Chapter 4: Operational Concept

4.1 INTRODUCTION

The purpose of this chapter is to describe the Operational Concept for the Bend region. The Operational Concept defines the roles and responsibilities of the participating key stakeholder agencies, and identifies information flows between the agencies. This chapter is divided into two main sections:

- **Operational Concept**: A high-level overall Operational Concept was developed as a database defining the roles, relationships, and information flows between the primary participating agencies, and the extended stakeholders.
- **Program Area Operational Concept**: This section describes the roles, responsibilities and information flows by program area for the region's ITS implementation plan. A schematic illustrating the information flows and a responsibility matrix is provided for each of the six Program Areas. The Program Areas are:

    - Traffic Operations & Management
    - Traveler Information
    - Incident and Emergency Management
    - Public Transportation Management
    - Information Management
    - Maintenance and Construction Management

4.1.1 Approach

Information used to develop the Operational Concept was gathered in interviews with the stakeholder agencies regarding their current and desired level of operational interaction with other transportation and safety agencies. In addition, the market packages selected for the region were used to help define current and future ITS program areas.

In the National ITS Architecture, market packages include a depiction of the relationship and data flow between different entities providing the "service" implemented by the deployment of the market package. For example, the incident management system market package includes an exchange of information between traffic management and emergency management centers. This implies that an Operational Concept and an institutional relationship is established between the two organizations that are cooperating, while the "service" implemented is the new video signal(s) or data flow(s) that assist both parties with their operations. Therefore, the identification of which market packages are and will be deployed in the Bend area help to define the Operational Concept.

4.2 OPERATIONAL CONCEPT OVERVIEW

The purpose of the Operational Concept is to describe the roles and responsibilities of the participating transportation and public safety agencies and to discuss the resources that each agency will apply or contribute in the deployment of ITS projects. The words "roles" and "responsibilities" are referred to often, and can be defined as:

- Roles: the part that each agency plays in each program area, such as lead, support or no involvement.
- Responsibilities: includes more definition of the agencies responsibilities for design, implementation, operation and maintenance, and the level of information, status, and control sharing among the entities.

The reasons for developing an Operational Concept include the following:

- Maintain conformance with US Department of Transportation (USDOT) guidelines for the development of a Regional ITS Architecture.
- Identify the requirements of and lay the groundwork for, the necessary institutional agreements, such as Memoranda of Understanding (MOUs) and Inter-governmental Agreements (IGAs).
- Identify outstanding issues, agreements, and relationships to be developed by the Steering Committee.
- Identify suggestions for continued regional coordination and cooperation during implementation of the Regional ITS Architecture and ITS projects.

Relationships between agencies embody two main components:

- The roles and responsibilities that each agency plays in the relationship, and
- The kinds of electronic information that are shared between the agencies.

4.2.1 AGENCY ROLES AND RESPONSIBILITIES

Eight types of agency-to-agency relationships define the range of potential institutional interactions that might occur between two organizations during the deployment of an ITS application. Table 4-1 defines the eight agency-to-agency relationship types, and includes an example of each type of relationship. The relationships are listed from lowest to highest level of interaction, with the top row in the table being the lowest level of interaction. The types of relationships begin at no interaction (level 1 or independent) and progress through consultation and cooperation (levels 2 and 3), where joint efforts are undertaken but electronic information is not exchanged up to information and control sharing (levels 4 and 5) where increasing levels of information exchange and device control are provided. The remaining relationships (levels 6-8) cover the levels of responsibilities for operation and maintenance.

Table 4-1: Agency-to-Agency Relationships

	Relationship	Definition	"From/To" Example
1	Independent	Parties operate independently with no interaction	No interaction.
2	Consultation	One party confers with another party, in accordance with an established process, about an anticipated action and then keeps that party informed about the actions taken. No electronic sharing of information.	FROM agency provides information on activities to interested TO agencies.
3	Cooperation	The parties involved in carrying out the planning, project development and operations processes work together to achieve common goals or objectives. No electronic sharing of information.	Both agencies cooperate in the development and execution of common plans, projects, and operational procedures.
4	Information Sharing	The electronic exchange of data and device status information between parties, for the purposes of coordinated operations, planning, and analysis.	FROM agency will provide status, data, and/or video information from the FROM agency's field devices (e.g. detectors) to the TO agency.
5	Control Sharing	The ability, through operational agreements, to allow for one party to control another party's field devices to properly respond to incident, event, weather, or traffic conditions	FROM agency is allowed by the TO agency to control the TO agency's field devices–(e.g. dynamic message sign, select signal timing patterns for specified defined occurrences).
6	Only Operational Responsibility Shifted	One party operates the field equipment of a second party on a full time basis.	FROM agency will operate the field devices of the TO agency (e.g. County operates a City's traffic signals but the City is responsible for maintenance and repairs.)
7	Only Maintenance Responsibility Shifted	One party maintains the field equipment of a second party.	FROM agency maintains the field devices of the TO agency, but the TO agency is responsible for operations.
8	Full Responsibility Shifted	One party has full responsibility for the field equipment of a second party including operations and preventative and emergency maintenance.	FROM agency operates and maintains the field devices of the TO agency.

