation systems has never been greater in the Treasure Valley.

2.1.2 Traffic Signal Systems

The increasing number of traffic signals in the Treasure Valley is a clear indicator of growth. As can be seen in the table below, the number of traffic signals has grown significantly in the past 8 years. Since 1998, 124 signals have been added in the study area, an increase of over 30%. Ada County signals have increased by 89 over this period which is consistent with their rough growth estimate of 10-12 signals per year. The portion of Canyon County in the study area has added 43 signals. This is indicative of the significant regional growth in the transportation network and traffic volumes in the Treasure Valley. This growth level has also had a major impact on the need for upgraded communications and management systems to maintain and control these signal systems.

<table>
<thead>
<tr>
<th>Agency/Numbers of Traffic Signals</th>
<th>1998</th>
<th>2006</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ada County Highway District</td>
<td>366</td>
<td>455</td>
</tr>
<tr>
<td>City of Nampa*</td>
<td>22</td>
<td>58</td>
</tr>
<tr>
<td>City of Caldwell*</td>
<td>15</td>
<td>22</td>
</tr>
<tr>
<td><strong>totals</strong></td>
<td><strong>411</strong></td>
<td><strong>535</strong></td>
</tr>
</tbody>
</table>

* Some of these signals are owned and operated by ITD
2.1.3 ITS Implementation

In response to the growth, the local agencies have made substantial progress in completing ITS projects since the original ITS Plan was prepared. The deployments have primarily focused on increased remote monitoring and surveillance equipment and traveler information. The table below indicates that in 1998 the Treasure Valley had virtually no ITS equipment deployed (with the exception of road weather information systems), although there were plans in place at that time to begin deployments. As an example, since the original ITS Plan was developed 63 CCTV cameras have been installed at major intersections, on principal arterials, and Interstates. These cameras, and the other deployments noted, have had a dramatic impact on improving the effectiveness of traffic managers and emergency dispatching agencies in conducting their jobs.

<table>
<thead>
<tr>
<th>Deployed ITS Devices</th>
<th>1998</th>
<th>2006</th>
</tr>
</thead>
<tbody>
<tr>
<td>Closed Circuit Television</td>
<td>0</td>
<td>63</td>
</tr>
<tr>
<td>Freeway Speed Monitoring Stations</td>
<td>0</td>
<td>33</td>
</tr>
<tr>
<td>Dynamic Message Signs</td>
<td>0</td>
<td>7</td>
</tr>
<tr>
<td>Road Weather Information Systems</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Arterial Signal Video Detection</td>
<td>0</td>
<td>35*</td>
</tr>
</tbody>
</table>

* ACHD only

Over $8 million has been spent to date to implement the Treasure Valley ITS program, including the equipment listed in the table above and other supporting infrastructure and management systems. Although this is an important accomplishment, it is only 28% of what the original ITS Plan recommended. This realization has primarily been because of scarcity of ITS deployment funds and the fact that the original plan was intentionally somewhat aggressive in scheduling the deployments. In any case, the Treasure Valley ITS program has only just begun and there is much to accomplish to capitalize on the advancing benefits that the full range of ITS technologies has to offer.

2.1.4 Public Transportation

The public transportation services and systems have undergone an important transformation since 1998. A regional transit authority, Valley Regional Transit (VRT), was formed that has responsibility for the entire Treasure Valley area (including all of Ada County and portions of Canyon County). The existence of VRT has served to focus management efforts and lay the foundation for true regional transit services linking major population and business areas.

Direct comparisons of number of vehicles or ridership between 1998 and 2006 are not possible because of the lack of data availability when the original ITS plan was developed. However, it is estimated that ridership has increased only slightly. Progress has focused more on laying the foundation for a more effective and efficient transit system. This has included the preparation of operations plans, transitioning the rural system in Canyon County to a urban system that also provides inter-county service, implementing a region wide management system, and deploying a limited electronic fare box system.

Commuteride, the Ada County van pool provider, has seen significant growth since the original ITS Plan was prepared. They currently sponsor 70 commuter vans providing service throughout the Treasure Valley, compared with just 30 vans in 1998.
The Treasure Valley has experienced an increased awareness and commitment to public transportation since the first ITS Plan was prepared. This includes efforts from VRT, ACHD and ITD. Additionally, there is a stronger interest in the deployment of ITS equipment and systems to support an effective and efficient regional public transportation system.

### 2.1.5 Communications

Extensive communications infrastructure has been deployed since the original ITS Plan was prepared. In 1998, the primary ITS-related communications was copper cable to some traffic signal cabinets. Although some additional copper cable has been installed since then, it is the current practice of the transportation agencies to replace the dependence on copper cable with the use of fiber optic cable and wireless communications. Ninety-eight miles of fiber optic cable has been laid since 1998 throughout the Treasure Valley supporting communications with signal systems and ITS equipment. This deployment followed the communications systems plan provided in the original ITS Plan and future infrastructure deployments are planned to complete the fiber optic network (to be updated as part of this planning effort). Wireless systems are also being used as a communications media to facilitate cost-effective solutions.

<table>
<thead>
<tr>
<th>Communication/Miles</th>
<th>1998</th>
<th>2006</th>
</tr>
</thead>
<tbody>
<tr>
<td>Copper Cable</td>
<td>200</td>
<td>250</td>
</tr>
<tr>
<td>Fiber Optic Cable</td>
<td>0</td>
<td>98</td>
</tr>
<tr>
<td>Wireless Systems</td>
<td>0</td>
<td>10</td>
</tr>
</tbody>
</table>

### 2.2 Freeway and Arterial Network

The Treasure Valley has experienced significant growth in population and traffic volumes over the past several years. According to US Census Bureau estimates, the population in Ada County grew from 300,904 in 2000 to 332,523 in 2004 and in Canyon County from 131,441 to 158,038 over the same time period. While Canyon County continues to grow at a faster rate than Ada County the overall growth in the Treasure Valley has a staggering impact on the transportation infrastructure.

While several highway projects have added a relatively small number of additional lane miles of roadway, the basic network of freeways and arterials remains unchanged over this period of growth. The primary regional access to the metropolitan area is provided by Interstate 84 (I-84) which essentially travels east-west through the Treasure Valley area. The I-184 freeway connects to I-84 at the “Wye” interchange and provides direct access into the downtown Boise area. Significant improvements have been made to the “Wye” interchange during the period since the original Treasure Valley ITS Plan was completed. These projects have been aimed primarily at additional capacity and improved safety.

The freeway facilities serve both regional (interstate) as well as local (within the metropolitan area) traffic. I-84 extends throughout the study area with 18 on/off ramps which provide access to the local arterial network. I-184 provides direct freeway access to the downtown Boise area, and provides connection to the arterial system via several on/off ramps. I-84 generally has traffic volumes ranging from 37,000 to 93,500 average daily traffic (ADT). Truck volumes range from 4,700 to 7,000 daily (approximately eight to 13 percent of the through freeway volume). It is estimated that in 2015 the volumes will increase to approximately 60,000 to 138,000 ADT, and 2030 volumes will range from 68,000 to 165,000 ADT. Currently the lane configurations for both I-84 and I-184 are two to three lanes in each direction with interchanges at major arterials. Currently, all on-ramp facilities are uncontrolled, providing direct freeway access at the following locations:
Arterial roadways are intended to handle the bulk of intra-regional traffic to complement the freeway system and the local street network. As congestion continues to increase on the freeway system, those arterials which are parallel to the freeway suffer an increased traffic volume; consequently, arterials such as Franklin Road, Overland Road, Fairview Avenue, and Chinden Boulevard are becoming increasingly congested. The Transportation Master Plans for the two Treasure Valley counties depict the following roadway classifications: Interstate, Principal Arterial, Minor Arterial, Collector, and Local Streets. The Federal functional classifications are defined as follows:

**Interstate:** The interstate system, I-84 specifically, travels through the study area. I-84 and I-184 promotes the movement of traffic, with limited access, high speed, and grade separated interchanges.

**Principal Arterial:** Principal arterials are generally the high traffic volume streets within the study area. These roadways contain the greatest proportion of through or long-distance travel. Access is limited to promote efficient traffic movement and the intersections are mostly signalized with coordination. Parking is usually prohibited in the urban areas with 35 to 45 mph speed limits. Principal arterials typically carry approximately 30,000 to 50,000 average daily traffic (ADT) on four to six through lanes.

**Minor Arterial:** The predominant function of minor arterials is to provide movement of through traffic; they also provide considerable access for local traffic that originates or is destined to points along the primary corridors. Minor arterials typically carry 10,000 to 30,000 ADT and usually have two to four through lanes. Minor arterials connect principal arterials and collectors to each other.

**Collector:** The predominant function of collector streets is to assemble and concentrate residential and rural traffic from local streets and direct it to the arterial system. Parking is generally permitted on these streets and the operating speeds are in the 25 to 30 mph range.

**Local Street:** Local streets provide access between properties adjacent to the local roadways and collectors.

The original ITS planning effort established priority corridors from an ITS perspective. The priority corridor designation is shown in Figure 2-1. The concept behind this designation was to clearly identify those routes and segments where implementation of various ITS devices could offer greater levels of traffic management and therefore provide expanded options to manage congestion, improve safety, and reduce emergency response times.

<table>
<thead>
<tr>
<th>Arterial Roadway</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>I-84 / Black's Creek</td>
<td></td>
</tr>
<tr>
<td>I-84 / Isaacs Canyon</td>
<td></td>
</tr>
<tr>
<td>I-84 / Gowen Rd.</td>
<td></td>
</tr>
<tr>
<td>I-84 / Broadway Ave.</td>
<td></td>
</tr>
<tr>
<td>I-84 / Vista Ave.</td>
<td></td>
</tr>
<tr>
<td>I-84 / Orchard St.</td>
<td></td>
</tr>
<tr>
<td>I-84 / Cole Rd./Overland Rd.</td>
<td></td>
</tr>
<tr>
<td>I-84 / I-184 (Wye Interchange)</td>
<td></td>
</tr>
<tr>
<td>I-84 / Eagle Rd.</td>
<td></td>
</tr>
<tr>
<td>I-84 / Meridian Rd.</td>
<td></td>
</tr>
<tr>
<td>I-84 / Garrity Blvd. (Nampa/Murphy)</td>
<td></td>
</tr>
<tr>
<td>I-84 / Franklin Blvd.</td>
<td></td>
</tr>
<tr>
<td>I-84 / Nampa Blvd (Marsing / Hwy 55)</td>
<td></td>
</tr>
<tr>
<td>I-84 / Franklin Rd / Highway 20/26 East</td>
<td></td>
</tr>
<tr>
<td>I-84 / 10th Ave. (City Center / 10th St.)</td>
<td></td>
</tr>
<tr>
<td>I-84 / Centennial Wd. (Northwest Connector)</td>
<td></td>
</tr>
<tr>
<td>I-84 / Parma, Nyssa, Hwy 20/26 West</td>
<td></td>
</tr>
<tr>
<td>I-84 / Highway 44 (Middleton)</td>
<td></td>
</tr>
<tr>
<td>I-184 / Franklin Rd. (near Wye Interchange)</td>
<td></td>
</tr>
<tr>
<td>I-184 / Cole Rd. (westbound off only)</td>
<td></td>
</tr>
<tr>
<td>I-184 / Curtis Rd.</td>
<td></td>
</tr>
<tr>
<td>I-184 / Fairview (crossover on-ramp)</td>
<td></td>
</tr>
<tr>
<td>I-184 / Chinden Blvd.</td>
<td></td>
</tr>
<tr>
<td>I-184 / River Street (eastbound off only)</td>
<td></td>
</tr>
</tbody>
</table>
Figure 2-1 1999 Treasure Valley ITS Priority Corridor
2.3  Congestion Assessment

Figure 2-2 illustrates the existing and projected future average daily traffic (ADT) at key locations in the study area. These values are based on model runs from the Community Planning Association of Southwest Idaho (COMPASS) transportation model for the years 2006, 2015, and 2030. It includes major capacity enhancements planned in the future, as appropriate. In general, traffic growth is projected to continue affecting travel times and delays, congestion levels, and number and severity of incidents.

Table 2-1 provides the 2005 twelve highest peak hour volume signalized intersections in Ada County. Canyon County intersections did not meet the volume thresholds. The overall increase in traffic volumes of the top 12 intersections was a moderate 2.5% from 2002 to 2005. This doesn't reflect a flattening of traffic growth so much as it indicates that intersections are reaching their capacity. Unless further intersection improvements are performed, the peak hour traffic volume will not increase significantly at intersections that are at capacity. The peak traffic time will continue to lengthen and drivers will experience more delay or shift to other streets to avoid the congestion. This list offers the planners some insight into which intersections may be the most likely candidates for ITS treatments in the future.

This projected growth will continue to stress the transportation system (Interstates and arterials), and challenge the traffic managers and emergency responders to provide an acceptable level of service. Intelligent transportation system applications are one set of possible solutions to counteract the increasing levels of congestion and incidents.

<table>
<thead>
<tr>
<th>2005 Rank</th>
<th>Intersection</th>
<th>2005 Peak Hour Volume</th>
<th>2002 Rank</th>
<th>2002 Peak Hour Volume</th>
<th>% Change from 2002 to 2005</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Eagle &amp; Fairview</td>
<td>6,320</td>
<td>2</td>
<td>5,770</td>
<td>+9.5%</td>
</tr>
<tr>
<td>2</td>
<td>Chinden &amp; Glenwood</td>
<td>5,850</td>
<td>8</td>
<td>5,420</td>
<td>+8.0%</td>
</tr>
<tr>
<td>3</td>
<td>Franklin &amp; Milwaukee</td>
<td>5,790</td>
<td>4</td>
<td>5,520</td>
<td>+4.9%</td>
</tr>
<tr>
<td>4</td>
<td>Front &amp; 9th</td>
<td>5,770</td>
<td>1</td>
<td>6,070</td>
<td>-4.9%</td>
</tr>
<tr>
<td>5</td>
<td>Chinden/Curtis/VMP</td>
<td>5,710</td>
<td>3</td>
<td>5,730</td>
<td>-0.3%</td>
</tr>
<tr>
<td>6</td>
<td>Cole &amp; Overland</td>
<td>5,670</td>
<td>9</td>
<td>5,210</td>
<td>+8.8%</td>
</tr>
<tr>
<td>7</td>
<td>Fairview &amp; Curtis</td>
<td>5,450</td>
<td>10</td>
<td>5,060</td>
<td>+7.7%</td>
</tr>
<tr>
<td>8</td>
<td>State/Glenwood/Gary</td>
<td>5,370</td>
<td>5</td>
<td>5,440</td>
<td>-1.3%</td>
</tr>
<tr>
<td>9</td>
<td>Chinden &amp; Eagle</td>
<td>5,280</td>
<td>12</td>
<td>4,980</td>
<td>+6.0%</td>
</tr>
<tr>
<td>10</td>
<td>Front &amp; 13th</td>
<td>5,210</td>
<td>7</td>
<td>5,430</td>
<td>-4.1%</td>
</tr>
<tr>
<td>11</td>
<td>I-84 WB Off Ramp/Meridian</td>
<td>5,080</td>
<td>13</td>
<td>4,870</td>
<td>+4.3%</td>
</tr>
<tr>
<td>12</td>
<td>State/VMP/36th</td>
<td>5,050</td>
<td>6</td>
<td>5,440</td>
<td>-7.2%</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>65,550</td>
<td></td>
<td>64,940</td>
<td>2.5%</td>
</tr>
</tbody>
</table>

* None of the intersections in Canyon County met the volume thresholds
Figure 2-2 Treasure Valley Current and Projected Future Average Daily Traffic
Table 2-2 shows the high frequency crash locations recorded in 2004. Figure 2-3 identifies the highest volume intersections and the highest crash locations (by number) on the study area map. The map clearly indicates that several of the high frequency crash locations are at the highest volume intersections.

### Table 2-2

<table>
<thead>
<tr>
<th>Intersection</th>
<th>Number of Crashes in 2004</th>
</tr>
</thead>
<tbody>
<tr>
<td>Karcher Rd./Nampa-Caldwell Blvd.</td>
<td>66</td>
</tr>
<tr>
<td>Fairview / ST55H (Eagle Road)</td>
<td>64</td>
</tr>
<tr>
<td>11th S. Ave/2nd S. St.</td>
<td>55</td>
</tr>
<tr>
<td>Cole / Overland</td>
<td>51</td>
</tr>
<tr>
<td>ST44H(State St.) / ST55H (Eagle Road)</td>
<td>36</td>
</tr>
<tr>
<td>Curtis / Fairview</td>
<td>27</td>
</tr>
<tr>
<td>Glenwood / State</td>
<td>27</td>
</tr>
<tr>
<td>Nampa-Caldwell Blvd./Ustick</td>
<td>24</td>
</tr>
<tr>
<td>Five Mile / Ustick</td>
<td>23</td>
</tr>
<tr>
<td>Franklin / Milwaukee</td>
<td>23</td>
</tr>
<tr>
<td>Fairview / Milwaukee</td>
<td>23</td>
</tr>
<tr>
<td>Chinden / ST55H (Eagle Road)</td>
<td>23</td>
</tr>
<tr>
<td>Karcher Rd./Middleton Rd.</td>
<td>23</td>
</tr>
<tr>
<td>Karcher Rd./Northside Blvd.</td>
<td>23</td>
</tr>
<tr>
<td>Karcher Rd./Midland Blvd.</td>
<td>20</td>
</tr>
<tr>
<td>Fairview / Locust Grove</td>
<td>19</td>
</tr>
<tr>
<td>Fairview / Maple Grove</td>
<td>19</td>
</tr>
<tr>
<td>Capitol / Myrtle</td>
<td>19</td>
</tr>
<tr>
<td>Fairview / Five Mile</td>
<td>19</td>
</tr>
<tr>
<td>Overland / ST69H</td>
<td>19</td>
</tr>
<tr>
<td>ST55H (Eagle Road) / Ustick</td>
<td>19</td>
</tr>
<tr>
<td>Franklin / ST55H (Eagle Road)</td>
<td>19</td>
</tr>
<tr>
<td>Chinden / Glenwood</td>
<td>19</td>
</tr>
<tr>
<td>Midland Blvd./Nampa-Caldwell Blvd.</td>
<td>19</td>
</tr>
<tr>
<td>Chinden / Linder</td>
<td>18</td>
</tr>
<tr>
<td>Magic View / ST55H (Eagle Road)</td>
<td>18</td>
</tr>
<tr>
<td>Orchard / Overland</td>
<td>17</td>
</tr>
<tr>
<td>10th Ave/Ustick</td>
<td>17</td>
</tr>
</tbody>
</table>

The methodology to measure congestion in the Treasure Valley was revised in 2002 and now focuses on travel time as the basis. Travel time is defined as the time it takes to travel a segment of the transportation system using a specific mode. It is a relatively simple and reliable measure of performance. Average travel times can be calculated and used to describe congestion along larger corridors or an entire system. Analysis of travel time data yields information about trends in roadway congestion on specific travel routes within cities, districts, or specific locations (e.g. near intersections). Community Planning Association of Southwest Idaho (COMPASS) and the Idaho Transportation Department (ITD) collaborate annually to collect travel time data as part of the Treasure Valley Congestion Management System (CMS) using an in-vehicle data collection methodology.

In the spring of each year ITD and COMPASS staff drive Treasure Valley interstates and principal arterials during peak (6:30 to 8:30 a.m. and 4:00 to 6:30 p.m.) and free flow, or ideal, (2:00 a.m. to 5:00 a.m.) periods. Travel times for a given section of roadway are recorded into a computer for processing. The ratio of peak travel time to ideal
Figure 2-3 Treasure Valley High Traffic Volume & Crash Frequency Locations

*NOTE: None of the intersections in Canyon County meet the volume thresholds*
travel time produces an index used to identify congestion. This ratio is referred to in the Treasure Valley CMS as the Sanderson Index (SI). A SI of 2.0, for example, means that it takes twice as long to travel the route during the peak (or congested) period than during free flow (or ideal) conditions. This process began in 2003 and is an annual practice. The most recent data available is for the year 2005.

A variety of indices are used in various parts of the country to define congestion based on measured data. This is due in part to the fact different levels of tolerance exist for congestion in different parts of the country. In general, larger metropolitan areas have developed a higher level of tolerance for congestion than the smaller urban areas. Financial considerations over the past decade have significantly contributed to an increased acceptance of congestion levels. Furthermore, an acceptable system performance may vary by transportation mode, roadway, geographic location, and/or time of day. The most important consideration, however, in defining congestion must be the vision that the community has adopted for its future transportation system.

In general, congestion is travel time delay in excess of what normally occurs under light traffic or free flow travel conditions. There are two types of congestion: recurring and non-recurring. Recurring congestion is the predictable congestion experienced regularly due to excessive demand over capacity (rush hour congestion). Non-recurring congestion is the congestion caused randomly by accidents, vehicle breakdown, construction work, inclement weather and special events. The Treasure Valley CMS is currently designed to measure and mitigate recurring roadway congestion.

Based on the SI and general location of a roadway, the Treasure Valley CMS defines low, medium, and high levels of congestion. The Table below displays the Treasure Valley CMS definitions of congestion, which were subjectively established by local transportation experts. The local experts used the 2003 travel time data and local knowledge to help establish the congestion thresholds for each of three roadway classifications: Freeway/Interstate, Suburban, and Urban. Urban roadways are differentiated from Suburban roadways as those located in the commercial districts and urban centers of major cities.

<table>
<thead>
<tr>
<th>Congestion Thresholds (Based on SI Values)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roadway Class</td>
</tr>
<tr>
<td>Freeway</td>
</tr>
<tr>
<td>Suburban</td>
</tr>
<tr>
<td>Urban</td>
</tr>
</tbody>
</table>

*Sanderson Index (SI) is a ratio of peak travel time to ideal travel time.

Table 2-3 identifies sections of roadway that have a congestion level of “high” in 2005. The yellow highlighted sections have been in the “high” category consistently since 2003 when data was first collected. All roadway classifications (freeway, suburban, and urban) are represented in the table, using their corresponding thresholds above to determine whether or not they are designated as having “high” congestion.

Although this new methodology has only been used since 2003, a trend is beginning to emerge. In addition to tracking sections that are consistently in the “high” category, the number of roadway miles in the “high” category has increased from 2003 to 2005. During this period, northbound and eastbound traveled roads indicating “high” congestion levels have increased from 7.8 miles in 2003 to 14.3 miles in 2005. Additionally, southbound and westbound traveled roads indicating “high” congestion levels have increased from 7.2 miles in 2003 to 9.8 miles in 2005.
### Table 2-3
**Treasure Valley Facilities Identified as Congestion Level “High” in 2005**

<table>
<thead>
<tr>
<th>Road Name</th>
<th>Location Description</th>
<th>Direction</th>
<th>City</th>
<th>SI 2005</th>
</tr>
</thead>
<tbody>
<tr>
<td>SH-69</td>
<td>Victory Rd. to Overland Rd.</td>
<td>Northbound</td>
<td>Meridian/Kuna</td>
<td>4.80</td>
</tr>
<tr>
<td>SH-55</td>
<td>St. Lukes Ln. to Franklin</td>
<td>Northbound</td>
<td>Boise</td>
<td>4.57</td>
</tr>
<tr>
<td>Vista/Capitol/9th</td>
<td>Main St. to Myrtle St.</td>
<td>Southbound</td>
<td>Boise</td>
<td>4.55</td>
</tr>
<tr>
<td>SH-69</td>
<td>I-84 EB Ramps to Overland Rd.</td>
<td>Southbound</td>
<td>Meridian/Kuna</td>
<td>4.38</td>
</tr>
<tr>
<td>US-20/26</td>
<td>Muller Rd. to I-84 WB ramps</td>
<td>Westbound</td>
<td>Caldwell</td>
<td>4.08</td>
</tr>
<tr>
<td>Farview Ave.</td>
<td>Mitchell St. to Five Mile Rd.</td>
<td>Westbound</td>
<td>Boise</td>
<td>3.81</td>
</tr>
<tr>
<td>Franklin Rd.</td>
<td>Milwaukee St. to Cole Rd.</td>
<td>Eastbound</td>
<td>Boise</td>
<td>3.67</td>
</tr>
<tr>
<td>IB-84</td>
<td>16th to Garrity/Franklin</td>
<td>Westbound</td>
<td>Nampa</td>
<td>3.64</td>
</tr>
<tr>
<td>Orchard St.</td>
<td>Bond St. to Chinden Blvd.</td>
<td>Northbound</td>
<td>Boise</td>
<td>3.48</td>
</tr>
<tr>
<td>US-20/26</td>
<td>Cloverdale Rd. to Eagle Rd.</td>
<td>Westbound</td>
<td>Boise</td>
<td>3.40</td>
</tr>
<tr>
<td>Franklin Rd.</td>
<td>Cole Rd. to Milwaukee St.</td>
<td>Westbound</td>
<td>Boise</td>
<td>3.27</td>
</tr>
<tr>
<td>SH-55</td>
<td>I-84 EB Ramps to St. Lukes Ln.</td>
<td>Northbound</td>
<td>Boise</td>
<td>3.21</td>
</tr>
<tr>
<td>Vista/Capitol/9th</td>
<td>Wright St. to I-84 EB Ramps</td>
<td>Northbound</td>
<td>Boise</td>
<td>3.20</td>
</tr>
<tr>
<td>US-20/26</td>
<td>Myrtle to Front</td>
<td>Eastbound</td>
<td>Boise</td>
<td>3.15</td>
</tr>
<tr>
<td>Cherry Lane/Fairview</td>
<td>Liberty St. to Curtis Rd.</td>
<td>Eastbound</td>
<td>Boise</td>
<td>3.06</td>
</tr>
<tr>
<td>Five Mile Rd.</td>
<td>Franklin Rd. to Fairview Ave.</td>
<td>Northbound</td>
<td>Boise</td>
<td>3.04</td>
</tr>
<tr>
<td>SH-55</td>
<td>Franklin to Fairview</td>
<td>Northbound</td>
<td>Boise</td>
<td>3.01</td>
</tr>
<tr>
<td>US-20/26</td>
<td>Eagle Rd. to Cloverdale Rd.</td>
<td>Eastbound</td>
<td>Boise</td>
<td>2.97</td>
</tr>
<tr>
<td>US-20/26</td>
<td>36th to Veterans Pkwy.</td>
<td>Westbound</td>
<td>Boise</td>
<td>2.96</td>
</tr>
<tr>
<td>SH-55</td>
<td>Ustick to McMillan</td>
<td>Northbound</td>
<td>Boise</td>
<td>2.88</td>
</tr>
<tr>
<td>US-20/26</td>
<td>36th to Main St.</td>
<td>Eastbound</td>
<td>Boise</td>
<td>2.86</td>
</tr>
<tr>
<td>Main Street</td>
<td>1st St. to Broadway/Ave B</td>
<td>Eastbound</td>
<td>Boise</td>
<td>2.76</td>
</tr>
<tr>
<td>IB-84</td>
<td>Kimball to 10th</td>
<td>Eastbound</td>
<td>Caldwell</td>
<td>2.72</td>
</tr>
<tr>
<td>SH-55</td>
<td>6th St. N to I-84 WB Ramps</td>
<td>Northbound</td>
<td>Nampa</td>
<td>2.71</td>
</tr>
<tr>
<td>21st Ave.</td>
<td>Franklin Rd. to I-84 EB Ramps</td>
<td>Northbound</td>
<td>Caldwell</td>
<td>2.67</td>
</tr>
<tr>
<td>Fairview/Main</td>
<td>W. End Boise River Br. to 27th</td>
<td>Eastbound</td>
<td>Boise</td>
<td>2.58</td>
</tr>
<tr>
<td>Vista/Capitol/9th</td>
<td>Eastover Rd. to University Dr.</td>
<td>Northbound</td>
<td>Boise</td>
<td>2.54</td>
</tr>
<tr>
<td>Ustick Rd.</td>
<td>Caldwell Blvd to RR Crossing</td>
<td>Eastbound</td>
<td>Caldwell</td>
<td>2.54</td>
</tr>
<tr>
<td>Vista/Capitol/9th</td>
<td>Vista Ave./Overland Rd. to Kootenai St.</td>
<td>Northbound</td>
<td>Boise</td>
<td>2.48</td>
</tr>
<tr>
<td>I-84</td>
<td>Vista Ave. to Broadway Ave.</td>
<td>Eastbound</td>
<td>Boise</td>
<td>2.47</td>
</tr>
<tr>
<td>Fairview Ave.</td>
<td>Locust Grove St. to Main St.</td>
<td>Westbound</td>
<td>Boise</td>
<td>2.41</td>
</tr>
<tr>
<td>US-20/26</td>
<td>Main St. to 36th</td>
<td>Westbound</td>
<td>Boise</td>
<td>2.41</td>
</tr>
<tr>
<td>SH-55</td>
<td>Fairview to Franklin</td>
<td>Southbound</td>
<td>Boise</td>
<td>2.37</td>
</tr>
<tr>
<td>SH-44</td>
<td>Palmer Lane to Linder</td>
<td>Eastbound</td>
<td>Star</td>
<td>2.37</td>
</tr>
<tr>
<td>Franklin Rd.</td>
<td>Cloverdale Rd. to Eagle Rd.</td>
<td>Westbound</td>
<td>Boise</td>
<td>2.36</td>
</tr>
<tr>
<td>Orchard St.</td>
<td>Bond St. to I-184 EB Ramp</td>
<td>Southbound</td>
<td>Boise</td>
<td>2.33</td>
</tr>
<tr>
<td>Cole Rd.</td>
<td>Franklin Rd. to Emerald St.</td>
<td>Northbound</td>
<td>Boise</td>
<td>2.30</td>
</tr>
<tr>
<td>I-84</td>
<td>Franklin Blvd. to Garrity IC</td>
<td>Eastbound</td>
<td>Nampa</td>
<td>2.11</td>
</tr>
<tr>
<td>I-84</td>
<td>Eagle Rd. to Meridian Rd.</td>
<td>Westbound</td>
<td>Boise</td>
<td>2.09</td>
</tr>
<tr>
<td>I-84</td>
<td>Broadway Ave. to Vista Ave.</td>
<td>Westbound</td>
<td>Boise</td>
<td>1.66</td>
</tr>
</tbody>
</table>

Consistently identified as "high" since 2003
2.4 Traffic Signal Systems

There are several types of National Electrical Manufacturers Association (NEMA) based traffic signal controllers used throughout the Treasure Valley area. While ACHD continues to upgrade to the new TS2, Type I Naztec controllers and cabinets and has replaced all controllers (and cabinets) in the Boise downtown core with Naztec, the majority of the signals in Ada County still use the older NEMA vintage TS1 Traconex controllers. In addition, ACHD maintains and operates the vast majority of the signals in the study area. Since the 1999 ITS plan, however, ITD and the city of Nampa have revised their agreement for maintenance of signals within the city limits and on state highways. Nampa has taken on the maintenance and operations of approximately 31 additional signals through this agreement. Table 2-4 summarizes the number of signalized intersections within each jurisdiction, and Figure 2-4 shows the location of signalized intersections.

<table>
<thead>
<tr>
<th>Jurisdiction</th>
<th>Number of Signals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ada County Highway District (ACHD)</td>
<td>455</td>
</tr>
<tr>
<td>Nampa Area</td>
<td>58</td>
</tr>
<tr>
<td>Caldwell Area</td>
<td>22</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>535</strong></td>
</tr>
</tbody>
</table>

2.4.1 Ada County Highway District

The ACHD has a total of 455 signal locations within its jurisdiction, of which about 84 are jointly owned with ITD. The operation of signalized intersections varies from fixed time to fully actuated. Most signalized intersections use 3M Opticom preemption for emergency vehicles.

Since 1999, ACHD has upgraded the network of signal controllers in the downtown Boise area with Naztec Model 980 TS 2 Type 1 controllers and cabinets and has adopted the central based Naztec StreetWise software in the Traffic Management Center (TMC). From the TMC ACHD operators are able to adjust timing plans at many of the signals. This provides a means of managing traffic during incidents or unusually heavy congestion periods.

The coordinated systems within the Boise Central Business District (CBD) operate with 65 to 130 second cycle length during peak periods. The subsystems in the Traconet System (these intersections are located outside of downtown Boise) operate with 110-180 second cycle lengths during the peak periods. Intersections in the rural areas of Treasure Valley typically operate fully actuated, and uncoordinated.

ACHD has plans that will continue to expand the traffic signal system network. These plans include installation of signals at a number of intersections, additional communications infrastructure, and ongoing advances to the management capabilities of the TMC. The planned improvements further reflect the expected growth in the valley and the need to integrate traffic signal systems throughout the region with other ITS deployments.
Figure 2-4 Treasure Valley Existing Signalized Intersections
Ada County Highway District (ACHD) currently has a distributed network of copper twisted pair cable ranging in size from 6, 12, and 25 pair cables throughout the metropolitan area. ACHD has replaced much of the twisted pair cable with fiber optic cable, especially in the downtown core and continues to install fiber optic cable to complete a high speed ring for communication with deployed ITS field devices. There is also a limited amount of spare conduit in place at select locations within the study area.

### 2.4.2 Idaho Transportation Department

There are total of 139 signals located on State Highways within the study area. Of these, 84 are located in Ada County and 55 are located in Canyon County. All 84 in Ada County are managed by ACHD under an agreement with ITD. The City of Nampa operates and maintains 29 of the Canyon County signals on State Highways under agreement with ITD. The only signals in Nampa that ITD maintains full control of are those at the intersections with Interstate ramp termini. In Caldwell, by contrast, for the 17 signals on State Highways, ITD adjusts timing plans and conducts the more advanced maintenance activities, while the city is responsible for minor maintenance only. ITD works with the local agencies to coordinate signals across jurisdictional boundaries.

### 2.4.3 City of Nampa

The City of Nampa has 58 signalized intersections within its boundaries, 49 of which are operated and maintained by city staff. The remaining nine intersections are at Interstate ramp termini and are managed by ITD. Of the 49 managed by Nampa, twenty are not on State Highways.

Nampa uses Peek NEMA TS1 controllers and cabinets. The city manages three signal interconnect groups that communicate via fiber optic cable and can be controlled via dial up modem by personnel in the signal technician's office. The time based coordination used with the downtown Nampa signals operate on a 70 second cycle length, while Nampa-Caldwell Boulevard and the interconnected signals on Karcher Road operate on a 90 second cycle length. The remaining time based signals in Nampa use cycle lengths ranging from 45 to 90 seconds. The group of four signals near the Garrity interchange operates in traffic responsive mode. These signals respond to traffic accumulation on the west bound I-84 exit ramp and to excess traffic on Franklin Road that results from event activity at the Idaho Center. The four signals at Nampa Boulevard, 2nd Street, Canyon Street, and Orchard Avenue form one group, while the signal at 6th Street North and 11th Avenue North is part of the remaining group that also includes signals on Garrity Boulevard at Franklin Boulevard and at 16th Avenue North.

### 2.4.4 City of Caldwell

The City of Caldwell has 22 signalized intersections within its boundaries, three of which are operated and maintained by the City of Caldwell. The remaining intersections are operated by ITD. Controllers and cabinets within Caldwell are PEEK NEMA TS1. The coordinated subsystems within downtown Caldwell operate with 60 second cycle length during peak periods. Intersections along 21st Street in the City of Caldwell operate with 60 and 80 second cycle lengths. Under existing conditions, the majority of the intersections in Nampa and Caldwell are not interconnected and are time base coordinated.
2.5 ITS Implementations

The Treasure Valley agencies have been implementing ITS using the original 1999 Plan as a guide. Significant progress has been made with the funding available. This section briefly describes the ITS implementations categorized as follows:

- Traffic Signal Control Systems
- Advanced Traffic Management System Software
- Closed Circuit Television Cameras
- Traffic Monitoring Devices
- Dynamic Message Signs
- Road Weather Information Systems
- Count Stations
- Incident Response Program

Figure 2-5 illustrates the Treasure Valley Existing ITS Deployments. The map identifies the locations of 58 closed circuit television cameras (CCTVs), 7 dynamic message signs (one not shown), 5 environmental sensor stations (part of RWIS network), and 7 speed detector zones. The following paragraphs describe the ITS implementations.

2.5.1 Traffic Signal Control Systems

ACHD currently manages several hundred signalized intersections within Ada County. Nearly one hundred of these signalized intersections are in downtown Boise and are operating on fixed time programs with no vehicle detection. The majority of the remaining signals are either fully or semi-actuated, either fully or partially, via in ground detection loops and overhead mounted video detection systems.

Prior to 1998 ACHD had two NEMA based signal control systems. A 1970's vintage Honeywell fixed time signal system was operating in downtown Boise and a 1980's actuated Traconet TS1 system was operating at intersections outside of the downtown Boise network.

In 1999 ACHD replaced the downtown Boise Honeywell system with a new state-of-the-art NEMA TS2, Type 1 Naztec system. The Naztec signal system is controlled from the TMC with MS Windows™ based software known as Streetwise. This software is a central based software and polls each intersection every few seconds.

The Traconet signal system is a closed loop signal system with a system master controller, TMM 500, which can communicate to a maximum of 32 intersections. ACHD currently has 9 closed loop Traconet systems in place. The Traconet control software is a DOS based software that is tied into an ACHD TMC computer. Approximately 138 of the existing 192 Traconet signals can be controlled from the TMC. The remaining intersections are stand alone intersections not interconnected into the ACHD TMC.

ACHD is in the process of replacing all existing Traconet NEMA TS1 closed loop system signal controllers to the newer Naztec signal control system. ACHD has been replacing approximately 15-20 intersections per year to the new Naztec system. There are currently 173 Naztec controlled intersections with approximately 143 tied into the ACHD TMC.
Figure 2-5 Treasure Valley Existing ITS Deployments
In the City of Nampa there are currently three interconnected groups of signals that can be controlled from the signal technician’s offices using CL MATS - MS Windows™ based software by Peek. One of these groups, four signals near Garrity Boulevard operates in a traffic responsive mode. There are plans to interconnect at least two more groups of signals, one in conjunction with the Karcher interchange project via fiber and one on 12th Avenue South via spread spectrum radio.

The Idaho Transportation Department also has the capability to manage traffic signal systems from their headquarters building, however, this generally provides backup support in the event that the City of Nampa require some assistance.

2.5.2 Advanced Traffic Management System (ATMS) Software

ACHD installed an ATMS system developed by the IBI Group in the TMC in 2004. The ATMS software is installed on all operator consoles and integrates control of various freeway and arterial ITS devices which include CCTV, DMS and freeway vehicle detectors into a single software management system.

The ATMS software also allows TMC operators to enter freeway and arterial incident and roadwork data into a GIS based mapping system. This information is automatically displayed on the ACHD web page and e-mailed to multiple agencies, as part of automated response plan.

ACHD is in the process of installing this ATMS software on the Idaho Transportation Department, Idaho State Police, Ada County Sheriff, and State Communications dispatch center workstations. When complete this will allow these agencies access to real-time incident information. This software has been installed at the Boise State University Virtual TMC and students have used the freeway detector data for various research projects.

2.5.3 Closed Circuit Television Cameras

Closed circuit television cameras serve several purposes. First, they are utilized to detect incidents and guide the management of those incidents. Second, they are used by emergency dispatchers to route responders to an incident and in some cases used to help identify the most appropriate response. Third, they are desired by the traveling public to view the traffic conditions at specific locations. Still images from the CCTV cameras are provided to the public through ACHD’s web page. Lastly, the cameras are used by traffic managers to identify congested areas, helping them to take actions to alleviate the affects of the congestion (change signal timing, post messages on DMS alerting motorists, etc.)

The CCTV network includes installations on arterials and the Interstate, in Ada and Canyon Counties. The cameras are controlled by ACHD, with links to Ada County Sheriff, ITD, State Communications Center, Boise State University, and local radio and TV stations. Additional installations and expanded use by other agencies are anticipated in the future.
2.5.4 Traffic Monitoring Devices

Currently, there are six traffic monitoring devices on the Interstate. These sensors provide traffic volume and speed information to the ACHD TMC and are used to display congestion on the ACHD webpage traffic flow map. They also can be used by the ATMS software to detect incidents and alert traffic managers. These six devices use radar technology to measure vehicle speeds in multiple independent travel lanes.

Additionally, the Wye interchange reconstruction project installed 27 microloop stations to detect traffic in and around that area (where I-84 and I-184 meet). The data from these sensors will soon be transmitted to the ACHD TMC and be integrated into the ATMS software.

Data from all these devices will be shared with the ITD planning section in 2007 via a fiber optic link.

2.5.5 Dynamic Message Signs

There are seven dynamic message signs (DMS) within the study area providing en-route messages to motorists regarding traffic conditions and incidents effecting Treasure Valley commuters and other through travelers. These DMS are located as follows:

- I-84 westbound between Vista Avenue and Orchard Street interchanges (Daktronics).
- I-84 eastbound between Meridian Road and Eagle Road interchanges (Daktronics).
- I-84 westbound between Hwy 20/26 and Hwy 44 interchanges (Daktronics).
- I-184 westbound at the beginning of the connector (Daktronics).
- Eagle Road southbound between Fairview Avenue and Franklin Road (Daktronics).
- Broadway Avenue southbound near Federal Way (McCain).
- Bogus Basin Road facing northbound, just north of Curling Road – operated in partnership with Bogus Basin Ski Resort - (McCain) (not shown on map)

The Daktronics signs are VF-1000 Full Matrix LED freeway signs. The sign's features include 3 lines, 18" characters and 21 characters/line. The McCain signs are Model 520B Full Matrix LED arterial signs. The sign’s features include 3 lines, 8" characters and 10 characters/line.

Control of these signs are conducted by a combination of ACHD TMC staff, State Communications, and ITD personnel. The State EMS Communications Center are able to control the freeway signs for ITD statewide any time of day, and for ACHD during non-work hours (evenings and weekends). Additionally, the State EMS Communications center activates the signs in the case of an Amber Alert.

There are three additional signs (not shown on the map) planned for installation in 2007, all on Interstate 84. They include the following locations:

- I-84 eastbound at MP 35, between the cities of Caldwell and Nampa
- I-84 westbound at MP 48, between the Wye and Eagle Road interchanges
- I-84 westbound at MP 45, between Eagle Road and Meridian Road interchanges
2.5.6 Road Weather Information Systems

Idaho’s RWIS network continues to grow in response to needs for both maintenance operations and traveler information. While plans for additional weather stations throughout the state are extensive, there are no planned additions within the study area. The five existing sites within the study area, identified on Figure 2-6, are located adjacent to Interstate 84 and are used primarily by ITD maintenance forces as an aid to manage winter maintenance activities. The information provided by the stations is made available to maintenance forces and the public through ITD’s Internet based RWIDS interface and provides pavement and atmospheric instrument readings.

2.5.7 Count Stations

Idaho Transportation Department maintains eight traffic count stations on I-84/l-184 in the study area. The data from these stations are used by ITD-Planning to retain Interstate volume data for future planning activities and to meet FHWA requirements. These data are not tied into the ACHD TMC and therefore are not used in traffic management activities.

2.5.8 Incident Response Program

The Idaho Transportation Department began the Incident Response Program as a pilot project in 1996. This program included two roving trucks that operated during the morning and afternoon peaks on Interstate 84 and 184. The pilot project was conceived to reduce congestion, reduce secondary incidents, reduce automotive emissions due to delay, and reduce risk of injury to EMS, fire, police, and motorists at the scene of an incident. The trucks assist stranded motorists and others involved in some type of incident. The program has been a tremendous success and funding for the program is secure. Another truck has recently been added (resulting in three active trucks).

In 2005, over 135,000 miles were logged (primarily by two trucks) that stopped 4755 times to assist motorists on the Interstate. A variety of services are provided during these stops. Some of the more frequently recorded include providing scene security, requested assistance by Idaho State Police, checking on a situation, tagging abandoned vehicles, and providing some type of automotive maintenance action.

2.6 Public Transportation

2.6.1 Valley Regional Transit

Valley Regional Transit (VRT) is the regional transit authority for Ada and Canyon counties. Their goal is to provide public transportation services, encourage private transportation programs and coordinate both public and private transportation programs, services and support functions in the Treasure Valley. Currently, VRT operates an interconnecting regional system that links ValleyRide Boise with ValleyRide Nampa and Caldwell through inter-county express services. VRT also provides paratransit services in Boise as well as Nampa and Caldwell service area.

VRT has accomplished some important milestones recently that establish the foundation for them to meet their goal of true regional services. These include:

- Completed a regional operations plan that changed a coverage system to a productivity system.
- Changed from a “rural” to an “urban” service in Canyon County
- Implemented a common management system (Fleetnet) that includes financial and operational data for all VRT services
- Initiated a “Rideline” service to serve as one source of information
• Deployed a new fare-box system in use on Valleyride-Boise buses that uses magnetic fare media and has the capability for smart-card media, with plans to expand to Valleyride-Nampa.
• Received a federal earmark to plan and construct a downtown Boise multi-modal center

Valleyride-Boise operates 39 fixed route buses (on fifteen routes) and 8 demand responsive vehicles that provide complimentary service in Boise. In 2005, Valleyride-Boise provided over 960,000 fixed route rider trips and 34,500 demand responsive rider trips. The Monday through Friday service operates from 5:30am to 8:00pm with 30 minute headways on the fixed routes. Reduced service is provided on the weekends and holidays.

Valleyride-Nampa operates 12 fixed route buses (on seven routes including inter-county services) that connect Canyon County with Ada County and 2 demand responsive vehicles that provide complimentary services in the Nampa and Caldwell service area. In 2005, Valleyride-Nampa provide over 59,700 fixed route rider trips, 50,600 inter-county rider trips, and 3,400 demand responsive rider trips. Monday through Friday service operates from 5:30am to 8:00pm with 30 minute headways on the fixed routes. Reduced service is provided on the weekends and holidays.

VRT is interested in investigating the possibilities that ITS has to offer to help them provide a customer focused, efficient transit system in the Treasure Valley. Enhancements to traveler information, operations management, safety, fare collection, and reacting faster to transportation network impacts are among the areas VRT would like ITS to address.

2.6.2 Commuteride

The Ada County Highway District’s Commuteride office works to reduce traffic congestion and improve air quality by promoting alternatives to driving alone. Since 1977 Commuteride has served the Treasure Valley by offering rideshare services, employer support and commuter benefits. This includes a carpool matching program, employer assistance program, and sponsoring van pools. These programs have grown rapidly in the past several years and plans for future growth are continuing.

Commuteride sponsors 70 vans that serve approximately 700 commuters throughout the Treasure Valley and destinations beyond. Some of the vans are dedicated to specific employers to support commuting to and from their work locations. The drivers are commuters themselves and currently Commuteride does not track the vehicles or have a dispatching function. There is no communication with the vans, except through personally owned cell phones if an emergency occurs.

Additionally, ACHD owns and operates several park and ride lots in the Treasure Valley and has plans to expand those numbers in the coming years. Additionally, Commuteride leases park-and-ride spaces from private land owners to serve the vanpool program. At two of the park-n-ride lots, ACHD recently installed CCTV cameras to monitor activities at the lots. These cameras were positioned such that they could also be used to monitor traffic.

Potential ITS applications that have been discussed in the past include an Automated Vehicle Location (AVL) system on the vans, and a dynamic rideshare program (currently being investigated).
2.7 Traveler Information

Accurate and timely traveler information is a cornerstone of any successful ITS program. Recently, Treasure Valley and statewide agencies have deployed separate systems to provide information to motorists and commuters. ACHD reports traffic conditions and access to over 60 camera images on a dedicated webpage developed in 2005. This webpage provides information throughout the Treasure Valley including portions of Canyon County, where available. ITD, in partnership with other agencies, has recently initiated a statewide 511 phone system and webpage providing road conditions and camera images throughout Idaho, including the Treasure Valley.

