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## 8 SUMMARY

The purpose of this document has been to provide an ITS maintenance plan for ODOT. Because the plan has a long-range planning horizon and ITS is still a very dynamic field, this plan should be considered as setting a blueprint for ITS maintenance in the future. This chapter will review some of the major findings of this planning effort, and identify directions for further work.

### 8.1 Key Conclusions

Some intermediate conclusions were presented at the end of many of the chapters in this maintenance plan. As means of summary, this section will review the main conclusions of this document in two categories: first, the highlights of this plan, and second, findings encountered in the development of this plan.

#### 8.1.1 Plan Highlights

Several key findings of this plan are summarized as follows.

Development of a maintenance model. The need for this plan was driven by the perspective that ITS maintenance has not been adequately considered or addressed to date, and that increasing deployment levels in the future mean that any such problems should be addressed. In developing this plan, these views were confirmed. The primary factors that currently hinder the performance of ITS maintenance include, but are not limited to:

- inadequate staffing levels and/or conflicting priorities,
- ambiguous responsibilities,
- inadequate training,
- poor logging and tracking systems, and
- non-standardized devices.

Based on discussions with stakeholders, it was agreed that a two-tier maintenance model, with separate maintenance processes depending upon whether or not a device is mainstreamed, was the best method for resolving many of these issues. While stakeholders agreed to the broad concept, many details relating to implementing the model remain.

Prioritization guidelines. Based on consultation with many stakeholders, guidelines were developed to prioritize ITS repair activities. These guidelines have been designed to reflect local needs in the context of ODOT's organizational mission, with the greatest emphasis placed on repairing those devices most critical to safety. To enforce these guidelines, it is important that the regions work in concert with the ITS Unit in Salem to identify those devices and locations which are most critical to the fulfillment of agency goals.

Preventative maintenance. In order to provide guidance for future maintenance activities, this plan included guidelines for frequency and type of preventative maintenance activities. If these activities are performed as recommended, it should improve the overall effectiveness of ODOT's ITS infrastructure.

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Resource analysis. Through extensive contacts with ODOT staff members, vendors, other agencies and other resources, this plan developed per-device estimates of maintenance needs for all devices that ODOT either has in the ground or is planning on deploying. A comparison of resource needs against resource availability showed that ODOT apparently has enough staffing resources to perform proper maintenance now, although there are isolated training gaps which hurt the efficiency at which technicians can perform repairs. Resource gaps are projected to widen considerably in the future, implying that there will be a need for significant investment in additional staff, a reliance on significant contracting efforts, or some sort of combination. This document then presented guidance on which components of which devices should have contract maintenance.

Maintenance budget. Finally, this document presented a comprehensive, statewide maintenance budget classified on a device and regional level. Given the absence of historical data, many simplifying assumptions were developed in order to estimate future budgetary requirements. The plan shows that the maintenance budget is expected to increase significantly between now and the completion of the STIP, and to the end of the Strategic Plan as well.

### **8.1.2 Plan Development**

ODOT's ITS maintenance plan appears to be the first document of its kind – a statewide plan that examines the end-to-end maintenance of ITS devices, not only with respect to technical issues, but examining organizational and institutional issues as well. In working on the development of this maintenance plan, many helpful insights were learned along the way that may assist in the development of a future maintenance plan, either by ODOT or by other transportation agencies.

- Stakeholder input is critical to the development of a successful maintenance plan. Outreach efforts by ODOT's ITS Unit succeeded in identifying diverse stakeholder groups whose combined perspectives proved to be invaluable in understanding the true issues with ITS maintenance. Moreover, soliciting stakeholder input has proved valuable in setting up an environment where recommendations may be implemented. Many methods – including face-to-face contact, telephone conversations, surveys and e-mail – proved to be useful in gathering information from stakeholders.
- A maintenance plan needs an agency champion. Getting these stakeholder groups to communicate requires a champion within the agency who is willing to coordinate and listen to various groups. For this plan, ODOT's ITS Unit, in conjunction with the ITS Executive Steering Committee, helped to champion the cause of ITS maintenance throughout the organization, achieving buy-in from many different constituencies.
- Organizational issues are as critical as technical issues. The temptation in developing a maintenance plan is to attempt to directly develop a maintenance budget, without examining organizational and institutional issues that may affect maintenance. For this plan, organizational issues determined what would be an optimal maintenance model, which in turn drove what resources would be needed for ITS maintenance.