4.2.2 Information Flows

Along with these eight agency-to-agency relationships, there are several types of information flows that are typical for agency-to-agency exchange. Table 4-2 describes the five primary types of information flows relevant to Intelligent Transportation Systems.

While the architecture defines information flows by specific market packages at a detailed level, the Operational Concept rolls those up into higher-level agency-to-agency flows that include data, video, status, request and control.

Table 4-2: Information Flow Definitions

Information Flows	Definition	"From/To" Example
Data	The dissemination of data gathered from one party's field devices to another party. Data can include, but is not limited to, traffic, weather, parking, transit data etc	FROM agency sends data to the TO agency's field devices
Video	The dissemination of live video and still images from one party's field camera's to another party	FROM agency sends live video and still images to the TO agency
Status	The ability for one party to monitor another parties field devices, and receive such information as current signal timing/response plan, current message sets, etc.	FROM agency sends status information on its devices to the TO agency
Request	The ability for one party to solicit either data or a command change, such as DMS messaging or signal timings, from another party.	FROM agency requests information or action from the TO agency
Control	The ability for one party to control another party's field devices. Control can include but is not limited to, changing DMS messaging, changing traffic signal timings, camera control, etc.	FROM agency issues control instruction to the TO agency's field devices

4.2.3 Operational Concept Database

The relationships and information flows between each key stakeholder have been identified based upon the agency-to-agency relationships and information flows defined above. The information has been input into a database with the following characteristics:

- From Agency
- To Agency
- Relationship
- Information Flow
- Verified with Agency

The relationships and flows are characterized as:

- Existing (relationship has been established or information flow is operational)
- Planned (relationship will be established or information flow is planned)
- Consider (relationship or information flow will be considered in the future)

This database defines the overall Operational Concept for the region and is included as Appendix J.

4.3 PROGRAM AREA OPERATIONAL CONCEPTS

For each program area, a flow diagram depicting the exchange of information is provided in the following subsection. These diagrams illustrate the flow of information between the various agencies and stakeholders providing ITS services in the region.

In addition, Roles and Responsibilities are presented in the Turbo Architecture database that further defines the roles and responsibilities of each of the key stakeholder agencies for the following set of activities[1]:

- **Design:** Includes the design of equipment, hardware, software and systems required under each Program Area. The design phase groups all efforts put forth to lay the framework for a project implementation. This includes the development of pertinent documents required for successful project execution. The types of documentation that may be required during the design phase of a ITS project include: a concept of operations, high-level requirements, detailed requirements, high-level design, detailed design, and operations and maintenance plans. Basically, the documentation provides the structure and understanding for how the project will be implemented. For example, high-level requirements are important in documenting the general vision of a project such as determining what facets and functions partners are interested in including in the design. Design-related documentation provides traceability to the initial goals and objectives of the project team, and further provides a point of reference in testing and validating the successful implementation of the final product. All aspects prior to the actual implementation of a project have been categorized into design.

[1] Under each activity an agency may be identified as the activity lead for the entire regional consortium or just for its "agency owned" equipment. Alternatively, they may simply be identified as participating in the regional effort, or not involved at all in that activity.

- **Construction:** Includes the construction or installation of equipment, hardware, software and systems required under each Program Area. An example of implementation is installing atmospheric monitoring equipment in the field. This includes all tasks necessary to install the hardware and software including tying into existing communications to pouring a new concrete pad to installing new servers in a central office. Implementation tasks are related to the actual execution of a project.
- **System Development and Integration:** Includes responsibility for development of new software interfaces and integration between systems to support each Program Area.
- **Operational Planning:** Includes each agency's role in defining operational planning process and procedures to support ongoing operations and future expansion of each Program Area.
- **Operations:** Includes each agency's role in actual operations of the equipment and systems in each Program Area. This may also include training technical or information technology staff and understanding any warranties, licenses or registration agreements with the vendor.
- **Maintenance:** Includes each agency's role in maintenance of the equipment, hardware, software, and systems in each Program Area. Maintenance roles may include repairing equipment outages, routine testing of equipment to ensure it is functioning correctly, and replacement of equipment subcomponents.