The ACHD webpage provides travelers with camera images, sign messages, incidents, and roadwork. Freeway speeds are also provided. The user can select to view Ada County, Canyon County, or Downtown Boise zoom levels. The web URL is: http://www.achd.ada.id.us. A screen shot of Ada County with all the options selected is shown below. Additional information including the camera image or road work description is easily retrieved by clicking on the appropriate icon.
The statewide 511/webpage system is important for several reasons. First, it makes information available via the phone for those travelers who have already left an available internet connection. Second, it provides information in the Treasure Valley (on state highways only). And third, it provides information on state highways beyond the Treasure Valley for those travelers who are planning travel outside the area. The web page provides travelers with specific tabs focusing on advisories, driving conditions, road work, trucking, cameras, weather, and mountain passes. Additionally, the user can select a region of the state – options include southwest Idaho or Boise area. The web URL to enter the site is: http://511.idaho.gov/. A screen shot illustrates the driving conditions (colored to indicate level of driving difficulty) for southwest Idaho below.

![Screen Shot of Driving Conditions](image)

2.8 Commercial Vehicle Operations

The recently expanding economy in Idaho, much of which has occurred in the Treasure Valley, has resulted in increased freight being shipped into, out of, and through the study area. The state of Idaho is actively pursuing and deploying ITS to improve efficiency of registering and regulating trucking companies. Idaho is a Commercial Vehicle Information Systems and Networks (CVISN) Level 1 state and is currently working to expand beyond Level 1. The East Boise Port of Entry (approximately 10 miles from the east study area boundary) has implemented high speed weigh-in-motion and mainline screening.

The update to the Treasure Valley ITS Plan acknowledges that the related ITS applications are a statewide function and are being planned, managed and deployed by ITD. Additionally, there are no ITS applications related to
commercial vehicle operations within the Treasure Valley. Therefore, no specific commercial vehicle operations ITS recommendations will be made in this report.

2.9 Airport Services

2.9.1 Boise Air Terminal

In 2005 the Boise Air Terminal located adjacent to I-84 at Vista Avenue and a department of Boise City, accommodated a total of 3,139,158 passenger visits, which represents a nine percent increase from 2004. Air service for Boise is provided by Alaska Airlines, Big Sky, Continental Express, Delta, Frontier, Horizon Air, Northwest Airlines, Skywest Airlines, Southwest, United, and US Airways via the Boise Air Terminal. These services provide non-stop flights to many major western and mid-western cities such as Salt Lake City, Seattle, Portland, Spokane, Minneapolis, Denver, Houston, Chicago, Las Vegas, Los Angeles, Phoenix, Reno, Sacramento, San Francisco, San Jose and Oakland.

Ground transportation to and from the airport is provided via both public and private transit services. Typical passenger amenities are provided within the airport including several restaurants and gift shops as well as wireless internet access. In addition, the airport provides hotel, car rental, and shuttle information and reservation kiosks and booths.

The Boise airport has experienced tremendous growth during the past several years. The volume of passenger traffic exceeded the capacity of several of the former terminal facilities. In response, Boise Airport is undergoing a long-term terminal expansion program to both accommodate short term traffic growth and provide for orderly expansion related to future growth and/or new carrier service. The expansion program has thus far focused on construction of a new 361,500-square-foot terminal building with a two-level roadway system, expanded air carrier apron and additional parking facilities. The master plan for the airport is currently being updated, however, known future improvements include further terminal and parking structure expansions, rerouting of Orchard Street west of the airport for expansion of runway and hangar facilities, and enhancements to the communications infrastructure in and around the airport.

It should be noted that Boise Air Terminal has numerous automated systems including security, runway sensing and parking management. The new terminal facilities have flight and baggage information display systems (FIDS & BIDS) and Common Use Terminal Equipment (CUTE) to make airline technology more efficient. Additionally, the airport web page (www.boise-airport.com) provides flight information and hot links to airline web sites.

2.9.2 Caldwell Industrial Airport

The Caldwell Industrial Airport is located on the north side of I-84 between Ustick and Linden Roads. The airport is owned by the City of Caldwell and is administered through the City's Public Works Department. In contrast with the Boise Air Terminal, Caldwell's Industrial Airport targets the general aviation community rather than air freight or passengers. The airport's master plan identifies future improvements including a new terminal building, a runway extension from 5,500 feet to 7,140 feet, and addition of a precision approach.

2.9.3 Nampa Airport

The Nampa Municipal Airport is located south of Garrity Boulevard between Kings Road and Happy Valley Road. It is owned by the City of Nampa and administered through the Public Works Department. It also focuses on general aviation and business travelers but does not provide commercial aviation services. The Nampa Airport master plan
was completed in 2001 and air traffic at the airport has already reached the 2020 projections. The airport administration is currently considering the options of updating the master plan or developing an Airport Layout Plan to accommodate the expected continuation of this growth trend.

2.10 ITS Operations

One of the primary areas that Intelligent Transportation Systems strives to improve is operations. In the Treasure Valley, operations activities include traffic management, emergency response, incident management, transit system management, and road maintenance. Various centers exist throughout the study area that conduct these operations. The information contained in each of the operations centers may be of value to other centers to facilitate seamless and efficient operations management in the Treasure Valley. The sharing of appropriate information is a goal of the involved agencies to enhance overall operations. While algorithms are being developed for incident detection, little has been done to date to disseminate the information from these TMC’s directly to the EMS, HazMat, Law Enforcement, and Rescue Personnel in their vehicles. The seamless passage of incident information through Computer Aided Dispatch (CAD) and other systems directly to responders and other field personnel is the optimal situation. These issues are important during the development of the ITS architecture. Section 4.0 will address these impacts in more detail.

Treasure Valley agencies and organizations are actively involved in the development of a regional TMC (called the Interagency Regional Operations Center – IROC). Phase 1, Feasibility Study, was completed in the summer of 2005. Phase 2 will begin in the spring of 2006 and will finalize occupancy numbers, determine the best location for a joint center, and establish the requirements and concept of operations.

This section briefly describes the operations (and centers) for the following organizations.

- Idaho Transportation Department
- Idaho State Police
- Idaho State EMS Communications Center
- Ada County Highway District
- Ada County Sheriff
- Ada County/City Disaster Services
- Canyon County Sheriff
- City of Nampa Police
- Bureau of Homeland Security
- Valley Regional Transit
- Capital City Development Corporation
- Universities

2.10.1 Idaho Transportation Department

The ITD District 3 office is involved in traffic management and maintenance operations. In their operations group they control one DMS (I-84 west of the City of Caldwell), operate and maintain 28 signals in Canyon County, and maintain all the RWIS ESS located in the Treasure Valley. Future plans include a more active role in the IROC and they plan to be collocated in that new facility, once built.
2.10.2 Idaho State Police

The Idaho State Police operate three dispatch centers statewide. One of those centers is located in Meridian and dispatches officers in southwest Idaho, including the Treasure Valley. This dispatch center, currently has 8 consoles (4 currently in use), and is collocated with the Idaho State EMS Communications Center. Additionally, the center has a fiber optic communication feed from the ACHD TMC that transmits the live video camera images throughout the Treasure Valley to the dispatch center’s video wall. This assists both ISP dispatchers and Idaho State EMS Communications Center staff.

The Idaho State Police are conducting a statewide pilot project to install mobile data computers in patrol cars. This includes 6 vehicles in the Treasure Valley. This pilot project will initially provide officers with access to the NCIC/ILETS databases to facilitate more efficient vehicle and driver checks, and limited network access for developing reports. Future plans include expansion of these capabilities to all patrol cars, facilitation of AVL, automated dispatching, and downloading of information from the ACHD TMC (such as CCTV camera images). Many of these future applications will require broadband wireless communications.

Additionally, ISP has acquired a new mobile command center which can be used to manage appropriate incidents. This new mobile center is a 5th wheel trailer and will contain advanced communications equipment including satellite communications, IP phone, and video conferencing capabilities.

2.10.3 Idaho State EMS Communications Center

The Idaho State EMS Communications Center, a section of the state EMS Bureau, dispatches for several agencies and emergency responders throughout the entire state. Emergency Medical Services (EMS) providers include quick response units, ambulances, and Regional Response Hazardous Materials Teams, some of which are city and county based fire departments.

Throughout the Treasure Valley, these services are typically dispatched from city and county 911 call and dispatch centers (see below). However, other Idaho State EMS Communications Center activities particularly pertinent to this study include dispatching for ITD maintenance forces, maintaining the winter road report for the new 511 system, and the central point for coordinating AMBER Alert information dissemination.

The center is tied into the ACHD ATMS software. This software has been adopted by ITD for statewide control of all ITD DMS signs. Additionally, State Communications can post Amber Alert messages statewide.

The Center is collocated with the Idaho State Police in Meridian, is operational 24/7, and has 4 consoles. Using two dedicated radio frequencies, the State EMS Communications Center maintains the ability to communicate with all EMS vehicles, hospital emergency departments, and district health preparedness officials statewide. When the subscription services like Onstar mature, they may be able to conference the caller in with a trained Emergency Medical Dispatcher. The State EMS Communications Center is uniquely positioned within the State of Idaho to
undertake that responsibility with regard to Emergency Medical Interrogation, and coordination with other incident response agencies – ranging from law enforcement, fire suppression, and HazMat, to air medical services.

The Idaho EMS Bureau is preparing to conduct a pilot project in Region 3 and 4 of an Internet based resource tracking, management, and notification system. This system will provide the capability for real-time assessments of resource needs and provide an automated mechanism for notifying participating stakeholders of any event that may affect their operations. The resources include vehicles such as ambulances or firetrucks and facilities such as hospitals and Emergency Operations Centers. Funding for continued use of the system being tested has not yet been identified.

2.10.4 Ada County Highway District

Ada County Highway District operates the only existing Transportation Management Center in the Treasure Valley. The center responsibility includes arterial traffic management (Ada County only) and freeway management (Ada and Canyon Counties). The ACHD TMC utilizes ITS devices discussed in Section 2.5 to facilitate its management activities. The 450sf operations room has 3 operator consoles. One console is used by an ACHD Operator, one by an ACHD Signal Engineer and the third by an independent radio broadcaster. The ACHD TMC operates M-F from 5:30am to 6:30pm.

The TMC has a video wall comprised of a 56" Barco screen and 18 – 20" TV monitors (see picture above right). An Advanced Transportation Management Software System (ATMS) developed by IBI Group was implemented in 2004. This software is used to control the CCTV cameras, DMS signs and freeway speed detectors. This software is used by ACHD Operators to log Treasure Valley incidents and the software can automatically post incident information directly to the ACHD web site.

ACHD staff also control 250 arterial and freeway off/on ramp traffic signals from the TMC using a standard PC with Naztec and Traconet signal software.

The ACHD TMC supports the dissemination of information by the private sector. The CCTV camera images are currently provided to several Treasure Valley television and radio stations and a local traffic reporting company, BoiseTraffic.com. BoiseTraffic.com maintains an independent website of traffic information throughout the valley and broadcasts radio reports from the TMC in the morning and afternoon peak times.

In addition to the operations room, the management center includes an equipment room which supports operations. The 75sf equipment room houses the ITS communications equipment for all ACHD devices. The equipment room is comprised of four 19" racks that contain a 256x128 Ultrak video switch, an International Fiber Systems (IFS) Orion video and data communication system and server, 40 IFS single mode video fiber receivers, five Enerdyne codec's and four Traconex TMM 500 traffic signal master controllers. There are also three 72 port fiber distribution centers to receive the fiber from the field and two 16-port digital servers.
The equipment room also houses the Barco projection screen and Helios projector, a Naztec traffic signal server and an IBI ATMS server, back-up server, utility server and RAID array. There are also three uninterruptible power supplies (UPS) that back-up this equipment for a short period of time during a power outage. The ACHD equipment room has reached its capacity and is not able to handle the addition of future ITS communications equipment.

Since the ACHD TMC monitors and manages traffic on the arterials and the freeway, it has a unique opportunity to assist traffic flow in the case of major incidents. In 2001, the Incident Management Operations Manual was prepared for the Treasure Valley. This manual was provided to the emergency management agencies as a tool to assist in efficiently managing traffic incidents along the I-84 and I-184 corridors. Response plans are contained in the manual that include scripted procedures, detour routes, and proposed management strategies for several scenarios of freeway closures throughout the Treasure Valley.

In addition to the TMC activities, ACHD also conducts road maintenance activities on all Ada County roadways. ITS applications are used primarily to support winter road maintenance. Currently, the liquid anti-icing and sand trucks all have mirror mounted sensors that measure ground temperature, assisting the operators with the appropriate level of material application. The operations center is constantly monitoring the CCTV camera images throughout the Treasure Valley and the weather forecasts via the Internet and other media to understand current and potential future conditions. Remote RWIS stations are needed in the foothills to augment the monitoring and response activities.

### 2.10.5 Ada County Sheriff

The Ada County Sheriff's office operates one of the 911 call center and emergency dispatch facilities 24 hours a day seven days a week in the Treasure Valley. They dispatch fire (6 departments) and law enforcement (5 departments) for Ada County, as well as the Ada County EMS units. The center also dispatches helicopter services in some instances, activates flood sirens located in foothills, and coordinates with other agencies as necessary. They currently have 14 consoles to conduct operations and have a fiber optic communication feed from the ACHD TMC that transmits some of the live video camera images throughout the Treasure Valley into the dispatch center.

The Ada County Sheriff's office, working in coordination with other agencies, has deployed advanced technology to facilitate efficient and safe operations. These technologies include:

- Mobile Data Terminals linked to dispatch in all emergency response vehicles
- Automated vehicle location devices on all fire and EMS units (with plans to expand to law enforcement vehicles)
- WI-FI communications in some response units for report writing and data transmissions
- E-911 Phase II compliant throughout Treasure Valley to include landlines, cell phones and Voice over IP systems
- Automated text paging system linked to the Computer Aided Dispatch (CAD) system for emergency notification to specific responders

The 911 call center has 48 phone lines that receive approximately 40,000 calls per month on average, without any caller receiving a busy signal. Additionally, the center has direct communication with the Idaho State Police through an intercom system and soon the CAD data will be shared with the ISP dispatch center.

The Ada County Sheriff’s Office is in the process of updating the radio system from conventional UHF/VHF to 700 MHz that will be used by all agencies dispatched from the center. This new system will be completed in the fall of 2006 and will require up to 3 years to fully implement. This will include updating the mobile communication/command center and their backup dispatch center.
Future plans include expansion of technology applications to all emergency responder units, display of (filtered) dispatch logs on an Internet website, increase bandwidth (additional fiber optic cables) from ACHD TMC to be able to display more camera images potentially with off-hour control, and possibly expanding wireless communications capability to provide camera images to fire and law enforcement vehicles.

2.10.6 Ada County/City Disaster Services

The Ada County/City Disaster Services is collocated with the Ada County Sheriff’s office. They primarily perform coordination activities among the Ada County emergency responding agencies, however, they also operate an Emergency Operations Center (EOC). The EOC would be activated in a disaster and has facilities for key decision makers to meet and coordinate emergency response and disaster recovery activities.

2.10.7 Canyon County Sheriff

The Canyon County Sheriff’s office operates another 911 call and dispatch center 24 hours a day seven days a week in the Treasure Valley. They dispatch fire and police for several Canyon County cities, including the city of Caldwell. This Center currently has 6 consoles, with an immediate need for expansion.

2.10.8 City of Nampa Police

The city of Nampa Police Department operates a third 911 call and dispatch center 24 hours a day seven days a week. This center dispatches law enforcement, fire and emergency medical services within the city of Nampa. The Upper Deer Flat Fire Department is also dispatched from this center. They currently operate 4 consoles.

2.10.9 Bureau of Homeland Security

The Idaho Bureau of Homeland Security operates a statewide center at Gowen Field, and is interested in monitoring activities in the Treasure Valley. Currently, communication links are being established with Idaho State Police and the ACHD TMC to facilitate the sharing of information. Additionally, an Emergency Operations Center (EOC) exists within the center that could be activated in the event of a statewide emergency.

2.10.10 Valley Regional Transit

Valley Regional Transit (VRT) operates two dispatch/control centers in the Treasure Valley, one for Valleyride-Boise and one for Valleyride-Nampa. These centers are active any time buses are operating. Two centers are needed because of the distance between the two operations. They use one financial and operations management software: Fleetnet. VRT also operates Rideline, a call center and primary access point with the public (in a separate location from either of the dispatch centers). VRT has shown a strong interest in relocating their Rideline service in the new IROC facility.

2.10.11 Capital City Development Corporation

Capital City Development Corporation (CCDC) is the urban renewal agency for Boise, Idaho. CCDC facilitates the ongoing redevelopment of downtown Boise and its neighborhoods, ensuring high quality physical environments and a versatile, modern infrastructure, while supporting social well-being and long-term economic vitality.

This unique role is accomplished both independently and through collaborative partnerships with public agencies and private entities focusing on professional master planning, historic preservation, infrastructure and facility development, financial tools, public property management and community-wide advocacy and education.
Related to potential ITS applications, CCDC owns and operates several parking facilities in downtown Boise and is interested in more advanced approaches to monitor, manage, and provide information to the public about the availability of parking in each facility. If a motorist knows where parking is available prior to arriving downtown, it can reduce unnecessary driving and contribute to a more efficient transportation system. A detailed study is required to determine the most appropriate application of ITS technologies to support CCDC’s goals for parking management.

2.10.12 Universities

Boise State University (BSU) and the University of Idaho (UI) are both working closely with ACHD and ITD on several ITS projects and research opportunities, as follows.

1. Freeway Incident Detection and Arterial Systems Management for the I-84 Corridor (Joint BSU and UI, 2002)
   - Testing of 6 incident detection algorithms to determine which ones are suitable for the I-84 corridor within the Treasure Valley,
   - Development and testing of signal control strategies on arterials in conjunction with I-84 diversion route plans to improve traffic flow on parallel arterials during incidents,
   - Development of simulation models, Synchro & Corsim, to train professionals and students on TMC operations.

2. Boise State University Virtual Traffic Management Center (BSU, 2003)
   - Joint project between BSU and ACHD to link ACHD TMC to new BSU virtual TMC.
   - BSU installed 4 operator workstations + one supervisor workstation. Workstations have ACHD video feeds, ATMS software and traffic signal software interface.
   - BSU installed, 56” projection TV and 56” projection screen to view video feed and for presentations.

   - Evaluation of benefits from the Treasure Valley Incident Management Plan,
   - Evaluation of benefits from the installation of ITS devices on I-84,
   - Lessons learned by Treasure Valley agencies

   - BSU students performed before/after travel time runs on 13 downtown Boise arterials.

5. Modeling and Assessing Large Scale Surface Transportation Network Component Criticality (UI, 2006)
   - Identification of critical intersections, communications systems and power grids within the City of Boise, ID,
   - Analysis of network dependability and security in the presence of malicious attacks, failures or accidents.

UI and BSU staff have assisted ITD/ACHD in the selection of the Treasure Valley ATMS software and have served on several evaluation teams for ACHD and ITD projects. Additionally, UI staff participated on the ACHD Traffic Signal System Peer Review Team.
2.11 Communication Systems

As the transportation agencies in the Treasure Valley have expanded traffic signal systems and deployed greater numbers of ITS devices, the communications infrastructure to reach these field elements has grown. These expanding communications needs have been met almost entirely through the deployment of publicly owned infrastructure as opposed to leased bandwidth arrangements. This has benefited the ITS network significantly through greater flexibility relative to the dedication of the available bandwidth. The efforts to install communications infrastructure has followed the Communications Plan in the original Treasure Valley ITS Plan.

2.11.1 Twisted Pair Copper Wire and Spread Spectrum Radio

Traditional twisted pair copper wire cables, while still a significant element among communication resources is rapidly being replaced with fiber optic cables. Some new copper cabling continues to be installed where less intensive needs can be met through the lower cost associated with copper cable. In addition, spread spectrum radio provides a key means of quickly, and frequently temporarily, linking to more distant field elements. Figure 2-6 shows the network of twisted pair copper cable and the spread spectrum radio hardware in use to communicate with traffic signals and ITS devices in the area.

Given ACHD’s traffic signal management responsibilities and camera deployment approach, they naturally have had the greatest interest in deployment and management of communications infrastructure related to ITS. As Figure 2-6 illustrates, much of the copper cable in place is in Ada County. ACHD currently has a distributed network of twisted pair cable ranging in size from 6, 12, and 25 pair cables throughout the metropolitan area. This infrastructure was originally deployed to manage the traffic signal network.

The City of Nampa is planning to deploy spread spectrum radio links to connect five signals on 12th Avenue South in the near future.

2.11.2 Fiber Optic Cable

The increasing bandwidth needs have generated the expansion of all communications infrastructure, but none so rapidly as the fiber optic network. As more and further distant elements are connected the overall bandwidth need has rapidly increased. This increasing need is amplified by the demand for faster data transfer rates associated with modern control equipment and the desire by private sector partners to have access to the many camera images available through ACHD’s deployment of closed circuit cameras. This rate of increase in the needs is particularly well met by the capacity advantages of fiber optic cable technologies.

ACHD has been the most aggressive in deploying single mode fiber optic cable (approx. 95 miles installed) and has replaced all of their copper wire in the downtown Boise core with fiber. They are also aggressively deploying fiber and replacing copper interconnect to other signals through out the county. ACHD has a future plan to tie all signalized intersections into an Internet Protocol (IP) based Ethernet communications system.

Fiber optic communication links have been established between the ACHD TMC and ITD, Idaho State Police, Ada County Sheriff dispatch center, and media outlets (TV and radio). These links serve as an information sharing portal between agencies.

The City of Nampa has also deployed fiber (approx. 3 miles installed) to those interconnected signals that they control. While this is currently very limited, they plan to continue to deploy fiber to signals as funding is available.

Figure 2-7 shows the current fiber optic infrastructure reported by the Treasure Valley transportation agencies.
2.11.3 Other

The City of Nampa uses telephone dial up through their local telephone company to access the three interconnected groups of signals that they control from the signal technician’s office.

In addition, privately owned communications infrastructure is in place through out the Treasure Valley. While leased communication capacity is an option for public agencies deploying ITS equipment, important questions regarding the long term viability and security of this resource have not been adequately addressed for many agencies.
Figure 2-6 Treasure Valley Existing Copper & Spread Spectrum Radio Networks
Figure 2-7 Treasure Valley Existing Fiber Optic Communication Network
SECTION 3.0
TREASURE VALLEY NEEDS AND PRIORITY CORRIDORS

This section identifies the needs and functional requirements from an ITS perspective and provides a very general look at the transportation corridors where ITS deployments can most effectively address the needs. The Needs and Functional Requirements discussion establishes the foundation for the Treasure Valley ITS Architecture discussed in the next section. The Priority Corridors discussion and map provide a relationship between the needs on a general level and the transportation facilities where ITS applications can be most effective in conjunction with current transportation planning.

3.1 Needs and Functional Requirements

Through meetings and discussions with the various stakeholder agencies and review of other planning documentation the ITS needs for the region have been identified. The needs are shown in the tables below in the identified ITS categories. Many are shared by more than one agency, while some are unique to a single agency. Similarly, some are more pressing than others and while this urgency is not captured in the tables it was discussed during the planning and is reflected to some degree in the high level prioritization of corridors in the Subsection 3.2 and in the prioritization of projects that appear later in the plan. The ITS needs do not necessarily apply throughout the valley, but rather are present at least somewhere in the region and are important enough to be independently listed here.

<table>
<thead>
<tr>
<th>ITS Category</th>
<th>Needs &amp; Functional Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freeway Management Systems</td>
<td>Congestion Mitigation</td>
</tr>
<tr>
<td>Vehicle/speed detection systems</td>
<td>- Freeway / Arterial integration</td>
</tr>
<tr>
<td>Video incident detection systems</td>
<td>- Ramp metering</td>
</tr>
<tr>
<td>Ramp metering</td>
<td>- Special lane assignment</td>
</tr>
<tr>
<td>Dynamic message signing</td>
<td>- Traveler information</td>
</tr>
<tr>
<td>Highway advisory radio</td>
<td>Traffic Flow Monitoring</td>
</tr>
<tr>
<td>Traffic management systems/center signal coordination</td>
<td>- Expanded video surveillance</td>
</tr>
<tr>
<td></td>
<td>- Speed detection monitoring</td>
</tr>
<tr>
<td></td>
<td>- Detection at more signals</td>
</tr>
<tr>
<td></td>
<td>- Ramp Metering</td>
</tr>
<tr>
<td></td>
<td>Incident Management</td>
</tr>
<tr>
<td></td>
<td>- Revisit incident management planning</td>
</tr>
<tr>
<td></td>
<td>- Video surveillance and incident verification</td>
</tr>
<tr>
<td></td>
<td>- Diversion routing implementation</td>
</tr>
<tr>
<td></td>
<td>- Center-to-Center communications and data sharing</td>
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<tr>
<td></td>
<td>Motorist Information</td>
</tr>
<tr>
<td></td>
<td>- 511, Internet, Kiosks, Media, DMS</td>
</tr>
<tr>
<td></td>
<td>- In-Vehicle Motorist Information</td>
</tr>
<tr>
<td>ITS Category</td>
<td>Needs &amp; Functional Requirements</td>
</tr>
<tr>
<td>----------------------------------</td>
<td>---------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Traffic Signal Control Systems</td>
<td><strong>Optimize System</strong></td>
</tr>
<tr>
<td></td>
<td>➢ <strong>Synchronize</strong></td>
</tr>
<tr>
<td></td>
<td>· Freeway / Arterial interaction</td>
</tr>
<tr>
<td></td>
<td>· Communication between intersections / masters</td>
</tr>
<tr>
<td></td>
<td>· Communication with Traffic Management Center (TMC)</td>
</tr>
<tr>
<td></td>
<td>· More frequent timing plan reevaluation</td>
</tr>
<tr>
<td></td>
<td>· Detection upgrades (video)</td>
</tr>
<tr>
<td></td>
<td>· Controller upgrades</td>
</tr>
<tr>
<td></td>
<td>· Detour route plans</td>
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<tr>
<td></td>
<td><strong>Tie to Centralized Control</strong></td>
</tr>
<tr>
<td></td>
<td>➢ <strong>Priority routes</strong></td>
</tr>
<tr>
<td></td>
<td>· Coordinated with ITS priority corridors</td>
</tr>
<tr>
<td></td>
<td>➢ <strong>Preemption (emergency/transit)</strong></td>
</tr>
<tr>
<td></td>
<td>· Emergency preemption / transit priority</td>
</tr>
<tr>
<td></td>
<td>· Incident management emphasis</td>
</tr>
<tr>
<td></td>
<td>➢ <strong>Transit</strong></td>
</tr>
<tr>
<td></td>
<td>· Transit priority</td>
</tr>
<tr>
<td></td>
<td>· Queue jumps</td>
</tr>
<tr>
<td></td>
<td><strong>Monitoring and detection (video, loops)</strong></td>
</tr>
<tr>
<td></td>
<td>➢ <strong>System performance measurement</strong></td>
</tr>
<tr>
<td></td>
<td>· Local &amp; system detectors</td>
</tr>
<tr>
<td></td>
<td>· Volume / System classification detection</td>
</tr>
<tr>
<td></td>
<td>· System evaluation</td>
</tr>
<tr>
<td></td>
<td>· System diagnostics</td>
</tr>
<tr>
<td></td>
<td>· System reliability</td>
</tr>
<tr>
<td></td>
<td><strong>Coordination Between Different Agencies/Systems</strong></td>
</tr>
<tr>
<td></td>
<td>➢ <strong>Compatibility</strong></td>
</tr>
<tr>
<td></td>
<td>· Shared Information</td>
</tr>
<tr>
<td></td>
<td>· National Transportation Communications for ITS Protocol (NTCIP)</td>
</tr>
<tr>
<td></td>
<td>· Communication between various agency staff</td>
</tr>
<tr>
<td></td>
<td>· Signal communication between various cities</td>
</tr>
<tr>
<td></td>
<td>· Transition greater levels of control and maintenance to local agencies</td>
</tr>
<tr>
<td></td>
<td><strong>Enforcement</strong></td>
</tr>
<tr>
<td></td>
<td>· Red light running enforcement</td>
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<tr>
<td></td>
<td><strong>Highway-Rail Intersection</strong></td>
</tr>
<tr>
<td></td>
<td>· Safety - camera enforcement, four-quad gates detection</td>
</tr>
</tbody>
</table>
### Table 3-3
**Needs & Functional Requirements: Transit Management System**

<table>
<thead>
<tr>
<th>ITS Category</th>
<th>Needs &amp; Functional Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Transit Management Systems</strong></td>
<td></td>
</tr>
<tr>
<td>Public transportation management</td>
<td></td>
</tr>
<tr>
<td>In-route transit information</td>
<td></td>
</tr>
<tr>
<td>Personalized public transit</td>
<td></td>
</tr>
<tr>
<td>Public travel safety</td>
<td></td>
</tr>
<tr>
<td>Traveler service information</td>
<td></td>
</tr>
<tr>
<td>Ride matching and reservations</td>
<td></td>
</tr>
<tr>
<td><strong>Ridership Data Collection</strong></td>
<td></td>
</tr>
<tr>
<td>· Automated passenger counting</td>
<td></td>
</tr>
<tr>
<td>· Automatic fare collection</td>
<td></td>
</tr>
<tr>
<td><strong>Fleet Management</strong></td>
<td></td>
</tr>
<tr>
<td>· Tracking system (management, information, etc.)</td>
<td></td>
</tr>
<tr>
<td><strong>Real-Time Traffic Management</strong></td>
<td></td>
</tr>
<tr>
<td>· Real-time schedule reporting</td>
<td></td>
</tr>
<tr>
<td>· Automatic Vehicle Location (AVL)</td>
<td></td>
</tr>
<tr>
<td>· Automatic Vehicle Identification (AVI)</td>
<td></td>
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<tr>
<td>· Advanced Traveler Information System (ATIS)</td>
<td></td>
</tr>
<tr>
<td><strong>Incident Notification</strong></td>
<td></td>
</tr>
<tr>
<td>· In-vehicle guidance system, Global Positioning System (GPS)</td>
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<tr>
<td><strong>Tie to Central Control</strong></td>
<td></td>
</tr>
<tr>
<td>· Communication with traffic management</td>
<td></td>
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<tr>
<td>· Advanced rerouting strategies/systems</td>
<td></td>
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<tr>
<td>· Road weather information</td>
<td></td>
</tr>
<tr>
<td><strong>Communication between Buses &amp; Dispatch</strong></td>
<td></td>
</tr>
<tr>
<td>· Communication between various transit systems (Canyon County and Boise City) with TMC</td>
<td></td>
</tr>
<tr>
<td>· Dynamic route assignment</td>
<td></td>
</tr>
<tr>
<td>· Scheduling coordination between different agencies</td>
<td></td>
</tr>
<tr>
<td>· GPS data for AVL</td>
<td></td>
</tr>
<tr>
<td><strong>Scheduling Dispatch</strong></td>
<td></td>
</tr>
<tr>
<td>· Real-time schedule reporting</td>
<td></td>
</tr>
<tr>
<td>· Kiosks at bus stations</td>
<td></td>
</tr>
<tr>
<td>· Traveler Information System</td>
<td></td>
</tr>
<tr>
<td><strong>Signal Priority</strong></td>
<td></td>
</tr>
<tr>
<td>· Partial / full priority</td>
<td></td>
</tr>
<tr>
<td>· Priority corridors</td>
<td></td>
</tr>
<tr>
<td>· Queue jumps</td>
<td></td>
</tr>
<tr>
<td><strong>Geometric Enhancements</strong></td>
<td></td>
</tr>
<tr>
<td>· Bus bays</td>
<td></td>
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<tr>
<td>· Dedicated bus lanes and Guide-ways</td>
<td></td>
</tr>
<tr>
<td><strong>Traffic Operations Enhancements</strong></td>
<td></td>
</tr>
<tr>
<td>· Signal timing adjustment</td>
<td></td>
</tr>
<tr>
<td>· Traffic signal equipment upgrade</td>
<td></td>
</tr>
<tr>
<td>ITS Category</td>
<td>Needs &amp; Functional Requirements</td>
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</tr>
<tr>
<td>Incident Management</td>
<td>Advanced Motorist Notification</td>
</tr>
<tr>
<td></td>
<td>· Incident detection (video, detectors, ...)</td>
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<tr>
<td></td>
<td>· Automated crash notifications (e.g. OnStar)</td>
</tr>
<tr>
<td></td>
<td>· Improvements to E-911</td>
</tr>
<tr>
<td></td>
<td>Early Detection Notification</td>
</tr>
<tr>
<td></td>
<td>➢ Video confirmation</td>
</tr>
<tr>
<td></td>
<td>· Comprehensive surveillance</td>
</tr>
<tr>
<td></td>
<td>· Communication between CCTV &amp; TMC</td>
</tr>
<tr>
<td></td>
<td>· Audio confirmation (emergency telecom)</td>
</tr>
<tr>
<td></td>
<td>➢ Response plan</td>
</tr>
<tr>
<td></td>
<td>· Revisit/update Incident Management Plan</td>
</tr>
<tr>
<td></td>
<td>· Coordination between involved agencies (i.e. police, fire, traffic, etc.)</td>
</tr>
<tr>
<td></td>
<td>· Special signal timing plans</td>
</tr>
<tr>
<td></td>
<td>· Special response plans</td>
</tr>
<tr>
<td></td>
<td>Agency Communication &amp; Integration</td>
</tr>
<tr>
<td></td>
<td>· Type of communication media between agencies</td>
</tr>
<tr>
<td></td>
<td>· Operations or incident level data sharing</td>
</tr>
<tr>
<td></td>
<td>· Emergency response vehicle AVI/AVL</td>
</tr>
<tr>
<td></td>
<td>· Center-to-Center communications and data sharing</td>
</tr>
<tr>
<td></td>
<td>Tie to Central Control</td>
</tr>
<tr>
<td></td>
<td>➢ Alternative routes</td>
</tr>
<tr>
<td></td>
<td>· DMS</td>
</tr>
<tr>
<td></td>
<td>· ATIS</td>
</tr>
<tr>
<td></td>
<td>· Signal timing adjustments</td>
</tr>
<tr>
<td></td>
<td>· Automated rerouting / diversion routing</td>
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<td></td>
<td>· Smart Corridor</td>
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<tr>
<td></td>
<td>Speedy Incident Clearance/Removal</td>
</tr>
<tr>
<td></td>
<td>· Public/Private partnership in CCTV installations</td>
</tr>
<tr>
<td></td>
<td>· Incident detection (video &amp; audio)</td>
</tr>
<tr>
<td></td>
<td>· Advanced incident data collection</td>
</tr>
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</table>
Table 3-5
Needs & Functional Requirements: Regional Traveler Information Systems

<table>
<thead>
<tr>
<th>ITS Category</th>
<th>Needs &amp; Functional Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regional Traveler Information Systems</td>
<td>Detection</td>
</tr>
<tr>
<td>Pre-trip travel information</td>
<td>· Real time detection of incidents and events</td>
</tr>
<tr>
<td>Route guidance</td>
<td>Incident Notification</td>
</tr>
<tr>
<td>Traffic information</td>
<td>· 511, internet, DMS, media</td>
</tr>
<tr>
<td>Tourist information systems</td>
<td>· Information push via pagers and cell phones</td>
</tr>
<tr>
<td></td>
<td>· Route guidance (in-vehicle guidance systems)</td>
</tr>
<tr>
<td></td>
<td>· Extend to provide information on local roads</td>
</tr>
<tr>
<td>Special Event Routing</td>
<td>Special Event Routing</td>
</tr>
<tr>
<td></td>
<td>· Signal timing adjustments</td>
</tr>
<tr>
<td></td>
<td>· Coordination between involved agencies</td>
</tr>
<tr>
<td></td>
<td>· 511, internet, DMS, media</td>
</tr>
<tr>
<td></td>
<td>· Information push via pagers and cell phones</td>
</tr>
<tr>
<td></td>
<td>· Extend to provide information on local roads</td>
</tr>
<tr>
<td>Real Time Traffic Conditions</td>
<td>Real Time Traffic Conditions</td>
</tr>
<tr>
<td></td>
<td>· Coordination with media</td>
</tr>
<tr>
<td></td>
<td>· Provide video feeds to media</td>
</tr>
<tr>
<td></td>
<td>· Traveler advisory recommendations</td>
</tr>
<tr>
<td></td>
<td>· Accurate information</td>
</tr>
<tr>
<td></td>
<td>· 511, internet, DMS, media</td>
</tr>
<tr>
<td></td>
<td>· Information push via pagers and cell phones</td>
</tr>
<tr>
<td></td>
<td>· Extend to provide information on local roads</td>
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<tr>
<td>Tie to Central Control</td>
<td>Tie to Central Control</td>
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<tr>
<td></td>
<td>· Communication media to TMC</td>
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<tr>
<td></td>
<td>· Speed detection</td>
</tr>
<tr>
<td></td>
<td>· 700 MHz radio</td>
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<tr>
<td></td>
<td>· Center-to-Center communications</td>
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<tr>
<td>Tourist Information</td>
<td>Tourist Information</td>
</tr>
<tr>
<td></td>
<td>· 511, internet</td>
</tr>
<tr>
<td></td>
<td>· Tourist information centers</td>
</tr>
<tr>
<td></td>
<td>· Kiosks</td>
</tr>
<tr>
<td>Real Time Transit Information</td>
<td>Real Time Transit Information</td>
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<tr>
<td></td>
<td>· Accurate information dissemination techniques</td>
</tr>
<tr>
<td></td>
<td>· AVL/AVI</td>
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</table>
Table 3-6
Needs & Functional Requirements: Emergency Management Systems

<table>
<thead>
<tr>
<th>ITS Category</th>
<th>Needs &amp; Functional Requirements</th>
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</thead>
<tbody>
<tr>
<td><strong>Emergency Management Systems</strong></td>
<td></td>
</tr>
<tr>
<td>Emergency notification and personal security</td>
<td></td>
</tr>
<tr>
<td>Emergency vehicle management</td>
<td></td>
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<tr>
<td>Mayday systems</td>
<td></td>
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<tr>
<td>Signal Preemption</td>
<td></td>
</tr>
<tr>
<td>➢ Expediting response</td>
<td></td>
</tr>
<tr>
<td>· Extension of green or early start of green time through interconnect</td>
<td></td>
</tr>
<tr>
<td>➢ Safety issue</td>
<td></td>
</tr>
<tr>
<td>· Enforcement</td>
<td></td>
</tr>
<tr>
<td>Efficient Allocation of Resources</td>
<td></td>
</tr>
<tr>
<td>· Resource / asset database</td>
<td></td>
</tr>
<tr>
<td>· AVI/AVL</td>
<td></td>
</tr>
<tr>
<td>· Traffic management based emergency response vehicle route guidance</td>
<td></td>
</tr>
<tr>
<td>· Data access tools in emergency response vehicles (MDT/MDC)</td>
<td></td>
</tr>
<tr>
<td>· Interagency vehicle to vehicle communications</td>
<td></td>
</tr>
<tr>
<td>· Automated text paging to select responders</td>
<td></td>
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<tr>
<td>Expansion of Incident Response</td>
<td></td>
</tr>
<tr>
<td>· Mobile/remote command capabilities</td>
<td></td>
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<tr>
<td>· Tow truck patrols during critical periods</td>
<td></td>
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<tr>
<td>· Expanded service patrols</td>
<td></td>
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<tr>
<td>Tie to Central Control</td>
<td></td>
</tr>
<tr>
<td>· Center-to-Center communications and data sharing (control of field elements during TMC off hours)</td>
<td></td>
</tr>
<tr>
<td>· High speed communications to emergency response vehicles</td>
<td></td>
</tr>
<tr>
<td>· Communication media</td>
<td></td>
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<tr>
<td>Emergency Medical Services (EMS)</td>
<td></td>
</tr>
<tr>
<td>· Telemedicine</td>
<td></td>
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<tr>
<td>· AVI/AVL</td>
<td></td>
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<tr>
<td>· Integration with TMC</td>
<td></td>
</tr>
<tr>
<td>· Facilitation of signal preemption systems</td>
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</tbody>
</table>
Table 3-7
Needs & Functional Requirements: Parking Management

<table>
<thead>
<tr>
<th>ITS Category</th>
<th>Needs &amp; Functional Requirements</th>
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</thead>
<tbody>
<tr>
<td><strong>Parking Management</strong></td>
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<tr>
<td>Parking Management Systems/Center</td>
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<tr>
<td>Enforcement</td>
<td></td>
</tr>
<tr>
<td>· Parking regulations</td>
<td></td>
</tr>
<tr>
<td>· Safety</td>
<td></td>
</tr>
<tr>
<td>· CCTV</td>
<td></td>
</tr>
<tr>
<td>Monitoring</td>
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<td>· In/Out control</td>
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<td>· Parking availability</td>
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<tr>
<td>Motorist Information</td>
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<td>· 511, internet, DMS, media</td>
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<td>· Support in-vehicle technologies</td>
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<td>Management Center</td>
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<td>· Maintenance</td>
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<td>· Communication</td>
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<td>· Staffing</td>
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Table 3-8
Needs & Functional Requirements: Operations and Maintenance

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<thead>
<tr>
<th>ITS Category</th>
<th>Needs &amp; Functional Requirements</th>
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<tbody>
<tr>
<td><strong>Operations and Maintenance</strong></td>
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<tr>
<td>Maintenance Vehicle Fleet Management</td>
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<td>Roadway Management</td>
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<td>Work Zone Management and Safety</td>
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<td>Roadway Maintenance Conditions and Work Plan</td>
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<td>Dissemination</td>
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<td>Road Weather Information Systems</td>
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<tr>
<td>· Additional sites to support local winter road maintenance</td>
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<tr>
<td>· Data integration with TMC</td>
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<tr>
<td>Motorist Information</td>
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<td>· Staffing</td>
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3.2 Priority Corridors

The Treasure Valley ITS Priority corridors were established during the 1999 ITS planning effort. These were routes that were experiencing significant traffic and growth and were frequently the primary commuter corridors in the valley. The process of identifying the ITS priority corridors was conducted to closely reflect the existing planning documents and the transportation planning underway at the time.

As part of this ITS plan update, ITS priority corridors were revisited and revised to reflect growth in the community and changes in the traffic patterns. The starting point for this effort was to review the priority corridors from the 1999 plan and then to compare that with improvements implemented since that time, changes in land use and traffic growth, current transportation construction projects, as well as planning efforts currently being conducted. In addition, important input from several of the stakeholders contributed to the development of the current ITS priority corridors. The Treasure Valley ITS priority corridors are shown in Figure 3-1.

The concept of priority corridors is more analogous to needs than to projects and is intended to provide an overview of the network where ITS deployments are likely to have the greatest beneficial impact. The deployments considered in the analysis to determine this include the full range of technologies. Identification of a route as a priority corridor is not an indication of any specific planned deployment but rather was a means of setting the stage for consideration of technologies as the planning process progressed. It is not intended that a priority corridor designation guarantees ITS deployment nor that lack of a designation prevents it.

The primary ITS priority corridors identified are Interstate 84 and 184 due to their traffic handling function, their use as key commuter routes, and the effectiveness that ITS deployments can have on improving traffic flow and emergency response. In addition, those routes that provide alternates to the I-84 and I-184 were considered with strong emphasis on inclusion or upgrading. These are key corridors not only because they supplement the commuter movement seen on the interstate, but also because they can provide alternate routing during incidents that block or slow traffic on the interstates. With ITS deployments in place and integrated along these routes the range and effectiveness of response by system managers during events can be vastly improved.

Beyond the focus on the interstate routes and associated alternates, the principle arterials throughout the valley, particularly those where traffic volumes are high and trends indicate future increases, were considered for inclusion as ITS priority corridors. This included proposed improvements such as the Lake Hazel/Gowen Road realignment and the I-84/Ten Mile Road interchange that will provide key links in the transportation network.

3.2.1 Time Frames

The priority corridors are designated as either short (0 to 5 years), medium (6 to 10 years), or long (beyond 10 years) term. The designations consider the understanding of current transportation planning, existing ITS focus, and connectivity to other key routes.

These time frames are intended to provide a general level of relative importance of the ITS deployments for the corridor as opposed to a strictly prescribed window for deployment. ITS deployments recommended for a corridor would ideally take place during the indicated time frame in order to reflect the identified needs; however, many additional constraints may alter the timing and extent of the technologies to be implemented. Also, an ideal deployment scenario will likely outpace available funding, forcing many deployments to occur in time frames beyond those indicated.
SECTION 4.0

TREASURE VALLEY REGIONAL ITS ARCHITECTURE

This section addresses the ITS Architecture for the Treasure Valley. It provides an explanation of the architecture development including identification of market packages and operational concepts, depictions of existing and proposed conceptual architectures, and an approach toward architecture maintenance.

4.1 Introduction To Architecture

An ITS architecture guides the efficient integration of ITS. It reflects the contributions of a broad cross-section of the transportation community (transportation practitioners, systems engineers, system developers, technology specialists, consultants, etc.). The architecture defines:

- The functions to be performed by ITS;
- The physical entities where the functions will be performed;
- The information flows and data flows that connect the functions and physical subsystems together into an integrated system.
- The roles and responsibilities of the ITS stakeholders;
- The technical goals to avoid duplication of investments in infrastructure; and
- The opportunities for integration and data sharing.

The Architecture also provides a means for tracking the progress of ITS development in the region. The completion of this planning effort is not the end of the architecture development; the architecture is flexible and meant to continue to adapt to reflect the ITS deployments and plans in the Treasure Valley.

4.1.1 USDOT Policy

The United States Department of Transportation (USDOT) published the Federal Highway Administration (FHWA) Final Rule and FTA Policy in 2001. Within the Rule and Policy is a requirement that ITS projects funded through the highway trust fund conform to the National ITS Architecture and its standards. The purpose of the rule is to ensure interoperability of ITS across regions, as well as reducing the cost of ITS deployment by creating common formats and protocols for data exchange.

Because a national or statewide architecture is unlikely to provide adequate detail for local projects, the Rule/Policy requires that regional ITS architectures be developed using the National ITS Architecture as a baseline. The regional architecture must address local issues and needs. A region can be a metropolitan area, state, multi-state or corridor.

4.1.2 Regional ITS Architecture

The Treasure Valley ITS Architecture is a regional architecture covering Ada and portions of Canyon Counties in Southwestern Idaho. As required by the Federal Highway Administration (FHWA) Rule/Policy, it uses the National ITS Architecture as its basis to ensure consistency with the Idaho Statewide ITS Architecture and District 3 ITS Architecture.

The regional architecture is a tool not only for planning, but also implementation. It documents the ITS that stakeholders wish to deploy in the short, medium and long-term timeframes. That documentation allows for the "mainstreaming" of ITS, meaning that the individual projects can be adopted in funding plans and in regional transportation plans. The architecture ensures efficient implementation by describing the ITS resources that are available. New ITS can be implemented with the opportunity to integrate with existing and planned ITS.
4.1.3 Architecture Elements

The National ITS Architecture contains many different concepts and is rich in transportation industry terminology and acronyms that describe and depict integrated systems. One of the strengths of National ITS Architecture is the introduction of a consistent "language" that can be spoken by transportation professionals nationally, to assure that everyone is "on the same page" with systems implementation, integration, and operation.

Figure 4-1 is a high level depiction of the world of ITS according to the National ITS Architecture, version 5.0. The diagram is frequently called the "Sausage Diagram" because of the oblong bubbles that link the various subsystems. The diagram illustrates the four types of ITS Subsystems: Travelers, Centers, Vehicles and Field. The oblong bubbles between the various subsystem types represent the communications media that is typically used to connect the various subsystems. Subsystems and information flows are described in more detail in the Market Packages section of this report.

