# TABLE OF CONTENTS

## Part 13 - INTELLIGENT TRANSPORTATION SYSTEMS (ITS)

### 1300 GENERAL

13-3

### 1301 23 CFR 940 COMPLIANCE

13-3

1301-1 General

1301-1.1 Background

1301-1.2 Introduction and Scope

1301-1.3 General Criteria

1301-2 Architecture

1301-2.1 General

1301-2.2 Architecture Conformity

1301-2.3 Project Level ITS Architecture

1301-2.4 If a Regional Architecture Exists

1301-2.5 If a Regional Architecture Does Not Exist

1301-3 Systems Engineering Analysis (SEA)

1301-3.1 General

1301-3.2 Systems Engineering Analysis Documentation

1301-3.3 Additional Requirements

1301-4 Ellis Requirements for ITS Projects

13-3

### 1303 FREEWAY MANAGEMENT SYSTEM ON ODOT-MAINTAINED HWYS.

13-13

1303-1 General

1303-2 Traffic Management Center (TMC)

1303-3 Closed Circuit Television (CCTV)

1303-4 Communication

1303-5 Dynamic Message Signs (DMS)

1303-6 Vehicle Detection or SFRD

1303-7 Highway Advisory Radio (HAR)

1303-8 Travel Time

1303-9 Road Weather Information System (RWIS)

1303-10 Ramp Metering

1303-11 Traffic Incident Management

1303-12 Variable Speed Limits

1303-13 Hard Shoulder Running

13-13

### 1340 DESIGN INFORMATION

13-23

1340-1 General

1340-2 Stage 1, 2 and 3 Plan Submittals

13-23

### 1342 PLAN NOTES

13-25

1342-1 General

1342-2 CCTV Installations

1342-3 Dynamic Message Sign Installations

1342-4 Vehicle Detection Installations

1342-5 Highway Advisory Radio Installations

1342-6 Ramp Metering Installations

1342-7 Items 625E25740 and 625E25750: Conduit 4" Multi-Cell Schedule 40 & Schedule 80, 725.20

1342-8 Tracer Wire

1342-9 Fiber Optic Cable Markers

1342-10 DMS & DDMS Support Structures

1342-11 Item 625E29931: Median Junction Box, As Per Plan

13-25

(7/20/2018)  October 23, 2002  13-1
<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1342-12</td>
<td>Utilities</td>
<td>13-28</td>
</tr>
<tr>
<td>1342-13</td>
<td>Protection of Traffic Monitoring Equipment</td>
<td>13-28</td>
</tr>
<tr>
<td>1343</td>
<td>SPECIFICATIONS</td>
<td>13-29</td>
</tr>
<tr>
<td>1395</td>
<td>REFERENCE RESOURCES</td>
<td>13-31</td>
</tr>
<tr>
<td>1395-1</td>
<td>General</td>
<td>13-31</td>
</tr>
<tr>
<td>1395-2</td>
<td>Traffic Operations Handbook</td>
<td>13-31</td>
</tr>
<tr>
<td>1395-3</td>
<td>Traffic Authorized Product (TAP) List</td>
<td>13-31</td>
</tr>
<tr>
<td>1396</td>
<td>FORMS INDEX</td>
<td>13-33</td>
</tr>
<tr>
<td>1397</td>
<td>TABLES INDEX</td>
<td>13-35</td>
</tr>
<tr>
<td>1397-1</td>
<td>Exempt, Low-Risk and High-Risk ITS Projects</td>
<td>13-37</td>
</tr>
<tr>
<td>1397-2</td>
<td>ITS User Services</td>
<td>13-38</td>
</tr>
<tr>
<td>1397-3</td>
<td>Regional ITS Architectures in Ohio</td>
<td>13-40</td>
</tr>
<tr>
<td>1397-4</td>
<td>Closed Circuit Television (CCTV) Installations</td>
<td>13-41</td>
</tr>
<tr>
<td>1397-5a</td>
<td>Full-Size Walk-In Dynamic Message Sign (DMS) Installations</td>
<td>13-42</td>
</tr>
<tr>
<td>1397-5b</td>
<td>Front Access Dynamic Message Sign (DMS) Installations</td>
<td>13-42</td>
</tr>
<tr>
<td>1397-6</td>
<td>Destination Dynamic Message Sign (DDMS) Installations</td>
<td>13-44</td>
</tr>
<tr>
<td>1397-7</td>
<td>Vehicle Detection (SFRD) Installations</td>
<td>13-45</td>
</tr>
<tr>
<td>1397-8</td>
<td>Highway Advisory Radio (HAR) Installations</td>
<td>13-46</td>
</tr>
<tr>
<td>1397-9</td>
<td>Ramp Metering Installations</td>
<td>13-47</td>
</tr>
<tr>
<td>1398</td>
<td>FIGURES INDEX</td>
<td>13-48</td>
</tr>
<tr>
<td>1398-1</td>
<td>Project Development Process (PDP)</td>
<td>13-49</td>
</tr>
<tr>
<td>1398-2</td>
<td>Fiber Optics Termination Diagram (Node Cabinet Assembly)</td>
<td>13-50</td>
</tr>
<tr>
<td>1398-3</td>
<td>Fiber Optics Termination Diagram (Underground Splice Enclosure)</td>
<td>13-51</td>
</tr>
<tr>
<td>1398-4</td>
<td>Fiber Optics Termination Diagram (Fiber Backbone Splice Chart)</td>
<td>13-52</td>
</tr>
<tr>
<td>1398-5</td>
<td>ITS Device Communication Diagram</td>
<td>13-53</td>
</tr>
</tbody>
</table>
1300 GENERAL