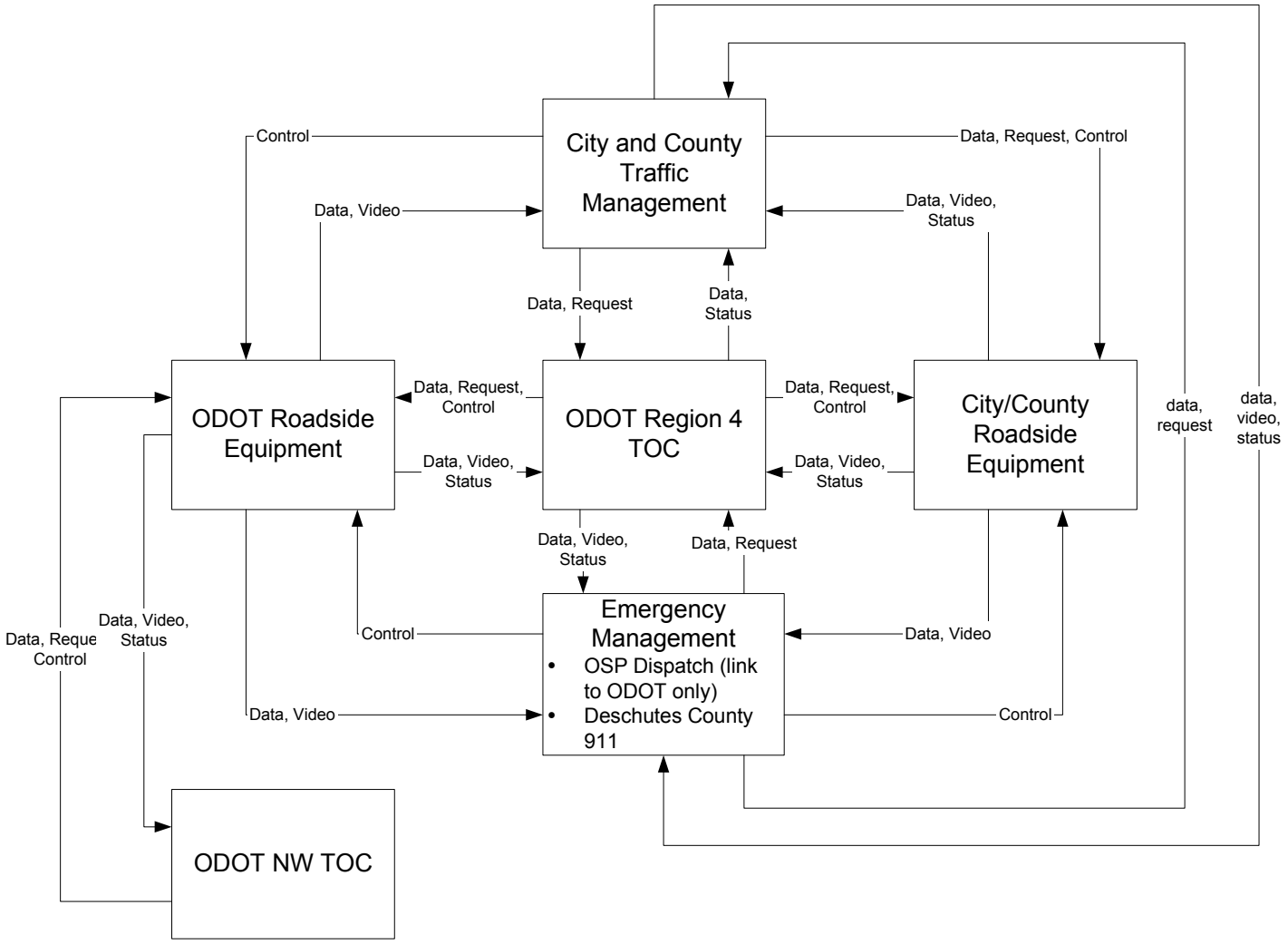
This information is presented in Turbo Architecture to streamline maintenance of the Regional ITS Architecture. A "Report" output from Turbo Architecture providing the Roles and Responsibilities information for review is provided as Appendix J.

4.3.1 Traffic Operations & Management

The Traffic Operations & Management Operational Concept focuses on the regional exchange of information between agencies for the purpose of relieving congestion and providing each participating agency with a "wide view" of the conditions on the road network – that is, conditions that are outside of their jurisdiction but still impact roadways under their management. Specifically, this Operational Concept, as depicted in the following diagram, provides for data and video exchanges between the cities, ODOT, and Deschutes County. In the Bend region, ODOT Region 4 operates and maintains all of the city and county signals. ODOT also owns and controls all of the existing cameras and Dynamic Message Signs. The ODOT Northwest TOC in Salem serves "back-up" functions for the Bend TOC and has the ability to control these devices. ODOT may consider allowing local agency control of traffic cameras under specific conditions, and in the future, the local agencies will likely deploy their own roadside devices, which ODOT in turn would like to have access to. In addition, a data link for sharing information such as traffic counts is considered highly desirable.