4.2 Treasure Valley ITS Architecture History

Prior to the previous ITS planning effort several Treasure Valley community leaders participated in a scanning tour visiting other cities where ITS technologies have been implemented to improve transportation management. The scanning tour generated heightened interest in advancing intelligent transportation systems and in planning for their deployment. This then led to the development of the 1999 Treasure Valley ITS Plan, which included a detailed regional ITS architecture.
The original Treasure Valley ITS architecture was developed using the FHWA publication *Regional ITS Architecture and Project Plan* as a guide. In addition, this original regional architecture was developed in conformance with Version 2.0 of the National ITS Architecture by following the associated guidance and instructions.

The stakeholders that participated in the early planning, many of whom had also participated in the scanning tour, represented the range of government agencies that were responsible for planning and management of the transportation infrastructure. In addition, emergency service agencies due to their uniquely critical use of the transportation system participated as stakeholders. While most of the original stakeholders participated in this plan and architecture update, some have experienced significant changes. For instance, the Ada Planning Association, the sponsoring agency for the 1999 plan, has transitioned to the Community Planning Association (COMPASS) and now serves as the planning organization for the entire Treasure Valley including that portion in Canyon County.

The first step in the development of the 1999 regional ITS Architecture was to understand the existing conditions and document them in a format that was consistent with systems engineering and allowed for addition of planned deployments. This existing architecture from the 1999 plan is shown in Figure 4-2.

The ITS deployments that were in place during the 1999 architecture development and those that were planned were organized within categories identified in the Metropolitan ITS Infrastructure Elements in the USDOT literature at the time. The categories are listed below:

- Traffic Signal Control System
- Freeway Management System
- Transit Management System
- Incident Management
- Regional Traveler Information System
- Emissions Mitigation
- Emergency Management Systems
- Electronic Payment Systems
- Commercial Vehicle Operation
- Parking Management
The improvements identified during the planning were then categorized by subsystem and user services which were traced to market packages. This effort incorporated 29 of the then 60 ITS market packages that made up the National ITS Architecture. Several alternative draft ITS architectures were then presented that varied in the degree to which ITD and ACHD would share TMC facilities and communications infrastructure.

The needed architecture flows were then identified based on the information sharing needs to support the planned ITS market packages. A recommended architecture was then developed from among the alternatives to best meet the needs and requirements associated with the planned systems. This recommended architecture was then adopted as part of the 1999 Treasure Valley ITS Plan and is shown in Figure 4-3.

This approach allowed for tailoring and expansion of the regional ITS architecture as the Treasure Valley systems and the National ITS Architecture evolved. It specifically allowed for the following issues:

- Long Term expansion
- Technology expansion
- Redundancy/backup
- Information access by other agencies
- Architecture updates
4.3 Market Packages

Market Packages are comprised of one or more subsystems. They are defined by their functions, which usually directly address regional needs. For example, a Market Package called “Network Surveillance” provides the function of monitoring traffic flows and incidents on the transportation network, and addresses several Treasure Valley needs including improved incident detection and comprehensive surveillance.

Market Packages are the underlying deployment mechanism for implementing the various Subsystems found in the National ITS Architecture sausage diagram.

Once a region has identified specific ITS needs, Market Packages that correlate most directly to the required services can be pulled out of the National ITS Architecture to serve as a beginning point for discussion of project deployment. Market Packages are then tailored to fit, separately or in combination, real world local transportation problems and needs identified during the ITS planning process.

Key items contained within Market Packages are:

1. **Subsystems** and **Terminators** that the regional stakeholders can identify or map to local systems.
2. **Information Flows** that go between systems and show the types of information that will be exchanged between Stakeholders’ systems.
Subsystems & Terminators – Subsystems are a cohesive set of functional definitions with required interfaces to other Subsystems. Subsystems are defined functionally, not physically. Subsystems as defined by the National ITS Architecture are typically related to transportation management or information processing. The functions associated with a Terminator, unlike those of the Subsystems, are not defined by the transportation industry. An example of a Terminator is a banking institution that may be utilized during the purchase of fare cards for transit. The banking institution subscribes to its own industry standards, but these standards and processes are critical to fare card payment, toll collection and other services provided in a region. Examples of Subsystems could include the following:

- A regional implementation may include a single physical center that co-locates the capabilities of several Subsystems. An example is the IROC planned in the Treasure Valley. A single facility may be identified or “mapped to” numerous Subsystems or functionalities. In this example, functions might include traffic management, emergency management, archived data management, transit management and information service provider.
- On the other hand, a single Subsystem may be replicated in many different physical centers. An example may be Maintenance and Construction Management, which may take place at one or more ITD maintenance sheds as well as county and city facilities.

Terminators are on the outside of what a region defines as transportation, but are frequently used by transportation to accomplish a mission or perform specific functions. Examples of Terminators could include the following:

- Weather services, such as the National Weather Service, may be used to determine if weather-related problems are going to impact traffic. These weather services are called Terminators because the transportation industry does not define their functions or how that information will be provided, it just uses the information. It is a “take it or leave it” arrangement that makes weather services a commonly used Terminator for many stakeholders.
- A computer user might access traveler information from an ACHD or ITD web site to view road and weather conditions, camera images or maintenance and construction information. Again, the computer user does not define how information will be provided, they are simply end users of it.

Information Flows – Information flows are defined as the information and data exchange between and among various Stakeholders systems that have been mapped to Subsystems and/or Terminators. Information Flows allow for coordinated system operation by following pre-defined interfaces between Subsystems, which may be deployed by different procuring and operating sectors.

Examples of Information Flows could include the following:

- This example cites two complementary information flows: “signal control data” and “signal control status.” The “signal control data” information flow starts at the Traffic Management Subsystem (the traffic signal control system) and flows to the Roadway Subsystem (the traffic signal controller in the field). “Signal control data” is information used to configure and control traffic signal systems. The Roadway Subsystem now has the instructions necessary to control the signals. In response, the Roadway Subsystem returns the “signal control status” information flow to the Traffic Management Subsystem. “Signal control status” is the status of surface street signal controls. Similarly, the Traffic Management Subsystem then has confirmation that the Roadway Subsystem is controlling the signals per the instructions.
- A similar example could be “environmental sensors control” from a Maintenance and Construction Management Subsystem to an environmental sensor, such as a Road Weather Information System sensor in the field to configure and control it. This allows for remote control of the sensor from the center and transfer of information from the sensor to the center.
Market Packages bring together elements that must work together to deliver a given transportation service as well as the information flows between Subsystems inside a region and those that connect them to other important external systems. In other words, Market Packages identify the pieces of the Physical Architecture that are required to implement a particular transportation service.

To provide a more detailed visual understanding of a Market Package, Figure 4-4 shows a traffic management Market Package. Only the most salient elements from the Architecture definition (e.g., directly involved Subsystems, system Terminators, and the highest level Information Flows) are depicted in the graphic to ensure clarity.

In Version 5.1 of the National ITS Architecture there are 85 Market Packages, in eight groupings. Table 4-1 contains a summary listing of all current National ITS Architecture Market Packages, by group. Each of the Market Packages is described in the National ITS Architecture documentation and has an accompanying diagram. To further review the National ITS Architecture Market Package descriptions and diagrams, please refer to http://itsarch.iteris.com/itsarch/ and click on Market Packages.
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<th>ARCHIVED DATA MANAGEMENT</th>
<th>VEHICLE SAFETY</th>
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<td>Advanced Vehicle Safety Systems (AVSS)</td>
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<td>AD1 ITS Data Mart</td>
<td>AVSS01 Vehicle Safety Monitoring</td>
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<td>AD2 ITS Data Warehouse</td>
<td>AVSS02 Driver Safety Monitoring</td>
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<td>AD3 ITS Virtual Data Warehouse</td>
<td>AVSS03 Longitudinal Safety Warning</td>
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<td>AVSS04 Lateral Safety Warning</td>
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**PUBLIC TRANSPORTATION**

| Advanced Public Transportation Systems (APTS) | AVSS05 Intersection Safety Warning                 |
| APTS1 Transit Vehicle Tracking                | AVSS06 Pre-Crash Restraint Deployment              |
| APTS2 Transit Fixed-Route Operations          | AVSS07 Driver Visibility Improvement               |
| APTS3 Demand Response Transit Operations       | AVSS08 Advanced Vehicle Longitudinal Control       |
| APTS4 Transit Passenger and Fare Management   | AVSS09 Advanced Vehicle Lateral Control            |
| APTS5 Transit Security                        | AVSS10 Intersection Collision Avoidance            |
| APTS6 Transit Maintenance                      | AVSS11 Automated Highway System                    |
| APTS7 Multi-modal Coordination                 |                                                    |
| APTS8 Transit Traveler Information             |                                                    |

**TRAVERSTER INFORMATION**

| Advanced Traveler Information Systems (ATIS)  |                                                    |
| ATIS1 Broadcast Traveler Information          |                                                    |
| ATIS2 Interactive Traveler Information        |                                                    |
| ATIS3 Autonomous Route Guidance              |                                                    |
| ATIS4 Dynamic Route Guidance                 |                                                    |
| ATIS5 ISP Based Route Guidance               |                                                    |
| ATIS6 Integrated Transportation Mgmt/Route Guidance |                                |
| ATIS7 Yellow Pages and Reservation            |                                                    |
| ATIS8 Dynamic Ridesharing                    |                                                    |
| ATIS9 In Vehicle Signing                      |                                                    |

**TRAFFIC MANAGEMENT**

| Advanced Transportation Management Systems (ATMS) |                                                    |
| ATMS01 Network Surveillance                      |                                                    |
| ATMS02 Probe Surveillance                        |                                                    |
| ATMS03 Surface Street Control                    |                                                    |
| ATMS04 Freeway Control                           |                                                    |
| ATMS05 HOV Lane Management                       |                                                    |
| ATMS06 Traffic Information Dissemination         |                                                    |
| ATMS07 Regional Traffic Control                  |                                                    |
| ATMS08 Traffic Incident Management System        |                                                    |
| ATMS09 Traffic Forecast and Demand Management   |                                                    |
| ATMS10 Electronic Toll Collection                |                                                    |
| ATMS11 Emissions Monitoring and Management       |                                                    |
| ATMS12 Virtual TMC and Smart Probe Data          |                                                    |
| ATMS13 Standard Railroad Grade Crossing          |                                                    |
| ATMS14 Advanced Railroad Grade Crossing          |                                                    |
| ATMS15 Railroad Operations Coordination          |                                                    |
| ATMS16 Parking Facility Management               |                                                    |
| ATMS17 Regional Parking Management               |                                                    |
| ATMS18 Reversible Lane Management                |                                                    |
| ATMS19 Speed Monitoring                          |                                                    |
| ATMS20 Drawbridge Management                     |                                                    |
| ATMS21 Roadway Closure Management                |                                                    |

**EMERGENCY MANAGEMENT**

| Emergency Management (EM)                      |                                                    |
| EM01 Emergency Call-Taking and Dispatch         |                                                    |
| EM02 Emergency Routing                          |                                                    |
| EM03 Mayday Support                             |                                                    |
| EM04 Roadway Service Patrols                    |                                                    |
| EM05 Transportation Infrastructure Protection   |                                                    |
| EM06 Wide-Area Alert                            |                                                    |
| EM07 Early Warning System                       |                                                    |
| EM08 Disaster Response and Recovery             |                                                    |
| EM09 Evacuation and Reentry Management          |                                                    |
| EM10 Disaster Traveler Information               |                                                    |

**MAINTENANCE & CONSTRUCTION OPERATIONS**

| Maintenance & Construction Operations (MCO)     |                                                    |
| MC01 Maintenance & Construction Vehicle & Equip. Tracking |                                |
| MC02 Maintenance and Construction Vehicle Maintenance |                                      |
| MC03 Road Weather Data Collection               |                                                    |
| MC04 Weather Information Processing and Distribution |                                    |
| MC05 Roadway Automated Treatment                |                                                    |
| MC06 Winter Maintenance                         |                                                    |
| MC07 Roadway Maintenance and Construction        |                                                    |
| MC08 Work Zone Management                       |                                                    |
| MC09 Work Zone Safety Monitoring                 |                                                    |
| MC10 Maintenance and Construction Activity Coordination |                              |
4.3.1 Treasure Valley Market Packages

Table 3.10 is a summary of Market Packages for the Treasure Valley. The table shows the entire listing of Market Packages from the National ITS Architecture and their respective status in the region. Appendix A of this Report contains the descriptions for the Market Packages selected for the Treasure Valley from version 5.1 of the National ITS Architecture.

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<tr>
<th>Table 4-2</th>
<th>Treasure Valley Market Package Analysis</th>
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<td><strong>Market Packages</strong></td>
<td><strong>Existing</strong></td>
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<td><strong>ARCHIVED DATA MANAGEMENT</strong></td>
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4.4 Operational Concepts

An operational concept is based on principles of systems engineering and is a summary that describes system operational characteristics from the stakeholder’s viewpoint. The use of operational concepts communicates the information that stakeholders need and expect from the system to system interconnect.

Applied to transportation management and operations, an operational concept is a strategy for achieving a shared set of expectations of operations and delivery of services by a regional transportation system. These activities are typically performed by system operators and system managers in response to the regional needs.

Operational concepts focus on a definition of each stakeholder’s role in delivering transportation systems and services. The process develops and documents stakeholders’ existing and future roles and responsibilities in the implementation and operation of ITS and related activities based on a common regional architecture. The process also assists in identifying gaps and duplication of efforts for clarification.

The benefits that result from the use of an operational concept include the following:

- Improved accountability and control for the various activities and functions that are undertaken in transportation management and operations.
- Provision of faster, more coordinated responses to incidents, emergencies, and natural disasters such as snowstorms, floods, and tornadoes.
- Avoidance of duplicative and/or conflicting efforts by various transportation and public safety jurisdictions, agencies, departments, and other entities.
- Clarifications of expectations and intent so that all stakeholders are aware of the consequences their actions have on other stakeholders.
- Clarification of roles/responsibilities of all stakeholders so activities do not “fall through the cracks.”
- Sharing of data and information across agency and jurisdictional boundaries to allow for seamless operations.

Table 4-3 lists the roles and responsibilities of the stakeholders relative to the Treasure Valley Regional ITS Architecture. Table 4-3 is not a complete list of each agency’s activities and responsibilities, but only the roles and responsibilities each has pertaining to ITS in the Treasure Valley.
### Table 4-3
### ITS Operational Concepts

<table>
<thead>
<tr>
<th>Operating Agency</th>
<th>Roles / Responsibility</th>
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| Ada County                | • Coordinate emergency response  
                          | • Operate and maintain an emergency operations center                                                                                                  |
| Ada County Highway District | • Operate and maintain the Traffic Management Center  
                          | • Manage traffic on arterials using traffic signals  
                          | • Operate and maintain traffic signals  
                          | • Coordinate with emergency responders for the deployment, operation and maintenance of emergency vehicle preemption  
                          | • Coordinate with transit operators for the deployment, operation and maintenance of transit vehicle signal preemption  
                          | • Provide traffic and incident information to the public, including construction, maintenance, road closures, detours, delays, congestion and incident information  
                          | • Share traffic information with emergency responders and other transportation agencies  
                          | • Interface with emergency and other traffic agencies to support coordinated emergency response  
                          | • Exchange incident information with emergency management systems  
                          | • Collect traffic data, including speed and volumes  
                          | • Create data archives of various operational parameters of the local transportation system for use in regional, state and national planning activities  
                          | • Monitor traffic on local arterial roads  
                          | • Maintain centralized traffic signal software  
                          | • Coordinate with other Treasure Valley agencies on the deployment and integration of new traffic signals  
                          | • Monitor freeway operations  
                          | • Maintain centralized freeway management systems software  
                          | • Receive weather data from road weather information systems and disseminate information to the traveling public  
                          | • Operate and maintain road weather information systems  
                          | • Implement traffic control response to incidents  
                          | • Coordinate traffic control response to incidents with emergency responders and other transportation agencies  
                          | • Operate and maintain dynamic message signs  
                          | • Operate and maintain closed circuit television system  
                          | • Provide and maintain vans for vanpool use  
                          | • Coordinate ridership for vanpools  
                          | • Maintain ridership management system for vanpools  
| Ada County Sheriff        | • Receive public safety calls and provide appropriate response  
                          | • Dispatch local emergency vehicles  
                          | • Interface with other emergency and transportation agencies to support coordinated emergency response  
                          | • Create, store and utilize emergency response plans to facilitate coordinated response  
                          | • Exchange incident and threat information with emergency management systems and with maintenance and construction systems  
                          | • Maintain centralized emergency management systems  
                          | • Track the location of emergency vehicles  
                          | • Dynamically route emergency vehicles based on real-time traffic information  
                          | • Monitor traffic via closed circuit television camera feeds  
                          | • Monitor the Traffic Management System  
| Boise Air Terminal        | • Oversee operations and maintenance of the Boise Air Terminal, including aviation-related and groundside transportation infrastructure  
                          | • Interface with emergency and traffic agencies to support coordinated emergency response  
                          | • Create, store and utilize emergency response plans to facilitate coordinated emergency response  
                          | • Exchange incident and threat information with emergency management systems  
                          | • Maintain centralized emergency management software systems  

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<tr>
<th>Operating Agency</th>
<th>Roles / Responsibility</th>
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| Boise State University   | • Monitor traffic via closed circuit television camera feeds  
• Operate and maintain a virtual traffic management center in coordination with ACHD  
• Collect and use freeway traffic data  
• Develop and test traffic management strategies                                                                                                            |
| Canyon County            | • Receive public safety calls and provide appropriate response  
• Dispatch local emergency vehicles  
• Interface with other emergency and transportation agencies to support coordinated emergency response  
• Create, store and utilize emergency response plans to facilitate coordinated response  
• Exchange incident and threat information with emergency management systems and with maintenance and construction systems  
• Maintain centralized emergency management systems  
• Track the location of emergency vehicles  
• Dynamically route emergency vehicles based on real-time traffic information                                                                                   |
| City of Boise            | • Maintain and operate emergency vehicles  
• Interface with other emergency and transportation agencies to support coordinated emergency response  
• Coordinate with emergency responders for the deployment, operation and maintenance of emergency vehicle preemption                                                                                     |
| City of Caldwell         | • Manage traffic on arterials using traffic signals  
• Operate and maintain traffic signals  
• Interface with other emergency and transportation agencies to support coordinated emergency response  
• Coordinate with emergency responders for the deployment, operation and maintenance of emergency vehicle preemption                                                                                   |
| City of Garden City      | • Interface with other emergency and transportation agencies to support coordinated emergency response  
• Coordinate with emergency responders for the deployment, operation and maintenance of emergency vehicle preemption                                                                                     |
| City of Meridian         | • Interface with other emergency and transportation agencies to support coordinated emergency response  
• Coordinate with emergency responders for the deployment, operation and maintenance of emergency vehicle preemption                                                                                     |
| City of Nampa            | • Manage traffic on arterials using traffic signals  
• Operate and maintain traffic signals  
• Coordinate with emergency responders for the deployment, operation and maintenance of emergency vehicle preemption  
• Receive public safety calls and provide appropriate response  
• Dispatch local emergency vehicles  
• Interface with other emergency and transportation agencies to support coordinated emergency response  
• Create, store and utilize emergency response plans to facilitate coordinated response  
• Exchange incident and threat information with emergency management systems and with maintenance and construction systems  
• Maintain centralized emergency management systems  
• Track the location of emergency vehicles  
• Dynamically route emergency vehicles based on real-time traffic information  
• Monitor the Advanced Traffic Management System                                                                                                               |
| Department of Homeland Security | • Monitor threats and risks in the Region  
• Coordinate disaster and emergency response beyond the regional level  
• Support local agencies in disaster and emergency response                                                                                                       |
| Idaho State Police       | • Dispatch Highway Patrol emergency vehicles  
• Interface with other emergency and transportation agencies to support coordinated emergency response  
• Create, store and utilize emergency response plans to facilitate coordinated response  
• Exchange incident and threat information with emergency management systems and with maintenance and construction systems  
• Monitor the Advanced Traffic Management System                                                                                                               |
### Operating Agency | Roles / Responsibility
--- | ---
Idaho Transportation Department | • Maintain centralized emergency management systems  
• Track the location of emergency vehicles  
• Dynamically route emergency vehicles based on real-time traffic information  
• Manage traffic on arterials using traffic signals  
• Operate and maintain traffic signals  
• Coordinate with emergency responders for the deployment, operation and maintenance of emergency vehicle preemption  
• Maintain a dynamic message sign  
• Operate dynamic message signs  
• Monitor traffic via closed circuit television camera feeds  
• Receive weather data from road weather information systems and disseminate information to the traveling public  
• Operate and maintain road weather information systems  
• Collect traffic data on freeways  
• Operate and maintain incident response vehicles  
• Dispatch incident response vehicles  
Media | • Monitor closed circuit television camera feeds  
• Collect information from traffic and emergency agencies regarding incidents, road closures, delays, congestion and weather related travel issues  
• Disseminate traffic and transportation information to the public  
Other Area Cities | • Monitor traffic via closed circuit television camera feeds  
State EMS Communications Center | • Receive public safety calls and provide appropriate response  
• Dispatch emergency vehicles statewide  
• Interface with other emergency and transportation agencies to support coordinated emergency response  
• Create, store and utilize emergency response plans to facilitate coordinated response  
• Monitor the Advanced Traffic Management System  
• Monitor closed circuit television camera feeds  
• Exchange incident and threat information with emergency management systems and with maintenance and construction systems  
• Maintain centralized emergency management systems  
• Track the location of emergency vehicles  
• Dynamically route emergency vehicles based on real-time traffic information  
• Dispatch maintenance vehicles  
Valley Regional Transit | • Schedule and dispatch fixed-route and paratransit vehicles  
• Maintain and service transit vehicles  
• Track the location of transit vehicles  
• Operate and maintain electronic payment and passenger count system  
• Coordinate passenger trips with other modes through multimodal center  
• Collect, process and disseminate transit information to the public  
• Issue requests for transit signal priority and queue jump  
• Operate and maintain centralized transit management software  
• Coordinate with other agencies in response to large-scale regional emergencies  
• Create, store and utilize emergency response plans to facilitate coordinated response  
• Remotely monitor audio and video from transit vehicles  
• Detect and respond to silent alarms aboard transit vehicles

#### 4.5 Treasure Valley Architecture

The ITS Architecture for the Treasure Valley region is based on the National ITS Architecture, and built upon the existing infrastructure and ITS in the region. This section provides an overview of the existing ITS in a conceptual view of the architecture, then provides the same view of the future Regional Architecture.
4.5.1 Use of Turbo Architecture

Turbo Architecture (Turbo) is a software application that supports development of regional and project ITS architectures using the National ITS Architecture as a starting point. It uses the Microsoft Access database application as the underlying foundation. Turbo Version 3.0 was released in coordination with, and corresponds to, the National ITS Architecture Version 5.0.

Information can be entered into Turbo using either an interview or tabular forms. The interview guides the user through a series of questions and options in an interactive manner that results in the creation of an ITS inventory and a set of ITS services. The user may also go directly to the tabular forms to create the inventory and set of ITS services. In either case, this information is the basis for the architecture development.

Once this initial data input is complete, Turbo provides powerful customization tools that allow the user to customize the architecture to match the specific requirements. For example, in addition to the ITS services selection process, the Turbo user is also able to select which systems in the inventory interconnect to other systems in the inventory, based on certain criteria of the National ITS Architecture. This interconnection also extends to the selection of information flows between the interconnected systems.

Many reports and diagrams are available from Turbo for display, print, or publication in other documents/formats. The user can extend the National ITS Architecture to build a customized regional ITS architecture by adding their own information flows and transportation elements for those areas not covered by the National ITS Architecture.

4.5.2 High Level Treasure Valley Architecture

Based on the systems inventory, the Market Package analysis and the Turbo Architecture work completed to date, Figure 4-5 shows the "sausage diagram" tailored for the Treasure Valley Regional ITS Architecture. It shows the four types of subsystems (Travelers, Centers, Vehicles and Field) for Treasure Valley as opposed to the sausage diagram shown in Figure 4-1, which is a generic National ITS Architecture sausage diagram.
Figure 4-5 Treasure Valley High Level ITS Architecture
The white boxes in Figure 4-5 indicate that one or more of those types of subsystems are represented in the Treasure Valley Regional ITS Architecture. The status (existing or planned) of the subsystems represented in the architecture is not indicated in this diagram. Alternatively, the gray boxes indicate that neither existing nor planned subsystems of that type are represented in the region. The bubbles between the subsystems represent typical communications media that are used by the subsystems to communicate between and among each other.

4.5.3 Existing Architecture

The existing Architecture is shown conceptually in Figure 4-6. The existing architecture diagram is a physical representation of the ITS inventory documented in the existing conditions chapter. The diagram shows the existing interconnects among the agencies, devices and vehicles in the region.
Figure 4-6 Treasure Valley Existing ITS Architecture
4.5.4 Proposed Conceptual Architecture

There are many decisions currently under consideration by the stakeholders regarding the extent of the functions that will be conducted in the IROC. Ultimately this depends on which stakeholders decide to house operations in the IROC and which operations they might transition there. Based on the current understanding in this regard stemming primarily from the results of the initial study of the IROC concept and for the purposes of developing the architecture, it is assumed that the following agencies will be conducting operations in the IROC:

- Valley Regional Transit
- Ada County Highway District
- Idaho Transportation Department
- State EMS Communications

The proposed architecture further assumes that those agencies that are not listed above will continue operations as they currently do. When the decisions regarding stakeholder participation in the IROC are finalized, the architecture will require updating. This also applies when and if other management center changes take place.

The proposed architecture is shown conceptually in Figure 4-7. It consolidates the function of some elements while adding new devices and significant functionality. This conceptual design has been used as the basis for development of the detailed physical architecture in this document.

While the proposed architecture appears very similar in structure to the existing architecture, it actually will serve many more functions and operate many more cameras, environmental sensors, traffic signals, DMS and detectors. In addition, there will be significantly more coordination among agencies and more data generated and shared.

The proposed architecture assumes a significant role by ACHD to manage traffic throughout the region through a regional operations center, the IROC. This approach has the potential to make smaller traffic operations, such as the City of Nampa’s redundant. However, this is entirely dependent on the level participation in the IROC by those agencies that have traffic management responsibilities. Similarly, it is anticipated that the functions of emergency management will be consolidated. The proposed architecture assumes that the majority of ITS will be under the ownership and control of ACHD, particularly off of the interstate routes. The architecture provides local agencies the ability to monitor and potentially control some elements. ITD will also own and operate some elements, but in most cases operation will be performed jointly at the IROC.
Figure 4-7  Proposed Treasure Valley Conceptual ITS Architecture
4.5.5 **Interconnects and Information Flows**

Interconnect Diagrams and Information Flow Diagrams are important in documenting and understanding a regional ITS architecture. Interconnect Diagrams graphically depict the various systems in a given region that are connected to other systems. Information Flow Diagrams graphically depict the type of information flowing between the connected systems. Both of these types of diagrams (among others) are generated from the Turbo Architecture tool, which is used to document the regional ITS architecture. This section describes the Turbo Architecture tool, Interconnect Diagrams and Information Flows in more detail.

4.5.6 **Treasure Valley Interconnect Diagrams and Information Flow Diagrams**

Interconnect Diagrams and Information Flow Diagrams are standard outputs from Turbo. The Interconnect Diagram depicts how a particular element of a regional ITS architecture interconnects to other elements in the regional architecture. Interconnect diagrams are less detailed than Information Flow diagrams. The Interconnect Diagram simply shows a physical or logical connection between two or more elements in the architecture. An Information Flow diagram, on the other hand, shows the detailed information exchange between the elements. One line on an Interconnect Diagram between two systems may represent many lines on the Information Flow Diagram between the same systems.

Figure 4-8 is an example of an Interconnect Diagram for the existing ACHD TMC and the Boise State University Virtual TMC. The Interconnect and Information Flow Diagrams usually show the target Element in the center of the diagram with each of the interconnected elements surrounding it – this is referred to as a “Centric View.” For Figure 4-8 the TMC is the central component of the diagram, with all of the other interconnected elements surrounding it.

![Interconnect Diagram Example](image)

**Figure 4-8 Sample Interconnect Diagram from the Treasure Valley Regional ITS Architecture**

Figure 4-9 is an example of an Information Flow Diagram in the Treasure Valley Regional ITS Architecture for the ACHD TMC. Where there was only one line connecting the TMC to each of the other Elements in the interconnect diagram there are now several lines connecting them. Each line also has a direction, and they represent the type of data flowing between elements, and which direction they flow.

**Appendix B** of this Report contains all of the Interconnect Diagrams and Information Flow Diagrams for the Regional ITS Architecture.
Figure 4-9  Sample Information Flow Diagram from the Treasure Valley Regional ITS Architecture
4.6 Agency Agreements

The intelligent transportation systems already in place and those planned for the Treasure Valley are dependent on their integration with one another to improve the safety and efficiency of travel in the region. Systems integration is the technical manifestation of the sharing of information among those agencies that own and manage the systems. For information sharing to be most effective and for it to meet the needs of the participating agencies they must agree on how the information will be shared, how it will be secured if necessary, and how capital, operations and maintenance costs will be divided.

In the Treasure Valley, some of these agreements are already in place. For instance, although ITD does not house any staff in the ACHD TMC, they do help to pay for the staff time required as well as costs associated with new equipment and operations. ITD does this through agreement with ACHD. Similarly, ITD supports the State EMS Communications center in exchange for statewide support of maintenance dispatch, road closures, road condition reporting, and a variety of other activities. Again, the conditions of this arrangement are spelled out in a formal agreement between the two agencies.

It is anticipated that many of the existing agreements will be revised and several new ones initiated as the Interagency Regional Operations Center is deployed. These agreements impact the Treasure Valley Regional ITS Architecture in that they document the official roles and responsibilities surrounding the sharing of data and integration of systems. Since these relationships are currently being reestablished or forged anew as part of the current IROC activities, the detailed understanding of the associated agreements will need to be addressed at a later time. This characteristic of the IROC study will further generate a need to update the regional ITS architecture.

4.7 Architecture Maintenance

The Treasure Valley ITS Architecture should be modified as plans and priorities change, ITS projects are implemented, and the region's ITS needs and services evolve. The Architecture was developed with a time horizon that extends somewhere beyond ten-years. With ITS planning it is difficult and unnecessary to be more exacting beyond the ten year time frame due to the inherent uncertainty of advancing technology. As the architecture is updated, this timeframe will be extended appropriately as planned projects are deployed and new projects are identified. The goal of maintaining the architecture is to keep an up-to-date regional ITS architecture accessible as a guide for deploying ITS in the Treasure Valley.

The key aspects of the ITS architecture maintenance process that will modify and change the architecture in a consistent manner are defined in this section:

- Maintenance responsibility
- Maintenance elements
- Update frequency
- Identifying needed Architecture changes
- Change Management Process

4.7.1 Responsibility for Maintaining the Regional ITS Architecture

Just as a group of stakeholders were needed to develop the ITS architecture, stakeholders must stay involved in the on-going maintenance. Changes can arise from many sources in the Treasure Valley, and it is likely that some may come from sources outside the technical expertise of a single agency. For these reasons, it is recommended that a group of stakeholders representing a range of areas and technological expertise be involved in the architecture maintenance. Agency representatives on this Architecture Maintenance Team would be responsible for facilitating
architecture updates, either by making use of technical expertise at one agency or another or by contracting for that expertise.

The Maintenance Team should make decisions together with input from other regional stakeholders, as needed and changes to the architecture should be made on a consensus basis. Within the Maintenance Team, it is recommended that one agency be identified to take the lead responsibility for maintaining the regional architecture. The most likely candidates for this are COMPASS, ACHD and ITD. Through the planning discussions, a preliminary determination for COMPASS to fill this role has been made, however, as this decision is finalized, documentation to this effect should be reflected in the architecture.

4.7.2 What is Maintained in the Architecture

The parts of a regional ITS architecture to be maintained are collectively referred to as the “baseline” architecture. This section considers the different parts of the regional ITS architecture and whether they should be a part of the maintained baseline.

Description of Region. This description includes the geographic scope, functional scope and architecture timeframe, and helps frame each of the following parts of a regional ITS architecture. Geographic scope defines the spatial boundaries that determine what ITS elements are in the region, although additional ITS elements outside the region may need to be described if they communicate ITS information to elements inside the region. Functional scope defines the services that are included in a regional ITS architecture. Architecture timeframe is the duration (in years) into the future that the regional ITS Architecture considers. The description of the Treasure Valley Regional ITS Architecture is contained in the architecture documentation, and should be reviewed and updated as needed when maintenance is performed.

List of Stakeholders. Stakeholders are critical to the definition of the architecture. Within a region, they may consolidate or separate, and such changes should be reflected in the architecture. Or, different projects under the purview of a single agency may necessitate that the agency be represented as more than one stakeholder. In addition, stakeholders that have not been engaged in the past might be approached through outreach to be sure that the regional ITS architecture represents their ITS requirements as well. The Treasure Valley stakeholders are described in the architecture documentation and also are listed in the Turbo database representing aspects of the regional ITS architecture. Their listings and descriptions should be part of the baseline and, as such, should be reviewed and updated in the maintenance process.

Operational Concepts. It is crucial that the operational concepts (which are represented as roles and responsibilities) in a regional ITS architecture accurately represent the consensus vision of how the stakeholders want regional ITS to operate for the benefit of surface transportation users. These should be reviewed and, if necessary, changed to represent what has been deployed (which may have been shown as “planned” in the earlier version of the regional ITS architecture). Many of the remaining maintenance efforts will depend on the outcome of the changes made to the operational concepts. They are contained in the documentation and Turbo database and should be considered part of the baseline.

List of ITS Elements. The ITS inventory is an important part of the regional ITS architecture. Changes in stakeholders as well as operational concepts may impact the inventory of ITS elements. Furthermore, recent implementation of ITS elements may change the individual status (e.g. from planned to existing). The list of elements is contained in the architecture documentation and the Turbo database. The list of ITS elements should be part of the architecture baseline.
List of Agreements. One of the greatest values of a regional ITS architecture is to identify where information crosses agency boundaries, which may indicate a need for a formal agreement between the respective agencies. An update to the list of agreements typically and most logically follows an update to the operational concepts and/or interfaces between elements. The list of agreements is usually part of the baseline, however, under the current circumstances in the Treasure Valley regarding the IROC development, the list of agreements will need to be developed as the IROC is implemented.

Interfaces between Elements (interconnects and information flows). Interfaces between elements are the details of the architecture. They describe how various ITS elements are or will be integrated throughout the timeframe of the architecture. These details are contained in the Turbo database. They are a fundamental part of the architecture baseline, and one that will likely see the greatest amount of change during the maintenance process.

System Functional Requirements. High-level functions are allocated to ITS elements as part of the regional ITS architecture. These can serve as a starting point for the functional definition of projects that map to portions of the regional ITS architecture. These details are contained in the architecture documentation and Turbo database and should be part of the baseline.

Applicable ITS Standards. The selection of standards depends on the information exchange requirements. The maintenance process should consider how ITS standards may evolve and mature since the last update, and consider how any change in the national standards development process may impact previous regional standards choices (especially where competing standards exist). For example, if eXtensible Markup Language (XML) based Center-to-Center standards reach a high level of maturity, reliability and cost-effectiveness, then a regional standards technology decision may be made to transition from other standards to XML. The description of the standards environment for the region, as well as the details of which standards apply to the architecture, are in the architecture documentation as well as the Turbo database, and should be part of the baseline.

Project Sequencing. While project sequencing is partly determined by functional dependencies (e.g. “surveillance” must be a precursor to “traffic management”), the reality is that for the most part, project sequences are local policy decisions. Project sequences should be reviewed to make sure that they are in line with current policy decisions. Furthermore, policy makers should be informed of the sequences, and their input should be sought to bring the project sequences in line with their expectations. This is crucial to avoid having the regional ITS architecture become irrelevant. The project sequencing is included in the architecture documentation and is part of the architecture baseline.

4.7.3 Architecture Update Frequency

It is recommended that the update process associated with the Treasure Valley Regional ITS Architecture be closely linked to the regional transportation budget planning processes. As these plans undergo formal updates on regular cycles, the architecture should also simultaneously undergo modifications to reflect these revisions. This is a natural result of the architecture and ITS being mainstreamed into the regional planning process to ensure that the ITS architecture continues to accurately represent the region.

The operational concepts, system functional requirements, project sequencing list, and the list of agency agreements represent high-level views of the architecture and do not necessarily need to be modified each time a revision is made. However, these documents will be modified as the architecture broadens to address new needs and services, add new stakeholders to the region, or on an as-needed basis.
In summary, the Architecture Maintenance Team should determine the timing for modifications to be submitted for inclusion into the Regional ITS Architecture but it is anticipated that, based on the schedule for updating planning documents, there will be minor updates annually with a major update to occur in cycle with other major regional plan updates.

4.7.4 Identifying Needed Architecture Changes

The Treasure Valley ITS Architecture is being created as a consensus view of the ITS elements currently implemented in the region and the systems planned for the future. The architecture must be updated to reflect changes resulting from project implementation or resulting from the transportation planning process itself. There are many actions that may cause a need to update the architecture, as described here:

**Changes in Project Definition.** When formally defined during procurement and deployment, a project may add, subtract or modify elements, interfaces, or information flows from the regional ITS architecture. Because the architecture is meant to describe not only ITS planned for the region, but also the current ITS implementations, it should be updated to correctly reflect projects as they are deployed.

**Changes for Project Addition/Deletion.** Occasionally a project will be added, deleted or modified during the planning process. When this occurs, the aspects of the architecture associated with the project must be added, deleted or modified.

**Changes in Project Status.** As projects are deployed, the status of the architecture elements, services, and flows that are part of the project must be changed from planned to existing. Elements, services, and flows are considered to change from “planned” to “existing” when they are substantially complete in that they have been installed, tested and are being used.

**Changes in Project Priority.** Due to funding constraints, technological changes or other considerations, a project planned in the region may be delayed or accelerated. Such changes need to be reflected in the Treasure Valley ITS Architecture.

**Changes in Regional Needs.** Over time, the needs in the Treasure Valley may change and the corresponding aspects of the regional ITS architecture will have to be updated. While the regional ITS Architecture is being developed with input from many ITS stakeholders in the region, not all potential stakeholders have participated in its development. As ITS deployment increases and the benefits are realized, additional entities may become interested in ITS. The architecture should be updated to reflect their place in the regional view of ITS. The systems they operate and their interfaces will also have to be added or revised based on actual information sharing gained from their participation.

**Changes in Stakeholder or Element Names.** An agency’s name or the name used to describe its element(s) may change. Transportation agencies occasionally merge, split, or simply rename themselves. In addition, element names may evolve as projects are defined. The ITS architecture should be updated to use the currently correct names for both stakeholders and elements.

**Changes in Other Architectures.** The Treasure Valley ITS Architecture covers not only the defined region, but also interfaces to elements in adjoining architectures and the Idaho Statewide Architecture. Changes in these other architectures may necessitate changes in the regional architecture to maintain consistency as the two architectures may overlap.
Additionally, the National ITS Architecture itself is a living resource of information. In order to keep a 20-year horizon on the National ITS Architecture, it is expanded and updated to refine existing services or add new user services. With any new user service is the potential for new subsystems, terminators, interconnects, flows, and equipment packages. It is recommended that during major updates the Maintenance Team reviews changes in the National ITS Architecture and determines how they may affect the Treasure Valley ITS Architecture.

### 4.7.5 Change Management Process

This section recommends a process for maintaining the Treasure Valley ITS Architecture. The process described below and illustrated graphically in Figure 4-10 is based upon the discipline of Configuration Management. It is a step-by-step description on how changes are identified, reviewed and implemented.

![Architecture Maintenance Process Diagram](image)

**Figure 4-10 Architecture Maintenance Process**

Section 4.7.1 described who will be responsible for maintaining the ITS Architecture, and Section 4.7.2 described the elements included in the baseline architecture. Now that these have been established, the following process can be used to complete an update cycle.

**Identify Potential Change.** Any stakeholder can identify a potential change in the architecture and submit a request to the Maintenance Team for review and evaluation. It is recommended that a simple change request form be created that contains at least the following information:

- Name of change
- Description of change
- Rationale for change
- Originator name or agency
- Originator contact information
- Date of origination

A sample Change Request Form is in Appendix C.
As part of the Configuration Management process this information should be maintained in a change log (or change database) that would contain the above information with the following additional information by the party responsible for managing the database:

- Change number (unique identifier)
- Change disposition (accepted, rejected, deferred)
- Change type (minor or major)
- Part of baseline affected
- Disposition comment or status
- Disposition date

There are many ways a change request can be made: via a web site, by submittal of formal hard copy, or by submittal of an e-mail containing all relevant information. It is recommended that the process be done electronically, with a web-based change form. The web-site approach generates an electronic copy of the request, and therefore an audit trail of all changes considered as well as a record of those approved, those rejected, and those deferred. In addition, electronic submittal may simplify the inclusion of changes into the Turbo database. The requester will get feedback regarding the status of the change request via e-mail and the web site.

On a regular basis (e.g. semi-annually), the Maintenance Team should meet to perform the following steps in the Change Request process.

**Evaluate Change Requests.** Each change request should be evaluated to determine its impact on the architecture baseline. If a request has an impact on other stakeholders, the Maintenance Team should contact the affected stakeholders to confirm their agreement with the modification. If the issue warrants, a stakeholders meeting or teleconference to discuss the modification may be held. In the case of a full baseline update, the change evaluation happens through stakeholder consensus as part of the scheduled update cycle.

**Approval.** The next step is to approve, defer, or reject the change request. This will be handled through email, the web site and/or through periodic face-to-face meetings. This is dependent upon the complexity of the proposed change(s). If a change request is rejected or deferred, the requester will be notified with an explanation. Approval by affected stakeholders effectively builds consensus. The result of the approval step will be communicated back to the requester.

**Update Baseline.** This activity involves updating the Treasure Valley ITS Turbo Architecture and documentation. This requires the same skills and techniques used in developing the initial baseline. The frequency of updating the Turbo Architecture will be established by the Maintenance Team. It is recommended that a staff member or outside firm with Turbo expertise perform the Turbo baseline updates. As few individuals as necessary should be authorized to perform Turbo updates to ensure consistency.

**Notify Stakeholders.** The final part of the maintenance process is to notify stakeholders of the changes or updates to the ITS Architecture. This can be accomplished by sending an email notification to the stakeholder list that a change has occurred and then link to more information on a website, or in a document attachment to the e-mail.

If there are no change requests between Maintenance Team meetings, and there are no other issues requiring discussion, the Team may decide to skip its next meeting.
SECTION 5.0
COMMUNICATIONS SYSTEMS

This section of the report provides relevant, current updates to the short, medium, and long term communication strategies for the Treasure Valley ITS Plan. Particular attention will be paid to the transportation related communications systems for the transmission of data and video information for the various ITS elements that continue to be deployed. The information presented in this section is based upon current technology trends as deployed in the ITS industry. Additionally, it takes into account the user goals and long term objectives as defined by area agencies.

Recommendations presented herewith will be based upon the ITS needs and requirements identified elsewhere in this report, the recommendations of involved agencies, and regional architecture for the area. Although the regional architecture does not necessarily dictate how the communications infrastructure is deployed, the general concepts are nonetheless followed. This ensures that both the architecture and communications plan are complimentary documents.

The analysis is presented in the following sections:

Section 5.1: History of ITS Related Communications in the Treasure Valley. This section provides a brief overview of ITS communications trends in the Treasure Valley and past recommendations. It also provides a current day “picture” of the central systems from which the communications is deployed.

Section 5.2: Communications Requirements and Standards. Identifies requirements for typical ITS communications deployments and provides an analysis of high speed communications typically employed to meet those requirements.

Section 5.3: Communications Technologies Recommendations. Based on the analysis of section 5.2 a recommendation for communications is identified in this section. It then presents current, available, and proven communication systems employed for deployment of the recommended communications and identifies options for employing these systems in the Treasure Valley area.

Section 5.4: Area Wide Communications Recommendations. This section presents area wide recommendations for the communications that should be employed in the Treasure Valley. Short, medium and long term communications media alternatives (and associated cost estimates) are also presented for expansion of the existing communications infrastructure.
5.1 History of ITS Related Communications in the Treasure Valley

Prior to the preparation of the 1999 ITS plan, the primary communications media in the Treasure Valley area consisted of hardwired twisted pair cable and dial-up telephone. The media was used primarily for traffic signal communications and no other ITS elements (video cameras, message signs, speed detectors, etc.) had yet to be deployed with exception of Road Weather Information Systems. Over this media, data/commands from the central traffic control center were transferred to intersection field masters and local controllers for limited centralized operations. Where this communication infrastructure did not exist (or currently does not exist), signals were typically interconnected and operated in Time Based Coordination (TBC) modes along major corridors. As noted in Section 2 - Existing Conditions, the number of traffic signals and ITS elements has grown beyond the original plans envisioned around year 2000. This increase in ITS elements and their associated communications interfaces are both shown in Table 5-1.

### Table 5-1

<table>
<thead>
<tr>
<th>Deployed ITS Elements</th>
<th>1998</th>
<th>Communications Interface</th>
<th>2006</th>
<th>Communications Interface</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACHD Traffic Signals</td>
<td>366 TP</td>
<td>dial-up, central system</td>
<td>455 TP</td>
<td>dial-up, fiber, TCP/IP, central system</td>
</tr>
<tr>
<td>Nampa Traffic Signals</td>
<td>22 TP</td>
<td>dial-up, central system</td>
<td>58 TP</td>
<td>dial-up, central system</td>
</tr>
<tr>
<td>Caldwell Traffic Signals</td>
<td>15 TP</td>
<td>dial-up, central system</td>
<td>22 TP</td>
<td>dial-up, central system</td>
</tr>
<tr>
<td>Closed Circuit Television (CCTV)</td>
<td>0 n/a</td>
<td></td>
<td>63 Fiber</td>
<td>SSR, digital PtoP, networked</td>
</tr>
<tr>
<td>Freeway Speed Monitoring</td>
<td>0 n/a</td>
<td></td>
<td>33 Dial-up</td>
<td>fiber, central system</td>
</tr>
<tr>
<td>Dynamic Message Signs (DMS)</td>
<td>0 n/a</td>
<td></td>
<td>7 Dial-up</td>
<td>fiber, central system</td>
</tr>
<tr>
<td>Road Weather Info. Systems (RWIS)</td>
<td>5 Dial-up</td>
<td>central system</td>
<td>5 Dial-up</td>
<td>central system</td>
</tr>
<tr>
<td>Video Detection System (VDS)</td>
<td>0 n/a</td>
<td></td>
<td>35 Local</td>
<td>only not centralized</td>
</tr>
</tbody>
</table>

Notes:
- TP – Twister Pair Copper interconnect,
- SSR – Spread Spectrum Radios
- P to P – Point to Point fiber employing digital transceivers,
- Dial-up – Low speed modem communications
- Central System – Centralized system providing user interface for monitoring and management
- Fiber – fiber optics interconnected in P to P or networked environment throughout the Treasure Valley
- TCP/IP - Short for Transmission Control Protocol/Internet Protocol, at times simply referred to as IP or Ethernet in the transportation industry, it is a suite of protocols used to connect hosts on a network.

As identified in Table 5-1, today much of the communications upgrades have included and/or are planned for fiber or wireless as the primary communications media. It is understood that this is being done with an ultimate goal of an all fiber high speed communications network connecting field traffic signal controllers, CCTV and other ITS related equipment in a redundant ring configuration. Since other agency partners (Sheriff's, Police, Fire, etc.) are coordinating with traffic operations, in an ever expanding manner, it is conceivable that all of these agencies can share the network communications being deployed. Please refer to Section 2 - Existing Conditions of the report for reference on existing communications media.