This Part of the TEM addresses policies, guidelines, standard procedures, etc. related to Intelligent Transportation Systems (ITS), which in this context means electronics, communications, or information processing used singly or in combination to improve the efficiency or safety of a surface transportation system.

Deployment and operation of these systems requires specialized coordination, design and device specifications, procurement/construction, and management. The Office of Traffic Operations (OTO) shall provide implementation plans for ITS and policies for ITS operation.

1301 23 CFR 940 Compliance

1301-1 General

1301-1.1 Background

Federal Regulation 23 CFR 940 requires ITS projects and traditional projects with ITS components funded through the highway trust fund to conform to the National ITS Architecture and applicable standards. The Ohio Procedures for Implementing ITS Regulations (23 CFR 940) documents the requirements to be used in Ohio for any ITS project utilizing Federal funds. These requirements apply to the ITS components.

The Ohio procedures incorporate guidance from several sources, including 23 CFR 940, the Programmatic Agreement for ITS Systems Engineering Analysis between the Federal Highway Administration’s (FHWA) Ohio Division Offices and ODOT and the Federal-Aid Highway Program Stewardship and Oversight Agreement. ODOT’s interpretation of the Federal policy provides a streamlined process to address project definitions, ITS architecture modifications, and systems engineering. This approach will permit ODOT and FHWA to establish concurrence in the level of ITS assessment and documentation needed.

As this is a Federal requirement for funding, it is imperative for ODOT to effectively administer this process so as to not adversely affect project delivery. ODOT will collaborate with the Ohio Division of FHWA to guide ODOT District offices and local agencies through the documentation for ITS projects.

The requirements in 23 CFR 940 include provisions for interoperability and future integration of equipment, software and systems. This FHWA requirement is similar to other separate and distinct Federal requirements which are accepted and are an inherent part of the project development process. This section provides guidance for using ODOT’s Project Development Process (PDP), L&D Manual and TEM for mainstreaming these requirements.

A major component of the CFR 940 documentation is the testing plan. The Programmatic Agreement for ITS Systems Engineering Analysis utilizes a risk-based approach to establish a streamlined process for the required Systems Engineering Analysis documentation. See Section 1301-3 for information on the risk-based Systems Engineering Analysis.
1301-1.2 Introduction and Scope

These requirements apply to Federal Aid projects, as required by 23 CFR 940, the Programmatic Agreement for ITS Systems Engineering Analysis between FHWA’s Ohio Division and ODOT and the Ohio Federal-aid Highway Program Stewardship and Oversight Agreement. It is recommended that State-funded projects follow the same process for regional consistency.

In accordance with 23 CFR 940, ITS projects funded through the highway trust fund shall conform to the National ITS Architecture and applicable standards. 23 CFR 940 also stipulates that “conformance with the National ITS Architecture is interpreted to mean the use of the National ITS Architecture to develop a Regional ITS Architecture, as applicable, and the subsequent adherence of all ITS projects to that Regional ITS Architecture.” This section outlines the ODOT procedures for implementing these requirements. The level of documentation should be commensurate with the project scope. The flowchart in Figure 1398-1 further illustrates the procedures described below.