Figure 4-1 is the flow diagram illustrating these relationships and information flows.

Figure 4-1: Traffic Operations and Management Flow Diagram



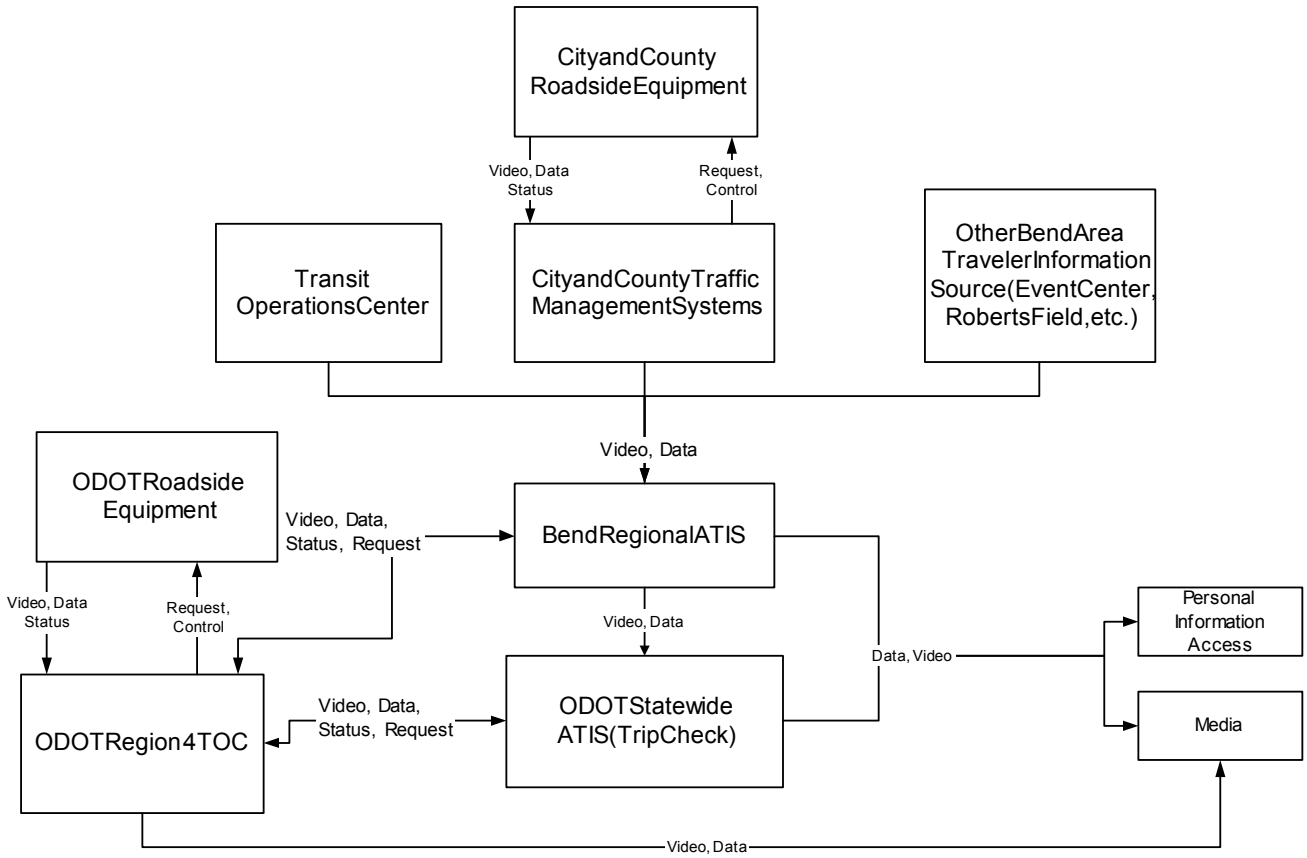
4.3.2 Traveler Information

ODOT's TripCheck web site, Bend Channel 48 and the 511 traveler information phone system are the primary sources of statewide traveler information in the Bend area. There are also a number of local tourism web sites operated by the Chambers of Commerce and other groups. As city and county owned cameras come online, these would be added to the camera images available over TripCheck, however, for local information such as road closures, delays, and planned events, this information should be provided through an external source hosted by each individual city and/or county that is linked to TripCheck to automate the reporting of traveler information data from multiple sources.