5.1.1 1999 Communications Master Plan – Selection of Hybrid

The 1999 Communications Master Plan provided a recommendation for a hybrid alternative. This approach was determined to be the solution making the most sense for the Treasure Valley, at the time. Implementation costs for this alternative were estimated at approximately $35 million for the full deployment, somewhat less than full fiber optic
deployment. It was further estimated that a larger cost savings could be received through the use of spread spectrum radio for tail circuit deployments. The primary elements of the recommended alternative were as follows:

1. Fiber optic cable was to be deployed throughout the Treasure Valley, and the formation of three communication backbone rings would be designed such that redundant communication paths were established.
2. The majority of the signalized intersections would be connected to the communication system hubs via fiber optic cable.
3. Video cameras would be deployed throughout the Treasure Valley, giving TMC operators instantaneous and simultaneous access to any combination of video images.
4. Data communication with remote signalized intersections and other ITS related elements would be transmitted to a fiber optic tail circuit. At this point, the signal will be converted to an optical signal and transmitted to the TMC.
5. The Caldwell-Nampa Communications loop and its associated video and data sources will be transmitted back to the ACHD TMC via leased line facilities during the short and mid term scenarios. In the long term, this leased link will be replaced by an agency-owned fiber cable.

As with most technology intensive deployments, the communication systems, standards, and protocols were expected to evolve. For this reason it was further recommended that the communication system be revisited, and fine-tuned prior to any design phase for each deployment scenario so that the latest technology could be used.

5.1.2 Existing Centralized Communications Systems in the Treasure Valley

The 1999 planning activities provided various recommendations for deployment of numerous ITS elements and communications media that would support these deployments. Many of these ITS recommendations have and continue to be deployed throughout the area. Most of the recommendations were deployed as extensions of the ACHD TMC operations.

Figure 5-1 represents the current centralized configuration of the Treasure Valley communications systems. Although any partner agency can access the video systems via the available network(s), as depicted in this figure most of the communications infrastructure is designed around centralized operations from the ACHD TMC. Most of the fiber optics deployed provide either a “home run” connection to the TMC, a connection on the network to a partner agency, a connection to a hub facility, or connection to a cabinet connected to the TMC. As recommended in the 1999 plan the existing fiber optics were deployed in manner that allows for the connection of future agencies on fiber optics rings throughout the area. The majority of the video transmission is achieved via point to point transceivers that encode and decode analog video/data and transport this digital information across one dedicated fiber strand per camera. Additionally the system is supported by two proprietary digital network systems that make up video and data networks. These two systems along with a wireless network make up the network based communications in the Treasure Valley. The three major network based communications systems employed to support the existing ITS elements in the Treasure Valley today are identified below:

**Orion™ Video Network System** Manufactured by International Fiber Systems (IFS), the Orion™ video network provides proprietary network based communications for the ACHD TMC and Treasure Valley agencies connected on the network. The solution is designed for large-scale video surveillance systems communicating on fiber optic ring circuits. The fiber optic communications platform is expandable and provides multiple input and simultaneous real-time video outputs to the TMC or any agency partner. Orion™ uses video compression methods to encode and decode video signals from existing Treasure Valley area cameras.
OTN (Optical Transport Network)  Manufactured by Siemens, the OTN network provides a proprietary fiber optic based communications network to interface ACHD traffic signals, (5) wireless camera systems along I-84, and for video transmission to a Boise State University connection. Currently four OTN nodes are deployed throughout the area. These nodes are interconnected via fiber optics.

Aurora™ 5.8 Mhz Spread Spectrum Radio  Manufactured by Harris, Aurora spread spectrum point-to-point digital radios are deployed along I-84 to reach ITS elements beyond the current reach of fiber optics from the TMC. They are centralized to the Cloverdale hub before transmitting on the OTN to the TMC. The current Aurora radios operate in the 5.8 GHz frequency range and provide up a 1.54 Mps connection (T1) wireless service for line-of-sight distances along I-84. These radios transmit to towers located at the Ada County Sheriff’s radio facility and an existing ACHD tower at the Cloverdale hub facility.
Figure 5-1  Existing ACHD TMC Systems and Interconnection with ITS Elements in the Treasure Valley
5.2 Communication Requirements, Standards, and Analysis

In simple terms, the primary goal for the Treasure Valley’s traffic communication system is to support the deployment of ITS elements that provide the following functionality:

- Monitor traffic operations through the use of CCTV camera systems
- Implement traffic signal timing plans in real time
- Monitor and manage freeway operations in real time
- Maintain and monitor signal, video detection, CCTV, DMS, RWIS systems from the TMC
- Facilitate the communications between partner agencies and allow for information sharing
- Improve traffic conditions for the area

In order to provide a communications system that will satisfy the above needs, the communications systems and standards employed must result in a high bandwidth, high speed network that supports the current needs of live video and data as well as future ITS applications and system expansions. Three standards based communications systems are typically employed for such high speed ITS networks, they include:

1. **SONET**: Short for Synchronous Optical Network, it is an international standard for high speed communication over fiber-optic networks. It defines a hierarchy of interface rates that allow data streams at different rates to be multiplexed.

2. **ATM**: Asynchronous Transfer Mode, is a high bandwidth, high speed (up to 155 Mbps) standard based on the controlled-delay of fixed-size packet switching and transmission systems designed to integrate voice, video, and data. ATM is often used to deploy Ethernet based communications.

3. **Gigabit Ethernet**: The most common and accepted network based communications, due to its use in common everyday application in office and home Ethernet networks. This standard is very mature with four different standards for Gigabit Ethernet using optical fiber, twisted pair cable, or balanced copper cable.

All three network standards have seen widespread use in ITS applications, nonetheless national and regional agencies are migrating in the direction of all Ethernet based communications. The following section presents the technical requirements and analysis for justification of each of these networks. A cost/benefit comparison of all three is provided herewith for recommending a standard for the Treasure Valley. It should be noted that the existing Siemens OTN and IFS Orion systems were not compared due to the proprietary and single vendor nature of these systems. Subsequent Sections 5.3 and 5.4 define communications recommendations for the Treasure Valley area network, based on this analysis.

5.2.1 Design Requirements

In developing a communication system for any agency, the following factors should be understood and considered:

**Cable Type** For high-speed network deployments, the ideal communication media will be comprised of the fiber infrastructure elements listed below.

- **Backbone Cable** The backbone cable is used to provide high speed data and video communications on the network backbone. It interconnects communication hubs, the ACHD TMC, and other agency centers such as ITD, Police, and eventually planned centers such as the IROC. The backbone cable aggregates data at the communication hubs. To maintain the integrity of the backbone cable, splicing is not performed on the backbone cable between hubs. Two fiber strands are generally required to support the backbone communication. Ideally, the backbone cable is a separate, dedicated, fiber optic cable that only terminates at the communication hubs and at the TMC. However, due to limitations in conduit capacity and funding, it is often not possible to install a
separate cable for use as the backbone cable. In these cases, fiber strands within separate fiber tubes (or bundles) are selected from the distribution cable and assigned for backbone communications.

**Distribution Cable** The distribution cable is mainly used to aggregate data from field elements and transmit data back to the communication hubs or the TMC. It is desirable to install the highest possible fiber count from an economic standpoint for the distribution cable, especially when also used for backbone or adjoining ring circuits. The advantages of providing a fiber optic cable with higher fiber count include:

Flexibility: With higher fiber count, there are more design options for the communication system. For example, the network can have a dedicated fiber for each device or utilize multiplexing add-drop modems to daisy-chain or group its devices.

Expandability: The additional fibers will provide opportunities for the Treasure Valley to share or sell its bandwidth with other departments and agencies.

**Drop Cable** The drop cable is the “last mile” link in the communication system. This cable, also known as the “home-run” cable, will connect the end device to the distribution cable (or hub) by splicing the used fiber strands to the distribution cable at the local splice vault (pull box). One end of the fiber is pre-connectorized and is normally terminated at a fiber patch panel (FPP) or wall interconnect center (WIC). The other end of the drop cable is spliced to the appropriate fiber strand(s) of the distribution cable. The size of a drop cable will depend on the supported equipment in the cabinet – the most common fiber counts for drop cables are six and twelve.

**Existing Communication System** Whether it is comprised of fiber, copper or wireless medias, any proposed communication system must integrate into an agency’s existing communication infrastructure. For the Treasure Valley area, some wireless, existing copper and fiber optic cable already provides communications to existing signalized intersections, CCTV, speed detectors, DMS, and other ITS elements. This communications media is located primarily in the Boise, Garden City and Meridian areas with most of the fiber “home running” back to the TMC in Boise.

In consideration of these existing conditions, any proposed fiber optic cable expansions should extend to the perimeter of all signalized intersections. This will result in implementation of branch or backbone communications legs that can extend out as the network that connects Treasure Valley area agencies.

**Reliability/Redundancy** Traffic signal applications require the communication system to be operational in all circumstances. Therefore, the Treasure Valley’s communication system should provide sufficient redundancy and automatic recovery capabilities from cable cuts or hub failures. The ideal communication system should be fault tolerant, self-healing, and route redundant. For networked based communications, these requirements would indicate the implementation of fiber optic rings comprised of the interconnection of multiple communication hubs. For the Treasure Valley, various stakeholders in the system should serve as hub location points on the network. Multiple hub locations help in the deployment of an overall network.

**Scalability and Ease of Installation** The communication system should provide a smooth migration path for future expansion, and should support the implementation of additional ITS elements in future projects. In addition, the communication system should readily provide an incremental increase or decrease in size of the communication system, with limited cost and risk due to the need to add or remove equipment. The use of modular communication equipment and maximizing the use of available bandwidth can best allow for future growth. In this application both standalone and plug-in module communication equipment can be used.
Security  With the ever increasing number of network threats, security measures should be one of the primary concerns when designing a communication system. Passwords, firewall, routers, and administrative privileges are means to prevent the network from unauthorized access and to reduce exposure to hacking and viruses.

Ease of Operations  The design shall provide a communication system that requires minimum training. The ideal communication system should provide some degree of automation, such as dynamic bandwidth assignment, spanning tree analysis, network failure alert, etc. This allows traffic managers to focus on higher priority tasks such as coordinating lane closures and dispatching emergency services and road crews.

Ease of Integration  Integration refers to interoperability or the capability to seamlessly access data across different hardware and software platforms. The communication equipment specified in the design should be able to integrate both legacy equipment and new technologies.

Ease of Maintenance  Maintenance activities of the communication equipment may involve the following:

- System configuration
- Problem diagnostics
- Network recovery
- Hardware, firmware, and software upgrades
- Performance monitoring
- System tune-up for performance

Modular and hot swappable equipment should be used to simplify maintenance. Modular and hot swappable devices are economical because they eliminate the necessity for replacing entire boards at the system level. Upgrades can be done with any number of units at a time, from an individual module to all the modules in a system. In the case of area wide Gigabit Ethernet systems these network maintenance and operations are often absorbed by the Network Manager of the respective agency IT departments involved.

Network Management  The use of network management software will reduce the maintenance needs and cost, increase network performance, and improve manageability of the system. The network management software should provide at least the following capabilities:

- Display a graphical, layered view of the communication system architecture
- Manage the bandwidth of the network
- Configure the network and diagnose network problems from a remote location
- Report system status
- Monitor network performance
- Provide system alerts relative to cable cuts, hub failures, and system failure
- Allow for graceful shut down and automatic system recovery

Technology Maturity  The communication equipment specified in the design should demonstrate successful operations and integration with other established and related products. Since communication equipment, especially the hub equipment, is typically the most expensive item associated with deployment cost, the initial investment risk should be mitigated by using equipment with significant industry support. Proprietary equipment and technology should be avoided where possible.

Availability of Environmentally Hardened Equipment  One consideration when deploying field equipment in ITS applications is that the typical field installation locations are not environmentally controlled. Field equipment should continue to function regardless of temperature or humidity. The lack of environmentally hardened equipment may...
impede the use of certain types of technology or equipment from certain vendors. As a matter of standard practice any equipment employed in ITS environments is usually required to meet NEMA TS2 environmental ratings, these are defined in Table 5-2 below:

Table 5-2
NEMA TS2 Standards

<table>
<thead>
<tr>
<th>Test</th>
<th>NEMA TS2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature</td>
<td>-34°C to 74°C (-29.2°F to 165.2°F)</td>
</tr>
<tr>
<td>Humidity</td>
<td>18% to 90% RH, non condensing</td>
</tr>
<tr>
<td>Voltage</td>
<td>120VAC–135VAC @ 57Hz - 63Hz</td>
</tr>
<tr>
<td>Vibration</td>
<td>0.5g @ (5-30) Hz</td>
</tr>
<tr>
<td>Shock</td>
<td>10g's for 11ms</td>
</tr>
</tbody>
</table>

Not adhering to these stringent requirements will typically result in continued maintenance issues throughout the life of the system. Many vendors provide equipment that can meet network requirements but not environmental requirements. This should be considered thoroughly before investing in any vendor platform.

5.2.2 Bandwidth Requirements

Some ITS field elements require the transmission of data only, such as the traffic signal controllers, while other ITS field elements require the transmission of video and data, such as CCTV cameras. The communication system for the Treasure Valley must be capable of providing data bandwidth for various ITS needs, which includes CCTV camera video, DMS, RWIS, data control, traffic signal controller data, VDS video and data, and network communications between the various stakeholder systems. The bandwidth requirements for data are generally low, while video transmission requires much greater bandwidth and therefore is the controlling factor for determining bandwidth requirements.

Video can be transmitted in either analog or digital format, depending on the communication media and technology. For analog full motion video (30 frames per second) transmission, the National Television System Committee (NTSC) requires a six (6) Megabits per second (Mbps) bandwidth. However, full motion digital video in its raw form can require a data rate from 45 Mbps to 192 Mbps, depending on the desired resolution. For High Definition Television (HDTV), the video bandwidth requirement can go to as high as 885 Mbps. This bandwidth requirement is reduced by encoding, which means compression and conversion to a streaming format. Although emerging technologies materialize almost yearly, the various standards used in ITS for video compression include:

- Motion JPEG (Joint Photographic Experts Group) is a compressed graphic file normally used for digital images or photographs that require many millions of colors. MJPEG is the result of applying JPEG to individual frames of a video and redisplaying them in a sequence.
- MPEG1 (Moving Picture Experts Group) is the standard for compression and storage of motion video though a network. MPEG1 refers to the delivery of video for a CD-ROM quality presentation.
- MPEG2 refers to broadcast quality video, it is the most widely accepted compression standard.
- MPEG3 was targeted for HDTV quality video and is not typically deployed in ITS.
- MPEG4 was developed to enable video transmission at low bit rates.

Table 5-3 summarizes ITS data types and bandwidth range for the transmission of data for typical ITS field elements:
Table 5-3
Data Types and Bandwidth Requirements

<table>
<thead>
<tr>
<th>ITS Element</th>
<th>Data Type</th>
<th>Bandwidth Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>PTZ Camera</td>
<td>Control data</td>
<td>1,200 to 19,200 bps</td>
</tr>
<tr>
<td>DMS</td>
<td>Control data, status</td>
<td>1,200 to 19,200 bps</td>
</tr>
<tr>
<td>Video Detection System Data</td>
<td>Detector Data</td>
<td>1,200 to 19,200 bps</td>
</tr>
<tr>
<td>Traffic Signal/System Detection</td>
<td>Traffic data, status</td>
<td>1,200 to 19,200 bps</td>
</tr>
</tbody>
</table>

Table 5-4 provides a summary of the most common video encoding methods used in ITS today, and the associated bandwidth requirement for full motion video.

Table 5-4
Video Encoding Methods

<table>
<thead>
<tr>
<th>Video Encoding Scheme</th>
<th>Bandwidth Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>MJPEG</td>
<td>240 Kbps</td>
</tr>
<tr>
<td>MPEG1</td>
<td>1.5 Mbps</td>
</tr>
<tr>
<td>MPEG2</td>
<td>3 to 10 Mbps</td>
</tr>
<tr>
<td>MPEG4</td>
<td>64 Kbps to 500 Kbps</td>
</tr>
</tbody>
</table>

5.2.3 Communications Standards Analysis

As defined earlier, there are two widely used backbone communication standards that support Ethernet-based transmissions; they are ATM and Gigabit Ethernet, each of which is discussed below. Additionally, a discussion on SONET has been included as it is also a widely deployed backbone communication system.

To analyze communications options for the Treasure Valley area, the following factors will be considered for SONET, ATM and Gigabit Ethernet:

1. Cost – The cost consideration will only include the communication equipment at the backbone and distribution level. The infrastructure costs, such as the cost of conduit, splice vaults, and pull boxes, should not be included for comparison because they will be the same regardless of the technology chosen. Costs used in the analysis are based on project experience of similar nature, discussions with manufacturers, and Internet research. Actual costs will depend on factors such as manufacturer, quantity, and technical specifications.

2. Requirements Satisfaction – Measures how well the technology satisfies the communication design requirements defined in Section 5.2.1.

3. Migration Path to the Ultimate Configuration – Since the Treasure Valley area will be implementing additional field devices in the near future, including new signalized intersections, CCTV cameras, DMS, speed monitoring, and VDS, the ultimate configuration of the system will depend on how the design and technology evolves in the future. The recommended technology should provide an easy migration path to the ultimate system.

4. Advantages and Disadvantages – This refers to the benefits and shortcomings of each technology.

Synchronous Optical Network – SONET

SONET defines the Optical Carrier (OC) levels and multiplexing hierarchy for fiber optic based transmission. It is available in different transmission rates, from OC-1 (51.84 Mbps) to OC-192 (9,953.28 Mbps).
Cost. Cost of SONET equipment will depend on the required bandwidth and the number of devices attached to the hub. The following provides a preliminary cost estimate based on the current typical cost for a SONET system:

- OC-1 switch: an average of $40,000 per location
- OC-3 switch: approximately $60,000 per location
- Digitally enhanced fiber optic data/video modem: approximately $11,000 per pair
- Digitally enhanced fiber optic data modem: approximately $5,500 per pair
- Digitally enhanced fiber optic video modem: approximately $6,000 per pair
- Network management software: $6,000 per user
- SONET training: $15,000 per system

Requirements Satisfaction. SONET is an internationally applicable standard endorsed by both ANSI (American National Standards Institute) and ITU (International Telecommunications Union). It has been a very reliable standard since 1988. It offers transmission speeds of up to 10 Gbps. Its high-speed backbone transport function provides reliable and economical long-distance transport. The robustness of this protocol has reduced the requirements in equipment and therefore increased the network reliability.

A SONET system will provide a significantly less-expensive network if more bandwidth is needed. Some vendors’ products support plug-and-play installation and most SONET equipment interface modules are hot swappable, so that they can be replaced without interrupting network traffic. The configuration of deployed modules can be provided in a database so that new modules can be configured with minimal downtime. SONET allows optical interconnection between networks regardless of the make of equipment. Next generation SONET equipment is equipped with security capabilities that ensure secure networking, safety from intruders and hacking tools.

However, SONET is a significantly more complicated network protocol than Ethernet. Although it has substantial overhead information to allow quicker troubleshooting and detection of failures, many Local Area Network (LAN) professionals are not familiar with the installation, operations, and maintenance of SONET. Most SONET equipment can meet all NEMA environmental specifications. Examples of SONET equipment manufacturers include Intelect, Tektronix, and Lightriver Technologies.

Table 5-5 summarizes the performance of SONET against each design requirement:

Migration Path to the Ultimate Configuration. Over time, if additional bandwidth is required, the Treasure Valley could replace the head end equipment at each hub. This upgrade can be done by replacing the chassis and the controller card at each hub. There is no need to replace the fiber optic modem at each device location.
Table 5-5
SONET Performance Comparison

<table>
<thead>
<tr>
<th>No.</th>
<th>Design Requirement</th>
<th>Performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Reliability/Redundancy</td>
<td>✓</td>
</tr>
<tr>
<td>2</td>
<td>Scalability</td>
<td>✓</td>
</tr>
<tr>
<td>3</td>
<td>Security</td>
<td>✓</td>
</tr>
<tr>
<td>4</td>
<td>Ease of Installation</td>
<td>✓</td>
</tr>
<tr>
<td>5</td>
<td>Ease of Operations</td>
<td>×</td>
</tr>
<tr>
<td>6</td>
<td>Ease of Integration</td>
<td>×</td>
</tr>
<tr>
<td>7</td>
<td>Ease of Maintenance</td>
<td>×</td>
</tr>
<tr>
<td>8</td>
<td>Network Management</td>
<td>✓</td>
</tr>
<tr>
<td>9</td>
<td>Technology Maturity</td>
<td>✓</td>
</tr>
<tr>
<td>10</td>
<td>Availability of Environmentally Hardened Equipment</td>
<td>✓</td>
</tr>
</tbody>
</table>

Legend
✓ Meet or Exceed Requirement, ✓× Meet Partial Requirement, × Does not Meet Requirement

Advantages and Disadvantages. Table 5-6 highlights the advantages and disadvantages of SONET:

Table 5-6
SONET Advantages and Disadvantages

<table>
<thead>
<tr>
<th>SONET</th>
<th>Advantage</th>
<th>Disadvantage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• SONET provides Automatic Protection Switching (APS) which protects the communication system against all network failure scenarios:</td>
<td>• High initial cost and operating expenses.</td>
</tr>
<tr>
<td></td>
<td>o Communication line card failure</td>
<td>• Complex technology, familiar to few professionals.</td>
</tr>
<tr>
<td></td>
<td>o Single cable cut</td>
<td>• Fixed bandwidth increment instead of dynamic bandwidth allocation means waste of system resources. For example, the bandwidth required for camera control is typically 9.6 kbps, but within a SONET system, a minimum bandwidth of 1.5 Mbps must be allocated.</td>
</tr>
<tr>
<td></td>
<td>o Dual cable cut</td>
<td>• Equipment is difficult to install and maintain.</td>
</tr>
<tr>
<td></td>
<td>o Node or site failure</td>
<td>• Requires replacement of any existing Ethernet switches.</td>
</tr>
<tr>
<td></td>
<td>• Superior to Ethernet in both general robustness and in technical areas related to timing and synchronization.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Superior to both ATM and Ethernet in network security.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Retains existing fiber optic transceivers.</td>
<td></td>
</tr>
</tbody>
</table>

Asynchronous Transfer Mode – ATM. ATM is a high bandwidth, high speed (up to 155 Mbps) standard based on the controlled-delay of fixed-size packet switching and transmission systems designed to integrate voice, video, and data. It uses fixed-size packets also known as “cells” (ATM is often referred to as “cell relay”).

Cost. Unlike SONET, ATM technology can be applied at both backbone and distribution levels. ATM equipment can be installed directly at a device location to eliminate the need of the fiber optic transceivers for the last mile link. However, a coder/decoder (CODEC) is always required to convert the video in digital format which can be transported on an ATM network. There are various compression schemes available. For the Treasure Valley
area, MPEG2 or MPEG4 compression is recommended. The following provides a preliminary cost estimate based on the current typical cost for an ATM system:

- Hub switch: an average of $35,000 per location
- MPEG4 CODEC with one video channel and bi-directional data: average $10,000 per pair
- Network management software: $5,000 per user
- ATM training: $15,000

Requirements Satisfaction ATM is a cell oriented switching and multiplexing communication technology that can be viewed as an evolution of packet switching, which is a fundamental communication technology for the telecommunications industry. ATM network is scalable in both speed and network size. It offers dynamic bandwidth for “bursting” data traffic. It shares a common architecture for both LAN and Wide Area Network (WAN). In addition, ATM allows all types of Ethernet LAN traffic to be multiplexed over a single ATM WAN and ATM equipment operate with direct SONET interface cards. However, like SONET, ATM is a more complicated protocol than Ethernet and its installation, operations, and maintenance are not familiar to many LAN professionals. In addition, an ATM network is less secure than a SONET because hackers can bypass the firewall. A wide range of ATM equipment is available in ruggedized formats that meet NEMA environmental specifications. Some of the ATM equipment manufacturers include Teleste, Cellstack, and Marconi.

Table 5-7 summarizes the performance of ATM against each design requirement:

\[
\begin{array}{|c|c|c|}
\hline
\text{No.} & \text{Design Requirement} & \text{Performance} \\
\hline
1 & \text{Reliability/Redundancy} & \checkmark \\
2 & \text{Scalability} & \checkmark \\
3 & \text{Security} & \checkmark \times \\
4 & \text{Ease of Installation} & \times \\
5 & \text{Ease of Operations} & \times \\
6 & \text{Ease of Integration} & \checkmark \\
7 & \text{Ease of Maintenance} & \times \\
8 & \text{Network Management} & \checkmark \\
9 & \text{Technology Maturity} & \checkmark \\
10 & \text{Availability of Environmentally Hardened Equipment} & \checkmark \\
\hline
\end{array}
\]

Legend

- \checkmark Meet or Exceed Requirement,
- \checkmark \times Meet Partial Requirement,
- \times Does not Meet Requirement

Advantages and Disadvantages Table 5-8 highlights the advantages and disadvantages of ATM.
Table 5-8
ATM Advantages and Disadvantages

<table>
<thead>
<tr>
<th>Advantage</th>
<th>Disadvantage</th>
</tr>
</thead>
<tbody>
<tr>
<td>- ATM was designed to handle voice, data, and video and has better video handling capability than both SONET and some say even Gigabit Ethernet.</td>
<td></td>
</tr>
<tr>
<td>- ATM has Quality of Service (QoS) support for multi-media traffic allowing applications with varying throughput and latency requirements to be met on a single network.</td>
<td></td>
</tr>
<tr>
<td>- Allow dynamic bandwidth allocation, which means the optimum utilization of bandwidth.</td>
<td></td>
</tr>
<tr>
<td>- Can support any existing Ethernet switches located at select field locations.</td>
<td></td>
</tr>
<tr>
<td>- Operating and managing an ATM network requires a steep learning curve. It is not inconceivable that dedicated staff would not be available for management of the network.</td>
<td></td>
</tr>
<tr>
<td>- ATM equipment is less expensive than SONET equipment but is more expensive than Gigabit Ethernet equipment.</td>
<td></td>
</tr>
<tr>
<td>- Requires replacing the fiber optic transceivers at field locations and TMC.</td>
<td></td>
</tr>
</tbody>
</table>

Gigabit Ethernet

Cost Like ATM, Gigabit Ethernet (GigE) technology can be used for the backbone level and at the distribution level. Ethernet equipment can be installed at both hubs and device locations. However, it is not required to provide the gigabit transmission rate at each device location. Typically, a 10Mbps or 100Mbps Ethernet switch, also known as 10/100 Base Edge Switch, will be installed at the device location to interface an ITS device, such as ACHDs existing signal controllers. For legacy equipment, such as NEMA, Type 170 or DMS controllers that do not have Ethernet ports, data signals need to be converted from serial to Ethernet format for transmission. Therefore, an RS-232 to Ethernet converter is required for each conversion. This may be applicable for some existing Treasure Valley equipment.

For a Gig-E deployment, cost variables will dictate transmission distance requirements. Most interface port modules in Layer 3 switches/routers employ lasers with a COTS range of 3-6 miles. For this reason, the maximum distance between a router and a hub switch should be kept to 3-6 miles if standard COTS equipment is to be employed. An example of this is can be demonstrated in the cost difference between an LX and LH mini GBIC modules. A standard LX module is rated for a 3.1 mile (5Km) range and retails for around $100, while a Long Haul LH module with a range of around 43.4 miles (70 Km) and retails for around $1,000. Mini GBIC modules, employed in routers are typically used to communicate with hub switches on a Gig-E ring.

The distance variables for edge switch circuits and hubs are more forgiving and can be extended to around 9 miles. Here again, more powerful port lasers are often employed in field switching equipment for distances in aggregates of 9.32, 24.85 and 46.60 miles (15, 40 and 75 kilometers) – this is done at a higher cost and can be avoided with proper planning and network design. Most switches typically come standard with 15 Km port lasers. The cost of a 15Km port is around $900, the cost of a 20Km port is $1200, and the cost of a 40 Km port is $1800 per port while 70 Km ports must be special ordered. The following provides a preliminary cost estimate based the typical costs, for a GigE system configured with hubs:

- Hardened 10/100/1000 Base Hardened GigE hub switch: an average of $8,000 per location
- Hardened 10/100 Base Ethernet Edge Switch: an average of $1,500 per unit for multi-drop switches
• Hardened 10/100/1000 Base Ethernet Edge Switch: an average of $3,500 per unit – typically used in full GigE ring configurations
• Layer 3 Router: an average of $9,000 per unit

Requirements Satisfaction Ethernet has traditionally been the technology for the home or office Local Area Network (LAN). In the past few years, Gigabit Ethernet or “GigE” is becoming popular as a LAN system due to its deployment over Cat 5 copper cabling. When GigE over fiber was approved by IEEE in 1998, many agencies began looking into applying a GigE system to their traffic communication system. Although GigE is an emerging system for traffic applications (less than three years), there has been substantial implementation by private companies in other market sectors which demand high communication bandwidth. Many cities throughout the country are employing either partial or full deployments of GigE technology for their communication systems. In the past three years, several vendors began offering hardened GigE equipment, accelerating the use of GigE for transportation applications.

Ethernet was not originally designed to provide redundancy and handle real-time voice and video. However, GigE has incorporated enhancements that are provided within SONET. Resilient Packet Ring (RPR) aims to give Ethernet the SONET-level protection and reliability with a data link layer optimized for packet traffic in both LAN and WAN environment. In addition, Quality of Service (QoS) is available to prioritize voice and video traffic across networks.

GigE or Ethernet is a familiar technology to Information System (IS) and LAN professionals. A GigE network is easily understood, configured, and highly scalable. While ATM can reach a capacity of 622 Mbps, GigE has the higher ultimate bandwidth, 1,000 Mbps. However, SONET still has the highest ultimate bandwidth, but the expense of added complexity.

The fact that Ethernet was developed for LANs and was mostly utilized in the air-conditioned environment of corporate and campus networks, heat and humidity was never an issue. However, NEMA specifications for outdoor traffic signal cabinets include upper temperatures of 70ºC (165ºF) and this limits the choices for hardened network equipment. Nonetheless, there are an increasing number of traffic equipment vendors supporting Ethernet communication, such as IP-addressable CCTV cameras (or encoder/camera combinations) and signal controllers – this will further the acceptance of Ethernet. When used in a GigE system, the IP-addressable devices can be accessed by their IP address from any standard Web browser or TCP/IP commands.

Some GigE switch equipment manufacturers include Extreme Network, IFS, Etherwan, GarretCom, and RuggedCom. Lastly, it should be noted that like ATM, a GigE network is less secure than a SONET network, but again, at the price of complexity.

Table 5-9 summarizes the performance of Gigabit Ethernet against each design requirement.

Migration Path to the Ultimate Configuration Between SONET, ATM, and GigE - GigE is the most scalable technology. Migration to the ultimate configuration is as simple as the replacement of network interface card (NIC) in a desktop computer. It is understood that a goal for ACHD and other Treasure Valley area agencies is to migrate to signal controllers employing Ethernet interface capability. This will eliminate the need for RS-232 to Ethernet converters and will allow these components to be accessed from anywhere on the network. With the use of IP-addressable PTZ CCTV and detection cameras, there is no need to have the video CODEC and RS-232 to Ethernet converter. Field equipment maintenance can be made much simpler.
Table 5-9
GigE Performance Comparison

<table>
<thead>
<tr>
<th>No.</th>
<th>Design Requirement</th>
<th>Performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Reliability/Redundancy</td>
<td>✓ ✗</td>
</tr>
<tr>
<td>2</td>
<td>Scalability</td>
<td>✓</td>
</tr>
<tr>
<td>3</td>
<td>Security</td>
<td>✓ ✗</td>
</tr>
<tr>
<td>4</td>
<td>Ease of Installation</td>
<td>✓</td>
</tr>
<tr>
<td>5</td>
<td>Ease of Operations</td>
<td>✓</td>
</tr>
<tr>
<td>6</td>
<td>Ease of Integration</td>
<td>✓</td>
</tr>
<tr>
<td>7</td>
<td>Ease of Maintenance</td>
<td>✓</td>
</tr>
<tr>
<td>8</td>
<td>Network Management</td>
<td>✓</td>
</tr>
<tr>
<td>9</td>
<td>Technology Maturity</td>
<td>✓ ✗</td>
</tr>
<tr>
<td>10</td>
<td>Availability of Environmentally Hardened Equipment</td>
<td>✓ ✗</td>
</tr>
</tbody>
</table>

Legend
✓  Meet or Exceed Requirement,  ✓ ✗  Meet Partial Requirement,  ✗  Does not Meet Requirement

Advantages and Disadvantages  Table 5-10 highlights the advantages and disadvantages of GigE.

Table 5-10
GigE Advantages and Disadvantages

<table>
<thead>
<tr>
<th>Advantage</th>
<th>Disadvantage</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Offers simpler, centralized management due to using a single protocol.</td>
<td>• Cost variables mandate transmission distance requirements on Gigabit Ethernet. It should be noted however that this is only a cost limitation, higher end lasers can be employed to reach up to 90 miles.</td>
</tr>
<tr>
<td>• Ability to easily upgrade network routers or nodes one at a time.</td>
<td></td>
</tr>
<tr>
<td>• Availability of equipment is high and prices are continuing to fall.</td>
<td></td>
</tr>
<tr>
<td>• Allows dynamic bandwidth allocation, which means the optimum utilization of bandwidth.</td>
<td></td>
</tr>
</tbody>
</table>
5.2.4 Summary of Communications Standards Analysis

Table 5-11 summarizes the evaluation of these technologies:

<table>
<thead>
<tr>
<th>General Consideration</th>
<th>SONET</th>
<th>ATM</th>
<th>GigE</th>
</tr>
</thead>
</table>
| Advantage              | • Built-in ring protection  
                        | • Robust and reliable technology | • Handles voice, data, and video better than others  
                        | | • QoS support for multi-media traffic  
                        | | • Allow dynamic bandwidth allocation |
|                        | • Simple and centralized management  
                        | • Easy to upgrade  
                        | | • Allow dynamic bandwidth allocation |
| Disadvantage           | • Complex technology  
                        | • Fixed bandwidth increment  
                        | • Difficult to install and maintain | • Not easy to manage and operate |
|                        | • Not easy to manage and operate  
                        | | | • Cost of COTS equipment will dictate transmission distance requirement |
| Migration to Ultimate Configuration | Good  
                        | Good  | Very Good |
| Design Requirements    | Reliability/ Redundancy | Good  | Good  | Good |
|                        | Security | Good  | Average | Average |
|                        | Scalability | Good  | Poor  | Very Good |
|                        | Ease of Installation | Average | Poor  | Good |
|                        | Ease of Operations | Poor  | Good  | Good |
|                        | Ease of Integration | Average | Poor  | Very Good |
|                        | Ease of Maintenance | Poor  | Good  | Very Good |
|                        | Network Management | Good  | Good  | Very Good |
|                        | Technology Maturity | Good  | Good  | Good |
|                        | Availability of Environmentally Hardened Equipment | Good  | Good  | Good |
| Cost Consideration     | Deployment Cost | Expensive | Expensive | Least Expensive |
5.3 Communication Technology Recommendations

Based upon the cost and benefit analysis identified in Section 5.2, a Gigabit Ethernet (GigE) Communications Network system is recommended for the Treasure Valley area. This network solution appears to be the most desirable communication technology that meets the goals of all agency partners as well as the requirements of the ITS systems being deployed. This conclusion is further confirmed by the fact that regional agencies are already beginning to employ Ethernet for communications in recent ITS deployments.

In deploying a GigE communications solution across an area the size of the Treasure Valley many design factors and systems should be reviewed. This section provides a discussion of these systems; identifies system components typically employed in deploying GigE networks; and provides possible alternatives to deploying ITS elements based on available communications media. Section 5.4 will provide recommendations for a high level plan to deploy GigE communications across the entire Treasure Valley area.

5.3.1 Communications Media

Communications media can be defined as that element that interconnects individual subsystems on a communications network. As an example, fiber optics is the premier media to deploy for any communications network. Since fiber optics is not available throughout the area and is at times expensive to deploy, other media options must be explored – especially for distribution and edge circuits of a network. For Ethernet based systems, media options are typically met by three basic elements - fiber, copper and wireless systems. The following is a brief discussion on the three most widely used media elements that make up a GigE communication networks. The alternatives presented herewith are not an exhaustive list but rather focus on the technologies currently in use and most suited for use in the Treasure Valley area.

Fiber Optics  Fiber optic technology transports information by sending light waves through the glass strands of a fiber optic cable. Therefore, in order to install a fiber optic network, a communications conduit and fiber optic cable infrastructure must be available. If not owned by the area agencies, it may be possible to lease fiber optic cable from private communications providers.

Fiber optic cable requires the use of fiber optic equipment to convert an analog signal into light encoded digitized data signals. This equipment ranges in price depending on the amount of network bandwidth required to be used. The fiber optic cable can be terminated on fiber distribution or patch panels and connected to fiber optic communications equipment (network switch, transceiver, etc.) at each location, i.e., controller cabinet, TMC, or hub communications room.

Where fiber is to be used for the communication media, it will consist mostly of a backbone, distribution, and drop cable interconnected through communication hubs. It is recommended that the Treasure Valley maintain its use of 6 or 12 strand single mode fiber optic cable for drop cables, 36 strand for distribution cable and 72 strand for backbone cable. Due to limited conduit availability and/or space found in typical existing conduits, plus the location density of the ITS elements to be supported, all cables will vary by segment of the communication system.

Twisted Pair Copper Interconnect  Twisted pair cabling can be used to support any existing communications technology. However, as in the case of fiber optics, a communications conduit and copper cable infrastructure must be available. These include dedicated circuits capable of transporting data at rates of 300 Bits per second (bps) to 45 Megabits per second (Mbps), with higher rates. New technologies available today allow for extensive use of existing twisted pair media for Ethernet based networks. This will be explored further in this section.
**Spread Spectrum Radio** Although not a tangible “media”, Spread Spectrum Radio (SSR) is one of the most widely used of the wireless technologies being applied in ITS. It is currently being used by ACHD for communications to some cameras along I-84. It is a non-licensed technology that uses radio broadcast power of less than 1 watt. The functional operation of SSR is identical to that of a modem. A problem with SSR is its sensitivity to line-of-sight antenna propagation, although this is generally overcome by the use of directional antennas. Deployment of these systems typically requires a pair of radios (transmitter and receiver). New advancements in this field have made available Non Line of Site (NLOS) technologies that allow Ethernet based wireless communications even in the case where obstructions exist between the radios. Orthogon Systems provides 5.4 GHz and 5.8 GHz wireless Ethernet bridges advertised to deliver 99.999% availability in even the most challenging environments. Acting as a bridge for fiber optic gaps makes them a cost-effective, faster to deploy, and easier to manage deployment over fiber and many other wireless solutions. These radios can typically provide throughput capacities of up 300 Mbps.

5.3.2 Network Communication Systems Topology

Another important variable in deploying Gig-E networks is the configuration or “topology” of the network. The most common types of network communication topologies in use for the Transportation Industry are Star, Ring, and Mesh. All of these topologies make use of a software network routing standard called Spanning Tree Protocol (STP), IEEE 802.1d and more recently Rapid Spanning Tree Protocol (RSTP), IEEE 802.1w. It is these standards that allow network designs that provide redundancy protection for fault tolerant operations. These algorithms provide the bridging required for networks to talk across multiple paths on a network. Spanning Tree manages the “re-building” of network bridges across alternate paths on a Star, Ring or Mesh network.

A Star network is the easiest to configure because all connections are point-to-point. The branch circuits can be any increment of 10/100/1000Mbps – depending on the equipment used. The typical configuration employs hub switches at a central site that connects to all Edge switches in the field. A disadvantage of a star network is its lack of redundancy and its use of two fiber strands (typical) for every edge device. A mitigating approach to this “lack of redundancy” is to configure the Star network with “logical rings” on the branch circuits. This provides redundant routes and allows for less use of fiber when employed in “daisy chained” connections on the branch circuits. When not used in a daisy chain, redundancy can become a fiber intensive approach for each edge switch. For this reason, the star topology works best at the distribution or edge circuit side of a network; this is illustrated in Figure 5-2.

![Figure 5-2 Star Network Topology](image-url)
A ring topology connects all of its network elements in a closed loop offering the highest level of system redundancy. This setup is typically deployed in a counter rotating configuration – typically achieved by network equipment employing the Rapid Spanning Tree protocol and/or other proprietary redundancy techniques. A ring topology provides more redundancy in the case of communications failures but does not offer the network segregation that does the Star/Ring configuration. Additionally, this approach requires much more conduit as a path to each edge device is required. This configuration is what most agencies strive for but is not always achieved because it is difficult and expensive to deploy throughout an entire city network. Since gaps will usually exist in fiber deployments during the early life of a system, other technologies may need to be employed for intermediate redundancy. Because of these gaps, until such time as the ring is complete redundancy is often not realized. It should also be noted, employing pure GigE ring topologies can be more expensive than a star networks, because of the associated equipment costs of fiber, conduit and network equipment. For this reason, hybrid solutions are typically deployed. An example of a Ring network is depicted in Figure 5-3.

A hybrid of the Star and Ring topologies utilizes GigE communication hubs on a backbone ring with edge equipment connected to the hubs in Star or Ring branches; this is illustrated in Figure 5-4. This approach is most typically used in ITS deployments and is one option for the network topology of the Treasure Valley area. A Star/Ring topology utilizing communication hubs does not provide total redundancy but does distribute the communication system into logical groupings and edge elements; this reduces the overall impact of a communications failure and simplifies network expansions – especially in terms of network growth, conduit and fiber use. One of the main advantages to this hybrid approach is the ability to expand the network without impacting on-going operations. This advantage makes the approach very attractive when considering that area wide networks are typically built-out through multiple projects as funding is available. For the Treasure Valley, this approach also makes expansion of the system simpler through the interconnection of multiple rings as will be discussed.
Finally, a mesh topology network connects its element using multiple paths. What this means is that in addition to system redundancy, it offers route redundancy. For the Treasure Valley communication system, the mesh topology was not considered because it involves the most infrastructure and highest deployment cost.

5.3.3 Network Switching Components

The basic building block of any Ethernet network is the network switch. The switching equipment employed for any GigE network in the Treasure Valley will be the most important components on the network. Network switches act as temporary homes, concentrators, traffic cops, and distribution points for data packets on the network. For ITS deployments that transmit video over a TCIP network this packet management is a critical issue that requires special handling. An addressing and broadcasting method known as Multicast Addressing or Broadcasting plays an important role in getting a video signal on a network from one port to another without clogging up the entire network.

Multicast allows for sending one copy of a data packet to a group of computers that want to receive it. Multicast can be implemented at the Ethernet link-layer or at the network layer (layer 3 of the OSI model) making a Layer 3 device a requirement for the network. Computers (or video encoders) join and leave multicast groups by using the IGMP (Internet Group Management Protocol). Each host computer can register itself as a member of selected multicast groups through use of the Internet Group Management Protocol (IGMP).

Multicast is commonly used in audio and video streaming applications. It allows a single source of traffic to be viewed by multiple destinations simultaneously. It is designed to provide an efficient transmission using the least amount of bandwidth on the network to save cost. IGMP is the standard IP protocol supported by most LAN/WAN vendors for LAN products. Most ATM and Gigabit Ethernet system switches can employ Multicast addressing.

When choosing Ethernet Switches for a network several factors should dictate the decision including:

- Specific port density requirements
- Network topology to be deployed
- Temperature hardened requirements (outdoor)
- Full support for IGMP protocol
- Preferred manufacturer
- Specific switch functionality on the network
- Product warranty and support

Figure 5-4 Hybrid GigE Backbone Ring with Star Network Hubs
There are 3 types of Ethernet Switches meeting specific functions on a network that can be considered for the Treasure Valley. Important factors to keep in mind when choosing these components are noted below:

- **Layer 2 Switch** – this switch is typically deployed at the edge of the network (the point closest to the Network Interface Card (NIC) on a device). A hardened unit is required. Layer 2 switches,
  - distribute traffic to each destination using addressing tables,
  - broadcast the Multicast data traffic across all its ports,
  - provide no Multicast traffic filters.

- **Layer 2 Switch with IGMP Snooping** – this switch is typically deployed at a hub location and therefore a hardened unit is typically required. This type of Layer 2 switch,
  - distributes traffic to each destination using addressing tables,
  - provides limited control of Multicast traffic preventing broadcast to all ports,
  - provides a level of multicast filtering but a Layer 3 IGMP master is still needed in the network.

- **Layer 3 Switch with IGMP** – this switch is typically the most expensive device and typically deployed at the TMC to manage the network traffic on a ring by ring basis. This switch,
  - distributes traffic to each destination using addressing tables,
  - distributes traffic to each destination using IP subnet addressing table,
  - provides maximum control of Multicast traffic preventing broadcast of traffic to all ports and subnet,
  - has many of the capabilities typically found on a dedicated router.

Some Ethernet switching equipment vendors and features for the products they typically provide for ITS video communications applications are as follows:

1. **Etherwan Systems** – Hardened and non-Hardened Layer 2 and some Layer 3 switches in 10/100/1000Mbps multi-port capacities for ITS environments. Provides options for a single GigE port option at the edge.

2. **IFS** – Hardened Layer 2 Edge switch. Newer to the Ethernet market but comparable to Etherwan Systems. Provides options for a single GigE port option at the edge and supported by IFS’s Lifetime Warranty program.

3. **GarrettCom** – Hardened and Non Hardened Layer 2 and Layer 3 switches in 10/100/100 Mbps capacities for ITS environments, comes with more industrial selections and configurations. Additionally it also provides options for dual GigE ports at the Edge side – this allows for true GigE rings implementations.

4. **Foundry Network** – Typically used for the Layer 3 Switch/Router at the.

5. **Cisco Networks** – Most extensive line of switching equipment but most accepted by Network Managers. Commonly deployed at the TMC in environmentally friendly rooms. Cisco does provide a hardened Layer 2 switch (Cisco 2955) but it does not meet high temp NEMA TS2 requirements.

### 5.3.4 IP Video Encoding Components

IP Video Encoders/Decoders are stand alone subsystems that encode and decode an analog video signal into TCP/IP packets for transmission on an Ethernet network. To deploy a successful IP video system it is important to adhere to industry standards. There are five major MPEG standards – MPEG1, MPEG2, MPEG4, MPEG7, and MPEG21. This section presents a short look at the two standards typically employed in traffic applications today.
MPEG2 is Digital Television (highest quality video) - The MPEG2 standard builds upon MPEG1, extending it to handle the highest-quality video applications. MPEG2 is a common standard for digital video transmission in traffic applications when a high end networks are available (i.e. Gig-E) and broadcast level video is a must! Broadcast distribution equipment, digital cable head-ends, video DVDs, and satellite television all employ MPEG2; as do point-to-point streaming devices like the PelcoNet, VBrick, iMPath, Mavix, Cornet, etc. This standard, by far produces the best picture quality but at a higher bandwidth sacrifice.

Although software encoding is available for lower resolution viewing on a workstation, to view MPEG-2 on a workstation, special capture cards are required to decode MPEG2 in real-time. Typically, in traffic applications, MPEG2 is used with encoders that produce analog video that is routed through a video matrix switch and displayed on TMC analog signal input monitors. MPEG2 needs about 6Mbps to provide the quality typically found on movie DVDs, although data rates up to 15Mbps are supported. 720X480 is the typical 4:3 default resolution, while 1920x1080 provides support for 16:9 high-definition televisions.

It should also be noted that MPEG2 is a compression format with mature and accepted standards, for this reason, it is more likely to be used in ITS applications than MPEG4. Its superior picture quality may however, at times, come at the expense of some latency in PTZ control. This is particularly noticeable in lower bandwidth deployments. If GigE is employed this issue should not be a problem for the Treasure Valley network.

MPEG4 – Internet Streaming and Synchronized Multimedia - Where MPEG2 was designed to scale up to broadcast and high-definition quality and operating requirements, MPEG4 goes the other way. It is designed to scale down – down to dial-up internet bandwidths and to tiny devices like cell phones and PDAs. It is designed to do this and still remain a viable solution for high-quality desktop streaming up to 1Mbps.