ODOT-administered ITS projects shall follow the Programmatic Agreement for ITS Systems Engineering Analysis between FHWA’s Ohio Division and ODOT and the current Ohio Federal-aid Highway Program Stewardship and Oversight Agreement with regard to oversight of the projects. Local agency project coordination for ITS projects will be through the ODOT District with coordination through the ODOT Office of Traffic Operations and FHWA Ohio Division Office, as applicable, for concurrence in the level of ITS assessment and documentation required.

1301-1.3 General Criteria

In accordance with 23 CFR 940.3, an ITS project is “any project that in whole or in part funds the acquisition of technologies or systems of technologies that provide or significantly contribute to the provision of one or more ITS user services as defined in the National ITS Architecture” and summarized in Table 1397-2. In Ohio, a project would be considered to be an ITS project if it meets any of the following:

1. It requires the integration of multiple separate systems.
2. It is a project that has significant potential to involve the integration of technologies on a multi-jurisdictional level.
3. It replaces existing or installs new centrally controlled software.

For non-Freeway Management System projects, a project, even one meeting the above criteria illustrated by the examples below and in Table 1397-1, would not be considered an ITS project if it is an expansion of an existing system and does not add functionality. However, expansion of a Freeway Management System through additional phases is always considered an ITS project. Enforcement systems and systems used primarily to gather and archive data not directly used for operational purposes are not generally considered to be ITS.

ITS projects come with various risk factors, such as cost overruns, not meeting agency needs and system failure. The level of risk varies depending on the presence of the following factors:

1. Number of jurisdictions and/or modes involved.
2. Extent of new, unproven software creation.
3. Extent of new, unproven hardware and communication technology being used.
4. Number and level of complexity of new interfaces to other systems.
5. Level of detail needed in defining the functional requirements.
6. Level of detail needed in defining the operations and management procedures.
7. Service life of the equipment and software technology.

The risk-based Systems Engineering Analysis approach classifies ITS projects into three types: Exempt, Low-Risk and High-Risk.

For examples of Exempt, Low-Risk and High-Risk projects see Table 1397-1. The decisive factor in this determination is the scale and complexity of the project.

1301-2 Architecture

1301-2.1 General

In areas served by a Metropolitan Planning Organization (MPO), the MPO needs to identify potential transit and highway ITS projects to the ODOT District when reviewing local programs for inclusion in the Transportation Infrastructure Plan TIP. In areas not served by an MPO, the ODOT Local Project Administrator (LPA) needs to perform this identifying function. It shall be the responsibility of the ODOT District to determine if a project is an ITS project, and if so, to identify it as an Exempt, Low-Risk or High-Risk ITS Project. If the determination of whether a project is ITS or non-ITS, or whether a project is an Exempt, Low-Risk or High-Risk ITS Project is not obvious, the project shall be discussed with the Office of Traffic Operations to make a determination. The District will notify the MPO and the project sponsor of the determination in writing.

An ITS Project will require a more comprehensive effort that analyzes several options for each type of technology selected, since these types of projects tend to be multifaceted. Generally, there are several elements that need to be evaluated and more options are analyzed in an ITS Project. If a consultant is used for an ITS Project, these procedures should be included in the consultant’s Scope of Work.

1301-2.2 Architecture Conformity

To ensure conformity with 23 CFR 940, several requirements must be met. The rule stipulates that conformance with the National ITS Architecture is interpreted to mean the use of the National ITS Architecture to develop a Regional ITS Architecture, and the subsequent adherence of all ITS projects to that Regional ITS Architecture.

According to 23 CFR 940.3, a Regional ITS Architecture is “a regional framework for ensuring institutional agreement and technical integration for the implementation of ITS projects or groups of projects.” It documents data flows and subsystems, roles and responsibilities, operating agreements, and ITS Standards to be used for a particular region. In Ohio, Regional ITS Architectures generally encompass an MPO area. A Statewide ITS Architecture is a form of a Regional ITS Architecture. Ohio is currently developing a statewide ITS architecture which can be found at http://ohioitsarch.transportation.ohio.gov/index.html. This site also has links to the available ITS Architectures from MPOs in Ohio. See Table 1397-3 for a listing of Regional ITS Architectures in Ohio.