The Operational Concept diagram below shows shared access to a Bend area Advanced Traveler Information System where the cities, transit, Deschutes County, and other tourism information providers could upload local information. This information would then be shared with the media and the public through personal information devices (home computers, Personal Digital Assistants, cell phones, etc.). TripCheck is shown with a similar configuration, receiving information from ODOT and then providing this information to the media and public. Between TripCheck and the Bend Area ATIS is a basic Internet link, intended to show that the two systems would not actively share information but would provide links on their respective web sites. TripCheck's local camera images would come through ODOT, rather than a direct local connection. However, it should be noted that ODOT is currently working to implement a Statewide Traveler Information project called TATII. This project will position TripCheck as a statewide traveler information source by providing the functionality for TripCheck to collect, compile and post information automatically "harvested" from local agency web sites.

Figure 4-2 is the flow diagram illustrating these relationships and information flows.

Figure 4-2: Traveler Information Flow Diagram



4.3.3 Emergency and Incident Management

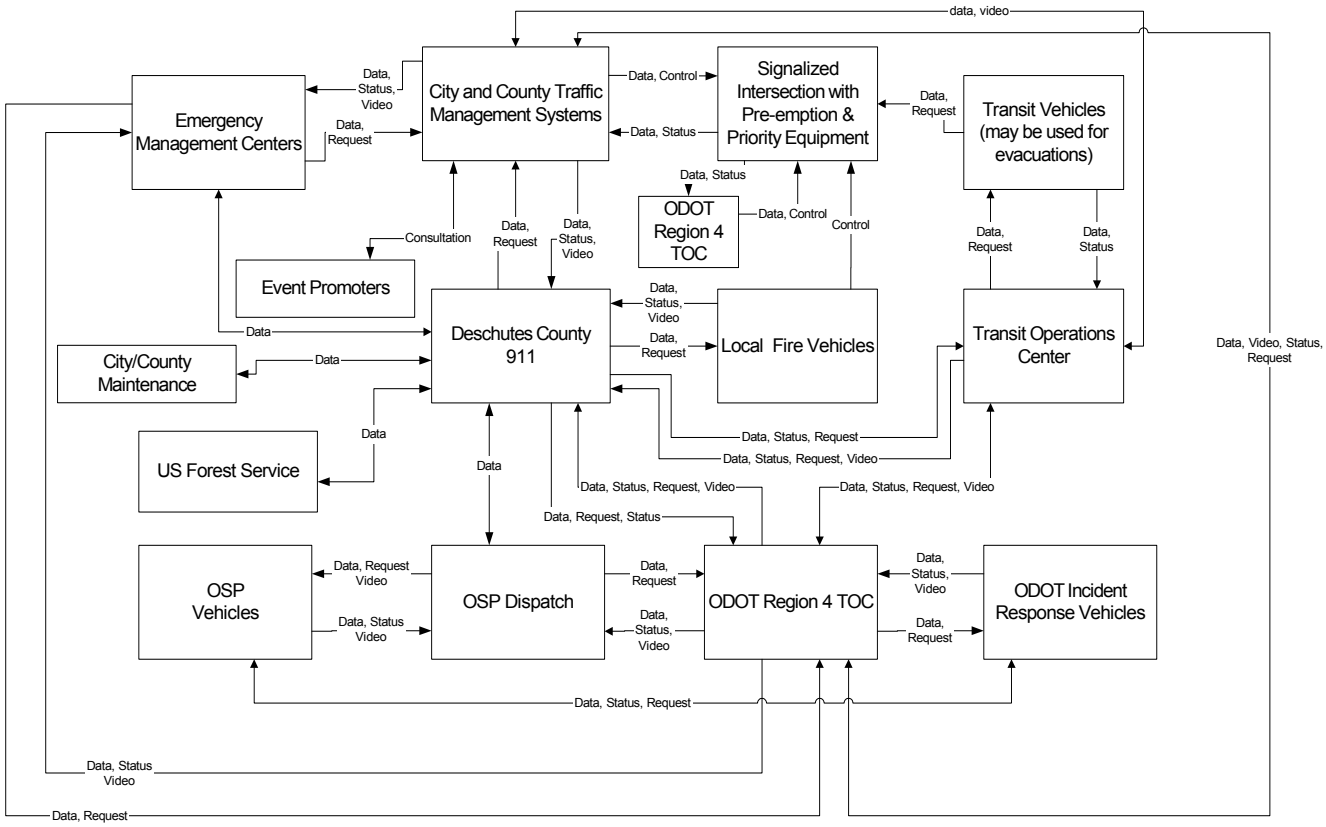
Response to both roadway incidents and regional emergencies involves coordination between multiple transportation and safety agencies to maximize rapid response and minimize impact on public safety and (secondly) the regional traffic flow. This Operational Concept addresses regional emergency and traffic management coordination for both planned events, such as fairs and conventions, and unplanned events and disasters, such as forest fires.