MPEG4 is still at the frontier of media technologies. The specification is extensive and vendors typically implement the standard in their own way. For this reason intermixing vendor encoders is never recommended. A review of a variety of MPEG4 tools will find numerous incompatibilities. The Internet Streaming Media Association (ISMA) is an industry consortium dedicated to interoperability among MPEG4 products and services. Essentially, any implementation that is ISMA-compliant will work with any other.

When choosing MPEG4 encoders, the quality of the image, cost, vendor support and environmental applications should determine the choice. For these reasons it is recommended that the various vendors be evaluated at time of deployment. One requirement that is worth maintaining is the encoder’s support for IGMP V2.0. This requirement is not supported by all vendors and is important to Multicast network operations. COHU, Cornet (Video Convergence) and VBrick provide MPEG4 encoders employed in ITS applications that meet this requirement. It should also be noted that new emerging technologies may also impede the future use of MPEG4.

H.264 - The next emerging standard that may become more popular than MPEG2 or MPEG4. H.264 provides the highest quality video at half the bandwidth of MPEG2. It is an emerging standard and therefore products for ITS applications are yet to be developed. Today all encoding equipment available for ITS environments is built around MPEG2 or MPEG4.

5.3.5 Wireless Network Components

Three basic wireless technologies are employed today for ITS wireless applications. These technologies include solutions based mostly on FHSS, DSSD, and OFDM radios. WiMAX and Wi-Fi solutions are also becoming available
but have not been proven for ITS applications and are not yet recommended for extensive network use although they could be employed in last leg or remote applications. These technologies are presented herein for consideration.

**FHSS (Frequency Hopping Spread Spectrum)** - An FHSS radio signal is broadcast on a very narrow band in very short bursts. The broadcast signal "hops" around within the channel frequency band. Both transmitter and receiver are synchronized to the same hopping pattern. FHSS provides only 3 Mbps capacity links, but it is a widely used technology, employed in harsh environments characterized by large areas of coverage, multiple collocated cells, noise, multi-path, Bluetooth presence, etc.

**DSSS (Direct Sequence Spread Spectrum)** - A DSSS data signal is combined with a higher-data rate data stream. The resulting signal is spread across at least 10x the bandwidth of the un-spread signal. The wider data-stream provides redundancy for data bits damaged in transmission. DSSS provides 11 Mbps capacity links, but it is sensitive to RF interference (collocation, multi-path, near/far, Bluetooth). The limiting factor, multi-path, is typically minimized by using the technology in short distances or in point-to-point applications.

**OFDM (Orthogonal Frequency Division Multiplexing)** - A spread spectrum technique that distributes the data over a large number of carriers that are spaced apart at precise frequencies. This spacing provides the "orthogonality" in this technique, which prevents the demodulators from seeing frequencies other than their own. The benefits of OFDM are high spectral efficiency, resiliency to RF interference, and lower multi-path distortion. OFDM is used by Digital Audio Broadcasting (DAB) standard in the European market and development is ongoing for wireless Local Area Networks - point-to-point and point-to-multipoint configurations.

**WiMax (IEEE 802.16)** - Two driving forces of modern Internet are broadband, and wireless communications. The WiMax standard combines the two, delivering high-speed broadband access over a wireless connection. Because it can be used over long distances, it is an effective "last mile" solution for delivering broadband level connections to remote places.

WiMAX and related broadband wireless access technologies offer a return on investment that is very compelling because conduit and cable is not required. WiMAX products are steadily coming into market in 2006, mostly for home and business applications. These initial offerings all conform to fixed wireless profiles, and mobility will not be available in WiMAX Forum Certified products until 2007 at the earliest. In addition, the first set of WiMAX products will operate at 3.4-3.6 GHz, (not always commercially available/allowable in the United States) so network operators without a license for this frequency band must seek alternative technologies in the near term.

Based on the IEEE 802.16 Air Interface Standard, WiMax can provide a point-to-multipoint architecture, making it an ideal method to deliver broadband level communications to ITS locations where wired connections would be difficult or costly. Since a WiMax connection can also be bridged or routed to a standard wired or wireless Local Area Network (LAN) this solution is ideal for "last mile" applications that connect to wire networks. Although it is a wireless technology, unlike other wireless technologies, it does not require a direct line of sight between the source and endpoint, and it has a service range of 50 kilometers. It provides a shared data rate of up to 70Mbps, which is enough to service most ITS applications on most corridors. WiMax also offers some advantages over WiFi and other similar wireless technologies, in that it offers a greater range and is more bandwidth-efficient.

WiMax requires a tower, similar to a cell phone tower, on which is mounted a Base Station Unit (BSU) which is connected to the Internet or dedicated network using a standard wired high-speed connections. A Subscriber Station Unit (SSU) acts as the interface point for network edge devices. Much of this tower and BSU infrastructure will be deployed by ISPs that can provide fee based access for the Treasure Valley Area use. A more extensive analysis between dedicated agency owned equipment and fee based service should be conducted as the technology
WiMax is a technology that will develop quickly in the near future and may become a major component of the Treasure Valley area network. This technology should be further reviewed as the standard matures and vendors begin to provide components suitable for ITS environments and applications. A notable point of review in current offerings are the temperature specifications for power inject units that provide power and network connectivity to the subscriber stations – example Proxim Tsunami MP.16 3500 units with temperature rating of 0ºC to 40ºC (32ºF to 104ºF) degrees. Clearly, a more hardened solution is required for applications within a traffic cabinet.

**Why not use Wi-Fi (IEEE 802.11b)?**

1. 802.11b uses high speed, short range, DSSS radios. This is fine for transferring files in a home or office environment but offers a much less robust RF connection than FHSS radios.

2. 802.11b systems are often used for IT LANs, barcode systems, or other non-critical, short-range networks throughout a city network. Using a non-802.11 technology isolates control networks from other LANs and reduces the chance of adverse RF interaction. As an example FHSS radios have a unique "Frequency Skip" feature that avoids the 802.11 Wi-Fi Ethernet channels. This means your control radios will not interfere with or suffer interference from co-located PC wireless networks.

3. Hackers expend considerable effort and time attempting to crack 802.11 data encryption and other software security schemes. As a result, these individuals are less likely to be familiar with non-802.11 systems and are less likely to have radios compatible with a non-802.11 system. Wi-Fi “denial of service” devices exist on the Black Market today that allow a person with malicious intentions to drop a Wi-Fi scrambling device into a public trash can and deny service to Wi-Fi networks within a 2 block radius.

Some wireless radio vendors that currently provide systems for ITS applications include Encom, Motorola, Proxium Tsunami, MeshNetworks, Freewave, and Orthogon. All have versions of radios that operate on varying un-licensed frequencies - either 900, 2.4 or 5.8MHz. Some vendors provide both Ethernet and traditional point to point serial radio solutions. Most vendors specify radio link rates from 100 to 400Kbps in hardened configurations. Higher end systems that do not meet NEMA TS2 ratings provide significantly higher link rates (up to GigE). This limitation makes MPEG4 based video encoders a very attractive solution for wireless applications. Motorola, MeshNetworks, Proxim and Orthogon offer higher end radios while Encom and Freewave provide NEMA TS2 rated solutions.

### 5.3.6 Ethernet over Copper Network Components

The IEEE 802.3ah subcommittee is the body developing the standards for Ethernet over voice-grade copper. Known as the Ethernet in the First Mile subcommittee (or EFM), it has made advances toward its goal of securing a standard for 10M bit/sec service over at least 2,500 feet of copper wire.

One vendor providing Ethernet over copper solutions for the ITS industry is Actelis Networks. Actelis' MetaLIGHT platforms have been used in ITS applications and are field proven. These platforms offer high-bandwidth, high-quality, symmetrical communications services for Ethernet or ATM networks. They do this with low delay over multiple copper pairs – as are typically available and employed for signal interconnect.

The MetaLIGHT platforms can be used in either point-to-point configurations, utilizing the same MetaLIGHT units for both the transmitter and receiver units, or in point-to-multipoint configurations utilizing two different models of MetaLIGHT platforms - one MetaLIGHT receiver unit and multiple MetaLIGHT transmitter units. For the Treasure Valley ITS Strategic Plan, Actelis' MetaLIGHT platforms have been selected as the solution for the Treasure Valley ITS project due to their high performance, reliability, and ease of deployment.
Treasure Valley ITS Strategic Plan

Valley GigE communications network these units can be used as “gap fillers” or “last mile” for branch circuits on networks that contain twisted pair interconnect. Point to Point bridge unit bandwidth capacities for this technology is defined in Table 5-12.

<table>
<thead>
<tr>
<th>Point-to-Point Platforms</th>
<th>Maximum Bandwidth</th>
<th># of Pairs</th>
<th>Services</th>
</tr>
</thead>
<tbody>
<tr>
<td>MetaLIGHT 50</td>
<td>45 Mbps</td>
<td>1-8 Pairs</td>
<td>Ethernet</td>
</tr>
<tr>
<td>ML600 MUNI</td>
<td>45 Mbps</td>
<td>1-8 Pairs</td>
<td>Ethernet</td>
</tr>
<tr>
<td>MetaLIGHT 100E</td>
<td>70 Mbps</td>
<td>1-16 Pairs</td>
<td>Ethernet</td>
</tr>
</tbody>
</table>

In applications where fiber is not available but copper is, the ML600 line of transceivers is recommended for branch circuits on the network. These units can be configured in point to point or daisy chained (add/drop) configurations making them compatible with existing signal interconnect wiring, the only requirement depending on the required throughput for the branch is the number of pairs employed (1–8). The ML600 line also comes with on board Ethernet ports, eliminating the requirement of an Edge switch at the field element.

5.3.7 Recommended Components for deploying ITS elements on Fiber Optics networks

Where fiber optic cable is available and utilized for the network branches, communications with ITS elements will typically require installation of the equipment listed below.

1. Where new traffic signals are installed or existing signals are upgraded; Ethernet-ready controllers, such as Naztec 900T are required. For existing NEMA controllers Ethernet SLIPs can be employed for serial to Ethernet communications conversion if controller upgrades are not feasible.

2. Where CCTV is to be deployed; they must be IP addressable with a hardened MPEG encoder that supports MPEG2, MPEG4 or both.

3. Where Video Detection Systems are deployed; a hardened four (or 2 dual) input IP video encoder is required.

4. Where Dynamic Message Signs are deployed, an Ethernet based DMS controller is required. Where existing controllers are deployed with serial connections a SLIP may be added for serial to IP conversion.

5. A network switch is required in the field cabinet. This is typically a FAST (10/100Mbps) hardened fiber Ethernet Edge switch for optical transmission and connection to the network GigE hub switch making up the backbone.

6. Network cabling (CAT6 cable preferred) connecting controllers and encoders to the edge switch. CAT5 cable is sufficient for most applications, but CAT6 provides additional bandwidth.

7. Connection to the GigE backbone will be made via a fiber connection to a Gigabit Ethernet switch located at a nearby communications hub. This hub switch forms the backbone communications for this leg of the network.

8. Gigabit-Ethernet router at the TMC to serve as the Layer 3 head-end switch for the entire network.

9. Miscellaneous fiber interface equipment such as termination splice enclosure, fiber jumper cords.

These network components and their associated interconnections are illustrated in Figure 5-5 for a typical Star network. Edge switches are connected via fiber optic cable at each hub switch for transmission back to the TMC over the backbone network. This will typically involve a FAST Ethernet switch at the controller cabinet and fiber connections to one or more Gigabit Ethernet switches in the communication hubs. A head-end Layer 3 switch at the
TMC will manage the network traffic for the ring. At each cabinet site, Ethernet switches can be used to support multiple ITS Ethernet devices and also possible ancillary components for use by other agencies partners.

**Figure 5-5  ITS Components Connect by Fiber on Ethernet Network**

### 5.3.8 Recommended Components for deploying ITS elements on wireless networks

Where fiber optic cable is not available, wireless communications can be utilized to provide communications to the ITS elements at the edge. ACHD currently employ serial-based Spread Spectrum Radios (SSR) for CCTV. Where wireless technologies are to be employed, new Ethernet-based spread spectrum radios are recommended. The approach detailed herein assumes the use of Ethernet-based SSR for “last mile” or “gap closure” applications only. These network components and interconnections are illustrated in Figure 5-6 for a typical Star network. Where wireless communications is to be utilized, the installation of the equipment listed below is typically required.

1. Where new traffic signals are installed or existing signals are upgraded; Ethernet-ready controllers, such as Naztec 900T are required. For existing NEMA controllers Ethernet SLIPs can be employed for serial to Ethernet communications conversion if controller upgrades are not feasible.

2. Where CCTV is to be deployed; a hardened MPEG encoder that supports MPEG2, MPEG4 or both is required.
3. Where Video Detection Systems are deployed; a hardened four (or 2 dual) input IP video encoder is required.

4. Where Dynamic Message Sings are deployed, an Ethernet based DMS controller is required. Where existing controllers are deployed with serial connections a SLIP may be added for serial to IP conversion.

5. Where more than one Ethernet port is required for multiple network connections. A network switch is required in the field cabinet. This is typically a FAST (10/100Mbps) hardened fiber Ethernet Edge switch for optical transmission and connection to the network GigE hub switch that makes up the backbone. Typically SSR systems will have at least one network port.

6. Network cabling (CAT6 cable preferred) connecting controllers and encoders to the edge switch. CAT5 cable is sufficient for most applications, but CAT6 provides additional bandwidth.

7. SSR Ethernet transmitter and antenna at Intersection #1; vendors include Encom, Orthogon, and Freewave.

8. Matching SSR Ethernet receiver system and antenna at an adjacent signalized intersection #2 or cabinet location supported by fiber optic cable. Communication between Intersection #1 and at Intersection #2 requires a direct line of sight and/or the use of repeaters between the signalized intersections. Orthogon Systems NLOS radios may eliminate this requirement.

9. Connection to the GigE backbone will be made via a fiber connection to a GigE switch at a communications hub. This hub switch forms the Gigabit Ethernet backbone communications for this leg of the network.

10. Gigabit-Ethernet router at the TMC to serve as the Layer 3 head-end switch for the entire network.

11. Miscellaneous fiber interface equipment such as termination splice enclosure, fiber jumper cords.

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**Figure 5-6  ITS Components Connected by Wireless Systems on Ethernet Network**
SSR transceivers transmit to other sites supported by fiber and equipped with a matching SSR receiver for transmission over the communication backbone, back to the TOC that is also on the backbone network. Once the SSR Ethernet radio is connected to the switch at intersection #2, data from Intersection #1 is now integrated into the Ethernet communication system. Data from Intersection #1 is transmitted back to the TMC as needed.

5.3.9 Recommended Components for deploying ITS elements using Ethernet over Copper

Where fiber optic cable is not available, but existing twisted pair copper interconnect is available, Ethernet over copper IP systems may be utilized to provide communications to the ITS elements. As with wireless communications this design approach assumes the use of Copper over Ethernet-based systems in "last mile" or "gap closure" applications only. Where Ethernet over copper is used communications for the network branches, communications with ITS elements will typically require installation of the equipment listed below.

1. Where new traffic signals are installed or existing signals are upgraded; Ethernet-ready controllers, such as Naztec 900T are required. For existing NEMA controllers Ethernet SLIPs can be employed for serial to Ethernet communications conversion if controller upgrades are not feasible. Where CCTV is to be deployed; hardened MPEG encoder that support MPEG2, MPEG4 or both is required.

2. Where Video Detection Systems are deployed; a hardened four (or 2 dual) input IP video encoder is required.

3. Where DMSs are deployed, an Ethernet based DMS controller or SLIPS is required.

4. An EFM transceiver is required at the device connection location along with a network switch.

5. Network cabling connecting controllers and encoders to the edge switch.

6. A matching EFM transceiver at the connection point of the GigE backbone is required. This assumes the existence of 2 to 8 pairs of twisted pair copper wiring between each EFM transmitter.

7. Gigabit-Ethernet router at the TMC to serve as the Layer 3 head-end switch for the entire network.

Ethernet over copper components and interconnections are illustrated in Figure 5-7 for a typical Star network.
5.3.10 Video Detection Systems

ACHD has installed video detection systems at many signalized intersections. It is anticipated that both ACHD and ITD will employ more video detection at future signalized intersections. These existing video detection systems include Iteris Inc. Vantage and Traficon units. Other agencies have centralized communications with these units to improve the overall performance and maintenance of these systems. One of the needs for the communication system is to provide communications from the TMC to the video detection systems. This will provide agencies the ability to manage video detection installations from the TMC. This will also allow TMC personnel the ability to modify detection zones and troubleshoot video detection issues directly from the TMC. An added benefit is the ability to use the video detection systems as supplemental video surveillance at signalized intersections without CCTV cameras.

The interface between the video detection installations and the TMC operators will be either a stand-alone VDS software system or existing IBI ATMS software modified to support this functionality by integrating the VDS management software. The GigE communication system will be the network used to provide the connection between the central software and the video detection installations.
In association with the Ethernet-based communication system, three installation alternatives have been identified in association with signal controller communications. Since deployment of traffic signal controllers will always be associated with VDS, the communications alternatives included for the traffic signal controllers directly apply for VDS. For VDS at freeway ramps, communications methods similar to those of DMS equipment may be employed.

Whether employed as part of a Fiber Optics, Wireless, or Twisted Pair Copper Ethernet system, centralized communications with the VDS equipment requires the same basic components at the VDS controller and traffic cabinet. Where video detection systems are employed, dedicated encoders can be used for video encoding and network interface of the VDS equipment. This configuration is illustrated in the previous diagrams.

5.3.11 Interconnecting Treasure Valley Agencies

The deployment of a high-bandwidth fiber optic communications system, especially one that supports Gigabit Ethernet-based communications will offer the Treasure Valley area a network that can provide flexibility and modularity to support more than just isolated street or freeway traffic operations.

Until the proposed IROC is deployed, ACHD and ITD, along with other Treasure Valley agencies will need to communicate and share data. Eventually, the IROC may act as a central point of operations but even then ITS field elements and other agencies will still need to be interconnected. The Ethernet communications systems employed for traffic operations can be used to not only connect ACHD and ITD computer networks but also computer networks of other Treasure Valley partner agencies. The communication system deployed should be designed to support communications between these agencies including Police, Fire and Paramedic Emergency services to name a few.

A key network strategy that will allow for the sharing of network equipment and bandwidth among agencies is a concept known a Virtual Local Area Networks (VLANs). A VLAN can be roughly equated to a broadcast domain or “area of broadcast” within a network. VLANs can be seen as analogous to a group of end-stations (PCs), perhaps on multiple physical LAN segments, that are not constrained by their physical location and can communicate as if they were on a common LAN (as if they were actually interconnected by physical wires). Individual VLANs would be defined for Traffic Data, Network Management, Video, Police, Fire, etc. on an area wide network to segregate functionality. In this manner, network traffic segmentation can be achieved allowing for a better distribution of network bandwidth. When communications is required between network rings the router will act as the traffic cop directing traffic. For traffic within the rings, tagged ports on the hub switches manage the inter VLAN traffic. In this manner heavy bandwidth users like video equipment will not interfere with data traffic of other network segments.

Figure 5-5 shows multiple network rings interconnected via routers within their respective ring circuits to achieve center-to-center communications. It is this interconnection of network segments or “rings” that will make up the entire network. For agencies to be part of the network, interconnecting into these sub-networks (or rings) will require the installation of fiber into the appropriate buildings, which typically involves the installation of conduit and backbone fiber into the building itself if it does not already exist. This fiber and conduit, along with the typical equipment illustrated in Figure 5-8, will be required for the interconnection of these agencies and expansion of the network beyond each ring. Note that the network equipment within the centers is typical networking equipment and may already exist as part of the agencies’ existing IT infrastructure.
Figure 5-8 Backbone Center to Center (Inter Ring) Communications
5.4 Area Wide Backbone Communications Recommendations

As with previous communications plans, a hybrid approach is recommended for continued support of ITS elements in the Treasure Valley area. The three communications strategies (Fiber Optics, Wireless and Ethernet over Copper) discussed in previous sections should be employed as a hybrid combination to continue expansion beyond the current limits. Where funding is available, fiber optics should be considered the primary choice for the communications media to deploy. Fiber optics cabling should always make up the network backbone, with wireless and copper solutions making up any missing gaps in distribution or edge circuits. This section provides recommendations for the backbone level requirements of a GigE network in the Treasure Valley.

In consideration of this continued hybrid approach to communications, it is important to keep in mind priority ITS corridors that are important to the area. For the Treasure Valley these corridors are identified in Chapter 3. Deploying fiber optics along these corridors will ultimately lead to an area wide fiber optics network suitable for GigE backbone rings. For this reason it is recommended that fiber be deployed along these corridors. This alignment with the corridors is what will allow for the interconnection of hubs or partner agency centers. The interconnection of these hubs and agencies will make up the overall (or multiple) future communications ring(s) for the area.

A major cost consideration for an area wide fiber network design is the distance between fiber transmission equipment – in the case of a GigE network; this is typically governed by the distance between hub switching equipment. As previously discussed because of the transmission requirements of lasers employed in fiber networks, the distance between each hub switch should be kept to less than nine miles. This is done to maintain the use of COTS switching equipment whenever possible. For connections between router and hub switches a three mile range should be observed.

Implementing a Gig-E ring throughout the area will require a plan that takes into account priority corridors, existing fiber, and possible future hub and agency locations within the entire Treasure Valley area. Since fiber deployments will likely be a phased approach, key partner centers, existing hubs, existing TMCs, proposed TMCs, and existing radio tower equipment room locations should all be considered as potential hub locations. Locations that have (or will have) available environmentally controlled communications rooms are preferred locations and should be used wherever possible. As a preliminary analysis of the GigE concept, a Conceptual Backbone Fiber Deployment and Ring Configuration for the Treasure Valley area is depicted in Figures 5-9 and 5-10. Section 5.3 provides details for Gig-E network technology options that can be employed at the distribution and edge circuit levels. A more detailed analysis is recommended for design of the initial rings and the entire Treasure Valley area to deploy Gig-E communications.

Figure 5-10 identifies several rings that could be deployed as part of a phased approach to several fiber optic projects defined in Figure 5-9. Network Rings are important because they allow for better redundancy and network management. Shown in Figure 5-10 diagram are proposed rings that could be recommended, based on existing infrastructure and alignments with the defined priority ITS corridors. Note that the ring circuits do not necessarily need to line up with the priority corridors but should allow for connection via distribution fiber legs, as they are implemented in the short, medium and long term deployments. Also note it is also possible to build each ring by encompassing successive rings as fiber is available, making use of lower level ring circuits as distribution legs or simply maintaining them as separate rings interconnected. This concept should be studied further to see how details for the west end of the Treasure Valley could be developed. Since this area has yet to begin fiber deployments, future fiber installations will define ring configurations that will make more sense for the area. Hub sites defined for
this conceptual discussion line up with phased fiber deployments, existing key partner centers, existing hubs, existing TMCs, proposed TMCs, and existing radio tower equipment room locations. An overall Treasure Valley area ring can also be made up of Rings 1, 2, 3, and 4 with distribution fiber intersecting and connecting each ring along priority corridors. Each ring circuit begins as distribution fiber leg then closes itself with proposed fiber. Lateral connections to the ring or distribution fiber will later provide individual ITS element connection to the network at the edge circuit side. These lateral connections can be achieved by the options identified in Section 5.3. Again, this should be explored further as the fiber is deployed.

A very conservative approach was taken for this initial analysis. Special consideration was given to the distances involved between hubs. Based on this analysis, indications are that full network coverage is feasible, even with COTS equipment. The potential hub locations identified are all within a 9-mile grid from each other. The hub locations are shown and noted for a very rough analysis only and will need to be explored further.

Since fiber improvement strategies are likely to be deployed in stages (short, medium, and long term) each stage must build upon the previous. To efficiently do this, it is important to review and make use of what has already been deployed – especially in terms of the central point of the network. The logical starting point for network upgrades should be from the central hub of the existing systems. Although it is highly conceivable that other locations or agency centers will turn into additional centralized communications hubs (ex. IROC, ITD, State Police), today the central hub for the majority of the communications in the area is the ACHD TMC. It is for this reason that the existing ACHD TMC systems were documented in Figure 5-1. It is the expansion of these systems that will ultimately lead to the deployment of GigE network Ring 1 and the multiple rings that can be interconnected to this initial network – note the ACHD TMC is located within Ring 1 in Figure 5-10. A high level conceptual design of the ultimate ACHD TMC system network required for a GigE backbone is depicted in Figure 5-11. The basic network concepts in this diagram are typical for any other agency partner deploying a TMC facility in the area.

Since it is the interconnection of multiple sub-networks that will make up the area wide system, major existing partner agency centers already connected to the ACHD TMC should begin the interconnection of strategic sections of their respective centers and networks onto the GigE backbone. Based on initial usage and operations, the two partner agencies that can benefit the most from this initial integration include Idaho State Police and ITD. For the purpose of this analysis, it is assumed that communications for these agencies and the IROC (future) will be deployed as hubs on the overall GigE network. Upgrades and integration for the three strategies presented herewith will include these agencies as initial GigE hub locations within Rings 1, 2, and 3.

Short, Medium, and Long Term fiber backbone deployment recommendations are presented in Sections 5.4.1, 5.4.2, and 5.4.3 herewith, and identified for their respective deployments on Figures 5-9 and 5-10. The respective ITS element deployment strategies are defined in Section 6 of this report. Each of these phases consists of stand-alone subsystem deployments capable of delivering benefits that can be constructed under separate contracts over a period of time. Although each strategy is considered a stand-alone deployment, the communication system must be able to accommodate the combined ITS element deployments and be expandable for long term ITS element deployment and technologies. For this reason, it is further recommended that upgrades begin with current ACHD TMC elements in parallel with any field upgrades. An example of this is the ORION video network system. For initial phases it is not recommended that this system be abandoned but merely augmented with IP video systems that can provide more cost effective expansions. Ultimately the ORION, OTN and Harris systems could be phased out, however this will happen only when all partner agencies are interconnected and the GigE network is fully deployed.
As part of each phase, it is recommended that a detailed and comprehensive design study of existing available fiber be conducted, to determine the best approach to completing the overall GigE network design. This should begin with an updated Master Communications Plan that has an emphasis on GigE deployments.
Figure 5-9  Proposed Short, Medium and Long Term Fiber Deployments for the Treasure Valley area
Figure 5-10  Proposed Ring Configuration Deployments for the Treasure Valley Area
Figure 5-11 Conceptual ACHD or Other Partner Agency GigE Design
5.4.1 **Short-Term Deployment (0-5 years)**

Short term recommendations are expected to generally follow priority corridor requirements and complete any short term ITS recommendations not completed (but are still required) from 1999 plans. They should continue fiber optics deployment to complete network rings. The following elements are envisioned to be deployed during the short term:

**Network Ring and Fiber Development**
- Implement remaining fiber optics communications within Rings 1 or 2 along the following corridors
  - Fairview Ave., Franklin Rd., State St., Chinden Blvd., Overland Rd., Caldwell Blvd., Cleveland Blvd., Federal Way, Ustick and I-84 on the east-west alignments
- Implement remaining fiber optics communications within Rings 1 or 2 and along the following corridors
  - Can Ada Rd. and Meridian Rd. near I-84, Eagle Rd, Broadway, Vista Ave. on the north-south alignments
- Complete deployment of Network Rings 1 and 2

**ACHD TMC upgrades**
- Add initial GigE network components to ACHD TMC systems (includes GigE Router, GigE hub switch, associated network cabling). Size accordingly to support short term deployments.
- Add initial IP Video components to TMC systems (includes video server, IP video software, decoder rack, decoder cards and joystick). Size accordingly to support short term deployments.
- Continue parallel ORION video capabilities until full deployment of Gig-E ring.
- New IP decoder racks will feed existing Ultrak video switch for retrofitted or newly deployed cameras. Ultrak will serve existing agency partners. New IP decoders will serve TMC wall and Ultrak switch.
- Implement as-required software upgrades to IBI ATMS software for interface with IP video system.

**Partner Agency expansion and Network Ring/Hub Development**
- Equip IROC (if implemented), ITD and Idaho State Police with initial hub networking components (includes GigE Router, GigE hub switch, associated cabling.)
- Equip IROC (if implemented), ITD and Idaho State Police with initial IP video decoding equipment and software (includes GigE hub switch, IP video rack and cards, associated cabling.)
- Continue parallel ORION video capabilities until full deployment of Gig-E ring.

5.4.2 **Medium-Term Deployment (6-10 years)**

Similar to short term recommendations, medium term recommendations complete what was not completed in initial plan and continue newly defined priority corridors. The following elements are envisioned for deployment during the medium term:

**Network Ring and Fiber Development**
- Implement remaining fiber optics communications along the following corridors
- Implement remaining fiber optics communications along the following corridors
  - 10th Ave., Happy Valley, McDermitt, Cole, 12th Ave., Highway 16, Highway 55, Happy Valley, Cleveland/Caldwell Boulevard and Kings Rd. on north-south corridors.
- Complete Network Rings 3, 4, 5 and 6.
ACHD TMC (or IROC) upgrades
- Add additional GigE network components to ACHD TMC systems (includes GigE hub switch, associated network cabling). Size accordingly to support medium term deployments.
- Add initial IP Video components to TMC systems (includes additional decoder rack, decoder cards). Size accordingly to support medium term deployments.
- Continue parallel ORION video capabilities until full deployment of Gig-E ring.
- New IP decoder racks will feed existing Ultrak video switch for retrofitted or newly deployed cameras.

Partner Agency expansion and Network Ring/Hub Development
- Equip selected partner agencies with hub networking components (includes GigE hub switch, associated cabling/fiber, decoder components software, joystick.)
- Continue parallel ORION video capabilities until full deployment of Gig-E ring.

5.4.3 Long-Term Deployment (beyond 10 years)
The following elements are envisioned to be deployed during the long term:

Network Ring and Fiber Development
- Implement remaining fiber optics communications along the following corridors
- Implement remaining fiber optics communications along the following corridors
- Complete Network Rings 7, 8, 9, 10, and 11.

Partner Agency expansion and Network Ring/Hub Development
- Equip selected partner agencies with hub networking components (includes GigE hub switch, associated cabling/fiber, decoder components software, joystick.) Size accordingly to support usage.
- Phase out ORION video systems for full deployment of Gig-E ring.
5.4.4 **Budgetary Cost Estimates**

Table 5-13 identifies projected planning level estimates for the short, medium and long Term GigE deployments and expansion of the Treasure Valley communications systems and fiber optics backbone.

### Table 5-13

**GigE Deployment Planning Level Cost Estimates**

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<tr>
<th></th>
<th>Short Term Deployments (0-5 years)</th>
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<td></td>
<td>1. Network Ring and Fiber Development</td>
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<td>2. Network Equipment and TMC upgrades:</td>
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<td>3. Partner Agency expansion and Network Ring/Hub Development</td>
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<table>
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<th>Long Term Deployments (beyond 10 years)</th>
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<tr>
<td></td>
<td>2. Network Equipment and TMC upgrades:</td>
<td>$20,000</td>
</tr>
<tr>
<td></td>
<td>3. Partner Agency expansion and Network Ring/Hub Development</td>
<td>$160,000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>$15,700,000</strong></td>
</tr>
</tbody>
</table>

In determining these cost estimates, specific estimates for short (less than 2 miles), medium (2-4 miles) and long haul (greater than 4 miles) fiber installation rates were used. These rates included $158,400/mile for long haul, $184,800/mile for medium haul, and $260,000/mile for short haul. These figures include typical costs for an average corridor employing communications for controllers and CCTV ITS elements and associated engineering costs. Since the majority of the fiber required for the ring deployments will be situated along alignments that may not have “fiber friendly” conduit (or none at all) this figure includes cost of the following components that have been assumed as required along any fiber alignment. They include: 2" HDPE conduit, 2" galvanized conduit and hangers at cabinets, Galvanized Pipe Installation, Directional Drill for HDPE Flex Conduits, Trenching for HDPE Flex Conduit, #10 green pull wire, 72-strand backbone SMFO cable, 6-strand drop SMFO cable, installation of Splice Vaults, installation of Pull Boxes, removal of existing old SIC, boxes, salvage of controller foundations, pole mounted service enclosure, installations of furnished controller and cabinet and foundation, installation of controller cabinet and foundation, Fusion Splicing for four (4) strands of 6-strand to two (2) strands of 72-strand SMFO cable, installation of Fiber Patch Panel (FPP) and FDU, installation and integration of network systems.
SECTION 6.0
ITS PROJECTS AND PROGRAMS

This section describes the ITS projects and programs identified through the architecture development process to address the needs discussed earlier in Section 3.0. Identification of projects and programs is often seen as the goal of the ITS planning process. While the projects do provide a culmination of much of the effort in understanding needs, developing the architecture, defining the roles and relationships among stakeholders, and planning for communications network buildout, this element simply forms the cornerstone in the foundation for deployment and integration of intelligent transportation systems. As part of a planning document, these projects are intended to help implement the systems whose primary benefits will be realized through cooperative operations.

6.1 Project Development Overview

The identification of the projects listed herein was accomplished through a series of steps with input from a variety of stakeholders. In addition, within each step in the process there were multiple sources of information such as current planning documents and ongoing planning activities. The first step was to thoroughly review the ITS projects that were identified in the 1999 Treasure Valley ITS Plan and to compare these projects with the deployment progress that has been made in the interim. Next it was necessary to develop an understanding of the various transportation needs and the potential for addressing them either partially or entirely by ITS. These tasks were conducted largely in conjunction with the stakeholder discussions regarding existing conditions and needs and the identified priority corridors. Subsequently, the deployment progress could then be considered in the context of today’s transportation environment.

The needs provide the basis for developing ITS deployments, which in turn allow the selection of market packages defined within the National ITS Architecture. This permits development of the regional architecture and determination of agency roles and responsibilities; both of which are critical components in defining projects and programs. The needs/functional requirements together with the architecture form the basis for selection of ITS elements that comprise the projects. Figure 6-1 illustrates the grouping of ITS strategies to meet the specific needs through project or program deployment.

Figure 6-1: ITS Projects and Programs Development
As the process of identifying projects proceeded, the stakeholders provided input through various discussions including a stakeholder meeting segment specifically for this purpose. In the meeting, the information representing project concepts was presented, discussed and subsequently revised. The projects were divided into the following categories:

- **ITS Field Elements**
  - CCTV Cameras (traffic monitoring)
  - Dynamic Message Signs (DMS)
  - Speed Detectors
  - Road Weather Information Systems (RWIS)
  - Ramp Metering
- **Programmatic/Planning**
  - Transit ITS
  - Emergency Services ITS
  - Parking Management
  - Regional ITS Plan and Architecture Update
  - ITS Communications System Detailed Plan
- **Signal Systems**
- **Traveler Information**
- **Transit ITS Deployments**
- **Emergency Services ITS Deployments**
- **Communications Infrastructure**
- **Transportation/Communications Centers**
- **Parking ITS Deployments**

The ITS field elements were presented on a corridor basis in map based graphics. These maps have been revised to reflect input from the stakeholders. The CCTV camera corridors are shown in Figure 6-2; DMS in Figure 6-3; and speed detectors, ramp meters, and RWIS in Figure 6-4.

Each of these graphics identifies corridors for deployment of field devices in terms of a projected time frame. For short term corridors, the deployments are estimated to take place in the first five years, medium term corridors are anticipated for the 6 to 10 year time frame, and long term corridors are those where the specific deployments are believed to be beyond 10 years in the future. The graphics show the time frames for each type of deployment based on the perceived need for the specific technology on that corridor. In many cases the time frames do not agree from one type of technology to the next. In addition, these graphics do not show all of the technologies that might be deployed and could be included in other types of projects. For example, traffic signal system upgrades are not shown in these maps but are anticipated throughout the network of signals.

This situation introduces difficulty in determining the planned time frame for projects where it makes sense economically to deploy multiple technologies at the same time. Furthermore, some technologies must necessarily be deployed prior to others and all need some form of communications infrastructure. To address this project time frames have been established using the flexibility to advance or delay some deployments to meet time frames set by other priorities and to identify multiple projects in different time frames for the same corridor. This flexibility was then used to set the time frames to best match the current understanding of needs.
Figure 6-2  CCTV Camera Deployment Corridors
Figure 6-3 Primary DMS Deployment Zones
Figure 6-4 Primary Speed Detector, RWIS, and Ramp Meter Deployment Zones
6.2 ITS Projects and Programs

The projects and programs are presented below and are organized first by priority. The priority of the projects translates generally into the same three timing categories explained above for the graphical depictions with short term referring to the first five years, medium term is the six to ten year time frame, and long term is beyond ten years. The projects can also be divided into planning or programmatic efforts, such as the update to the Treasure Valley Incident Management Operations Manual, and corridor projects. Most of the potential ITS projects identified straightforwardly fall into one of these two categories, however, some do not, particularly where deployment of field elements is involved. For example, the traffic signal system improvement projects in this plan might logically fit into corridor projects, however, due to the nature of the improvements and the way in which they are managed, funded and deployed, they are more easily accounted for through identification of programmatic efforts.

As mentioned, the timing of the projects generally reflects the priority of the technology being deployed or the planning being conducted. In some cases however, deployments are delayed in the plan to allow time for deployment of other prerequisite infrastructure such as communication or integration capacity.

The project descriptions in this strategic plan are provided at a high level as they have thus far only been defined to meet the broadly identified needs and should be used to guide development of future ITS projects. It is understood that several factors will determine how the precise projects (or combination of projects) will be formulated by an agency, or logical groups of agencies. Further, project development will be impacted by funding availability, area growth patterns, planned roadway improvements, and agency partnerships. Each of the projects will require varying levels of planning and design as part of the overall effort. In addition, deployment projects will have communication and integration components that are not explicitly noted in the descriptions.

The corridor projects each include deployment of one or more ITS field devices. While the field devices are identified in each project description, the need being addressed is not always entirely obvious. Table 6-1 below identifies on a general level, the need targeted by the various devices. Traffic signal systems are not included in the corridor projects, however, as deployments for these projects tend to occur as part of local traffic signal upgrade plans. Where significant departures from this logic occur among the projects, the description provides additional information.

<table>
<thead>
<tr>
<th>Type of ITS Deployment</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>CCTV Camera</td>
<td>Provide real-time traffic, traffic signal, incident, and weather monitoring</td>
</tr>
<tr>
<td>DMS</td>
<td>Display traffic, incident, and general broadcast information to enroute travelers</td>
</tr>
<tr>
<td>Speed Detector</td>
<td>Provide traffic speed information to operators in the TMC</td>
</tr>
<tr>
<td>RWIS</td>
<td>Provide real-time weather and pavement condition information to maintenance forces and the public</td>
</tr>
<tr>
<td>Ramp Meter</td>
<td>Manage flow of traffic onto controlled access facilities for improved operations</td>
</tr>
<tr>
<td>Traffic Signal Systems</td>
<td>Improve traffic management capabilities and flexibility in response to congestion, safety and operations.</td>
</tr>
</tbody>
</table>
Ideally, these projects would be used in conjunction with traditional highway improvements to most effectively address the transportation needs of the specific corridor. They might also be used as a means to mitigate congestion impacts while larger highway projects are being prepared. In some cases, they will stand alone to address needs for which no other highway projects are planned and for which the ITS deployments singularly provide the best solution currently available.

It should also be remembered that the full power of ITS comes from the integration of the various devices and systems deployed to provide broad benefits toward addressing transportation problems. In as much, it is difficult to singularly identify the impacts on specific issues. For example, CCTV cameras or system detectors do not provide a means of addressing congestion by themselves, but provide critical information to traffic management operations that, in conjunction with other resources can be focused on relieving congestion.

The project descriptions also include a preliminary identification of the likely stakeholder agencies that will conduct the project. This is somewhat speculative and reflects the current approach and thinking regarding how the various agencies currently share responsibility for transportation systems management. This structure could change, however, particularly in light of the current efforts associated with the Interagency Regional Operations Center. This effort will likely combine some or all of the traffic management and emergency dispatch efforts under one roof either physically or virtually. In any case, most projects will require a cooperative effort by multiple agencies both from a deployment viewpoint and from an integration perspective.

Each project identifies a planning level cost estimate, in 2006 dollars. Costs were developed using FHWA cost estimates for intelligent transportation system elements in conjunction with actual costs for previous projects in the Treasure Valley. Capital costs for each corridor project consist of estimates for ITS elements and assumed communications costs. Factors for Design and Engineering and Contingency were applied including 20% and 10%, respectively. Operations and Maintenance costs are not included for each project, but rather are addressed separately in Section 6.3.
6.2.1 Short Term

Table 6-2 lists the Treasure Valley ITS projects and programs suggested for implementation within the next 5 years each with a cost estimate. This list combines ITS planning and corridor deployment projects. Each project is briefly described below.

<table>
<thead>
<tr>
<th>Number</th>
<th>Project Title</th>
<th>Cost</th>
<th>ITS Category Addressed</th>
</tr>
</thead>
<tbody>
<tr>
<td>S-1</td>
<td>Regional Transit ITS Plan</td>
<td>$150K</td>
<td>Programming/Planning</td>
</tr>
<tr>
<td>S-2</td>
<td>Regional Emergency Medical Services ITS Plan</td>
<td>$150K</td>
<td>Programming/Planning</td>
</tr>
<tr>
<td>S-3</td>
<td>Update Treasure Valley ITS Plan and Architecture</td>
<td>$85K</td>
<td>Programming/Planning</td>
</tr>
<tr>
<td>S-4</td>
<td>ITS Communications System Detailed Plan</td>
<td>$175K</td>
<td>Programming/Planning</td>
</tr>
<tr>
<td>S-5</td>
<td>Update Treasure Valley Incident Management Plan</td>
<td>$100K</td>
<td>Programming/Planning</td>
</tr>
<tr>
<td>S-6</td>
<td>Downtown Boise Parking Management/ITS Plan</td>
<td>$75K</td>
<td>Programming/Planning</td>
</tr>
<tr>
<td>S-7</td>
<td>Ada County Signal System Improvements</td>
<td>$2,000K</td>
<td>Traffic Signal Control Systems</td>
</tr>
<tr>
<td>S-8</td>
<td>ITD owned Signal System Improvements</td>
<td>$500K</td>
<td>Traffic Signal Control Systems</td>
</tr>
<tr>
<td>S-9</td>
<td>Nampa City Signal System Improvements</td>
<td>$500K</td>
<td>Traffic Signal Control Systems</td>
</tr>
<tr>
<td>S-10</td>
<td>Caldwell City Signal System Improvements</td>
<td>$500K</td>
<td>Traffic Signal Control Systems</td>
</tr>
<tr>
<td>S-11</td>
<td>IROC Center Design-Build</td>
<td>$15,000K</td>
<td>All</td>
</tr>
<tr>
<td>S-12</td>
<td>Downtown Boise Multimodal Center ITS Applications</td>
<td>$300K</td>
<td>Transit Management Systems</td>
</tr>
<tr>
<td>S-13</td>
<td>Update State and Local Traveler Information Systems</td>
<td>$200K</td>
<td>Regional Traveler Information Systems</td>
</tr>
<tr>
<td>S-14</td>
<td>Communication Infrastructure Deployment</td>
<td>$12,800K</td>
<td>All</td>
</tr>
<tr>
<td>S-15</td>
<td>Ada County RWIS Deployment Study</td>
<td>$50K</td>
<td>Operations and Management</td>
</tr>
<tr>
<td>S-16</td>
<td>Canyon County RWIS Deployment Study</td>
<td>$50K</td>
<td>Operations and Management</td>
</tr>
<tr>
<td>S-17</td>
<td>City of Nampa Signal System Management Study</td>
<td>$100K</td>
<td>Traffic Signal Control Systems</td>
</tr>
<tr>
<td>S-18</td>
<td>City of Caldwell Signal System Management Study</td>
<td>$100K</td>
<td>Traffic Signal Control Systems</td>
</tr>
<tr>
<td>S-19</td>
<td>ACHD TMC CAD Interface, Phase 1</td>
<td>$25K</td>
<td>Freeway/Incident/Emergency Mgmt Sys.</td>
</tr>
<tr>
<td>S-20</td>
<td>Ramp Metering Study</td>
<td>$150K</td>
<td>Freeway Management Systems</td>
</tr>
<tr>
<td>S-21</td>
<td>ITS Development Application Software (IDAS)</td>
<td>$60K</td>
<td>All</td>
</tr>
<tr>
<td>S-22</td>
<td>ATMS Software Enhancements and Integration</td>
<td>$350K</td>
<td>Freeway Management Systems and Regional Traveler Information Systems</td>
</tr>
<tr>
<td>S-23</td>
<td>Regional Transit ITS Implementation, Phase 1</td>
<td>$500K</td>
<td>Transit Management Systems</td>
</tr>
<tr>
<td>S-24</td>
<td>ACHD ITS Maintenance Plan</td>
<td>$100K</td>
<td>Programming/Planning</td>
</tr>
<tr>
<td>S-25</td>
<td>I-84 Corridor</td>
<td>$1,570K</td>
<td>Corridor Management Systems*</td>
</tr>
<tr>
<td>S-26</td>
<td>Franklin Boulevard/11th Ave/Garrity Boulevard/Can-Ada Road</td>
<td>$200K</td>
<td>Corridor Management Systems*</td>
</tr>
<tr>
<td>S-27</td>
<td>Highway 44/State Street</td>
<td>$185K</td>
<td>Corridor Management Systems*</td>
</tr>
<tr>
<td>S-28</td>
<td>US 20/26 Corridor</td>
<td>$340K</td>
<td>Corridor Management Systems*</td>
</tr>
<tr>
<td>S-29</td>
<td>Ustick Road</td>
<td>$40K</td>
<td>Corridor Management Systems*</td>
</tr>
<tr>
<td>S-30</td>
<td>Fairview/Cherry Lane</td>
<td>$175K</td>
<td>Corridor Management Systems*</td>
</tr>
<tr>
<td>S-31</td>
<td>Franklin Road</td>
<td>$30K</td>
<td>Corridor Management Systems*</td>
</tr>
<tr>
<td>S-32</td>
<td>Meridian Road</td>
<td>$180K</td>
<td>Corridor Management Systems*</td>
</tr>
<tr>
<td>S-33</td>
<td>Overland Road</td>
<td>$225K</td>
<td>Corridor Management Systems*</td>
</tr>
<tr>
<td>Number</td>
<td>Project Title</td>
<td>Cost</td>
<td>ITS Category Addressed</td>
</tr>
<tr>
<td>--------</td>
<td>------------------------</td>
<td>-------</td>
<td>---------------------------------------------</td>
</tr>
<tr>
<td>S-34</td>
<td>I-184 Corridor</td>
<td>$460K</td>
<td>Corridor Management Systems*</td>
</tr>
<tr>
<td>S-35</td>
<td>Vista Avenue</td>
<td>$90K</td>
<td>Corridor Management Systems*</td>
</tr>
<tr>
<td>S-36</td>
<td>Federal Way</td>
<td>$30K</td>
<td>Corridor Management Systems*</td>
</tr>
<tr>
<td>S-37</td>
<td>Glenwood</td>
<td>$45K</td>
<td>Corridor Management Systems*</td>
</tr>
<tr>
<td>S-38</td>
<td>Capitol Boulevard</td>
<td>$20K</td>
<td>Corridor Management Systems*</td>
</tr>
<tr>
<td>S-39</td>
<td>Eagle Road</td>
<td>$590K</td>
<td>Corridor Management Systems*</td>
</tr>
<tr>
<td></td>
<td>TOTAL</td>
<td>$38,200K</td>
<td></td>
</tr>
</tbody>
</table>


S-1: Regional Transit ITS Plan $150,000

It is clear the regional transit authority, Valley Regional Transit (VRT), is very interested in utilizing ITS technologies to help enhance their customer service and improve the efficiency and safety of their operations. The first step in this process is to develop a detailed plan which will identify the most appropriate ITS solutions. This plan will also provide more detailed costs and timelines for deployment. Enhancements to traveler information, operations management, safety, fare collection, and reacting faster to transportation network impacts are among the areas VRT would hope ITS could address. This plan will guide deployments in the short, medium, and long term – projects identified below.