1301-2.3 Project Level ITS Architecture

A Project Level ITS Architecture, according to 23 CFR 940.3 is a framework that identifies the institutional agreement and technical integration necessary to interface an ITS project with other ITS projects and systems. The Project Level ITS Architecture indicates the data flows and subsystems that the project will implement. To achieve the significant benefits derived from the documentation, a Project Level ITS Architecture needs to be developed for all ITS Projects. For further information, refer to Subsection 1301-3.2, Systems Engineering Analysis Documentation.

1301-2.4 If a Regional ITS Architecture Exists

If an ITS project falls within the boundaries of a Regional ITS Architecture (see Table 1397-3) the Project Level ITS Architecture should be developed as follows:
1. **If the project functions exist in the Regional ITS Architecture:** Copy the appropriate pages from the Regional ITS Architecture and use a highlighter to highlight the data flows that will be implemented by the project. This highlighting will satisfy the requirements for a Project Level ITS Architecture.

2. **If some project functions do not exist in the Regional Architecture:** The Project Level ITS Architecture must supplement the Regional ITS Architecture with any missing data flows. Copy the appropriate pages from the Regional ITS Architecture and use a highlighter to highlight the existing data flows that will be implemented by the project and add the additional data flows that will be implemented. The MPO maintaining the Regional ITS Architecture also needs to be notified of the changes, for purposes of updating the Regional ITS Architecture.

3. **If none of the project functions exist in the Regional ITS Architecture:** A Project Level ITS Architecture shall be created, using as a base the Regional ITS Architecture and the National ITS Architecture. The MPO maintaining the Regional ITS Architecture shall be notified of the changes, for purposes of updating the Regional ITS Architecture.

The final design of all ITS projects shall accommodate the interface requirements and information exchanges as specified in the Regional ITS Architecture. If the final design of the ITS project is inconsistent with the Regional ITS Architecture, then the discrepancies shall be reconciled and the Regional ITS Architecture or the project shall be modified as appropriate.

### 1301-2.5 If a Regional ITS Architecture Does Not Exist

In the future, when a statewide ITS architecture is available (see Section 1301-2.2) if an ITS project falls in an area not covered by the boundaries of a Regional ITS architecture (see Table 1397-3), the statewide provisions will apply. Currently, if an ITS project falls in an area not covered by the boundaries of a Regional ITS Architecture, a few additional procedures will be required in the development of the Project Level ITS Architecture.

First, determine if the ITS project should be added to an existing Regional ITS Architecture. The decision should be based upon geographic, stakeholder, and system function considerations.

If the new ITS project will not be added to an existing Regional ITS Architecture, then Project Level ITS Architecture will need to be created using the National ITS Architecture as a basis.

If this is the first ITS project in the area, the timeframe for developing a Regional ITS Architecture begins, and the Region will have four years from the date that the project advances to final design to create a Regional ITS Architecture that is “Ready for Use.” Final design is defined as entry to Stage 3 Design at the appropriate step of the PDP.

For subsequent projects in the Region, until the four years have passed or the Regional ITS Architecture is developed, whichever is earlier, Project Level ITS Architecture shall use the National ITS Architecture as a basis.

For Federal funds to be considered once the four years have passed, the Regional ITS Architecture must be completed for ITS projects to be authorized for construction.

### 1301-3 Systems Engineering Analysis (SEA)

#### 1301-3.1 General

In Ohio, all ITS projects shall be based on a Systems Engineering Analysis (SEA). This is a process or a structured approach which can control costs, lead to reduced risks, maintain the project schedule, satisfy user needs, and meet the requirements of ODOT and the Federal...
regulation. The SEA effort will vary based on the level of risk associated with the ITS project. ITS Projects are classified into three types: Exempt, Low-Risk and High-Risk.

Exempt ITS Projects do not require Systems Engineering Analysis documentation, nor any ITS-specific approval action, as long as they only affect one maintaining agency. Exempt ITS projects affecting multiple agencies are also considered exempt if there is an Operations and Management Agreement between the affected agencies that details the procedures and resources necessary for the operations and management of the system. Projects affecting multiple agencies without such an agreement are considered High-Risk and require a project-specific Systems Engineering Analysis be completed and approved. See Table 1397-1 for projects that classify as Exempt ITS Projects.