Currently, the ODOT Region 4 TOC has a computer aided dispatch (CAD) link to the Oregon State Police, and is working on developing a link to Deschutes County 911. As the County provides dispatching for the local police and fire departments, this link would provide ODOT with extensive local incident information that could also be shared with local city and county traffic management. Some of the local police and fire departments, including the County Sheriff, can share information through access to each other's 800 MHz radio channels, however, local emergency management coordination with OSP must occur at the dispatch level, as OSP does not use 800 MHz radio.

The Operational Concept flow diagram shows the incident and emergency management coordination occurring at both the state and local levels. OSP is shown exchanging information with ODOT and Deschutes County 911. Deschutes County 911 is shown exchanging information with ODOT, local Traffic Management, police and fire vehicles, the Forest Service, City and County maintenance, Emergency Operations Centers (activated in major emergencies). A future connection would be with transit, in the situation that future fixed route transit or existing paratransit vehicles are used to assist in an evacuation.

Figure 4-3 is the flow diagram illustrating these relationships and information flows.

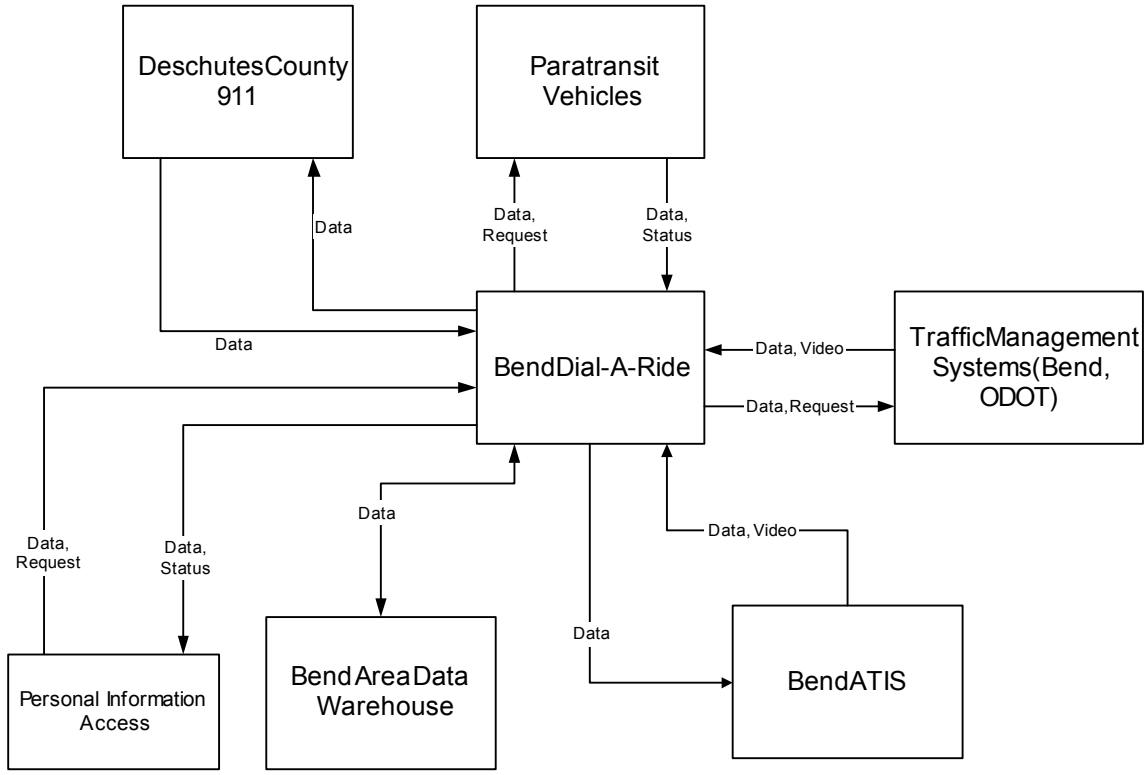
Figure 4-3: Emergency and Incident Management



4.3.4 Public Transportation Management

Although there is currently no fixed route transit service in the Bend area, this Operational Concept has been developed to support both the existing Dial-A-Ride paratransit service and also future fixed-route service. For the near-term, Bend Dial-A-Ride is shown exchanging information with Bend, ODOT, and the Bend ATIS for information on road closures and weather conditions and with Deschutes County 911 for emergency management. Bend Dial-A-Ride is also shown exchanging data with its paratransit vehicles, which could include real-time location information from an AVL/CAD system. This information could then be used to enable near-real-time scheduling of ride requests through a web page. The near-term Operational Concept for Bend Dial-A-Ride is shown in Figure 4-4.