Key Stakeholders: Valley Regional Transit, ITD, ACHD, COMPASS, and Boise City

S-2: Regional Emergency Medical Services ITS Plan $150,000

There are several potential ITS applications that could support safer and more efficient emergency medical services operations including AVI/AVL of EMS units, advanced communications to hospitals and TMCs, telemedicine applications, and facilitation of signal preemption systems. The Treasure Valley would be an ideal test bed for some of these technologies. Additionally, there is a strong link between EMS and law enforcement and fire emergency responders. The law enforcement and fire agencies are well underway with deploying corresponding technologies to support their operations. This project will develop a plan to deploy ITS technologies for EMS operations and document the other related plans and activities.

Key Stakeholders: Idaho Emergency Medical Services Bureau, Ada County Sheriff, Canyon County Sheriff, Idaho State Police, local EM agencies and air medical services, and other law enforcement and fire agencies

S-3: Update Treasure Valley ITS Plan and Architecture $85,000

The continued strong growth and enhancements to the transportation system dictates the need for more frequent updates of this ITS plan and architecture. In the next 5 years, it is suggested that two small updates are conducted. The first update, projected for FY 2008, the ITS architecture will need to be updated to correspond with the IROC operations concept and agency collocation decisions. Following this update the entire plan should be updated in FY 2010 to reflect the most current ITS implementations and transportation system conditions. It is envisioned that these updates be supplements to this document and not represent a complete re-write to this plan.

Key Stakeholders: All
S-4: ITS Communications System Detailed Plan $175,000

The Communications system plan identified in Section 5.0 provides a top-level view of the technologies, communication media, and ring configuration that will be necessary to operate the planned ITS devices. The next step toward implementation is a detailed plan that will design the system in phases and identify the equipment and integration required to begin deployment. This project will develop such a detailed communications system plan. This plan will be used in subsequent deployments projects (in the short, medium, and long term) to fully realize the system. This project will encompass all of the Treasure Valley, which will include agencies in Ada ($100K) and Canyon ($75K) Counties.

Key Stakeholders: ACHD, City of Nampa, City of Caldwell, Nampa Highway District, Canyon Highway District, and ITD

S-5: Update Treasure Valley Incident Management Plan $100,000

In 2001, the Treasure Valley agencies prepared an Incident Management Plan. This project will update the plan. The updates will focus on updating the incident response plans and designated detour routes. Additionally, this activity will work closely with local emergency responders and transportation operations agencies to identify an implementation strategy.

Key Stakeholders: ACHD, ITD, Boise, Nampa, Caldwell, Meridian, and all interested emergency response agencies

S-6: Downtown Boise Parking Management/ITS Plan $75,000

Capital City Development Corporation (CCDC) owns and manages most of the parking facilities in downtown Boise. As Boise continues to grow the need for a more advanced and automated parking management system, including approaches to provide information to motorists looking for parking, is desired. This planning project will document the existing parking facilities and determine appropriate technology applications to enhance parking management in downtown Boise and provide motorists information about parking availability.

Key Stakeholders: Capital City Development Corporation and Boise City

S-7: Ada County Signal System Improvements $2,000,000

Signal system improvements are an integral part of any ITS program. Ada County Highway District budgets each year for such improvements. Improvements within Ada County may include:

- Installation of new signals
- Upgrade of controllers, communications, and management systems
- Enhancements to signal coordination (through interconnect, signal timing, or traffic responsive control)
- Consideration of enforcement technologies
- Possibly other additional supportive equipment and software

These activities may be separate specific projects to enhance signal systems or may be combined within a corridor project (below). The costs associated with signal system improvements are identified here.

Key Stakeholders: ACHD and ITD
S-8: ITD Owned Signal System Improvements $500,000

ITD owns and manages many signals in the Treasure Valley, most of which are in Canyon County. The trend is to transfer the maintenance and management to the local jurisdiction (as has been done in Ada County). However, ITD continues to perform these functions in the region on state owned facilities (Interstate ramps and state highways). Improvements may include:

- Installation of new signals
- Upgrade of controllers, communications, and management systems
- Enhancements to signal coordination (through interconnect, signal timing, or traffic responsive control)
- Consideration of enforcement technologies
- Possibly other additional supportive equipment and software

These activities may be separate specific projects to enhance signal systems or may be combined within a corridor project (below). The costs associated with signal system improvements are identified here.

Key Stakeholders: ITD, ACHD, City of Nampa, and City of Caldwell

S-9: City of Nampa Signal System Improvements $500,000

The city of Nampa owns and operates 58 signals within their city limits, including several on state highways under agreement with ITD. The growth in the area is dictating the need for improvements to the signalized intersections. Improvements may include:

- Installation of new signals
- Upgrade of controllers, communications, and management systems
- Enhancements to signal coordination (through interconnect, signal timing, or traffic responsive control)
- Consideration of enforcement technologies
- Possibly other additional supportive equipment and software

These activities may be separate specific projects to enhance signal systems or may be combined within a corridor project (below). The costs associated with signal system improvements are identified here.

Key Stakeholders: City of Nampa and ITD

S-10: City of Caldwell Owned Signal System Improvements $500,000

The city of Caldwell owns and operates 5 signals within their city limits; another 17 signals are the responsibility of ITD. The growth in the area is dictating the need for improvements to the signalized intersections. Improvements may include:

- Installation of new signals
- Upgrade of controllers, communications, and management systems
- Enhancements to signal coordination (through interconnect or signal timing)
- Consideration of enforcement technologies
- Possibly other additional supportive equipment and software

These activities may be separate specific projects to enhance signal systems or may be combined within a corridor project (below). The costs associated with signal system improvements are identified here.

Key Stakeholders: City of Caldwell and ITD
S-11: IROC Center Design-Build $15,000,000

The Interagency Regional Operations Center will allow enhanced coordination of emergency response and traffic management throughout the Treasure Valley. It will be the clearinghouse for related information and the single source of traveler information. Currently, a phase 2 planning study is refining the operations concept, making decisions regarding agency involvement (including agency collocation), and identifying a location for a new facility. The next step will be to design the facility based on the results of the Phase 2 efforts. It is anticipated that phase 3 will be a development effort to design and build the facility. The funding allocated to this effort is very preliminary because the size of the facility is still unknown and is dependent on the results of the phase 2 study.

Key Stakeholders: All

S-12: Downtown Boise Multimodal Center ITS Applications $300,000

Valley Regional Transit, in coordination with other Treasure Valley agencies, is planning to design and build (within the next 5 years) a multimodal center near downtown Boise. VRT envisions ITS as an integral element of this new center to support efficient operations and enhance customer service. Traveler information will be a key aspect of the center. This project will be coordinated with the Regional Transit ITS Plan (S-1) and the multimodal center design and build activities. Additionally, it will ensure that ITS applications are analyzed and the most appropriate are implemented as part of the design and construction of the new multimodal center.

Key Stakeholders: Valley Regional Transit, ITD and Boise City

S-13: Update State and Local Traveler Information Systems $200,000

Extensive work has taken place in the past 3 years to provide motorists with traveler information in the Treasure Valley. The information is provided by an ACHD webpage and an ITD webpage and phone system (Interstate and state highways). These systems will need updates and enhancements as the ITS program moves forward. Also, the IROC will be the central focal point for traveler information in the region. It will be necessary to ensure this information is easily available to all the agencies (and others, such as the media) who wish to receive it. This project will provide the mechanism for updating the state and local traveler information systems. The amount of funding supports these activities within the Treasure Valley – state funding to support updates and enhancements to the state system is not included.

Also included within this project is the deployment of information kiosk stations in key locations throughout the Treasure Valley as portals to access the Internet based information for those who do not have immediate access by others means. Key locations may include city or county offices, Boise airport, and primary businesses.

Key Stakeholders: ITD, ACHD and Valley Regional Transit

S-14: Communication Infrastructure Deployment $12,800,000

Deployment of the short-term communications deployment project is identified in the Communications System Plan of Section 5.0. This effort will provide the initial communications infrastructure centered in downtown Boise and along the north-side of I-84 as well as laying the groundwork for future deployment. The infrastructure deployed will provide communication to ITS field elements within their vicinity and trunk connectivity to facilitate tail circuits for other nearby ITS field elements. The details for this deployment will be defined in the ITS Communications System Plan identified in S-4. This project encompasses deployment throughout the Treasure Valley, within Ada and Canyon Counties. It is assumed that this would be accomplished in several smaller projects to support ITS deployments and as funding opportunities present themselves.
Key Stakeholders: ACHD, City of Nampa, City of Caldwell, Nampa Highway District, Canyon Highway District, and ITD

S-15: Ada County RWIS Deployment Study $50,000
Ada County Highway District road maintenance expressed an interest in some additional Road Weather Information System (RWIS) stations in the foothills. These stations would provide ACHD (at their central maintenance dispatch) the weather and road condition information – supporting the efficiency of their activities in the winter time. This project would analyze their needs, locate specific potential sites, and identify the sensing equipment needed. Deployment projects would follow in future years.

Key Stakeholders: ACHD and ITD

S-16: Canyon County RWIS Deployment Study $50,000
Canyon and Nampa Highway Districts, in Canyon County, expressed an interest in deploying Road Weather Information System (RWIS) stations in key locations throughout the study area for which they are responsible for winter road maintenance. These stations would provide the highway district maintenance personnel (at their central maintenance dispatch locations) the weather and road condition information – supporting the efficiency of their activities in the winter time. This project would analyze their needs, locate specific potential sites, and identify the sensing equipment needed. Deployment projects would follow in future years.

Key Stakeholders: Nampa Highway District, Canyon Highway District, and ITD

S-17: City of Nampa Signal System Management Study $100,000
The continued growth within the city limits of Nampa is expected to accelerate in the next several years. With this growth are plans to add numerous traffic signals and enhance the way the signals are managed. This study will determine the most beneficial approaches to perform signal timing, coordination, and possibly central control. Additionally, the study will address the need for communication infrastructure to accommodate the management approach selected.

Key Stakeholders: City of Nampa, Nampa Highway District, and ITD

S-18: City of Caldwell Signal System Management Study $100,000
The continued growth within the city limits of Caldwell is expected to accelerate in the next several years. With this growth are plans to add numerous traffic signals and enhance the way the signals are managed. This study will determine the most beneficial approaches to perform signal timing, coordination, and possibly central control. Additionally, the study will address the need for communication infrastructure to accommodate the management approach selected.

Key Stakeholders: City of Caldwell, Canyon Highway District, and ITD

S-19: ACHD TMC CAD Interface, Phase 1 $25,000
This project will begin the process to incorporate emergency response agencies information in the ACHD TMC. The activities under this phase 1 effort include installing two workstations within the TMC that will provide real-time Computer Aided Dispatch (CAD) information from Ada County Sheriff and Idaho State Police. Although this will not be fully “integrated” information, it will assist the traffic managers perform more effective and efficient operations. Future projects will eventually integrate the CAD information into the TMC management software.

Key Stakeholders: ACHD, Ada County Sheriff, and Idaho State Police
S-20: Ramp Metering Study $150,000
Metering the traffic entering the Interstate with signals has proven very effective in other metropolitan areas across the country in improving safety and decreasing congestion. Some of the key interchanges may be ready for these types of ITS systems. This study will analyze a selected number of interchanges and recommend specific locations for ramp metering systems for possible future deployment. Additionally, the study will review the success of other regions in using such systems, identify the potential advantages and disadvantages of their use, acknowledge the constraints of such systems, include limited public involvement (more to follow in deployment phases), estimate the costs of specific locations being recommended, and develop potential timeframes for implementation.

Key Stakeholders: ITD, ACHD, City of Boise, City of Meridian, City of Nampa, COMPASS and City of Caldwell

S-21: ITS Development Application Software (IDAS) $60,000
The ITS Deployment Analysis System (IDAS) is designed to assist public agencies and consultants in integrating ITS in the transportation planning process. IDAS offers the capability for a systematic assessment of ITS with one analysis tool and is used for determining the benefits and costs of various ITS deployments. This project will install this software and integrate it with COMPASS’ transportation planning models to conduct analysis of existing and future ITS deployments.

Key Stakeholders: ACHD, ITD, and COMPASS

S-22: ATMS Software Enhancements and Integration $350,000
The advanced traffic management system software currently being used in the ACHD TMC will require annual updates and enhancements. Also, the system may need significant enhancements when it is implemented in the IROC. The ACHD TMC is obtaining several requests from cities and other agencies to receive certain types of information that is collected by the TMC (such as CCTV camera images and incident notifications). This project will provide the funding necessary to keep the ATMS software up to date and the equipment and communications needed to provide the connections to other centers to ensure effective information sharing.

Key Stakeholders: ACHD, ITD, and other involved cities or organizations

S-23: Regional Transit ITS Implementation, Phase 1 $500,000
Project S-1 (Transit ITS Plan) determined the specific ITS implementations recommended. This project will be the first of three phases of implementation of transit oriented ITS on a regional basis. Individual ITS deployments will likely include technologies supporting dynamic ridesharing and traveler information.

Key Stakeholders: Valley Regional Transit, ITD, ACHD, COMPASS, and Boise City

S-24: ACHD ITS Maintenance Plan $100,000
The ITS elements deployed by ACHD require a detailed maintenance plan that identifies the ITS devices and systems in use and outlines the procedures and policies for maintaining them. This project will also include the development of an RFP to establish a maintenance contract for on-call services.

Key Stakeholders: ACHD

S-25: I-84 Corridor $1,570,000
As the primary commuter corridor for the Treasure Valley, a short-term deployment of ITS elements would be ideal to mitigate congestion; especially as the population of the valley continues to grow. Coordination of this project with those outlined in the Idaho Transportation Department’s STIP report could help to reduce costs and traffic interruption. Dynamic Message signs along this corridor are assumed to be erected on bridge structures.
This project includes:

Garrity Boulevard to Meridian Road
- 4 CCTV
- 2 DMS
- Install 4 system detector stations

Meridian Road to Gowen Road
- 3 CCTV
- 2 DMS
- Deploy 2 spread spectrum (or other) wireless communication devices
- Install 5 system detector stations

Key Stakeholders: ITD and ACHD

S-26 Franklin Boulevard/11th Avenue/Garrity Boulevard/Can-Ada Road $200,000
This project includes portions of 11th Avenue, Garrity Boulevard and Can-Ada Road. It is assumed that existing communications for this corridor are limited to a short stretch of 11th Avenue around the intersection of Franklin Boulevard. Further communications details can be found in section 5.0 Communications Systems.
This project includes:

11th Avenue & 3rd Street to Cherry Lane
- 1 CCTV
- 2 DMS
- Deploy 2 spread spectrum (or other) wireless communication devices
- Install 1 system detector station

Key Stakeholders: ITD, Canyon Highway District, Nampa Highway District, City of Nampa

S-27: Highway 44/State Street $185,000
ITS applications on Highway 44/State Street serve the purpose of reducing congestion and improving operations along this busy commuter route. It is assumed that fiber optic communications are already in place along the eastern portion of State Street and that cameras have been installed and some controllers upgraded since the 1999 report.

This project includes:

Eagle Road to 23rd Street
- 5 CCTV
- 1 DMS
- Install 3 system detector stations

Key Stakeholders: ITD, ACHD, Canyon Highway District, Nampa Highway District

S-28: US 20/26 Corridor/Chinden Boulevard $340,000
As a major east-west commuter route, the establishment of ITS elements along this corridor in the short-term will aid in reducing congestion and improving both safety and operations. While it is assumed that existing communications infrastructure is limited to the east end, between Glenwood and I-184, it is intended that a portion of one GigE ring be placed directly on this route. This project includes:

US 20/26/Chinden Boulevard - McDermott to I-184
- 8 CCTV
- 3 DMS
• Install 3 system detector stations  

   *Key Stakeholders: ITD, ACHD*

S-29: Ustick Road $40,000
Traffic monitoring will increase this route’s capacity and safety. While not noted as a major east-west commuter route, three of the Treasure Valley’s highest frequency crash intersections are within this corridor as detailed in Section 2.0 Existing Conditions. This project includes:

   Eagle Road to Curtis Road
   • 4 CCTV

   *Key Stakeholders: ACHD*

S-30: Fairview/Cherry Lane $175,000
To improve safety and operations along Fairview, traffic monitoring will be increased. This project includes:

   Can-Ada Road to I-184
   • 10 CCTV
   • 1 DMS

   *Key Stakeholder: ACHD*

S-31: Franklin Road $30,000
The purpose of this project is to complete the ITS implementation that has already been initiated on the Franklin Road corridor. In addition, the role of Franklin Road as a designated detour route emphasizes the need for both monitoring and traveler information. This project includes:

   Garrity Boulevard to Meridian Road
   • 3 CCTV

   *Key Stakeholders: ACHD, Nampa Highway District, City of Nampa, ITD*

S-32: Meridian Road $180,000
The purpose of this project is to improve traffic operations, particularly with respect to this corridor’s proximity to I-84 and its designation as a detour route. This project includes:

   Kuna to Fairview Avenue
   • 6 CCTV
   • 1 DMS
   • Install 3 system detector stations

   *Key Stakeholders: ACHD, ITD, City of Meridian*

S-33: Overland Road $225,000
The purpose of this project is to continue implementation of ITS elements along Overland Road and enhance this corridor’s function as a designated detour route. It is assumed that there are significant quantities of fiber optic cable already in place. This project includes:

   Ten Mile to Cole/I-84
   • 3 DMS

   *Key Stakeholder: ACHD*
S-34: I-184 Corridor $460,000
The implementation of ITS elements along this corridor, particularly in consideration of the proximity to downtown Boise, will ease congestion and improve operations. Deployment, including the installation of fiber optic cable, has already been initiated. This project includes:
I-84 to 13th Street
- 3 CCTV
- 1 DMS
- Install 4 system detector stations
- Deploy 1 spread spectrum (or other) wireless communication devices
Key Stakeholder: ITD

S-35: Vista Avenue $90,000
The purpose of this project is to improve operations and provide monitoring and traveler information along a designated detour route. It is assumed that portions of Vista Avenue are already equipped with fiber optic cable. This project includes:
I-84 to Capitol Boulevard
- 2 CCTV
- 1 DMS
Key Stakeholder: ACHD

S-36: Federal Way $30,000
This project emphasizes traffic monitoring and includes 3 CCTV between Gowen Road and Broadway Avenue
Key Stakeholder: ACHD

S-37: Glenwood $45,000
State Street to Chinden Boulevard
- 1 CCTV
- Install 2 system detector stations
Key Stakeholder: ACHD

S-38: Capitol Boulevard $20,000
Rose Hill to Myrtle Street
- 2 CCTV
Key Stakeholder: ACHD

S-39: Eagle Road $590,000
Eagle Road has seen substantial growth in traffic numbers and is known for congestion. The aim of this project is to improve overall traffic operations. This project includes:
Victory Road to State Street
- 2 DMS
- Install 12 system detector stations
Key Stakeholder: ITD, ACHD
### 6.2.2 Medium Term

Table 6-3 lists the Treasure Valley ITS projects and programs suggested for implementation between six and ten years from now, each with a cost estimate. This list suggests deployments as a result of the planning completed in the short term and expansion of corridor projects. Each project is briefly described below.

**Table 6-3**

<table>
<thead>
<tr>
<th>Number</th>
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<td>Transit Management Systems</td>
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<td>M-2</td>
<td>Regional EMS ITS Implementation, Phase 1</td>
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<td>Emergency Management Systems</td>
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<td>M-3</td>
<td>Update Treasure Valley ITS Plan and Architecture</td>
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<td>Planning/Programming</td>
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<td>M-4</td>
<td>Downtown Boise Parking Management/ITS Implementation</td>
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<td>Parking Management Systems</td>
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<td>M-5</td>
<td>Ada County Signal System Improvements</td>
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<td>Traffic Signal Control Systems</td>
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<td>M-6</td>
<td>ITD owned Signal System Improvements</td>
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<td>Traffic Signal Control Systems</td>
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<td>Nampa City Signal System Improvements</td>
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<tr>
<td>M-8</td>
<td>Caldwell City Signal System Improvements</td>
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<td>M-9</td>
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<td>M-10</td>
<td>ACHD Maintenance Vehicle AVL Implementation</td>
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<td>Update State and Local Traveler Information Systems</td>
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<td>Canyon County RWIS Deployment</td>
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<td>ITD Incident Response Vehicle Program Expansion</td>
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<td>M-16</td>
<td>ACHD ATMS- CAD Interface</td>
<td>$250K</td>
<td>Freeway/Incident/Emergency Mgmt Sys.</td>
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<td>Ramp Metering Implementation, Phase 1</td>
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<td>M-18</td>
<td>ATMS Software Enhancements and Integration</td>
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<td>Orchard Road</td>
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<td>Capitol Boulevard</td>
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<td>State Street</td>
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M-1: Regional Transit ITS Implementation, Phase 2  $2,000,000
Project S-1 (Transit ITS Plan) determined the specific ITS implementations recommended. This project will be the first of two phases of implementation of transit oriented ITS on a regional basis. Individual ITS deployments will likely include technologies supporting traveler information, operation enhancements, and transit management.

Key Stakeholders: Valley Regional Transit, ITD, ACHD, COMPASS, and Boise City

M-2: Regional EMS ITS Implementation, Phase 1  $1,000,000
Project S-2 (EMS ITS Plan) determined the best course of action for implementation of Emergency Medical System ITS applications. This project will be the first of two phases to begin implementation of such technologies. Individual ITS deployments may include initial application of AVI/AVL for some EMS units, and demonstration projects of advanced communications to hospitals.

Key Stakeholders: Idaho Emergency Medical Services Bureau, Ada County Sheriff, Canyon County Sheriff, Idaho State Police, local EM agencies and air medical services, and other law enforcement and fire agencies

M-3: Update Treasure Valley ITS Plan and Architecture  $150,000
This project will conduct a major update of the Treasure Valley ITS Plan and Architecture. It will be necessary to update the stakeholder needs and develop a revised set of projects based on the current conditions and technologies available. The communications plan will require updating based on the deployments to date and the success of the chosen technologies. Additionally, the regional ITS architecture will need updating to reflect the deployed and planned projects, and the existing stakeholder structure and responsibilities.

Key Stakeholders: All

M-4: Downtown Boise Parking Management/ITS Implementation  $300,000
Project S-6 prepared a plan to use ITS technologies to assist with parking management in downtown Boise. This project will implement the recommended ITS applications throughout the parking facilities owned by Capital City Development Corporation (CCDC). Individual deployments will likely include an automated parking management system that will provide parking availability information to motorists via the Internet and signs strategically located on major entry points into downtown Boise.

Key Stakeholders: Capital City Development Corporation and Boise City

M-5: Ada County Signal System Improvements  $2,500,000
This project will continue signal system improvement throughout Ada County. Improvements may include:
- Installation of new signals
- Upgrade of controllers, communications, and management systems
- Enhancements to signal coordination (through interconnect, signal timing, or signal responsive control)
- Consideration of enforcement technologies
- Possibly other additional supportive equipment and software

These activities may be separate specific projects to enhance signal systems or may be combined within a corridor project (below). The costs associated with signal system improvements are identified here.

Key Stakeholders: ACHD and ITD
M-6: ITD Owned Signal System Improvements $750,000
This project will continue signal system improvements of ITD owned signals throughout the Treasure Valley. Improvements may include:

- Installation of new signals
- Upgrade of controllers, communications, and management systems
- Enhancements to signal coordination (through interconnect, signal timing, or signal responsive control)
- Consideration of enforcement technologies
- Possibly other additional supportive equipment and software

These activities may be separate specific projects to enhance signal systems or may be combined within a corridor project (below). The costs associated with signal system improvements are identified here.

_Key Stakeholders: ITD, ACHD, City of Nampa, and City of Caldwell_

M-7: Nampa City Signal System Improvements $750,000
This project will continue signal system improvement within the Nampa City limits. Improvements may include:

- Installation of new signals
- Upgrade of controllers, communications, and management systems
- Enhancements to signal coordination (through interconnect, signal timing, or traffic responsive control)
- Consideration of enforcement technologies
- Possibly other additional supportive equipment and software

These activities may be separate specific projects to enhance signal systems or may be combined within a corridor project (below). The costs associated with signal system improvements are identified here.

_Key Stakeholders: City of Nampa and ITD_

M-8: Caldwell City Signal System Improvements $750,000
This project will continue signal system improvement within the Caldwell City limits. Improvements may include:

- Installation of new signals
- Upgrade of controllers, communications, and management systems
- Enhancements to signal coordination (through interconnect or signal timing)
- Consideration of enforcement technologies
- Possibly other additional supportive equipment and software

These activities may be separate specific projects to enhance signal systems or may be combined within a corridor project (below). The costs associated with signal system improvements are identified here.

_Key Stakeholders: City of Caldwell and ITD_

M-9: IROC System Integration Upgrades $2,000,000
As the IROC becomes fully operational in 2010, it is anticipated that the need for integration of existing and new management systems and sources of information will increase. Additional communication links to other agencies interested in sharing information with the IROC is also likely to occur after initial start-up of the center. This may require integration links be established. This project provides the funding to accommodate these integration needs.

_Key Stakeholders: All_
M-10: ACHD Maintenance Vehicle AVL Implementation $100,000

ACHD maintenance vehicles currently use radio communications with a dispatch center to determine current location and transfer information about next location needing service. This project will assist that management process by installing an Automated Vehicle Location (AVL) system on all ACHD maintenance vehicles. The initial efforts will develop a plan to determine the most cost effective technology solution to address the specific requirements of the system. This project will allow the dispatch center to know the location of each vehicle and better manage the resources to address Ada County’s winter road condition treatment needs.

Key Stakeholders: ACHD

M-11: Update State and Local Traveler Information Systems $200,000

The ACHD and related portions of the ITD statewide traveler information systems (within the Treasure Valley) will continue to require updates to stay current with the technology available and provide enhanced services to motorists interested in receiving accurate and timely traveler information in the region. This project will perform the necessary updates to achieve these goals. Additionally, as the IROC expands its ability to collect and manage traffic data, the traveler information system will need to keep pace and provide information in more varied ways to meet motorist’s needs and desires. The amount of funding supports these activities within the Treasure Valley – state funding to support updates and enhancements to the state system is not included.

Key Stakeholders: ITD, ACHD and Valley Regional Transit

M-12: Communications Infrastructure Deployment $17,000,000

Deployment of the medium-term communications deployment project is identified in the Communications System Plan of Section 5.0. This effort will provide further communications infrastructure to the west of Boise, including additions to the communications ring deployed in S-14 as well as provide communication to ITS field elements within their vicinity and trunk connectivity to facilitate tail circuits for other nearby ITS field elements. This project encompasses deployment throughout the Treasure Valley, within Ada and Canyon Counties. It is assumed that this would be accomplished in several smaller projects to support ITS deployments and as funding opportunities present themselves.

Key Stakeholders: ACHD, City of Nampa, City of Caldwell, Nampa Highway District, Canyon Highway District, and ITD

M-13: Ada County RWIS Deployment $500,000

The RWIS stations would provide ACHD (at their central maintenance dispatch) current weather and road condition information for specific locations – supporting the efficiency of their activities in the winter time. Project S-15 defined the systems to be deployed and there locations. It is anticipated that 4-6 new RWIS stations would be required in the foothills areas. This project would deploy these RWIS stations and provide communications to the ACHD maintenance dispatch center.

Key Stakeholders: ACHD and ITD
M-14: Canyon County RWIS Deployment $1,000,000
The RWIS stations would provide Canyon and Nampa Highway Districts, in Canyon County, (at their maintenance dispatch centers) current weather and road condition information for specific locations – supporting the efficiency of their activities in the winter time. Project S-16 defined the systems to be deployed and their locations. It is anticipated that approximately 8-10 sites would be required throughout Canyon County (within the Treasure Valley region) to support maintenance operations. This project would deploy these RWIS stations and provide communications to the appropriate maintenance dispatch centers.

*Key Stakeholders: Nampa Highway District, Canyon Highway District, and ITD*

M-15: ITD Incident Response Vehicle Program Expansion $200,000
The ITD incident response vehicle program has been very successful and a third vehicle was added to the fleet in 2006. It is anticipated, as traffic growth continues on the Interstate and expands to the west, that additional vehicles will be needed in the medium term. Additionally, vehicles will need replacing. This project provides for 2 new vehicles in this time period. One of the vehicles will expand the fleet to 4 and the other will replace one of the aging vehicles.

*Key Stakeholders: ITD*

M-16: ACHD ATMS-CAD Interface $250,000
Project S-17 began the efforts to receive computer aided dispatch information from Ada County Sheriff and Idaho State Police into the ACHD TMC to assist traffic managers respond to incidents. This project will enhance the TMC’s capabilities by fully integrating the CAD information into the ATMS software. These efforts will more fully automate traveler information dissemination and responses to ease traffic congestion due to incidents in the region by building a software interface between the ATMS and the CAD information.

*Key Stakeholders: ACHD, Ada County Sheriff, and Idaho State Police*

M-17: Ramp Metering Implementation, Phase 1 $500,000
Project S-20 prepared a study to analyze the use of ramp meters at strategic locations throughout the valley and made recommendations regarding implementation. This project is the first to two implementation projects to begin installation of ramp meters at specific locations. It is estimated that 4 ramp meters will be installed as part of this phase in the medium term timeframe. The locations will be determined during the planning (Project S-18). Each implementation will include traffic monitoring devices at several locations including the ramp, Interstate mainline, and interchange streets, signals at the on-ramps, a controller system which may link into existing signals, and the necessary communications to facilitate operation. The cost estimate also includes public involvement activities.

*Key Stakeholders: ITD, ACHD, City of Boise, City of Meridian, City of Nampa, and City of Caldwell*

M-18: ATMS Software Enhancements and Integration $350,000
The advanced traffic management system software currently being used in the ACHD TMC will require annual updates and enhancements. The ACHD TMC is obtaining several requests from cities and other agencies to receive certain types of information that is collected by the TMC (such as CCTV camera images and incident notifications). This project will provide the funding necessary to keep the ATMS software up to date and the equipment and communications needed to provide the connections to other centers to ensure effective information sharing.

*Key Stakeholders: ACHD, ITD, and other involved cities or organizations*
M-19: Highway 44 Corridor  
$250,000
Essentially the second phase of project S-27 above, the aim of this project is to further improve operations along a busy commuter route. This project includes:

Highway 16 to Eagle Road
- 5 CCTV
- 2 DMS
- Install 3 system detector stations

*Key Stakeholders: ITD, ACHD, Canyon Highway District, City of Star, City of Middleton*

M-20: Broadway Avenue  
$75,000

I-84 to Myrtle St
- 1 DMS

*Key Stakeholders: ITD, ACHD*

M-21: I-84 Corridor  
$1,250,000

As the main carrier of commuter traffic, the operations of Interstate I-84 would be optimized with the deployment of ITS elements. Coordination of this project with those outlined in the Idaho Transportation Department’s STIP report could help to reduce costs and traffic interruption. This project includes:

Purple Sage Way to Garrity Boulevard
- 6 CCTV
- 3 DMS
- Install 19 system detector stations

*Key Stakeholder: ITD*

M-22: Ustick Road  
$70,000

Traffic monitoring and associated communications equipment will increase this route’s capacity and safety. This project includes:

Can-Ada to Eagle Road
- 7 CCTV

*Key Stakeholder: ACHD*

M-23: Highway 55 Corridor  
$65,000

As one of a small number of traffic conduits between Eagle and the rest of the Treasure Valley, ITS implementation on Highway 55 aims to increase safety, mitigate congestion and provide greater traveler information. This project includes:

Chinden Boulevard to Beacon Light
- 3 CCTV
- Install 2 system detector stations

*Key Stakeholders: ITD, ACHD*
M-24: Cleveland Boulevard $540,000
The infrastructure included in this corridor includes Cleveland Boulevard, the Karcher-I-84 interchange, the Centennial Way Loop and Northside Boulevard. The purpose of this project is to mitigate congestion along all routes and improve the safety of the Karcher interchange. This project includes:

Cleveland/Caldwell Boulevard, Karcher Interchange and Northside Boulevard
- 6 CCTV
- 2 DMS
- Install 14 system detector stations

Centennial Loop: Simplot to I-84
- 1 CCTV
- Install 4 system detector stations

Key Stakeholders: ITD, Nampa Highway District, City of Nampa, City of Caldwell

M-25: Ten Mile Road $30,000
This project emphasizes traffic monitoring and includes 3 CCTV between Cherry Lane and Chinden Boulevard

Key Stakeholder: ACHD

M-26: Overland Road $30,000
This project emphasizes traffic monitoring and includes 3 CCTV between I-84 and Vista Avenue

Key Stakeholder: ACHD

M-27: Orchard Road $30,000
This project emphasizes traffic monitoring and includes 3 CCTV between I-84 and Vista Avenue

Key Stakeholder: ACHD

M-28: Capitol Boulevard $75,000
This project emphasizes traveler information and includes 1 DMS near Myrtle Street

Key Stakeholder: ACHD

M-29: State Street $150,000
This project emphasizes traveler information and includes 2 DMS between Glenwood and 27th Street
### Long Term

Table 6-4 lists the Treasure Valley ITS projects and programs suggested for implementation beyond ten years, each with a cost estimate. This list suggests further deployments during this time period.

#### Table 6-4
Treasure Valley ITS Projects and Programs – Long Term

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<th>Number</th>
<th>Project Title</th>
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<td>Update Treasure Valley ITS Plan and Architecture</td>
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<td>Traffic Signal Control Systems</td>
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<tr>
<td>L-8</td>
<td>IROC System Integration Upgrades</td>
<td>$2,000K</td>
<td>All</td>
</tr>
<tr>
<td>L-9</td>
<td>Update State and Local Traveler Information Systems</td>
<td>$200K</td>
<td>Regional Traveler Information Systems</td>
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<tr>
<td>L-10</td>
<td>Communication Infrastructure Deployment</td>
<td>$15,700K</td>
<td>All</td>
</tr>
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<td>L-11</td>
<td>ITD Incident Response Vehicle Program Expansion</td>
<td>$300K</td>
<td>Freeway Management Systems</td>
</tr>
<tr>
<td>L-12</td>
<td>Ramp Metering Implementation, Phase 2</td>
<td>$500K</td>
<td>Freeway Management Systems</td>
</tr>
<tr>
<td>L-13</td>
<td>ATMS Software Enhancements and Integration</td>
<td>$350K</td>
<td>Freeway/Incident/Emergency Mgmt Sys.</td>
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<td>L-14</td>
<td>ACHD Incident Response Vehicles</td>
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<td>Traffic Management</td>
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<td>L-15</td>
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<td>L-16</td>
<td>Franklin Boulevard</td>
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<td>US 20/26 Corridor</td>
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<td>Corridor Management Systems*</td>
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<td>L-18</td>
<td>McDermott/Highway 16 Road</td>
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<td>Corridor Management Systems*</td>
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<td>L-19</td>
<td>Ustick Road</td>
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<td>L-20</td>
<td>Victory Road</td>
<td>$275K</td>
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<td>Lake Hazel Road/Gowen Road Extension</td>
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<td>L-22</td>
<td>Kuna-Mora Road</td>
<td>$290K</td>
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<td>Karcher Road</td>
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<td>I-84 Corridor</td>
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<td>L-28</td>
<td>Nampa Boulevard</td>
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<td>Highway 44 Corridor</td>
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<td>Highway 55 Corridor</td>
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<td>Overland Road</td>
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<td>Corridor Management Systems*</td>
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<td>L-33</td>
<td>Happy Valley Road</td>
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<td>Corridor Management Systems*</td>
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<td><strong>TOTAL</strong></td>
<td></td>
<td><strong>$30,590K</strong></td>
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The definitions of the projects are less detailed because of the lack of clarity this far in the future. This information can be used during future plan updates as a starting point for bring more accuracy to the project descriptions based on the current conditions and agency needs. Each project is briefly described below.

**L-1: Regional Transit ITS Implementation, Phase 3**  
$2,000,000
Project S-1 and Project M-1 planned and deployed initial transit ITS. This project is the second of two phases to continue implementation of transit oriented ITS on a regional basis. Individual ITS deployments in this phase will be dependent on the planning and what was implemented in the medium term. They will likely include more advanced ITS applications and address the needs of the transit agency in the long term. Additional planning may be necessary to revisit the needs and most appropriate technologies available to address those needs.

*Key Stakeholders: Valley Regional Transit, ITD, ACHD, COMPASS, and Boise City*

**L-2: Regional EMS ITS Implementation, Phase 2**  
$1,500,000
Project S-2 and Project M-2 determined the plan and began implementation of Emergency Medical System ITS applications. This project is the second phase of implementation of such technologies. Individual ITS deployments may include completion of AVI/AVL for all EMS units, expansion of advanced communications to hospitals and the TMC, and initial applications of telemedicine technologies.

*Key Stakeholders: Idaho Emergency Medical Services Bureau, Ada County Sheriff, Canyon County Sheriff, Idaho State Police, local EM agencies and air medical services, and other law enforcement and fire agencies*

**L-3: Update Treasure Valley ITS Plan and Architecture**  
$150,000
This project will conduct a major update of the Treasure Valley ITS Plan and Architecture. It will be necessary to update the stakeholder needs and develop a revised set of projects based on the current conditions and technologies available. The communications plan will require updating based on the deployments to date and the success of the chosen technologies. Additionally, the regional ITS architecture will need updating to reflect the deployed and planned projects, and the existing stakeholder structure and responsibilities.

*Key Stakeholders: All*

**L-4: Ada County Signal System Improvements**  
$2,500,000
This project will continue signal system improvement throughout Ada County. Improvements may include:
- Installation of new signals
- Upgrade of controllers, communications, and management systems
- Enhancements to signal coordination (through interconnect, signal timing, or traffic responsive control)
- Consideration of enforcement technologies
- Possibly other additional supportive equipment and software

These activities may be separate specific projects to enhance signal systems or may be combined within a corridor project (below). The costs associated with signal system improvements are identified here.

*Key Stakeholders: ACHD and ITD*
L-5: ITD Owned Signal System Improvements $750,000
This project will continue signal system improvements of ITD owned signals throughout the Treasure Valley. Improvements may include:
- Installation of new signals
- Upgrade of controllers, communications, and management systems
- Enhancements to signal coordination (through interconnect, signal timing, or traffic responsive control)
- Consideration of enforcement technologies
- Possibly other additional supportive equipment and software

These activities may be separate specific projects to enhance signal systems or may be combined within a corridor project (below). The costs associated with signal system improvements are identified here.

Key Stakeholders: ITD, ACHD, City of Nampa, and City of Caldwell

L-6: Nampa City Signal System Improvements $750,000
This project will continue signal system improvement within the Nampa City limits. Improvements may include:
- Installation of new signals
- Upgrade of controllers, communications, and management systems
- Enhancements to signal coordination (through interconnect, signal timing, or traffic responsive control)
- Consideration of enforcement technologies
- Possibly other additional supportive equipment and software

These activities may be separate specific projects to enhance signal systems or may be combined within a corridor project (below). The costs associated with signal system improvements are identified here.

Key Stakeholders: City of Nampa and ITD

L-7: Caldwell City Signal System Improvements $750,000
This project will continue signal system improvement within the Caldwell City limits. Improvements may include:
- Installation of new signals
- Upgrade of controllers, communications, and management systems
- Enhancements to signal coordination (through interconnect, signal timing, or traffic responsive control)
- Consideration of enforcement technologies
- Possibly other additional supportive equipment and software

These activities may be separate specific projects to enhance signal systems or may be combined within a corridor project (below). The costs associated with signal system improvements are identified here.

Key Stakeholders: City of Caldwell and ITD

L-8: IROC System Integration Upgrades $2,000,000
The IROC will continue to require integration upgrades as the center continues operation and expands its relationships with other transportation and emergency response agencies. This project provides the funding to accommodate these integration needs in the long term.

Key Stakeholders: All
L-9: Update State and Local Traveler Information Systems $200,000
The ACHD and related portions of the ITD statewide traveler information systems (within the Treasure Valley) will continue to require updates to stay current with the technology available and provide enhanced services to motorists interested in receiving accurate and timely traveler information in the region. This project will perform the necessary updates to achieve these goals. Additionally, as the IROC expands its ability to collect and manage traffic data, the traveler information system will need to keep pace and provide information in more varied ways to meet motorist’s needs and desires. The amount of funding supports these activities within the Treasure Valley – state funding to support updates and enhancements to the state system is not included.

Key Stakeholders: ITD, ACHD and Valley Regional Transit

L-10: Communications Infrastructure Deployment $15,700,000
Deployment of the long-term communications deployment project is identified in the Communications System Plan of Section 5.0. This effort will provide further communications infrastructure to areas on the northern and southern edges of the Treasure Valley, including additions to the communications ring deployed in S-14 and M-12 as well as provide communication to ITS field elements within their vicinity and trunk connectivity to facilitate tail circuits for other nearby ITS field elements. This project encompasses deployment throughout the Treasure Valley, within Ada and Canyon Counties. It is assumed that this would be accomplished in several smaller projects to support ITS deployments and as funding opportunities present themselves.

Key Stakeholders: ACHD, City of Nampa, City of Caldwell, Nampa Highway District, Canyon Highway District, and ITD

L-11: ITD Incident Response Vehicle Program Expansion $300,000
This project is a continuation of the ITD incident response vehicle program begun in Project M-15. This project provides for 3 new vehicles in this time period. One of the vehicles will expand the fleet to 5 and the other will replace two of the aging vehicles.

Key Stakeholders: ITD

L-12: Ramp Metering Implementation, Phase 2 $500,000
Project M-17 began the first to two implementation projects to install ramp meters at specific locations with system deployments at an estimated 4 locations. This project will continue the ramp metering implementation with an estimated 4 additional ramp meters installations as part of this long term timeframe. The locations will be determined during the planning (Project S-18) and an update to that plan following evaluation of the first installations in the Phase 1. The cost estimate also includes public involvement activities.

Key Stakeholders: ITD, ACHD, City of Boise, City of Meridian, City of Nampa, COMPASS and City of Caldwell

L-13: ATMS Software Enhancements and Integration $350,000
The advanced traffic management system software currently being used in the ACHD TMC will require annual updates and enhancements. The ACHD TMC is obtaining several requests from cities and other agencies to receive certain types of information that is collected by the TMC (such as CCTV camera images and incident notifications). This project will provide the funding necessary to keep the ATMS software up to date and the equipment and communications needed to provide the connections to other centers to ensure effective information sharing.

Key Stakeholders: ACHD, ITD, and other involved cities or organizations
L-14: ACHD Incident Response Vehicles $200,000

Many large transportation management agencies throughout the United States use incident response vehicles to assist motorists and emergency response personnel address traffic congestion – similar to what ITD’s program does for the Interstate. ACHD envisions beginning such a program in the long term timeframe. This project would purchase 2 vehicles in a demonstration project and outfit them with the necessary equipment, systems and communications to effective conduct their mission. Expansion of the program will depend on the evaluation of this initial demonstration project.

Key Stakeholders: ACHD

L-15: Highway 45 $280,000

The intention of this project is to further modernize Nampa’s traffic operations system. This project includes:

South Nampa Boulevard to 2nd Street
- 3 CCTV
- Deploy 6 spread spectrum (or other) wireless communication devices
- Install 6 system detector stations

Key Stakeholders: ITD, City of Nampa, Canyon Highway District

L-16: Franklin Boulevard $290,000

The role of Franklin Boulevard as a designated detour route emphasizes the need for both monitoring and traveler information. This project includes:

I-84/11th Avenue to Franklin Road
- 4 CCTV
- 2 DMS
- Install 6 system detector stations

Key Stakeholders: Canyon Highway District, Nampa Highway District

L-17: US 20/26 Corridor $210,000

The aim of this project is to complete ITS deployment along US 20/26, a known heavy-volume commuter route that will be experiencing increasing traffic volumes in the future. This project includes:

I-84 to Highway 16
- 3 CCTV
- 1 DMS
- Install 6 system detector stations

Key Stakeholders: ITD, ACHD, Canyon County Highway District

L-18: McDermott Road/Highway 16 $370,000

The purpose of this project is to increase monitoring capabilities on McDermott road. This project includes:

Amity Road to Beacon Light Road
- 10 CCTV
- 2 DMS
- Install 7 system detector stations

Key Stakeholders: ACHD, Nampa Highway District, Canyon Highway District
L-19: Ustick Road $30,000
Traffic monitoring and associated communications equipment will increase this route’s capacity and safety. This project includes:
10th Avenue to Can-Ada
  • 3 CCTV

Key Stakeholders: Canyon Highway District, Nampa Highway District

L-20: Victory Road $275,000
The purpose of this project is to optimize traffic operations along Victory Road. This project includes:
Ten Mile Road to Orchard St
  • 6 CCTV
  • Install 12 system detector stations

Key Stakeholder: ACHD

L-21: Lake Hazel Road/ Gowen Road Extension $120,000
This project focuses on monitoring along Lake Hazel Road. This project includes:
Highway 69 to Pleasant Valley Road
  • 2 CCTV
Gowen Road Extension
  • 4 CCTV
  • Deploy 4 spread spectrum (or other) wireless communication devices

Key Stakeholders: ACHD, Nampa Highway District

L-22: Kuna-Mora Road $290,000
This project is aimed at modernizing the Kuna-Mora Road corridor, specifically in the areas of traffic operations, monitoring and traveler information. This project includes:
Happy Valley Road to Blacks Creek Road
  • 5 CCTV
  • Install 8 system detector stations
  • Deploy 8 spread spectrum (or other) wireless communication devices

Key Stakeholders: ITD, ACHD

L-23: Amity Road $30,000
This project emphasizes traffic monitoring, it includes:
Highway 45 to Meridian Road/Highway 69
  • 3 CCTV

Key Stakeholder: ACHD
L-24: 10th Avenue  
This project emphasizes traffic monitoring, it includes:
Karcher Road to Cleveland Boulevard  
- 2 CCTV  
  
*Key Stakeholders: Canyon Highway District, Nampa Highway District, City of Caldwell*

L-25: Karcher Road  
This project emphasizes traffic monitoring, it includes:
Farmway Road to Middleton Road  
- 3 CCTV  
- Install 5 system detector stations  
  
*Key Stakeholders: ITD, City of Nampa, Nampa Highway District*

L-26: Middleton Road  
This project emphasizes traveler information, it includes:
Karcher Rd to Highway 44  
- 1 DMS  
  
*Key Stakeholders: Canyon Highway District, Nampa Highway District*

L-27: I-84 Corridor  
This project finalizes I-84 implementation and focuses on traffic monitoring and data gathering, it includes:
Gowen Road to Blacks Creek Road  
- 3 CCTV  
- Install 4 system detector stations  
  
*Key Stakeholders: ITD, ACHD*

L-28: Nampa Boulevard  
This project emphasizes traffic monitoring, it includes:
I-84 to Franklin/US 20  
- 2 CCTV  
  
*Key Stakeholders: Canyon Highway District, Nampa Highway District*

L-29: Highway 44 Corridor  
Essentially the second phase of project S-27 above, the aim of this project is to further improve operations along a busy commuter route. This project includes:
I-84 to Highway 16  
- 3 CCTV  
- 2 DMS  
- Install 7 system detector stations  
  
*Key Stakeholders: ITD, Canyon Highway District*
L-30: Highway 55 Corridor $75,000
As one of a small number of traffic conduits between Eagle and the rest of the Treasure Valley, ITS implementation on Highway 55 aims to increase safety, mitigate congestion and provide greater traveler information. This project includes:
Chinden Boulevard to Beacon Light
• 1 DMS

**Key Stakeholders: ITD and ACHD**

L-31: Franklin Road $225,000
The purpose of this project is to complete the ITS implementation that has already been initiated on the Franklin Road corridor. In addition, the role of Franklin Road as a designated detour route emphasizes the need for both monitoring and traveler information. This project includes:
Garrity to Vista
• 3 DMS

**Key Stakeholders: ACHD, Nampa Highway District**

L-32: Overland Road $150,000
The purpose of this project is to continue implementation of ITS elements along Overland Road and enhance this corridor’s function as a designated detour route. It is assumed that there are significant quantities of fiber optic cable already in place. This project includes:
Ten Mile to Cole/I-84
• 2 DMS

**Key Stakeholder: ACHD**

L-33: Happy Valley Road $30,000
This project emphasizes traffic monitoring and includes 3 CCTV between Garrity Boulevard and Kuna Road

**Key Stakeholder: ACHD**
6.3 Operations and Maintenance

A variety of ITS deployments have been accomplished since the 1999 plan providing an ever more detailed track record of the cost of operating and maintaining field equipment, communications services and hardware, and central control and monitoring infrastructure. As noted, these costs are not included in the project costs, but need to be accounted for in agency budgeting processes.