Low-Risk ITS projects shall utilize a Systems Engineering Review Form (SERF) to assess the level of risk and confirm that it is indeed “low risk”. If all of the questions on the SERF are answered in the affirmative, i.e. “Yes”, then the project can be considered Low-Risk. The SERF will also document that the project is in conformance with the Functional Requirements document for that particular project category and the Systems Engineering Analysis requirements of 23 CFR 940.11. See Table 1397-1 for projects that classify as Low-Risk ITS Projects. See Section 1396-3 for information on completing a Systems Engineering Review Form (SERF) for these projects.

High-Risk ITS projects require a project-specific Systems Engineering Analysis be completed and approved. These types of projects typically involve new or unproven technology, multiple maintaining agencies and/or new hardware, software or interfaces. See Table 1397-1 for projects that classify as High-Risk ITS Projects.

For High-Risk ITS projects, an SEA will provide:

- a description of the scope of the ITS project (the general location, conceptual alternative, and logical termini or service area of the proposed project);
- a concept of operations that identifies the roles and responsibilities of participating agencies and stakeholders in the operation and implementation of the ITS project;
- functional requirements of the ITS project;
- interface requirements and information exchanges between the ITS project and other planned and existing systems and subsystems; and
- identification of applicable ITS standards.

The scale of the analysis should be commensurate with the project scope of the ITS portion of the project. In Ohio, the full SEA is comprised of twelve Items to be addressed, which further describe these elements. The twelve items are elaborated in Subsection 1301-3.2, Systems Engineering Analysis Documentation.

ITS projects are required to follow the Project Development Process (PDP), see TEM Figure 1398-1. The various SEA documents (see Subsections 1301-3.2 and 1301-3.3) are to be developed and submitted at the appropriate point in the project.

For Design-Build projects, reference the Office of Traffic Operations in the Plan Notes with the following contact information:

Office of Traffic Operations
Phone: 614-387-4113
Fax: 614-887-4134
Email: cen.its.lab@dot.state.oh.us
1301-3.2 Systems Engineering Analysis Documentation

All submissions required by the PDP (see Sections 140-7 and L&D Manual Volume 1) shall be required for ITS projects.

A Project Level ITS Architecture and a Systems Engineering Analysis (SEA) are required for any High-Risk ITS project. The documentation is expected to be commensurate with the scope of the ITS work. Both the Project Level ITS Architecture and the SEA must be completed and approved prior to authorization of construction funding. For examples of how to address SEA Items 1-12 for some projects, refer to Form 1396-1. For clarity, page breaks should be inserted between each of the twelve items. The SEA will consist of providing items 1 through 12, listed below:

**SEA Item #1 - Define the scope of work for the project (the general location, conceptual alternative, and logical termini or service area of the proposed project).** Scoping shall also include inter-agency coordination and possible effects on neighboring jurisdictions.

Define the scope of work for the overall project and the ITS components (the general location, conceptual alternative, level of development and logical termini or service area of the proposed project) Scoping shall also include inter-agency coordination and possible effects on neighboring jurisdictions. Include the PID, location, project description from ELLIS or other sources, description of the ITS work, and the project background (summary of purpose and need).

Be as descriptive as possible and briefly address any proprietary equipment/software requirements.

**SEA Item #2 - Identify portions of the Regional ITS Architecture being implemented.**

Identify portions of the Regional ITS Architecture being implemented or, if a Regional ITS Architecture does not exist, the applicable portions of the National ITS Architecture. Include identification of the ITS User Services which will apply to the project and a graphic from the Regional ITS Architecture illustrating the data flows that will be incorporated. Inclusion of SEA Item #2 will satisfy the Project Level ITS Architecture requirements. The use of the FHWA software product TurboArchitecture is highly recommended. This software can be downloaded free of charge from the FHWA.

*If no Regional ITS Architecture exists for the project area, contact the ODOT Office of Traffic Operations (OTO).*

**SEA Item #3 - Provide a list of all stakeholders, including the roles and responsibilities of each and the Operational Concept and Concept of Operations.**

Provide a list of stakeholders that have a direct role in the project.