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- Geography is a critical plan consideration. The differences between urban and rural regions in ODOT affected many key elements in this plan, including repair prioritization, the nature of device deployment, travel time to service devices, and other factors. Similar planning efforts should strive to recognize the unique characteristics of each region within the planning area.
  - Accurate device inventories drive accurate estimates of resource needs. ODOT is in the process of enhancing its ITS inventory database to include heretofore undocumented legacy systems. This should help future planning efforts. Other agencies wishing to engage in similar planning efforts should endeavor to have specific inventories for future deployment, through short-term funding programs as well as strategic planning efforts.
  - Maintenance should not be an afterthought in ITS planning. This study has demonstrated the importance of proper maintenance of ITS devices to the success of ITS initiatives. It is anticipated that this planning effort will result in increased emphasis within ODOT of the ongoing maintenance needs of field devices, and how these needs may be recognized during procurement.

## **8.2 Recommendations for Further Action**

This plan has presented many recommendations for ODOT designed to help either in ITS maintenance or in ITS maintenance planning activities. This section will emphasize some of these action items, not to minimize other items but to provide a strategic direction for ODOT to build off of this plan. These items are broken up into short-term, medium-term and long-term items.

### **8.2.1 Short-Term**

These recommendations should be pursued within the next twelve months.

1. Continue to develop an organizational consensus as to the importance of ITS in fulfilling ODOT's mission.
2. Continue to pursue implementation of the two-tier maintenance model, including identifying individuals who will fill the support coordinator role for each region.
3. Research and implement a statewide logging and tracking system for ITS maintenance activities.
4. Develop regional guidelines for prioritization of ITS repair maintenance activities.
5. Develop checklists for preventative maintenance tasks on each device.
6. List and quantity an appropriate spare parts inventory for each device.
7. Identify and procure equipment that may be needed in performing diagnostics on ITS field devices.

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8. Schedule cross-training activities to improve the overall skill level of ODOT technicians.
  9. Investigate contracting alternatives on non-mission-critical devices.
  10. Disseminate this plan document to other agencies, to assist them in analyzing ITS maintenance alternatives.

### **8.2.2 *Medium-Term***

These recommendations should be pursued in conjunction with the completion of the current STIP.

1. Develop process for on-going cross-training on new devices.
2. Improve the statewide logging and tracking system to minimize time on data entry.
3. Develop statewide, scalable standards for ITS devices, as well as a process for these standards to be developed and implemented in the future.
4. Investigate alternatives for competition between ODOT and contractors on ITS maintenance, in order to evaluate the benefits and consequences of contracting.
5. Research contracting alternatives that may be used in procurement of new devices to reduce maintenance costs.

### **8.2.3 *Long-Term***

These recommendations should be pursued as long-term concerns, over a ten- to twenty-year time frame.

1. Replace non-standardized devices with devices that are compatible with ODOT's standards.
2. Regularly evaluate ITS maintenance activities on a series of performance measures, including repair response time and the length of time a device is inoperable.
3. Pursue strategic planning efforts that incorporate maintenance planning as a key consideration.

## **8.3 Future Research Activities**

There are other activities not related directly to ITS maintenance which are recommended as potential research activities to build on promising areas identified in this research project.

- Maintenance model evaluation. A before-and-after comparison of the effect of the two-tier maintenance model would help to evaluate how effective the model has been in improving ITS maintenance.

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- Maintenance budget planning. Upon implementation of a statewide logging and tracking system, a database of historical cost data will then be available to estimate future maintenance costs, such as was done for ADOT through its maintenance tracking system (9). This would serve as a good follow-up to check and refine the assumptions developed in Appendix K.
  - Statewide maintenance contracting. As ITS becomes mainstreamed, the decision to contract ITS maintenance activities should be viewed in the larger context of highway maintenance activities for ODOT. Future research efforts could identify other ODOT activities for which contracting would be appropriate, and how the decision to contract these activities may improve ITS maintenance.