There are several key components that make up operations and maintenance and contribute to the associated resource burden. Among these are the cost of electrical power for field devices, communications infrastructure, and center operations; communications costs for leased services, if any; staff time for device maintenance and repair; and device and system replacement parts; but the most significant costs may lie in staffing associated with the operations center. This element is critical particularly as the need in the community pushes for a transition of traffic management operations to a full time activity. Operations and maintenance costs will also increase with time as more devices are deployed and need to be addressed during stakeholder budgeting.

For planning purposes, operations and maintenance costs must be considered. Table 6-5 provides an estimate of yearly O&M costs as a percentage of capital investment for typical ITS field elements; as defined by the Federal Highway Administration’s cost estimation tool. The typical cost for Operations and Maintenance ranges from less than 1% for underground infrastructure to over 10% for CCTV installations. The FHWA maintains good cost estimates for both capital investment and operations and maintenance on their website, deriving current costs from the actual expenditures of ITS projects around the country. Elements not listed in Table 6-5 may be represented by the FHWA or, at least in the initial stages of planning, may be assumed to fall somewhere in the range of 1-10%.

<table>
<thead>
<tr>
<th>Element</th>
<th>O&amp;M Cost as a % of Capital Investment</th>
<th>Lifecycle</th>
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<tbody>
<tr>
<td>Conduit</td>
<td>0.04%</td>
<td>20</td>
</tr>
<tr>
<td>Fiber</td>
<td>5.00%</td>
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<tr>
<td>Twisted Pair</td>
<td>0.18%</td>
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<td>Communications Equip.</td>
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<td>Spread Spectrum</td>
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<td>Video Detection System</td>
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<td>CCTV Camera</td>
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<td>RWIS</td>
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<td>Ramp Meter</td>
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<tr>
<td>DMS</td>
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SECTION 7.0
OPPORTUNITIES

The final chapter of this report addresses the opportunities for implementation of this plan. The ITS program in the Treasure Valley has been growing over the past several years resulting in more educated motorists, better managed transportation assets, enhanced coordination between traffic managers and emergency response agencies, and safer facilities. The participating stakeholders have made it clear that they want to expand deployment of ITS throughout the valley and begin immediate implementation of this plan. This section provides the recommendations and funding opportunities to continue expansion of the Treasure Valley ITS program.

7.1 Recommendations

The goal of the stakeholders is that this plan does not “sit on a shelf”, but rather is “on the desks” being used to guide ITS implementation. The following recommendations are offered to help make this goal a reality:

1. This plan be adopted by the participating Treasure Valley agencies and used to begin immediate implementation of future ITS projects identified herein. There are numerous ITS projects suggested for implementation divided into three timeframes: short (within 5 years), medium (6 to 10 years), and long (beyond 10 years). These projects include additional planning, system and communication deployment, and corridor deployment of field devices. Stakeholder involvement efforts as part of these planning activities indicated a strong desire to begin immediate implementation of these projects, with an emphasis on the short term activities. It is recommended that the appropriate agencies adopt the plan so implementation can begin and appropriate projects are “programmed” for deployment in the timeframes suggested.

2. This plan be updated approximately every 5 years. Additionally, portions of this plan be updated in 2 years to incorporate the new Interagency Regional Operations Center (IROC) Phase 2 results. The IROC Phase 2 planning activity will determine which agencies will collocate in the facility and which will obtain dedicated communication to the center. Once these decisions are finalized, the ITS architecture defined in this document will require updating. It is anticipated that this will need to happen in FY 2008. The continued pace of growth and change in the Treasure Valley will result in several significant changes to the conditions of the transportation system and operations. It is further recommended that this plan be updated approximately every 5 years to accommodate these changes and establish a meaningful and relevant path to future ITS implementations.

3. Agency stakeholders (established during this study) continue to meet at least twice a year to discuss and coordinate ITS implementations, potentials for increased data sharing, and ITS architecture updates. The three stakeholder meetings conducted as part of this study were informative and meaningful to those in attendance to understand different perspectives and coordinate activities. This recommendation will ensure that these opportunities for discussion continue as ITS projects are planned, designed, and deployed. Regular meetings of this group will also ensure the ITS architecture is kept current and reflective of ongoing changes.

4. The Community Planning Association of Southwest Idaho assume the responsibility for maintaining the ITS Architecture. The ITS architecture will require updating as projects are deployed and other changes occur. Recommendation 2 above mentioned the first opportunity to update the architecture (after key decisions related to the IROC development). However, other possible events that could require a change in the ITS architecture could include ownership of field devices or systems, management of transportation networks, implemented projects, or a change in deployment approach. It is important that one organization has the responsibility for maintaining the Treasure Valley ITS architecture. COMPASS, as
the region’s metropolitan planning organization, is best suited for this assignment because of their constant involvement and strong relationship with most of the participating agencies.

5. **A regional, multi-agency operations center be established to enhance the level of agency coordination in the Treasure Valley.** The current congestion levels and frequency and timing of incidents are increasing throughout the Treasure Valley. A regional, multi-agency operations center is needed to act as an information clearinghouse, operate 24 hours seven days of the week, and foster enhanced coordination between the numerous transportation agencies and with the emergency responders. Such a center is currently being planned for the region. This recommendation emphasizes the importance of such a center to the transportation management and emergency service agencies. It could also form the hub of ITS activities and information in the region.

6. **Establish an initiative to develop a Treasure Valley ITS benefits database.** The ITS benefits information currently available from FHWA is incomplete and at best represents averages from various projects across the country. Although this information is of some value for planning purposes, it does not reflect the unique Treasure Valley conditions and is therefore only somewhat useful in prioritizing how funding should be allocated to deploy ITS projects. This recommendation will begin to develop an ITS benefits database specific to the Treasure Valley deployments. Some information already exists that can be used as a starting point. As a way of beginning this initiative, and where practical, agencies should consider including a before and after evaluation activity into their ITS implementation tasks.

7.2 **Funding Opportunities**

At the federal level, the potential funding options for ITS deployments have migrated from special programs such as the early operational test effort sponsored by the FHWA to more mainstream transportation programs including identification of high priority projects within funding legislation. Typically, ITS deployments are incorporated into larger transportation projects as an integrated element aimed at supporting the overall project goals. Highway projects that are already planned or programmed can be developed to include ITS technologies. These technology elements should be viewed as critical to the success of not only the individual project, but the effectiveness of the transportation system as a whole. Some ITS projects are conducted as a separate activity but are also focused on improving efficiency and safety of the transportation system. All funding categories extend to at least some forms of ITS deployment and accommodate them as integrated components in a comprehensive approach to solving the transportation needs being addressed.

This approach lends greater assistance to the funding difficulties associated with transportation infrastructure implementations, particularly in the case of fiber optic or associated conduit, by timing them in a complementary fashion that allows activities, conduit trenching for instance, to be completed at an optimal time relative to other roadway work. The timing of the projects in Section 6 is based on several factors including transportation needs, coordination with other associated projects, and logical dependence on other infrastructure. These timings have not yet been coordinated with other roadway projects. They will need to be fine tuned as those schedules become known to make the most of the coordination concept.

**Division of Highways Funding**

Although not all, most ITS deployments are funded in part using federal funds, either through the Federal Highway Administration (FHWA) or the Federal Transit Authority (FTA). Funding from the FHWA is administered through the Idaho Transportation Department. The ITD Division of Highways has transitioned to an outcome/performance based approach in programming highway funds to clarify commitment and progress toward specific goals and a strategic
vision regarding the future of transportation in Idaho. Not all of the funding categories under this approach are available for ITS or projects that would logically include ITS in the Treasure Valley. The full range of funding categories under this Division of Highways approach is listed below with those that would most likely be used for ITS implementation or projects that include ITS are shown in bold:

- Debt Service – GARVEE
- Connecting Idaho
- State High Priority
- Preservation
- Bridge
- Safety
- Rest Area
- Planning/SPR
- Enhancement
- Congestion Mitigation and Air Quality (CMAQ)
- Local High Priority
- Local Urban/TMA/Rural
- Bridge, Local/Offsystem
- Local Metro/Recreational Trail/LTAP

Below are brief explanations of the categories most applicable to the ITS projects discussed in Section 6. As mentioned, ITS deployments are often part of larger projects. Therefore, the funding categories are often more focused on comprehensive transportation projects or programs of which ITS is a part. This can sometimes confuse the eligibility of funding and must be viewed in a broader context to capture the applicability of ITS components. More information on the funding categories and specific eligibility can be found in the Idaho Statewide Transportation Improvement Program on the ITD web site at http://www.itd.idaho.gov/planning/reports/stip/stipfirst.htm.

**Connecting Idaho** – This funding category has two basic sources. The first is the GARVEE bonding program passed by the Idaho legislature which borrows against future federal highway funding. The second comes from portions of the federal funding programs available to Idaho through the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU). This program is aimed at simply advancing high priority highway projects to take advantage of funding those projects before the rapid pace of increasing construction costs puts them out of realistic reach from a funding perspective. The economic advantages of this are based on the concept that increases in construction costs will continue to outpace the interest rates on the borrowed funds.

**State and Local High Priority** – ITD administers various state high priority funds from both TEA-21 and SAFETEA-LU federal transportation bills. Projects under this category typically have an overriding emphasis but are not scoped to even a high level of detail. This model could be adopted at the state or local level, particularly in light of the recent GARVEE funding program. For select ITS projects that fall within the limits of these identified high priority projects combining the ITS components into these larger projects is a viable strategy.

**Safety** – This funding category is to be used for various safety initiatives as identified by executive management. The list of initiatives includes Intelligent Transportation Systems as one of the primary goals of ITS to improve safety. Furthermore, most traditional safety projects can be enhanced by inclusion of ITS elements, particularly in the urban environment characteristic of the study area.
Planning/SPR – Corridor and regional based transportation planning studies are eligible under this program. Many of the ITS projects in this plan are aimed at a much more focused planning effort than the scope of this effort allowed but clearly fall within this funding category. In fact, some corridor planning projects that would be applicable to elements of the projects herein are already underway. All of these should include consideration for needed ITS deployments to address both the immediate needs of the specific corridor project and the long term ITS needs.

Congestion Mitigation and Air Quality (CMAQ) – The CMAQ program is a state wide competitive program that provides federal transportation funds to implement cost-effective activities, plans and projects that are mutually beneficial to transportation and air quality. This can include planning activities that identify additional projects designed to reduce transportation related air quality problems. Many ITS projects have positive impacts on congestion and subsequently, air quality, and are therefore potentially eligible for this funding stream. Some types of projects eligible for CMAQ funds include ITS, public transportation, bike and pedestrian route construction, traffic signals, and alternative transportation education/outreach.

Local Urban/TMA/Rural – Funding for this program comes from the federal STP funds and is focused on highways under the jurisdiction of local governments. Urban funds are available for areas with populations between 5000 and 200,000. The Transportation Management Area (TMA) funds are for urbanized areas with populations greater than 200,000. The Boise urbanized area is, currently, the only area in Idaho meeting this FHWA designation. Rural funds are available for projects outside of the areas described for Urban and TMA funds. Projects must be located on a local route within the TMA. There are several eligible activities under this program including both operational and safety improvements.

Other Funding

As noted these are the most likely funding categories among those being administered through the ITD Division of Highways. Other categories from the bullet list above may be applicable. For instance, bridge funds could potentially be used for an ITS deployment such as an RWIS site or CCTV camera if the deployment is part of a bridge project. This is not the typical approach and could only be used in a very limited number of applications as so has not been emphasized herein.

In addition to the above highway funds, several other potential sources of funding may provide avenues to ITS deployment in the region. While these funding sources do not flow through highway programs, they are administered, at least in part, by stakeholder agencies with an interest not only in specific ITS deployments that are focused on benefits to them, but also on the successful integration of the technology being employed to better manage the transportation system as a whole.

Public Transportation – The Division of Public Transportation administers various Federal Transit Administration grants that may be applicable to ITS projects, most obviously those that focus on or have significant elements addressing public transportation.

Emergency Service - Various funding programs are also available to emergency service providers that may be applicable to improvements to the emergency response and management related services addressed by the projects in this plan. This category also includes Homeland Security funds.

Also, state and local Agency Funds can often be focused on ITS projects depending, of course, on availability and the priorities set at that level of government. In association with these agency funds is the concept of agency assessed impact fees that are generated in conjunction with land development. Developers are often required to
either pay impact fees to government agencies or construct transportation infrastructure, such as traffic signals, in an effort to mediate the traffic and other impacts of development. These resources can often be justifiably used on projects that include ITS elements.

### Table 7-1
Treasure Valley ITS Project Funding Opportunities

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<tr>
<th>No.</th>
<th>Project</th>
<th>Connecting Idaho</th>
<th>High Priority</th>
<th>Safety</th>
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7.3 Implementation Considerations

The outcomes of this ITS planning effort are strategic in nature. The Plan does not consider some of the real-world challenges faced by agencies that wish to begin project implementation such as project programming/scheduling, funding availability, and staffing requirements. During the final stakeholder meeting, the agenda included a discussion of implementation challenges and potential solutions. A summary of that discussion is presented below.

**Funding.** Several agency representatives expressed the concern that funding was not available to implement this ITS plan, and further that the current 5-year plans do not include these ITS suggested projects specifically, which could result in a substantial delay in beginning deployment. It was acknowledged that the continued growth in the valley and the corresponding transportation improvement and operations needs have outpaced the available funding and therefore it was felt that funding would be limited for ITS projects. On the other hand, it is possible that ITS deployments can cost effectively address many of the needs.

There were several potential solutions discussed. As discussed in Section 7.2, there are many more potential funding sources for ITS deployments than ever before, and FHWA and FTA are encouraging such solutions as a way of addressing transportation needs. Also, it was suggested that in many cases agencies do not need to wait for the next 5-year cycle. Some of the ITS projects are already programmed (approximately 15%). Additionally, ITS projects can begin to be programmed and integrated into existing projects as part of the solution. ITS projects should not be thought of as separate from other transportation solutions, but rather as complementing those solutions with applications that can improve efficiency and increase safety. It is hoped that this plan will assist in establishing the needs and identifying possible solutions – resulting in the substantiation needed to obtain funding for implementation.
Need for meaningful ITS benefits information. The funding discussion highlighted the need for a better understanding of the potential benefits of ITS deployments. This better understanding would assist with project prioritization and funding allocations. The difficulty is that the FHWA benefits databases in many cases do not contain the necessary information specific to the Treasure Valley conditions.

It was suggested that an additional recommendation be included in the plan to initiate development of an ITS benefits database for Treasure Valley projects. This information would help to fill in the gaps and tailor benefit data in order to make better decisions regarding ITS project implementations. One approach to beginning this effort is to include an evaluation task in future Treasure Valley ITS projects so that meaningful data can be collected and documented.

Interagency cooperation. It was acknowledged by the group that many of the suggested ITS projects require more involved interagency cooperation to achieve success. Although the group realizes that much has been accomplished in recent years along these lines, there is still work to be done to achieve the level of cooperation needed to implement some of the ITS projects.

It was suggested that as part of the next steps toward ITS project design and development that the agencies include activities that will address these issues. One opportunity for such discussion is integrated in recommendation number 3 above, where the stakeholder agencies would continue to meet to discuss important ITS related deployment challenges and continue coordination efforts to ensure successful implementations.

Staff time requirements. Transportation and emergency service agencies are extremely busy dealing with the day-to-day operations and planning for how to address current and future needs. The group expressed a concern that there will not be time to plan for and participate in ITS implementation activities. Additionally, staff time is limited to address the maintenance requirements of the ITS equipment and systems.

Although this is a real concern, ITS implementations must be seen as additional tools in the tool-box to address agency needs – and therefore part of the solution to address the growing list of needs in the region. It is hoped that one day ITS applications are fully integrated into transportation improvement projects and the perceived “extra” staff time required would become a non-issue.
Appendix A
National ITS Architecture® Market Packages
Descriptions and Diagrams
Traffic Management Market Packages

Network Surveillance (ATMS01)
This market package includes traffic detectors, other surveillance equipment, the supporting field equipment, and fixed-point to fixed-point communications to transmit the collected data back to the Traffic Management Subsystem. The derived data can be used locally such as when traffic detectors are connected directly to a signal control system or remotely (e.g., when a CCTV system sends data back to the Traffic Management Subsystem). The data generated by this market package enables traffic managers to monitor traffic and road conditions, identify and verify incidents, detect faults in indicator operations, and collect census data for traffic strategy development and long range planning. The collected data can also be analyzed and made available to users and the Information Service Provider Subsystem.

*Note: Graphic shows key market package elements. Some elements are omitted for clarity.*
Probe Surveillance (ATMS02)

This market package provides an alternative approach for surveillance of the roadway network. Two general implementation paths are supported by this market package: 1) wide-area wireless communications between the vehicle and Information Service Provider is used to communicate current vehicle location and status, and 2) dedicated short range communications between the vehicle and roadside is used to provide equivalent information directly to the Traffic Management Subsystem. The first approach leverages wide area communications equipment that may already be in the vehicle to support personal safety and advanced traveler information services. The second approach utilizes vehicle equipment that supports toll collection, in-vehicle signing, and other short range communications applications identified within the architecture. The market package enables traffic managers to monitor road conditions, identify incidents, analyze and reduce the collected data, and make it available to users and private information providers. It requires one of the communications options identified above, roadside beacons and fixed-point to fixed-point communications for the short range communications option, data reduction software, and utilizes fixed-point to fixed-point links between the Traffic Management Subsystem and Information Service Provider Subsystem to share the collected information. Both “Opt out” and “Opt in” strategies are available to ensure the user has the ability to turn off the probe functions to ensure individual privacy. Due to the large volume of data collected by probes, data reduction techniques are required, such as the ability to identify and filter out-of-bounds or extreme data reports.

*Note: Graphic shows key market package elements. Some elements are omitted for clarity.*
Surface Street Control (ATMS03)
This market package provides the central control and monitoring equipment, communication links, and the signal control equipment that support local surface street control and/or arterial traffic management. A range of traffic signal control systems are represented by this market package ranging from fixed-schedule control systems to fully traffic responsive systems that dynamically adjust control plans and strategies based on current traffic conditions and priority requests. Additionally, general advisory and traffic control information can be provided to the driver while en route. This market package is generally an intra-jurisdictional package that does not rely on real-time communications between separate control systems to achieve area-wide traffic signal coordination. Systems that achieve coordination across jurisdictions by using a common time base or other strategies that do not require real time coordination would be represented by this package. This market package is consistent with typical urban traffic signal control systems.

*Note: Graphic shows key market package elements. Some elements are omitted for clarity.*
Freeway Control (ATMS04)
This market package provides the communications and roadside equipment to support ramp control, lane controls, and interchange control for freeways. Coordination and integration of ramp meters are included as part of this market package. This package is consistent with typical urban traffic freeway control systems. This package incorporates the instrumentation included in the Network Surveillance Market Package to support freeway monitoring and adaptive strategies as an option.

This market package also includes the capability to utilize surveillance information for detection of incidents. Typically, the processing would be performed at a traffic management center; however, developments might allow for point detection with roadway equipment. For example, a CCTV might include the capability to detect an incident based upon image changes. Additionally, this market package allows general advisory and traffic control information to be provided to the driver while en-route.

*Note: Graphic shows key market package elements. Some elements are omitted for clarity.*
**HOV Lane Management (ATMS05)**
This market package manages HOV lanes by coordinating freeway ramp meters and connector signals with HOV lane usage signals. Preferential treatment is given to HOV lanes using special bypasses, reserved lanes, and exclusive rights-of-way that may vary by time of day. Vehicle occupancy detectors may be installed to verify HOV compliance and to notify enforcement agencies of violations.

*Note: Graphic shows key market package elements. Some elements are omitted for clarity.*
Traffic Information Dissemination (ATMS06)
This market package provides driver information using roadway equipment such as dynamic message signs or highway advisory radio. A wide range of information can be disseminated including traffic and road conditions, closure and detour information, incident information, and emergency alerts and driver advisories. This package provides information to drivers at specific equipped locations on the road network. Careful placement of the roadway equipment provides the information at points in the network where the drivers have recourse and can tailor their routes to account for the new information. This package also covers the equipment and interfaces that provide traffic information from a traffic management center to the media (for instance via a direct tie-in between a traffic management center and radio or television station computer systems), Transit Management, Emergency Management, and Information Service Providers. A link to the Maintenance and Construction Management subsystem allows real time information on road/bridge closures due to maintenance and construction activities to be disseminated.

*Note: Graphic shows key market package elements. Some elements are omitted for clarity.*
Regional Traffic Control (ATMS07)
This market package provides for the sharing of traffic information and control among traffic management centers to support a regional control strategy. This market package advances the Surface Street Control and Freeway Control Market Packages by adding the communications links and integrated control strategies that enable integrated interjurisdictional traffic control. The nature of optimization and extent of information and control sharing is determined through working arrangements between jurisdictions. This package relies principally on roadside instrumentation supported by the Surface Street Control and Freeway Control Market Packages and adds hardware, software, and fixed-point to fixed-point communications capabilities to implement traffic management strategies that are coordinated between allied traffic management centers. Several levels of coordination are supported from sharing of information through sharing of control between traffic management centers.

*Note: Graphic shows key market package elements. Some elements are omitted for clarity.*
Traffic Incident Management System (ATMS08)

This market package manages both unexpected incidents and planned events so that the impact to the transportation network and traveler safety is minimized. The market package includes incident detection capabilities through roadside surveillance devices (e.g. CCTV) and through regional coordination with other traffic management, maintenance and construction management and emergency management centers as well as rail operations and event promoters. Information from these diverse sources is collected and correlated by this market package to detect and verify incidents and implement an appropriate response. This market package supports traffic operations personnel in developing an appropriate response in coordination with emergency management, maintenance and construction management, and other incident response personnel to confirmed incidents. The response may include traffic control strategy modifications or resource coordination between center subsystems. Incident response also includes presentation of information to affected travelers using the Traffic Information Dissemination market package and dissemination of incident information to travelers through the Broadcast Traveler Information or Interactive Traveler Information market packages. The roadside equipment used to detect and verify incidents also allows the operator to monitor incident status as the response unfolds. The coordination with emergency management might be through a CAD system or through other communication with emergency field personnel. The coordination can also extend to tow trucks and other allied response agencies and field service personnel.

*Note: Graphic shows key market package elements. Some elements are omitted for clarity.*
Traffic Forecast and Demand Management (ATMS09)
This market package includes advanced algorithms, processing, and mass storage capabilities that support historical evaluation, real-time assessment, and forecast of the roadway network performance. This includes the prediction of travel demand patterns to support better link travel time forecasts. The source data would come from the Traffic Management Subsystem itself as well as other traffic management centers and forecasted traffic loads derived from route plans supplied by the Information Service Provider Subsystem. This market package provides data that supports the implementation of TDM programs, and policies managing both traffic and the environment. The package collects information on vehicle pollution levels, parking availability, usage levels, and vehicle occupancy to support these functions. Demand management requests can also be made to Toll Administration, Transit Management, and Parking Management Subsystems.

*Note: Graphic shows key market package elements. Some elements are omitted for clarity.*
Electronic Toll Collection (ATMS10)
This market package provides toll operators with the ability to collect tolls electronically and detect and process violations. The fees that are collected may be adjusted to implement demand management strategies. Dedicated short range communication between the roadway equipment and the vehicle is required as well as fixed-point to fixed-point interfaces between the toll collection equipment and transportation authorities and the financial infrastructure that supports fee collection. Vehicle tags of toll violators are read and electronically posted to vehicle owners. Standards, inter-agency coordination, and financial clearinghouse capabilities enable regional, and ultimately national interoperability for these services. Two other market packages, APTS4: Transit Passenger and Fare Management and ATMS16: Parking Facility Management also provide electronic payment services. These three market packages in combination provide an integrated electronic payment system for transportation services.

The toll tags and roadside readers that these systems utilize can also be used to collect road use statistics for highway authorities. This data can be collected as a natural by-product of the toll collection process or collected by separate readers that are dedicated to probe data collection.

*Note: Graphic shows key market package elements. Some elements are omitted for clarity.*
Emissions Monitoring and Management (ATMS11)

This market package monitors individual vehicle emissions and provides general air quality monitoring using distributed sensors to collect the data. The collected information is transmitted to the emissions management subsystem for processing. Both area wide air quality monitoring and point emissions monitoring are supported by this market package. For area wide monitoring, this market package measures air quality, identifies sectors that are non-compliant with air quality standards, and collects, stores and reports supporting statistical data. For point emissions monitoring, this market package measures tail pipe emissions and identifies vehicles that exceed emissions standards. Summary emissions information or warnings can also be displayed to drivers. The gathered information can be used to implement environmentally sensitive TDM programs, policies, and regulations.

*Note: Graphic shows key market package elements. Some elements are omitted for clarity.*
Virtual TMC and Smart Probe Data (ATMS12)
This market package provides for special requirements of rural road systems. Instead of a central TMC, the traffic management is distributed over a very wide area (e.g., a whole state or collection of states). Each locality has the capability of accessing available information for assessment of road conditions. The package uses vehicles as smart probes that are capable of measuring road conditions and providing this information to the roadway for relay to the Traffic Management Subsystem and potentially direct relay to following vehicles (i.e., the automated road signing equipment is capable of autonomous operation). In-vehicle signing is used to inform drivers of detected road conditions.

*Note: Graphic shows key market package elements. Some elements are omitted for clarity.*
Standard Railroad Grade Crossing (ATMS13)
This market package manages highway traffic at highway-rail intersections (HRIs) where operational requirements do not dictate more advanced features (e.g., where rail operational speeds are less than 80 miles per hour). Both passive (e.g., the crossbucksign) and active warning systems (e.g., flashing lights and gates) are supported. (Note that passive systems exercise only the single interface between the roadway subsystem and the driver in the architecture definition.) These traditional HRI warning systems may also be augmented with other standard traffic management devices. The warning systems are activated on notification by interfaced wayside equipment of an approaching train. The equipment at the HRI may also be interconnected with adjacent signalized intersections so that local control can be adapted to highway-rail intersection activities. Health monitoring of the HRI equipment and interfaces is performed; detected abnormalities are reported to both highway and railroad officials through wayside interfaces and interfaces to the traffic management subsystem.

*Note: Graphic shows key market package elements. Some elements are omitted for clarity.*
**Advanced Railroad Grade Crossing (ATMS14)**

This market package manages highway traffic at highway-rail intersections (HRIs) where operational requirements demand advanced features (e.g., where rail operational speeds are greater than 80 miles per hour). This market package includes all capabilities from the Standard Railroad Grade Crossing Market Package and augments these with additional safety features to mitigate the risks associated with higher rail speeds. The active warning systems supported by this market package include positive barrier systems that preclude entrance into the intersection when the barriers are activated. Like the Standard Package, the HRI equipment is activated on notification by wayside interface equipment which detects, or communicates with the approaching train. In this market package, the wayside equipment provides additional information about the arriving train so that the train’s direction of travel, estimated time of arrival, and estimated duration of closure may be derived. This enhanced information may be conveyed to the driver prior to, or in context with, warning system activation. This market package also includes additional detection capabilities that enable it to detect an entrapped or otherwise immobilized vehicle within the HRI and provide an immediate notification to highway and railroad officials.

*Note: Graphic shows key market package elements. Some elements are omitted for clarity.*
**Railroad Operations Coordination (ATMS15)**
This market package provides an additional level of strategic coordination between freight rail operations and traffic management centers. Rail operations provides train schedules, maintenance schedules, and any other forecast events that will result in highway-rail intersection (HRI) closures. This information is used to develop forecast HRI closure times and durations that may be used in advanced traffic control strategies or to enhance the quality of traveler information.

*Note: Graphic shows key market package elements. Some elements are omitted for clarity.*
Parking Facility Management (ATMS16)
This market package provides enhanced monitoring and management of parking facilities. It assists in the management of parking operations, coordinates with transportation authorities, and supports electronic collection of parking fees. This market package collects current parking status, shares this data with Information Service Providers and Traffic Management, and collects parking fees using the same in-vehicle equipment utilized for electronic toll collection or contact or proximity traveler cards used for electronic payment. Two other market packages, APTS4: Transit Passenger and Fare Management and ATMS10: Electronic Toll Collection also provide electronic payment services. These three market packages in combination provide an integrated electronic payment system for transportation services.

*Note: Graphic shows key market package elements. Some elements are omitted for clarity.*
Regional Parking Management (ATMS17)
This market package supports coordination between parking facilities to enable regional parking management strategies.

ATMS17 – Regional Parking Management

*Note: Graphic shows key market package elements. Some elements are omitted for clarity.*
Reversible Lane Management (ATMS18)
This market package provides for the management of reversible lane facilities. In addition to standard surveillance capabilities, this market package includes sensory functions that detect wrong-way vehicles and other special surveillance capabilities that mitigate safety hazards associated with reversible lanes. The package includes the field equipment, physical lane access controls, and associated control electronics that manage and control these special lanes. This market package also includes the equipment used to electronically reconfigure intersections and manage right-of-way to address dynamic demand changes and special events.

*Note: Graphic shows key market package elements. Some elements are omitted for clarity.*
Speed Monitoring (ATMS19)
This market package monitors the speeds of vehicles traveling through a roadway system. If the speed is determined to be excessive, roadside equipment can suggest a safe driving speed. Environmental conditions may be monitored and factored into the safe speed advisories that are provided to the motorist. This service can also support notifications to an enforcement agency to enforce the speed limit on a roadway system.

*Note: Graphic shows key market package elements. Some elements are omitted for clarity.*
**Drawbridge Management (ATMS20)**
This market package supports systems that manage drawbridges at rivers and canals and other multimodal crossings (other than railroad grade crossings which are specifically covered by other market packages). The equipment managed by this market package includes control devices (e.g., gates, warning lights, dynamic message signs) at the drawbridge as well as the information systems that are used to keep travelers appraised of current and forecasted drawbridge status.

*Note: Graphic shows key market package elements. Some elements are omitted for clarity.*
Roadway Closure Management (ATMS21)
This market package closes roadways to vehicular traffic when driving conditions are unsafe, maintenance must be performed, and other scenarios where access to the roadway must be prohibited. The market package includes automatic or remotely controlled gates or barriers that control access to roadway segments including ramps and traffic lanes. Remote control systems allow the gates to be controlled from a central location, improving system efficiency and reducing personnel exposure to unsafe conditions during severe weather and other situations where roads must be closed. Surveillance systems allow operating personnel to visually verify the safe activation of the closure system and driver information systems (e.g., DMS) provide closure information to motorists in the vicinity of the closure. The equipment managed by this market package includes the control and monitoring systems, the field devices (e.g., gates, warning lights, DMS, CCTV cameras) at the closure location(s), and the information systems that notify other systems of a closure. This market package covers general road closure applications; specific closure systems that are used at railroad grade crossings, drawbridges, reversible lanes, etc. are covered by other ATMS market packages.

*Note: Graphic shows key market package elements. Some elements are omitted for clarity.*
Public Transportation Market Packages

Transit Vehicle Tracking (APTS1)
This market package monitors current transit vehicle location using an Automated Vehicle Location System. The location data may be used to determine real-time schedule adherence and update the transit system’s schedule in real-time. Vehicle position may be determined either by the vehicle (e.g., through GPS) and relayed to the infrastructure or may be determined directly by the communications infrastructure. A two-way wireless communication link with the Transit Management Subsystem is used for relaying vehicle position and control measures. Fixed route transit systems may also employ beacons along the route to enable position determination and facilitate communications with each vehicle at fixed intervals. The Transit Management Subsystem processes this information, updates the transit schedule and makes real-time schedule information available to the Information Service Provider.

*Note: Graphic shows key market package elements. Some elements are omitted for clarity.*
Transit Fixed-Route Operations (APTS2)
This market package performs vehicle routing and scheduling, as well as automatic operator assignment and system monitoring for fixed-route and flexible-route transit services. This service determines current schedule performance using AVL data and provides information displays at the Transit Management Subsystem. Static and real time transit data is exchanged with Information Service Providers where it is integrated with that from other transportation modes (e.g. rail, ferry, air) to provide the public with integrated and personalized dynamic schedules.

*Note: Graphic shows key market package elements. Some elements are omitted for clarity.*
Demand Response Transit Operations (APTS3)
This market package performs vehicle routing and scheduling as well as automatic operator assignment and monitoring for demand responsive transit services. In addition, this market package performs similar functions to support dynamic features of flexible-route transit services. This package monitors the current status of the transit fleet and supports allocation of these fleet resources to service incoming requests for transit service while also considering traffic conditions. The Transit Management Subsystem provides the necessary data processing and information display to assist the transit operator in making optimal use of the transit fleet. This service includes the capability for a traveler request for personalized transit services to be made through the Information Service Provider (ISP) Subsystem. The ISP may either be operated by a transit management center or be independently owned and operated by a separate service provider. In the first scenario, the traveler makes a direct request to a specific paratransit service. In the second scenario, a third party service provider determines that the paratransit service is a viable means of satisfying a traveler request and makes a reservation for the traveler.

*Note: Graphic shows key market package elements. Some elements are omitted for clarity.*
Transit Passenger and Fare Management (APTS4)
This market package manages passenger loading and fare payments on-board transit vehicles using electronic means. It allows transit users to use a traveler card or other electronic payment device. Sensors mounted on the vehicle permit the operator and central operations to determine vehicle loads, and readers located either in the infrastructure or on-board the transit vehicle allow electronic fare payment. Data is processed, stored, and displayed on the transit vehicle and communicated as needed to the Transit Management Subsystem. Two other market packages, ATMS10: Electronic Toll Collection and ATMS16: Parking Facility Management also provide electronic payment services. These three market packages in combination provide an integrated electronic payment system for transportation services.

*Note: Graphic shows key market package elements. Some elements are omitted for clarity.*
Transit Security (APTS5)

This market package provides for the physical security of transit passengers and transit vehicle operators. On-board equipment is deployed to perform surveillance and sensor monitoring in order to warn of potentially hazardous situations. The surveillance equipment includes video (e.g., CCTV cameras), audio systems and/or event recorder systems. The sensor equipment includes threat sensors (e.g., chemical agent, toxic industrial chemical, biological, explosives, and radiological sensors) and object detection sensors (e.g., metal detectors). Transit user or transit vehicle operator activated alarms are provided onboard. Public areas (e.g., transit stops, park and ride lots, stations) are also monitored with similar surveillance and sensor equipment and provided with transit user activated alarms. In addition this market package provides surveillance and sensor monitoring of non-public areas of transit facilities (e.g., transit yards) and transit infrastructure such as bridges, tunnels, and transit railways or bus rapid transit (BRT) guideways. The surveillance equipment includes video and/or audio systems. The sensor equipment includes threat sensors and object detection sensors as described above as well as intrusion or motion detection sensors and infrastructure integrity monitoring (e.g., rail track continuity checking or bridge structural integrity monitoring).

The surveillance and sensor information is transmitted to the Emergency Management Subsystem, as are transit user activated alarms in public secure areas. On-board alarms, activated by transit users or transit vehicle operators are transmitted to both the Emergency Management Subsystem and the Transit Management Subsystem, indicating two possible approaches to implementing this market package.

In addition the market package supports remote transit vehicle disabling by the Transit Management Subsystem and transit vehicle operator authentication.

*Note: Graphic shows key market package elements. Some elements are omitted for clarity.
Transit Maintenance (APTS6)
This market package supports automatic transit maintenance scheduling and monitoring. On-board condition sensors monitor system status and transmit critical status information to the Transit Management Subsystem. Hardware and software in the Transit Management Subsystem processes this data and schedules preventative and corrective maintenance.

APTS6 - Transit Maintenance

*Note: Graphic shows key market package elements. Some elements are omitted for clarity.*
Multi-modal Coordination (APTS7)
This market package establishes two way communications between multiple transit and traffic agencies to improve service coordination. Multimodal coordination between transit agencies can increase traveler convenience at transit transfer points and clusters (a collection of stops, stations, or terminals where transfers can be made conveniently) and also improve operating efficiency. Transit transfer information is shared between Multimodal Transportation Service Providers, Transit Agencies, and ISPs.

Coordination between traffic and transit management is intended to improve on-time performance of the transit system to the extent that this can be accommodated without degrading overall performance of the traffic network. More limited local coordination between the transit vehicle and the individual intersection for signal priority is also supported by this package.

*Note: Graphic shows key market package elements. Some elements are omitted for clarity.*
Transit Traveler Information (APTS8)
This market package provides transit users at transit stops and on-board transit vehicles with ready access to transit information. The information services include transit stop annunciation, imminent arrival signs, and real-time transit schedule displays that are of general interest to transit users. Systems that provide custom transit trip itineraries and other tailored transit information services are also represented by this market package.

*Note: Graphic shows key market package elements. Some elements are omitted for clarity.*
Traveler Information Market Packages

Broadcast Traveler Information (ATIS1)
This market package collects traffic conditions, advisories, general public transportation, toll and parking information, incident information, roadway maintenance and construction information, air quality and weather information, and broadly disseminates this information through existing infrastructures and low cost user equipment (e.g., FM subcarrier, cellular data broadcast). The information may be provided directly to travelers or provided to merchants and other traveler service providers so that they can better inform their customers of travel conditions. Different from the market package ATMS6 - Traffic Information Dissemination, which provides localized HAR and DMS information capabilities, ATIS1 provides a wide area digital broadcast service. Successful deployment of this market package relies on availability of real-time traveler information from roadway instrumentation, probe vehicles or other sources.

*Note: Graphic shows key market package elements. Some elements are omitted for clarity.*
Interactive Traveler Information (ATIS2)

This market package provides tailored information in response to a traveler request. Both real-time interactive request/response systems and information systems that "push" a tailored stream of information to the traveler based on a submitted profile are supported. The traveler can obtain current information regarding traffic conditions, roadway maintenance and construction, transit services, ride share/ride match, parking management, detours and pricing information. A range of two-way wide-area wireless and fixed-point to fixed-point communications systems may be used to support the required data communications between the traveler and Information Service Provider. A variety of interactive devices may be used by the traveler to access information prior to a trip or en route including phone via a 511-like portal, kiosk, Personal Digital Assistant, personal computer, and a variety of in-vehicle devices. This market package also allows value-added resellers to collect transportation information that can be aggregated and be available to their personal devices or remote traveler systems to better inform their customers of transportation conditions. Successful deployment of this market package relies on availability of real-time transportation data from roadway instrumentation, transit, probe vehicles or other means. A traveler may also input personal preferences and identification information via a “traveler card” that can convey information to the system about the traveler as well as receive updates from the system so the card can be updated over time.

*Note: Graphic shows key market package elements. Some elements are omitted for clarity.*
Autonomous Route Guidance (ATIS3)
This market package relies on in-vehicle sensory, location determination, computational, map database, and interactive driver interface equipment to enable route planning and detailed route guidance based on static, stored information. No communication with the infrastructure is assumed or required. Identical capabilities are available to the traveler outside the vehicle by integrating a similar suite of equipment into portable devices.

*Note: Graphic shows key market package elements. Some elements are omitted for clarity.*
Dynamic Route Guidance (ATIS4)
This market package offers advanced route planning and guidance that is responsive to current conditions. The package combines the autonomous route guidance user equipment with a digital receiver capable of receiving real-time traffic, transit, and road condition information, which is considered by the user equipment in provision of route guidance.

*Note: Graphic shows key market package elements. Some elements are omitted for clarity.*
ISP-Based Route Guidance (ATIS5)
This market package offers the user pre-trip route planning and turn-by-turn route guidance services. Routes may be based on static information or reflect real time network conditions. Unlike ATIS3 and ATIS4, where the user equipment determines the route, the route determination functions are performed in the Information Service Provider Subsystem in this market package. This approach simplifies the user equipment requirements and can provide the infrastructure better information on which to predict future traffic. The package includes two way data communications and optionally also equips the vehicle with the databases, location determination capability, and display technology to support turn by turn route guidance.

*Note: Graphic shows key market package elements. Some elements are omitted for clarity.*
Integrated Transportation Management/Route Guidance (ATIS6)
This market package provides advanced route planning and guidance which is responsive to current conditions, and supports collection of near-real time information on intended routes for a proportion of the vehicles in the network. This comprehensive road network probe information can be used by the Traffic Management Subsystem to optimize the traffic control strategy based on anticipated vehicle routes. The Traffic Management Subsystem would utilize the individual and ISP route planning information to optimize signal timing while at the same time providing updated signal timing information to allow optimized route plans. The predictive link times used by this market package are provided by the market package ATMS9--Traffic Forecast and Demand Management--at the traffic management center.

*Note: Graphic shows key market package elements. Some elements are omitted for clarity.
Yellow Pages and Reservation (ATIS7)
This market package provides yellow pages and reservation services to the user. These additional traveler services may be provided using the same basic user equipment used for Interactive Traveler Information. This market package provides multiple ways for accessing information either while en route in a vehicle using wide-area wireless communications or pre-trip via fixed-point to fixed-point connections.

ATIS7 - Yellow Pages and Reservation

*Note: Graphic shows key market package elements. Some elements are omitted for clarity.*
Dynamic Ridesharing (ATIS8)
This market package provides dynamic ridesharing/ride matching services to travelers. This service could allow near real time ridesharing reservations to be made through the same basic user equipment used for Interactive Traveler Information. This ridesharing/ride matching capability also includes arranging connections to transit or other multimodal services.

*Note: Graphic shows key market package elements. Some elements are omitted for clarity.*
In Vehicle Signing (ATIS9)
This market package supports distribution of traffic and travel advisory information to drivers through in-vehicle devices. It includes short range communications between roadside equipment and the vehicle and wireline connections to the Traffic Management Subsystem for coordination and control. This market package also informs the driver of both highway-highway and highway-rail intersection status.

*Note: Graphic shows key market package elements. Some elements are omitted for clarity.*
Advanced Vehicle Safety System Market Packages

Vehicle Safety Monitoring (AVSS01)
This market package will diagnose critical components of the vehicle and warn the driver of potential dangers. On-board sensors will determine the vehicle’s condition, performance, on-board safety data, and display information.

AVSS01 - Vehicle Safety Monitoring

*Note: Graphic shows key market package elements. Some elements are omitted for clarity.*
Driver Safety Monitoring (AVSS02)
This market package will determine the driver’s condition, and warn the driver of potential dangers. On-board sensors will determine the driver’s condition, performance, on-board safety data, and display information.

AVSS02 - Driver Safety Monitoring

*Note: Graphic shows key market package elements. Some elements are omitted for clarity.*
Longitudinal Safety Warning (AVSS03)
This market package allows for longitudinal warning. It utilizes safety sensors and collision sensors. It requires on-board sensors to monitor the areas in front of and behind the vehicle and present warnings to the driver about potential hazards.

AVSS03 - Longitudinal Safety Warning

*Note: Graphic shows key market package elements. Some elements are omitted for clarity.*
Lateral Safety Warning (AVSS04)
This market package allows for lateral warning. It utilizes safety sensors and collision sensors. It requires on-board sensors to monitor the areas to the sides of the vehicle and present warnings to the driver about potential hazards.

AVSS04 - Lateral Safety Warning

*Note: Graphic shows key market package elements. Some elements are omitted for clarity.*
Intersection Safety Warning (AVSS05)

This market package will determine the probability of a collision in an equipped intersection (either highway-highway or highway-rail) and provide timely warnings to drivers in response to hazardous conditions. Monitors in the roadway infrastructure assess vehicle locations and speeds near an intersection. Using this information, a warning is determined and communicated to the approaching vehicle using a short range communications system. Information can be provided to the driver through the market package ATIS9--In-Vehicle Signing.

*Note: Graphic shows key market package elements. Some elements are omitted for clarity.*
Pre-Crash Restraint Deployment (AVSS06)
This market package provides in-vehicle sensors to monitor the vehicle's local environment, determine collision probability and deploy a pre-crash safety system. It will include on-board sensors to measure lateral and longitudinal gaps and together with weather and roadway conditions will determine lateral and longitudinal collision probability. It will have the mechanism to deploy a pre-crash safety system.

*Note: Graphic shows key market package elements. Some elements are omitted for clarity.*
Driver Visibility Improvement (AVSS07)
This market package will enhance driver visibility using an enhanced vision system. On-board display hardware is needed.

*Note: Graphic shows key market package elements. Some elements are omitted for clarity.*
Advanced Vehicle Longitudinal Control (AVSS08)
This market package automates the speed and headway control functions on board the vehicle. It utilizes safety sensors and collision sensors combined with vehicle dynamics processing to control the throttle and brakes. It requires on-board sensors to measure longitudinal gaps and a processor for controlling the vehicle speed.

*Note: Graphic shows key market package elements. Some elements are omitted for clarity.*
**Advanced Vehicle Lateral Control (AVSS09)**
This market package automates the steering control on board the vehicle. It utilizes safety sensors and collision sensors combined with vehicle dynamics processing to control the steering. It requires on-board sensors to measure lane position and lateral deviations and a processor for controlling the vehicle steering.

*Note: Graphic shows key market package elements. Some elements are omitted for clarity.*
Intersection Collision Avoidance (AVSS10)
This market package will determine the probability of an intersection collision and provide timely warnings to approaching vehicles so that avoidance actions can be taken. This market package builds on the Intersection Collision Warning infrastructure and in-vehicle equipment and adds equipment in the vehicle that can take control of the vehicle in emergency situations. The same monitors in the roadway infrastructure are needed to assess vehicle locations and speeds near an intersection. This information is determined and communicated to the approaching vehicle using a short range communications system. The vehicle uses this information to develop control actions which alter the vehicle’s speed and steering control and potentially activate its pre-crash safety system.

AVSS10 - Intersection Collision Avoidance

*Note: Graphic shows key market package elements. Some elements are omitted for clarity.
Automated Highway System (AVSS11)
This market package enables “hands-off” operation of the vehicle on the automated portion of the highway system. Implementation requires lateral lane holding, vehicle speed and steering control, and Automated Highway System check-in and checkout. This market package currently supports a balance in intelligence allocation between infrastructure and the vehicle pending selection of a single operational concept by the AHS consortium.

*Note: Graphic shows key market package elements. Some elements are omitted for clarity.*
Commercial Vehicle Operations Market Packages

Fleet Administration (CVO01)
This market package provides the capabilities to manage a fleet of commercial vehicles. The Fleet and Freight Management subsystem provides the route for a commercial vehicle by either utilizing an in-house routing software package or an Information Service Provider. Routes generated by either approach are constrained by hazardous materials and other restrictions (such as height or weight). Any such restricted areas are determined by the Commercial Vehicle Administration. A route would be electronically sent to the Commercial Vehicle with any appropriate dispatch instructions. The location of the Commercial Vehicle can be monitored by the Fleet and Freight Management subsystem and routing changes can be made depending on current road network conditions. Once a route has been assigned, changes must be coordinated between the Fleet and Freight Management subsystem and the Commercial Vehicle. Commercial Vehicle Drivers would be alerted to any changes in route from the planned route and given an opportunity to justify a rerouting. Any unauthorized or unexpected route changes by the Commercial Vehicle will register a route deviation alert with the Fleet and Freight Management subsystem. The Fleet and Freight Management subsystem can also notify local public safety agencies of the route deviation when appropriate (e.g., if there is safety sensitive HAZMAT being carried), by sending an alarm to the Emergency Management subsystem.