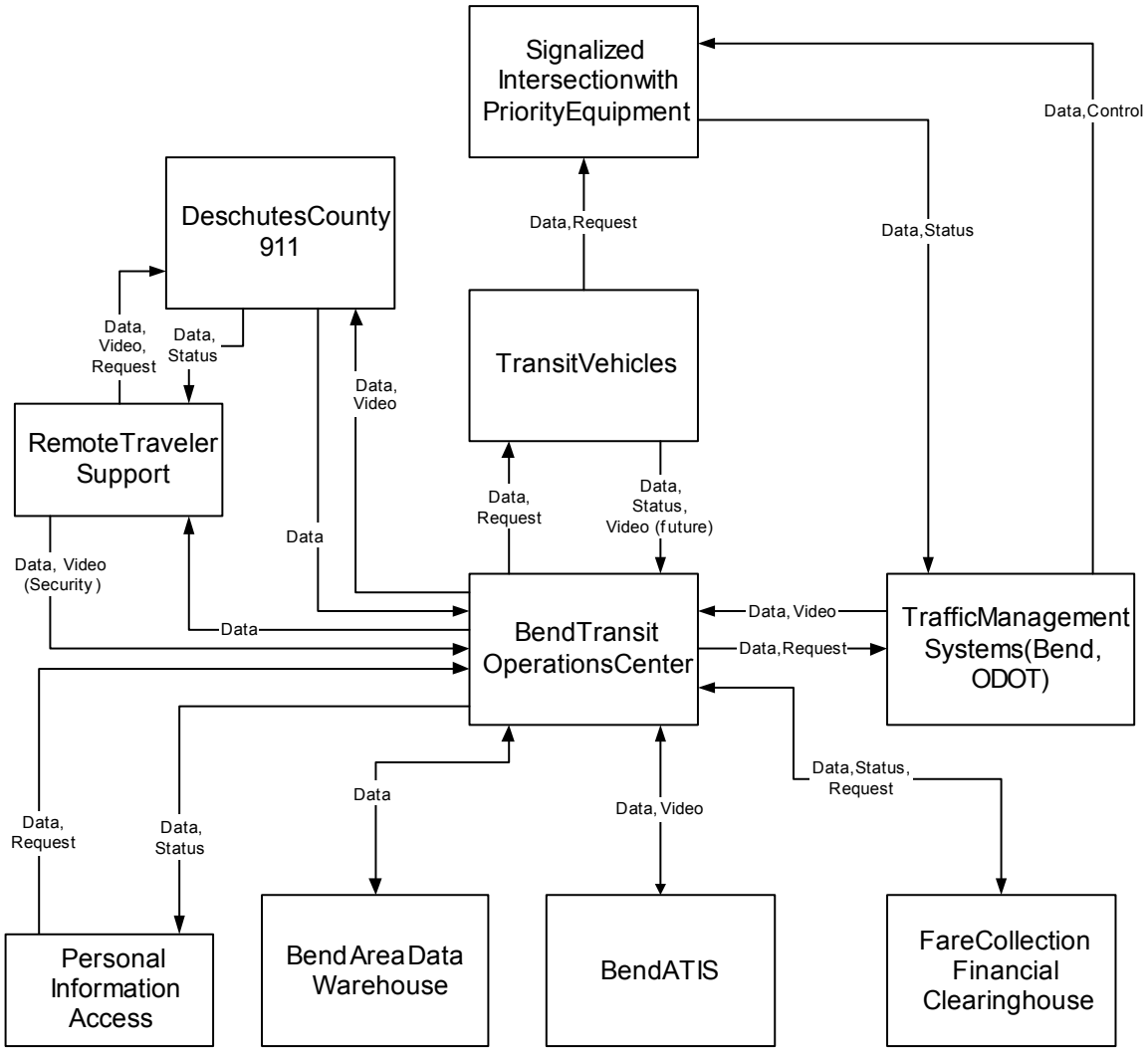
Figure 4-4: Bend Dial-A-Ride Paratransit Operational Concept



For future fixed-route transit services, Bend Transit District is shown interacting with Deschutes County 911 for security support, as well as communicating with local traffic management systems for information regarding road network conditions or closures. The Remote Traveler Support link provides video monitoring and alarms at transit stops and centers for rider safety. Future applications such as real-time next bus information at bus stops and transit center information display devices, electronic fare collection, Transit Signal Priority and security video feeds to the transit center are also represented. A link to post transit schedule and service information to the local ATIS is also provided. The link to Personal Information Access represents information flows to users requesting real-time schedule information and services through a transit information web site.

Figure 4-5 is the flow diagram illustrating these relationships and information flows.