CVO01 - Fleet Administration

*Note: Graphic shows key market package elements. Some elements are omitted for clarity.*
Freight Administration (CVO02)
This market package tracks the movement of cargo and monitors the cargo condition. Interconnections are provided to intermodal freight shippers and intermodal freight depots for tracking of cargo from source to destination. In addition to the usual cargo monitoring required to insure that cargo gets from origin to destination, the Fleet and Freight Management subsystem monitors shipments to make sure that no tampering or breach of security occurs to the cargo on commercial vehicles. Any such tampering will be reported to the Fleet and Freight Management subsystem. In addition to exceptions (e.g., alerts) that are reported, on-going indications of the state of the various freight equipment are reported to the Fleet and Freight Management subsystem. The commercial vehicle driver is also alerted of any tampering or breach of cargo security. Freight managers may decide to take further action on the alerts and/or provide responses that explain that the alerts are false alarms. If no explanation is received, the Fleet and Freight Management subsystem may notify the Emergency Management subsystem.

*Note: Graphic shows key market package elements. Some elements are omitted for clarity.*
Electronic Clearance (CVO03)
This market package provides for automated clearance at roadside check facilities. The roadside check facility communicates with the Commercial Vehicle Administration subsystem to retrieve infrastructure snapshots of critical carrier, vehicle, and driver data to be used to sort passing vehicles. This allows a good driver/vehicle/carrier to pass roadside facilities at highway speeds using transponders and dedicated short range communications to the roadside. Results of roadside clearance activities will be passed on to the Commercial Vehicle Administration. The roadside check facility may be equipped with Automated Vehicle Identification (AVI), weighing sensors, transponder read/write devices and computer workstations.

*CNote: Graphic shows key market package elements. Some elements are omitted for clarity.*
CV Administrative Processes (CVO04)
This market package provides for electronic application, processing, fee collection, issuance, and distribution of CVO credential and tax filing. Through this process, carriers, drivers, and vehicles may be enrolled in the electronic clearance program provided by a separate market package which allows commercial vehicles to be screened at mainline speeds at roadside check facilities. Through this enrollment process, current profile databases are maintained in the Commercial Vehicle Administration subsystem and snapshots of this database are made available to the roadside check facilities at the roadside to support the electronic clearance process.

Commercial Vehicle Administration subsystems can share credential information with other Commercial Vehicle Administration subsystems, so that it is possible for any Commercial Vehicle Administration subsystem to have access to all credentials, credential fees, credentials status and safety status information. In addition, it is possible for one Commercial Vehicle Administration subsystem to collect HAZMAT route restrictions information from other Commercial Vehicle Administration subsystems and then act as a clearinghouse for this route restrictions information for Information Service Providers, Map Update Providers, and Fleet and Freight Management subsystems.

*CNote: Graphic shows key market package elements. Some elements are omitted for clarity.*
International Border Electronic Clearance (CVO05)
This market package provides for automated clearance at international border crossings. This package augments the electronic clearance package by allowing interface with customs related functions.

*Note: Graphic shows key market package elements. Some elements are omitted for clarity.*
Weigh-In-Motion (CVO06)
This market package provides for high speed weigh-in-motion with or without Automated Vehicle Identification (AVI) capabilities. This market package provides the roadside equipment that could be used as a stand-alone system or to augment the Electronic Clearance (CVO03) market package.

*Note: Graphic shows key market package elements. Some elements are omitted for clarity.*
Roadside CVO Safety (CVO07)
This market package provides for automated roadside safety monitoring and reporting. It automates commercial vehicle safety inspections at the roadside check facilities. The capabilities for performing the safety inspection are shared between this market package and the On-board CVO and Freight Safety & Security (CVO08) Market Package which enables a variety of implementation options. The basic option, directly supported by this market package, facilitates safety inspection of vehicles that have been pulled in, perhaps as a result of the automated screening process provided by the Electronic Clearance (CVO03) Market Package. In this scenario, only basic identification data and status information is read from the electronic tag on the commercial vehicle. The identification data from the tag enables access to additional safety data maintained in the infrastructure which is used to support the safety inspection, and may also inform the pull-in decision if system timing requirements can be met. More advanced implementations, supported by the On-board CVO and Freight Safety & Security (CVO08) market package, utilize additional on-board vehicle safety monitoring and reporting capabilities in the commercial vehicle to augment the roadside safety check.

*Note: Graphic shows key market package elements. Some elements are omitted for clarity.*
On-board CVO and Freight Safety & Security (CVO08)

This market package provides for on-board commercial vehicle safety monitoring and reporting. It is an enhancement of the Roadside CVO Safety Market Package and includes roadside support for reading on-board safety data via tags. Safety warnings are provided to the driver as a priority with secondary requirements to notify the Commercial Vehicle Check roadside elements. This market package allows for the Fleet and Freight Management subsystem to have access to the on-board safety data. In addition to safety data, this market package provides a means for monitoring the security of the Commercial Vehicle along with the cargo, containers, trailers, and other equipment that are being hauled. Commercial Vehicle on-board tamper and breach sensors provide an indication of any security irregularities and the sensor data is provided to the Fleet and Freight Management subsystem along with particular notification of any breach alerts. Commercial Vehicle Drivers may be aware of the sensor readings and can provide an explanation back to the Fleet and Freight Management subsystem via the Commercial Vehicle. Commercial vehicle and freight security breaches are also sent to the commercial vehicle check.

*Note: Graphic shows key market package elements. Some elements are omitted for clarity.*
CVO Fleet Maintenance (CVO09)
This market package supports maintenance of CVO fleet vehicles with on-board monitoring equipment and Automated Vehicle Location (AVL) capabilities within the Fleet and Freight Management Subsystem. Records of vehicle mileage, repairs, and safety violations are maintained to assure safe vehicles on the highway.

*Note: Graphic shows key market package elements. Some elements are omitted for clarity.
HAZMAT Management (CVO10)
This market package integrates incident management capabilities with commercial vehicle tracking to assure effective treatment of HAZMAT material and incidents. HAZMAT tracking is performed by the Fleet and Freight Management Subsystem. The Emergency Management subsystem is notified by the Commercial Vehicle if an incident occurs and coordinates the response. The response is tailored based on information that is provided as part of the original incident notification or derived from supplemental information provided by the Fleet and Freight Management Subsystem. The latter information can be provided prior to the beginning of the trip or gathered following the incident depending on the selected policy and implementation.

*CNote: Graphic shows key market package elements. Some elements are omitted for clarity.*
Roadside HAZMAT Security Detection and Mitigation (CVO11)
This market package provides the capability to detect and classify security sensitive HAZMAT on commercial vehicles using roadside sensing and imaging technology. Credentials information can be accessed to verify if the commercial driver, vehicle and carrier are permitted to transport the identified HAZMAT. If the credentials analysis and sensed HAZMAT information do not agree, the vehicle can be signaled to pull in, and if required, an alarm can be sent to Emergency Management to request they monitor, traffic stop or disable the vehicle.

*CNote: Graphic shows key market package elements. Some elements are omitted for clarity.*
CV Driver Security Authentication (CVO12)
This market package provides the ability for Fleet and Freight Management to detect when an unauthorized commercial vehicle driver attempts to drive their vehicle based on stored driver identity information. If an unauthorized driver has been detected, Fleet and Freight Management can activate commands to safely disable the commercial vehicle. Alarms can also be sent to emergency management to inform them of a potential commercial vehicle hijacking or theft and potential hazardous situation. In addition, Emergency Management can request Fleet and Freight Management to disable a specific vehicle in their fleet.

*Note: Graphic shows key market package elements. Some elements are omitted for clarity.*
Freight Assignment Tracking (CVO13)
This market package provides for the planning and tracking of three aspects of commercial vehicle shipments. For each shipment, the commercial vehicle, the freight equipment, and the commercial vehicle driver are monitored for consistency with the planned assignment. Any unauthorized changes are determined by the Fleet and Freight Management subsystem and then the appropriate people and subsystems are notified. Data collected by the On-board CV and Freight Safety & Security and the On-board Driver Authentication equipment packages used in other market packages are also used to monitor the three aspects of assignment for this market package. In addition to this market package, Fleet and Freight Managers may also monitor routes and itineraries and this capability is included in Fleet Administration.

*Note: Graphic shows key market package elements. Some elements are omitted for clarity.*
Emergency Management Market Packages

Emergency Call-Taking and Dispatch (EM01)
This market package provides basic public safety call-taking and dispatch services. It includes emergency vehicle equipment, equipment used to receive and route emergency calls, and wireless communications that enable safe and rapid deployment of appropriate resources to an emergency. Coordination between Emergency Management Subsystems supports emergency notification between agencies. Wide area wireless communications between the Emergency Management Subsystem and an Emergency Vehicle supports dispatch and provision of information to responding personnel.

*Note: Graphic shows key market package elements. Some elements are omitted for clarity.*
Emergency Routing (EM02)
This market package supports automated vehicle location and dynamic routing of emergency vehicles. Traffic information, road conditions, and suggested routing information are provided to enhance emergency vehicle routing. Special priority or other specific emergency traffic control strategies can be coordinated to improve the safety and time-efficiency of responding vehicle travel on the selected route(s). The Emergency Management Subsystem provides the routing for the emergency fleet based on real-time conditions and has the option of requesting a route from the Traffic Management subsystem. The Emergency Vehicle may also be equipped with dedicated short-range communications for local signal preemption. The service provides for information exchange between care facilities and both the Emergency Management Subsystem and emergency vehicles.

*Note: Graphic shows key market package elements. Some elements are omitted for clarity.*
Mayday Support (EM03)
This market package allows the user (driver or non-driver) to initiate a request for emergency assistance and enables the Emergency Management Subsystem to locate the user, gather information about the incident, and determine the appropriate response. The request for assistance may be manually initiated or automated and linked to vehicle sensors. This market package also includes general surveillance capabilities that enable the Emergency Management Subsystem to remotely monitor public areas (e.g., rest stops, parking lots) to improve security in these areas. The Emergency Management Subsystem may be operated by the public sector or by a private sector telematics service provider.

*Note: Graphic shows key market package elements. Some elements are omitted for clarity.*
Roadway Service Patrols (EM04)
This market package supports roadway service patrol vehicles that monitor roads that aid motorists, offering rapid response to minor incidents (flat tire, accidents, out of gas) to minimize disruption to the traffic stream. If problems are detected, the roadway service patrol vehicles will provide assistance to the motorist (e.g., push a vehicle to the shoulder or median). The market package monitors service patrol vehicle locations and supports vehicle dispatch to identified incident locations. Incident information collected by the service patrol is shared with traffic, maintenance and construction, and traveler information systems.

*Note: Graphic shows key market package elements. Some elements are omitted for clarity.
Transportation Infrastructure Protection (EM05)

This market package includes the monitoring of transportation infrastructure (e.g., bridges, tunnels and management centers) for potential threats using sensors and surveillance equipment and barrier and safeguard systems to preclude an incident, control access during and after an incident or mitigate impact of an incident. Threats can result from acts of nature (e.g., hurricanes, earthquakes), terrorist attacks or other incidents causing damage to the infrastructure (e.g., stray barge hitting a bridge support). Infrastructure may be monitored with acoustic, environmental threat (such as nuclear, biological, chemical, and explosives), infrastructure condition and integrity, motion and object sensors and video and audio surveillance equipment. Data from such sensors and surveillance equipment may be processed in the field or sent to a center for processing. The data enables operators at the center to detect and verify threats. When a threat is detected, agencies are notified. Detected threats or advisories received from other agencies result in an increased level of system preparedness. In response to threats, barrier and safeguard systems may be activated by Traffic Management Subsystems to deter an incident, control access to an area or mitigate the impact of an incident. Barrier systems include gates, barriers and other automated and remotely controlled systems that manage entry to transportation infrastructure. Safeguard systems include blast shields, exhaust systems and other automated and remotely controlled systems that mitigate impact of an incident.

*Note: Graphic shows key market package elements. Some elements are omitted for clarity.
Wide-Area Alert (EM06)
This market package uses ITS driver and traveler information systems to alert the public in emergency situations such as child abductions, severe weather events, civil emergencies, and other situations that pose a threat to life and property. The alert includes information and instructions for transportation system operators and the traveling public, improving public safety and enlisting the public’s help in some scenarios. The ITS technologies will supplement and support other emergency and homeland security alert systems such as the Emergency Alert System (EAS). When an emergency situation is reported and verified and the terms and conditions for system activation are satisfied, a designated agency broadcasts emergency information to traffic agencies, transit agencies, information service providers, toll operators, and others that operate ITS systems. The ITS systems, in turn, provide the alert information to transportation system operators and the traveling public using ITS technologies such as dynamic message signs, highway advisory radios, in-vehicle displays, transit displays, 511 traveler information systems, and traveler information web sites.

*Note: Graphic shows key market package elements. Some elements are omitted for clarity.*
Early Warning System (EM07)
This market package monitors and detects potential, looming, and actual disasters including natural disasters (hurricanes, earthquakes, floods, winter storms, tsunamis, etc.) and technological and man-made disasters (hazardous materials incidents, nuclear power plant accidents, and acts of terrorism including nuclear, chemical, biological, and radiological weapons attacks). The market package monitors alerting and advisory systems, ITS sensors and surveillance systems, field reports, and emergency call-taking systems to identify emergencies and notifies all responding agencies of detected emergencies.

*Note: Graphic shows key market package elements. Some elements are omitted for clarity.*
Disaster Response and Recovery (EM08)
This market package enhances the ability of the surface transportation system to respond to and recover from disasters. It addresses the most severe incidents that require an extraordinary response from outside the local community. All types of disasters are addressed including natural disasters (hurricanes, earthquakes, floods, winter storms, tsunamis, etc.) and technological and man-made disasters (hazardous materials incidents, nuclear power plant accidents, and national security emergencies such as nuclear, chemical, biological, and radiological weapons attacks).

The market package supports coordination of emergency response plans, including general plans developed before a disaster as well as specific tactical plans with short time horizon that are developed as part of a disaster response. The market package provides enhanced access to the scene for response personnel and resources, provides better information about the transportation system in the vicinity of the disaster, and maintains situation awareness regarding the disaster itself. In addition, this market package tracks and coordinates the transportation resources - the transportation professionals, equipment, and materials - that constitute a portion of the disaster response.

The market package identifies the key points of integration between transportation systems and the public safety, emergency management, and other allied organizations that form the overall disaster response. In this market package, the Emergency Management subsystem represents the federal, regional, state, and local Emergency Operations Centers and the Incident Commands that are established to respond to the disaster. The interface between the Emergency Management Subsystem and the other center subsystems provides situation awareness and resource coordination among transportation and other allied response agencies. In its role, traffic management implements special traffic control strategies and detours and restrictions to effectively manage traffic in and around the disaster. Maintenance and construction provides damage assessment of road network facilities and manages service restoration. Transit management provides a similar assessment of status for transit facilities and modifies transit operations to meet the special demands of the disaster. As immediate public safety concerns are addressed and disaster response transitions into recovery, this market package supports transition back to normal transportation system operation, recovering resources, managing on-going transportation facility repair, supporting data collection and revised plan coordination, and other recovery activities.

This market package builds on the basic traffic incident response service that is provided by ATMS08, the Traffic Incident Management market package. This market package addresses the additional complexities and coordination requirements that are associated with the most severe incidents that warrant an extraordinary response from outside the local jurisdictions and require special measures such as the activation of one or more emergency operations centers. Many users of the National ITS Architecture will want to consider both ATMS08 and this market package since every region is concerned with both day-to-day management of traffic-related incidents and occasional management of disasters that require extraordinary response.

Disaster Response and Recovery is also supported by EM10, the "Disaster Traveler Information" market package that keeps the public informed during a disaster response. See that market package for more information.
EM08 - Disaster Response and Recovery

**Transit Management**
- Emergency transit service request
- Emergency plan coordination
- Incident response status
- Transportation system status
- Emergency transit service response
- Transportation system status assessment
- Emergency transit schedule information

**Traffic Management**
- Resource request
- Emergency traffic control information
- Resource deployment status
- Emergency traffic control information
- Road network status assessment
- Road network status
- Incident response status
- Transportation system status
- Emergency traffic control request

**Emergency Management**
- Resource coordination
- Emergency plan coordination
- Incident response status
- Transportation system status
- Incident command

**Other Emergency Management**

**Incident Command**
- Resource coordination
- Emergency plan coordination
- Transportation system status
- Incident command

**Rail Operations**
- Emergency plan coordination
- Incident response status
- Transportation system status
- Rail system status assessment

**Maintenance and Construction Management**
- Emergency plan coordination
- Resource response
- Transportation system status
- Incident response status

**MCM Incident Management**
- Workzone information
- Maintenance and construction resource request
- Maintenance and construction resource response
- Maintenance and construction workplan

**MCM Roadway Maintenance and Construction**

**Other MCM**

*Note: Graphic shows key market package elements. Some elements are omitted for clarity.*
Evacuation and Reentry Management (EM09)
This market package supports evacuation of the general public from a disaster area and manages subsequent reentry to the disaster area. The market package addresses evacuations for all types of disasters, including disasters like hurricanes that are anticipated and occur slowly, allowing a well-planned orderly evacuation, as well as disasters like terrorist acts that occur rapidly, without warning, and allow little or no time for preparation or public warning.

This market package supports coordination of evacuation plans among the federal, state, and local transportation, emergency, and law enforcement agencies that may be involved in a large-scale evacuation. All affected jurisdictions (e.g., states and counties) at the evacuation origin, evacuation destination, and along the evacuation route are informed of the plan. Information is shared with traffic management agencies to implement special traffic control strategies and to control evacuation traffic, including traffic on local streets and arterials as well as the major evacuation routes. Reversible lanes, shoulder use, closures, special signal control strategies, and other special strategies may be implemented to maximize capacity along the evacuation routes. Transit resources play an important role in an evacuation, removing many people from an evacuated area while making efficient use of limited capacity. Additional shared transit resources may be added and managed in evacuation scenarios. Resource requirements are forecast based on the evacuation plans, and the necessary resources are located, shared between agencies if necessary, and deployed at the right locations at the appropriate times.

Evacuations are also supported by EM10, the "Disaster Traveler Information" market package, which keeps the public informed during evacuations. See that market package for more information.

*Note: Graphic shows key market package elements. Some elements are omitted for clarity.*
Disaster Traveler Information (EM10)
This market package uses ITS to provide disaster-related traveler information to the general public, including evacuation and reentry information and other information concerning the operation of the transportation system during a disaster. This market package collects information from multiple sources including traffic, transit, public safety, emergency management, shelter provider, and travel service provider organizations. The collected information is processed and the public is provided with real-time disaster and evacuation information using ITS traveler information systems.

A disaster will stress the surface transportation system since it may damage transportation facilities at the same time that it places unique demands on these facilities to support public evacuation and provide access for emergency responders. Similarly, a disaster may interrupt or degrade the operation of many traveler information systems at the same time that safety-critical information must be provided to the traveling public. This market package keeps the public informed in these scenarios, using all available means to provide information about the disaster area including damage to the transportation system, detours and closures in effect, special traffic restrictions and allowances, special transit schedules, and real-time information on traffic conditions and transit system performance in and around the disaster.

This market package also provides emergency information to assist the public with evacuations when necessary. Information on mandatory and voluntary evacuation zones, evacuation times, and instructions are provided. Available evacuation routes and destinations and current and anticipated travel conditions along those routes are provided so evacuees are prepared and know their destination and preferred evacuation route. Information on available transit services and traveler services (shelters, medical services, hotels, restaurants, gas stations, etc.) is also provided. In addition to general evacuation information, this market package provides specific evacuation trip planning information that is tailored for the evacuee based on origin, selected destination, and evacuee-specified evacuation requirements and route parameters.

This market package augments the ATIS market packages that provide traveler information on a day-to-day basis for the surface transportation system. This market package provides focus on the special requirements for traveler information dissemination in disaster situations.
*Note: Graphic shows key market package elements. Some elements are omitted for clarity.
Archived Data Management Market Packages

ITS Data Mart (AD1)
This market package provides a focused archive that houses data collected and owned by a single agency, district, private sector provider, research institution, or other organization. This focused archive typically includes data covering a single transportation mode and one jurisdiction that is collected from an operational data store and archived for future use. It provides the basic data quality, data privacy, and meta data management common to all ITS archives and provides general query and report access to archive data users.

*Note: Graphic shows key market package elements. Some elements are omitted for clarity.
ITS Data Warehouse (AD2)
This market package includes all the data collection and management capabilities provided by the ITS Data Mart, and adds the functionality and interface definitions that allow collection of data from multiple agencies and data sources spanning across modal and jurisdictional boundaries. It performs the additional transformations and provides the additional meta data management features that are necessary so that all this data can be managed in a single repository with consistent formats. The potential for large volumes of varied data suggests additional on-line analysis and data mining features that are also included in this market package in addition to the basic query and reporting user access features offered by the ITS Data Mart.

*Note: Graphic shows key market package elements. Some elements are omitted for clarity.*
ITS Virtual Data Warehouse (AD3)

This market package provides the same broad access to multimodal, multidimensional data from varied data sources as in the ITS Data Warehouse Market Package, but provides this access using enhanced interoperability between physically distributed ITS archives that are each locally managed. Requests for data that are satisfied by access to a single repository in the ITS Data Warehouse Market Package are parsed by the local archive and dynamically translated to requests to remote archives which relay the data necessary to satisfy the request.

*Note: Graphic shows key market package elements. Some elements are omitted for clarity.*
Maintenance and Construction Operation Market Packages

Maintenance and Construction Vehicle and Equipment Tracking (MCO1)
This market package will track the location of maintenance and construction vehicles and other equipment to ascertain the progress of their activities. These activities can include ensuring the correct roads are being plowed and work activity is being performed at the correct locations.

MC01 - Maintenance and Construction Vehicle and Equipment Tracking

*Note: Graphic shows key market package elements. Some elements are omitted for clarity.*
Maintenance and Construction Vehicle Maintenance (MCO2)
This market package performs vehicle maintenance scheduling and manages both routine and corrective maintenance activities on vehicles and other maintenance and construction equipment. It includes on-board sensors capable of automatically performing diagnostics for maintenance and construction vehicles, and the systems that collect this diagnostic information and use it to schedule and manage vehicle maintenance.

*Note: Graphic shows key market package elements. Some elements are omitted for clarity.
Road Weather Data Collection (MCO3)
This market package collects current road and weather conditions using data collected from environmental sensors deployed on and about the roadway (or guideway in the case of transit related rail systems). In addition to fixed sensor stations at the roadside, sensing of the roadway environment can also occur from sensor systems located on Maintenance and Construction Vehicles and on-board sensors provided by auto manufacturers. The collected environmental data is used by the Weather Information Processing and Distribution Market Package to process the information and make decisions on operations.

*Note: Graphic shows key market package elements. Some elements are omitted for clarity.*
Weather Information Processing and Distribution (MCO4)
This market package processes and distributes the environmental information collected from the Road Weather Data Collection market package. This market package uses the environmental data to detect environmental hazards such as icy road conditions, high winds, dense fog, etc. so system operators and decision support systems can make decisions on corrective actions to take. The continuing updates of road condition information and current temperatures can be used by system operators to more effectively deploy road maintenance resources, issue general traveler advisories, issue location specific warnings to drivers using the Traffic Information Dissemination market package, and aid operators in scheduling work activity.

*Note: Graphic shows key market package elements. Some elements are omitted for clarity.*
Roadway Automated Treatment (MCO5)
This market package automatically treats a roadway section based on environmental or atmospheric conditions. Treatments include fog dispersion, anti-icing chemicals, etc. The market package includes the environmental sensors that detect adverse conditions, the automated treatment system itself, and driver information systems (e.g., dynamic message signs) that warn drivers when the treatment system is activated.

*Note: Graphic shows key market package elements. Some elements are omitted for clarity.*
Winter Maintenance (MCO6)
This market package supports winter road maintenance including snow plow operations, roadway treatments (e.g., salt spraying and other anti-icing material applications), and other snow and ice control activities. This package monitors environmental conditions and weather forecasts and uses the information to schedule winter maintenance activities, determine the appropriate snow and ice control response, and track and manage response operations.

*Note: Graphic shows key market package elements. Some elements are omitted for clarity.*
Roadway Maintenance and Construction (MCO7)

This market package supports numerous services for scheduled and unscheduled maintenance and construction on a roadway system or right-of-way. Maintenance services would include landscape maintenance, hazard removal (roadway debris, dead animals), routine maintenance activities (roadway cleaning, grass cutting), and repair and maintenance of both ITS and non-ITS equipment on the roadway (e.g., signs, traffic controllers, traffic detectors, dynamic message signs, traffic signals, CCTV, etc.). Environmental conditions information is also received from various weather sources to aid in scheduling maintenance and construction activities.

MCO7 – Roadway Maintenance and Construction

*Note: Graphic shows key market package elements. Some elements are omitted for clarity.*
Work Zone Management (MCO8)
This market package directs activity in work zones, controlling traffic through portable dynamic message signs (DMS) and informing other groups of activity (e.g., ISP, traffic management, other maintenance and construction centers) for better coordination management. Work zone speeds and delays are provided to the motorist prior to the work zones.

*MNote: Graphic shows key market package elements. Some elements are omitted for clarity.*
Work Zone Safety Monitoring (MCO9)
This market package includes systems that improve work crew safety and reduce collisions between the motoring public and maintenance and construction vehicles. This market package detects vehicle intrusions in work zones and warns crew workers and drivers of imminent encroachment or other potential safety hazards. Crew movements are also monitored so that the crew can be warned of movement beyond the designated safe zone. The market package supports both stationary and mobile work zones. The intrusion detection and alarm systems may be col-located or distributed, allowing systems that detect safety issues far upstream from a work zone (e.g., detection of over dimension vehicles before they enter the work zone).

MC09 - Work Zone Safety Monitoring

*Note: Graphic shows key market package elements. Some elements are omitted for clarity.*
Maintenance and Construction Activity Coordination (MC10)
This market package supports the dissemination of maintenance and construction activity to centers that can utilize it as part of their operations, or to the Information Service Providers who can provide the information to travelers.

*Note: Graphic shows key market package elements. Some elements are omitted for clarity.*
Appendix B
Treasure Valley
Interconnect and
Information Flow Diagrams
Interconnect: ATMS01: Network Surveillance (IROC)

Idaho Transportation Department - DI...
ITD Roadside Equipment

Ada County Highway District
ACHD Roadside Equipment

Ada County Highway District
IROC

Planned
Information Flow: ATMS01: Network Surveillance (IROC)

Ada County Highway District
IROC

——— traffic images
——— video surveillance control

Ada County Highway District
ACHD Roadside Equipment

——— Planned
Interconnect: ATMS01: Network Surveillance (ACHD)

Ada County Highway District
ACHD Roadside Equipment

Ada County Highway District
ACHD Traffic Management Center

Existing
Information Flow: ATMS01: Network Surveillance (ACHD)

Existing

Ada County Highway District
ACHD Traffic Management Center

- traffic flow
- traffic images
- traffic sensor control
- video surveillance control

Ada County Highway District
ACHD Roadside Equipment
Interconnect: ATMS01: Network Surveillance (Boise State University)

Boise State University Virtual TMC

Ada County Highway District
ACHD Roadside Equipment

Existing
Information Flow: ATMS01 (Boise State University)

Ada County Highway District
ACHD Roadside Equipment

- traffic sensor control
- video surveillance control
- traffic flow
- traffic images

Boise State University Virtual TMC

Existing
Interconnect: ATMS01: Network Surveillance (ITD)

Idaho Transportation Department - DI...
ITD Roadside Equipment

Ada County Highway District
ACHD Roadside Equipment

Idaho Transportation Department - DI...
ITD Traffic Management Center

Existing
Planned
Information Flow: ATMS01 (ITD)

Ada County Highway District
ACHD Roadside Equipment

Idaho Transportation Department - District
ITD Roadside Equipment

Idaho Transportation Department - District
ITD Traffic Management Center

- video surveillance control
- traffic flow
- traffic images

Existing
Planned
Interconnect: ATMS03: Surface Street Control (IROC)

Idaho Transportation Department - Di...
ITD Roadside Equipment

Ada County Highway District
ACHD Roadside Equipment

Ada County Highway District
IROC

Planned
Information Flow: ATMS03: Surface Street Control (IROC)

Ada County Highway District
ACHD Roadside Equipment

Idaho Transportation Department - Di...
ITD Roadside Equipment

Ada County Highway District
IROC

- signal control data
- video surveillance control
- request for right-of-way
- signal control status
- traffic images

Planned
Interconnect: ATMS03: Surface Street Control (ACHD)

- Idaho Transportation Department - District
  - ITD Roadside Equipment

- Boise State University Virtual TMC

- Ada County Highway District
  - ACHD Traffic Management Center

- Ada County Highway District
  - ACHD Roadside Equipment

Existing
Information Flow: ATMS03: Surface Street Control (ACHD)

- Ada County Highway District
  - ACHD Roadside Equipment

- Idaho Transportation Department - Division of Operations
  - ITD Roadside Equipment

- Boise State University Virtual TMC
  - ACHD Traffic Management Center

Signals:
- Signal control data
- Traffic sensor control
- Video surveillance control
- Request for right-of-way
- Traffic flow
- Traffic images
- Traffic control status

Existing

Planned
Interconnect: ATMS03: Surface Street Control (ITD)

Idaho Transportation Department - District
ITD Roadside Equipment

Idaho Transportation Department - District
ITD Traffic Management Center

Existing
Information Flow: ATMS03: Surface Street Control (ITD)

- signal control status
- traffic flow
- traffic images
- signal control data
- video surveillance control

Existing
Interconnect: ATMS04: Freeway Control

Idaho Transportation Department - District 
ITD Roadside Equipment

Ada County Highway District
ACHD Roadside Equipment

Ada County Highway District
IROC

Planned
Information Flow: ATMS04: Freeway Control

Ada County Highway District
ACHD Roadside Equipment

- freeway control data
- roadway information system data
- video surveillance control
- freeway control status
- roadway information system status
- traffic images

Planned
Interconnect: ATMS06: Traffic Information Dissemination (IROC)

Ada County Highway District
ACHD Traffic Management Center

Boise State University Virtual TMC

Idaho Transportation Department - Di...
ITD Roadside Equipment

Existing
Information Flow: ATMS06: Traffic Information Dissemination (IROC)

Ada County Highway District
ACHD Roadside Equipment

Roadway information system data
Roadway information system status

Idaho Transportation Department - Di...
ITD Roadside Equipment

roadway information system data
roadway information system status

Planned
Interconnect: ATMS06: Traffic Information Dissemination (ACHD)

Ada County Highway District
ACHD Traffic Management Center

Boise State University Virtual TMC

Idaho Transportation Department - Di...
ITD Roadside Equipment

Existing
Information Flow: ATMS06: Traffic Information Dissemination (ACHD)

Ada County Highway District
ACHD Roadside Equipment

roadway information system data
roadway information system status

road network conditions

Idaho Transportation Department - Di...
ITD Roadside Equipment

roadway information system data
roadway information system status

Planned

Ada County Highway District
ACHD Web Site

Ada County Highway District
IROC
Interconnect: ATMS06: Traffic Information Dissemination (ITD)

Idaho Transportation Department - Di...
  ITD Roadside Equipment

Idaho Transportation Department - Di...
  ITD Traffic Management Center

Existing
Information Flow: ATMS06: Traffic Information Dissemination (ITD)

Idaho Transportation Department - Di...
ITD Traffic Management Center

roadway information system status
roadway information system data

Idaho Transportation Department - Di...
ITD Roadside Equipment

Existing
Planned
Interconnect: ATMS07: Regional Traffic Control

Idaho Transportation Department - Di...
ITD Roadside Equipment

Ada County Highway District
ACHD Roadside Equipment

Ada County Highway District
IROC

Planned
Information Flow: ATMS07: Regional Traffic Control

Ada County Highway District
ACHD Roadside Equipment

Idaho Transportation Department - Di...
ITD Roadside Equipment

Ada County Highway District
IROC

- Freeway control data
- Signal control data
- Freeway control status
- Signal control status

Planned
Interconnect: ATMS08: Traffic Incident Management

- Ada County Highway District
  - IROC
- Ada County
  - Ada County 911 Emergency Call Center
- Nampa Police Department
  - Nampa Police Dispatch
- Ada County Highway District
  - ACHD Traffic Management Center
- Canyon County
  - Canyon County 911 Center
- Idaho Transportation Department - District:
  - ITD Traffic Management Center
- Idaho State Police
  - Idaho State Police Dispatch Center
- Idaho Transportation Department - District:
  - ITD Roadside Equipment
- Idaho Transportation Department - District:
  - ITD Incident Response Vehicles

Existing
Planned
Information Flow: ATMS08: Traffic Incident Management

- Ada County Highway District
  - ACHD Roadside Equipment

- Ada County
  - Ada County 911 Emergency Call Center

- Idaho Transportation Department - Di...
  - ITD Traffic Management Center

- Eagle County
  - Idaho State Police
    - Idaho State Police Dispatch Center

- Canyon County
  - Canyon County 911 Center

- Ada County
  - Nampa Police Department
    - IROC
    - Nampa Police Dispatch

- Idaho Transportation Department - Di...
  - ITD Roadside Equipment
  - ITD Incident Response Vehicles

- Traffic information coordination
- Traffic images
- Video surveillance control
- Remote surveillance control
- Traffic flow
- Traffic sensor control
- Incident response coordination
- Road network conditions
- Decision support information
- Incident status

Existing
Planned
Interconnect: ATMS16: Parking Facility Management

Boise Air Terminal
Boise Airport Parking Management

Ada County Highway District
IROC

Planned
Information Flow: ATMS16: Parking Facility Management

Ada County Highway District
IROC

Boise Air Terminal
Boise Airport Parking Management

parking lot inputs

Planned
Interconnect: ATMS17: Regional Parking Management

Boise Parking Management

Ada County Highway District
IROC

Planned
Information Flow: ATMS17: Regional Parking Management

Ada County Highway District
IROC

- parking archive data
- parking demand management response
- parking information
- parking demand management request
- parking lot data request
- parking lot inputs
- parking reservations request
- parking coordination

Boise Parking Management

Planned
Interconnect: MC03: Road Weather Data Collection

Idaho Transportation Department - Di...
ITD Road Weather Information System

Idaho Transportation Department - Di...
ITD Roadside Equipment

Existing
Information Flow: MC03: Road Weather Data Collection

Idaho Transportation Department - Di...
ITD Roadside Equipment

environmental sensors control
environmental conditions data

Idaho Transportation Department - Di...
ITD Road Weather Information System

Existing
Interconnect: MC04: Weather Information Processing and Distribution

- Ada County
  - Ada County Maintenance

- Ada County Highway District
  - IROC

- Treasure Valley Transit
  - Valley Regional Transit Center

- Ada County
  - Ada County 911 Emergency Call Center

Planned
Information Flow: MC04: Weather Information Processing and Distribution

- Ada County Highway District
  - IROC
- Ada County
  - Ada County 911 Emergency Call Center
- Treasure Valley Transit
  - Valley Regional Transit Center
- Ada County
  - Ada County Maintenance

Flow arrows indicate:
- Equipment maintenance status
- Roadway maintenance status
- Work zone information
- Field equipment status
- Remote surveillance control
- Traffic images
- Transit emergency data
- Work zone information

Planned
Interconnect: MC06: Winter Maintenance

Idaho Transportation Department - District
ITD Regional Maintenance

Idaho Transportation Department - District
ITD Road Weather Information System

Existing
Information Flow: MC06: Winter Maintenance

Idaho Transportation Department - Districts
ITD Road Weather Information System

- road weather information
- roadway maintenance status
- maint and constr resource coordination

Idaho Transportation Department - Districts
ITD Regional Maintenance

Existing
Interconnect: MC07: Roadway Maintenance and Construction

Ada County
Ada County Maintenance

Ada County Highway District
IROC

Planned
Information Flow: MC07: Roadway Maintenance and Construction

Ada County Highway District
IROC

- equipment maintenance status
- field equipment status

Ada County
Ada County Maintenance

Planned
Interconnect: MC08: Workzone Management

Ada County Highway District
ACHD Roadside Equipment

Ada County
Ada County Maintenance Vehicles

Ada County
Ada County Maintenance

Planned
Information Flow: MC08: Workzone Management

Ada County Highway District
ACHD Roadside Equipment

Ada County
Ada County Maintenance Vehicles

Ada County
Ada County Maintenance

- barrier system status
- roadway information system status
- work zone status

Planned
Interconnect: MC10: Maintenance and Construction Activity Coordination

Ada County
Ada County Maintenance

Ada County Highway District
IROC

Treasure Valley Transit
Valley Regional Transit Center

Ada County
Ada County 911 Emergency Call Center

Planned
Information Flow: MC10: Maintenance and Construction Activity Coordination

Ada County Highway District
IROC

Ada County
Ada County 911 Emergency Call Center

Treasure Valley Transit
Valley Regional Transit Center

Ada County
Ada County Maintenance

- equipment maintenance status
- roadway maintenance status
- work zone information
- field equipment status
- traffic images
- remote surveillance control
- transit emergency data
- work zone information

Planned
Interconnect: APTS1: Transit Vehicle Tracking

Treasure Valley Transit
Valley Regional Transit Center

Treasure Valley Transit
Valley Regional Transit Vehicles

Planned
Information Flow: APTS1: Transit Vehicle Tracking

Treasure Valley Transit
Valley Regional Transit Vehicles

- transit vehicle location data
- transit vehicle schedule performance

Treasure Valley Transit
Valley Regional Transit Center

Planned
Interconnect: APTS2: Transit Fixed-Route Operations

Treasure Valley Transit
Valley Regional Transit Center

Planned

Treasure Valley Transit
Valley Regional Transit Vehicles
Information Flow: APTS2: Transit Fixed-Route Operations

- Treasure Valley Transit
  - Valley Regional Transit Vehicles

- Valley Regional Transit Center

- transit schedule information
- transit vehicle operator information
- transit vehicle schedule performance

Planned
Interconnect: APTS3: Demand Response Transit Operations

Treasure Valley Transit
Valley Regional Transit Center

Planned
Information Flow: APTS3: Demand Response Transit Operations

- transit vehicle operator information
- transit vehicle passenger and use data

Planned
Interconnect: APTS4: Transit Passenger and Fare Information

Treasure Valley Transit
Valley Regional Transit Vehicles

Treasure Valley Transit
Valley Regional Transit Center_Kiosks

Treasure Valley Transit
Valley Regional Transit Center

Planned
Information Flow: APTS4: Transit Passenger and Fare Information

- bad tag list
- fare management information
- fare and payment status
- request for bad tag list
- transit vehicle passenger and use data

Treasure Valley Transit
Valley Regional Transit Vehicles

- transit fare information
- transit fare and passenger status

Treasure Valley Transit
Valley Regional Transit Center

Planned
Interconnect: APTS6: Transit Maintenance

Treasure Valley Transit
Valley Regional Transit Center

Treasure Valley Transit
Valley Regional Transit Vehicles

Planned
Information Flow: APTS6: Transit Maintenance

Treasure Valley Transit
Valley Regional Transit Vehicles

Treasure Valley Transit
Valley Regional Transit Center

- request for vehicle measures
- transit vehicle conditions

Planned
Interconnect: APTS7: Multi-modal Coordination

- Ada County Highway District
  - ACHD Roadside Equipment
- Ada County Highway District
  - IROC
- Treasure Valley Transit
  - Valley Regional Transit Center
- Treasure Valley Transit
  - Valley Regional Transit Vehicles

Planned
Information Flow: APTS7: Multi-Modal Coordination

- request for right-of-way
- signal control status
- signal control data

- transit vehicle schedule performance
- transit schedule information

- local signal priority request

Planned
Interconnect: APTS8: Transit Traveler Information

Treasure Valley Transit
Valley Regional Transit Center_Kiosks

Treasure Valley Transit
Valley Regional Transit Center

Planned
Information Flow: APTS8: Transit Traveler Information

Treasure Valley Transit
Valley Regional Transit Center

Treasure Valley Transit
Valley Regional Transit Center_Kiosks

- transit information user request
- transit traveler information

Planned
Interconnect: ATIS1: Broadcast Traveler Information

User Personal Computing Devices

Ada County Highway District
ACHD Kiosks

Ada County Highway District
IROC

Planned
Information Flow: ATIS1: Broadcast Traveler Information

Ada County Highway District

ACHD Kiosks

User Personal Computing Devices

Ada County Highway District

IROC

Planned

broadcast information

broadcast information
Interconnect: ATIS2: Interactive Traveler Information

User Personal Computing Devices

Ada County Highway District
ACHD Kiosks

Ada County Highway District
IROC

Planned
Information Flow: ATIS2: Interactive Traveler Information

User Personal Computing Devices

Ada County Highway District
ACHD Kiosks

Ada County Highway District
IROC

- traveler information
- traveler profile
- traveler request

Planned
Interconnect: ATIS8: Dynamic Ridesharing

- Ada County Highway District
  - ACHD Web Site

- Ada County Highway District
  - ACHD Kiosks

- Ada County Highway District
  - CommuterRide Ridesharing

- User Personal Computing Devices

Planned
Information Flow: ATIS8: Dynamic Ridesharing

Ada County Highway District
  ACHD Kiosks

User Personal Computing Devices

Ada County Highway District
  ACHD Web Site

Ada County Highway District
  CommuterRide Ridesharing

Trip plan
Trip confirmation
Trip request

Planned
Interconnect: EM01: Call-Taking and Dispatch (Ada County)

Ada County
Ada County Emergency Vehicles

Ada County
Ada County 911 Emergency Call Center

Existing
Information Flow: EM01: Call-Taking and Dispatch (Ada County)

Ada County
Ada County 911 Emergency Call Center

- emergency dispatch response
- emergency vehicle tracking data
- emergency dispatch requests

Ada County
Ada County Emergency Vehicles

Existing

Planned
Interconnect: EM01: Call-Taking and Dispatch (Canyon County)

Canyon County
Canyon County Emergency Vehicles

Canyon County
Canyon County 911 Center

Existing
Information Flow: EM01: Call-Taking and Dispatch (Canyon County)

- Emergency dispatch response
- Emergency vehicle tracking data
- Emergency dispatch requests

Existing

Planned

Canyon County
Canyon County 911 Center

Canyon County
Canyon County Emergency Vehicles
Interconnect: EM01: Call-Taking and Dispatch (ISP)

- Idaho State Police
  - Idaho State Police Vehicles

- Idaho State Police
  - Idaho State Police Dispatch Center

Existing
Information Flow: EM01: Call-Taking and Dispatch (ISP)

Idaho State Police
Idaho State Police Dispatch Center

-- Existing

emergency dispatch response
emergency dispatch requests

Idaho State Police
Idaho State Police Vehicles
Interconnect: EM01: Call-Taking and Dispatch (Nampa County)

Nampa Police Department
Nampa Police Vehicles

Nampa Police Department
Nampa Police Dispatch

Existing
Information Flow: EM01: Call-Taking and Dispatch (Nampa County)

Nampa Police Department
Nampa Police Dispatch

Nampa Police Department
Nampa Police Vehicles

- emergency dispatch response
- emergency dispatch requests

Existing
Interconnect: EM02: Emergency Routing

Idaho Transportation Department - DI...
ITD Roadside Equipment

Ada County Highway District
ACHD Roadside Equipment

Ada County Highway District
IROC

Planned
Information Flow: EM02: Emergency Routing

Ada County Highway District
ACHD Roadside Equipment

Idaho Transportation Department - ITD
ITD Roadside Equipment

Ada County Highway District
IROC

signal control data
request for right-of-way
signal control status

signal control status

Planned
Interconnect: EM04: Roadway Service Patrols

Idaho Transportation Department - Di...
ITD Incident Response Vehicles

Idaho State Police
Idaho State Police Dispatch Center

Planned
Information Flow: EM04: Roadway Service Patrols

Idaho State Police
Idaho State Police Dispatch Center

- emergency dispatch response
- incident status
- decision support information
- emergency dispatch requests

Idaho Transportation Department - Di...
ITD Incident Response Vehicles

Planned
Interconnect: EM06: Wide-Area Alert
Information Flow: EM06: Wide-Area Alert

- Idaho Transportation Department - District Roadside Equipment
- Treasure Valley Transit - Valley Regional Transit Center
- Ada County Highway District - ACHD Roadside Equipment
- Treasure Valley Transit - Valley Regional Transit Center
- Ada County Highway District - ACHD Traffic Management Center
- Idaho Transportation Department - ITD Traffic Management Center
- Ada County Highway District - IROC
- Treasure Valley Transit - Valley Regional Transit Center Kiosks
- Ada County Highway District - ACHD Kiosks
- User Personal Computing Devices
- Idaho Transportation Department (HQ) - ITD 511

Existing
Planned
Interconnect: EM08: Disaster Response and Recovery

- Nampa Police Department
  - Nampa Police Dispatch

- Canyon County
  - Canyon County 911 Center

- Ada County Highway District
  - IROC

- Ada County
  - Ada County 911 Emergency Call Center

- Idaho State Police
  - Idaho State Police Dispatch Center

- Treasure Valley Transit
  - Valley Regional Transit Center

Existing
Planned
Information Flow: EM08: Disaster Response and Recovery

Ada County
Ada County 911 Emergency Call Center

Idaho Transportation Department - Di...
ITD Traffic Management Center

Canyon County
Canyon County 911 Center

Nampa Police Department
Nampa Police Dispatch

Idaho State Police
Idaho State Police Dispatch Center

Planned
Interconnect: EM09: Evacuation and Reentry Management

Ada County Highway District
IROC

Treasure Valley Transit
Valley Regional Transit Center

Ada County
Ada County Maintenance

Ada County
Ada County 911 Emergency Call Center

Planned
Information Flow: EM09: Evacuation and Reentry Management
Interconnect: EM10: Disaster Traveler Information

- **Ada County**
  - Ada County 911 Emergency Call Center

- **Canyon County**
  - Canyon County 911 Center

- **Ada County Highway District**
  - IROC

- **Nampa Police Department**
  - Nampa Police Dispatch

Planned connections between the entities.
Information Flow: EM10: Disaster Traveler Information

Canyon County
Canyon County 911 Center

Ada County
Ada County 911 Emergency Call Center

Nampa Police Department
Nampa Police Dispatch

Ada County Highway District
IROC

Evacuation information
Incident information
Transportation system status

Planned
Appendix C: Regional ITS Architecture Sample Change Management Form

The following is a sample Regional ITS Architecture Change Request Form, indicating the type of information one might expect to find as part of a Change Management Plan and Process.

<table>
<thead>
<tr>
<th>Change Title:</th>
<th>Brief title that is descriptive of change needed</th>
<th>Date of Origination:</th>
<th>Date request is made</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description of Suggested Change:</td>
<td>Describes the change requested and the known elements it affects. To be completed by the change requestor.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rationale for Change:</td>
<td>Describes why the change should be made in terms of why the current architecture is inaccurate or will be inaccurate (e.g. excludes stakeholders, flows or function descriptions).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Request Originator Name:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phone Number:</td>
<td>Contact information for the change requestor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Email:</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| To Be Filled Out By Maintaining Organization |
| Change #: | A unique identifier to use in tracking the request in a database. |
| Change Disposition: | Accept | Reject | Defer |
| Baseline Affected: | Briefly describe components of the baseline architecture that will be affected by change (only if change request is accepted). |
| Disposition Comments: | Describe why request was accepted, rejected or deferred and what actions were taken as a result. |
| Disposition Date: | Date the request was acted upon. |