Figure 4-5: Future Fixed-Route Transit Flow Diagram



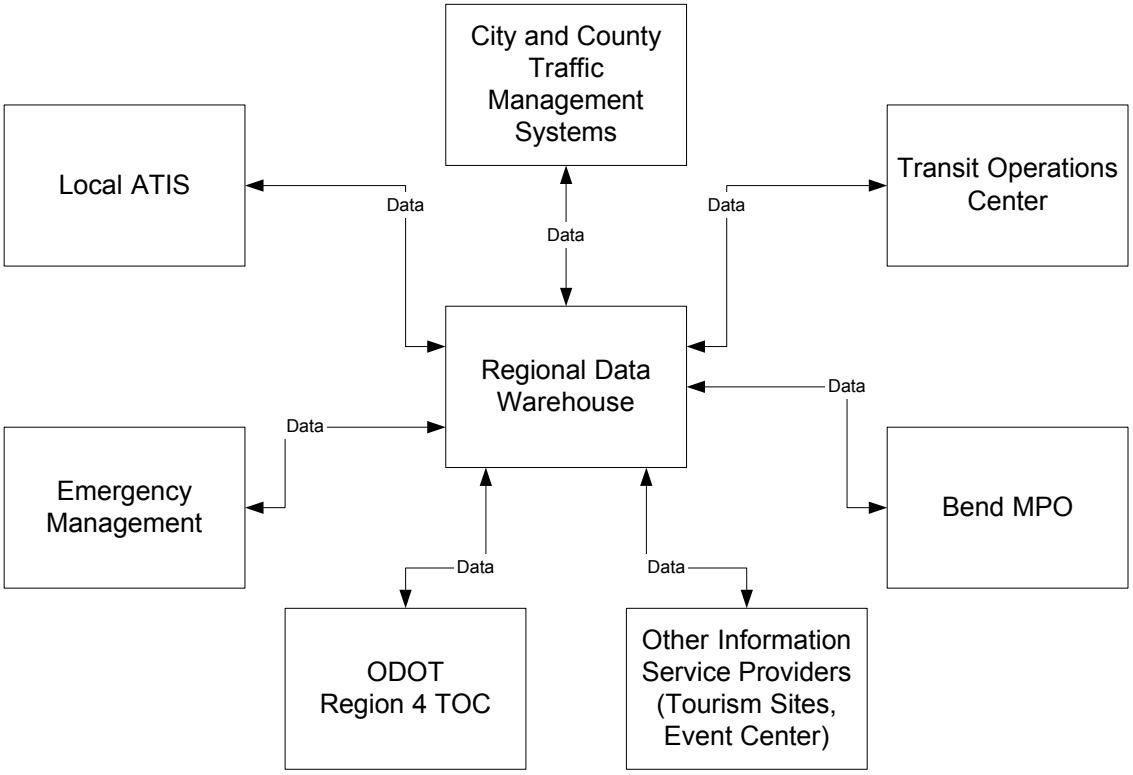
4.3.5 Information Management

The Information Management Operational Concept covers the collection, short-term storage, and eventual archiving of regional transportation data. This data may range from the real-time data used to power TripCheck, to yearlong accumulations of traffic count data available for further analysis. The collection of diverse types of data will require coordination with existing and future management procedures and policies. The Information Management concept can be implemented by a sole agency, or it may be operated as a data repository that collects and "warehouses" data from multiple agencies and sources for further analysis. The Bend Area Data Warehouse will receive input from the following sources:

- Deschutes County
- City of Bend
- City of Redmond
- Local ATIS
- Bend Transit Operations
- ODOT Region 4 TOC
- Bend MPO
- Emergency Management Agencies

Figure 4-6 is the flow diagram illustrating these relationships and information flows.

Figure 4-6: Information Management Flow Diagram



4.3.6 Maintenance and Construction Management

The Maintenance and Construction Operational Concept focuses on the exchange of roadway maintenance/construction schedules between agencies, including both real-time and advance alerts of road closures and construction-related delays to the media and transit. These information exchanges help to ensure that other agencies can plan for impacts to their road networks as a result of road or lane closures in another jurisdiction. "Maintenance" includes routine maintenance of roadways and both ITS and non-ITS equipment, as well as activities specifically related to inclement weather such as snowplowing and ice removal.

Also included as part of Maintenance and Construction Management are electronic linkages to maintenance vehicles for dispatch and location tracking. Roadside equipment information links include control of cameras to verify conditions and also data from devices such as automatic anti-icing or ice detectors on bridges or roadways. The City of Bend and other local traffic agencies will likely deploy some of these devices along roadways in their jurisdiction. This information could then be provided to TripCheck for greater coverage of local weather and road conditions information. TripCheck is a primary source of weather and road conditions information, and currently receives statewide conditions reports from ODOT and Oregon State Patrol staff, as well as data from their weather stations, and the National Oceanic & Atmospheric Administration.

Figure 4-7 is the flow diagram illustrating these relationships and information flows.

Figure 4-7: Maintenance and Construction Management Flow Diagram