Provide an Operational Concept. The Operational Concept is a high level description of the roles and responsibilities of the primary stakeholders and the systems they operate.

Provide a Concept of Operations. The Concept of Operations is a more detailed description of how the system will be used. It should discuss what the project is to accomplish, including identifying stakeholder needs and resources that stakeholders can provide. It is non-technical and provides a bridge between the needs motivating the project and the specific technical requirements. The greater the expected impact on operations, the more detailed explanation will be required. For complex projects, operational scenarios may be necessary to illustrate the operations.

**SEA Item #4 - Define the functional requirements of the project.**
The functional requirements of the project describe how the project will be built and operated and typically are based upon the ITS Market Packages. High level functional requirements should be listed and can further be used to develop specific contract specifications language. Provide interface/communication requirements for all stakeholders in the project. This includes the existing systems already deployed in the region.

Functional requirements are statements of the capabilities that a system must have ("functions"), geared to addressing the business needs that a system must satisfy. Business needs are the objectives for which the system is built. These functional requirements will be traced through the life of the project.

A key aspect of the functional requirements is that they address what a system must do, but does not address how the system should accomplish the what. In other words, a functional requirement should not go into the details of how to implement the function.

For more information on functional requirements, see the USDOT publication “Developing Functional Requirements for ITS Projects” which is available on the FHWA website.

**SEA Item #5 - Provide analysis of alternative system configurations and technology options to meet requirements, including rationale for technology selection.**

Describe the basis of the project scope and how it was developed. Identify any proprietary items and explain the necessity and rationale for these items. Show the link between the system design concept and the operations and maintenance of the constructed project.

**SEA Item #6 - Provide analysis of procurement methods considered including rationale for selected option.**

Describe possible procurement methods for the design, construction, and operations/maintenance (as applicable) of the project and why the preferred method was selected. In some cases, the procurement methods may be determined by State law.

**SEA Item #7 - Identify the existing ITS Standards that will be used in the project. An explanation is required for not using the applicable Standards.**

ITS Standards are available on-line from the FHWA website. List all ITS Standards which may be applicable to the project, indicate if the Standard is to be used in the project, and if not used, provide an explanation of why they are not being used.

**SEA Item #8 - Identify the testing procedures to verify compliance with the standards as well as the requirement for interoperability.**

The testing procedures verify the individual elements of the project comply with the project specifications. The specifications are based upon the high level functional requirements identified in SEA Item #4. For some projects, the testing procedures may be provided by a product vendor.

Project submittal cut sheets, laboratory reports and precertification may be substituted for some field testing. Devices on a Qualified Providers List (QPL) do not need to be tested. Other devices or additional functionality will be included on the traceability matrix for field testing.

**SEA Item #9 - Provide a traceability matrix for documenting compliance with the above.**

Provide a traceability matrix for documenting compliance of the testing procedures. The traceability matrix provides a mechanism for ensuring that each functional requirement is tested and that each item to be tested has been addressed in the specifications.
A sample traceability matrix applicable to an emergency vehicle preemption project is shown as part of Form 1396-2 and is available on the OTO Forms web page. The form may be modified as necessary.

The traceability matrix will be included in the contract documents for use during construction. The completed traceability matrix will include the results of the test and any necessary work to address failures during the test and will be included in the project construction records.

SEA Item #10 - Provide change management control.

Provide a description of the change management control. Describe what changes were made during project development, how changes were accommodated, and how change orders will be processed and managed during construction, including identifying necessary approvals. In many cases standard procedures used by the agency will incorporate many of these items.

This item requires documentation of changes in design, construction, and operations.

SEA Item #11 - Provide a Maintenance Plan and a funding analysis for the maintenance, operation and funding of the system after completion. This includes an analysis of cost, personnel, and anything further required to maintain and operate.

Provide a Maintenance Plan and a funding analysis for the maintenance and operation of the system after completion. This includes an analysis of cost, personnel, software, utilities and anything further required to maintain and operate the system, typically on an annual basis. Examples of this item are available on the OTO website.

SEA Item #12 - Provide documentation for revising the Regional ITS Architecture.

Provide documentation for revising the Regional ITS Architecture after project construction. Contact the appropriate MPO for preferred or required formats for submitting this information.

1301-3.3 Additional Requirements

The Programmatic Agreement for ITS Systems Engineering Analysis and the Ohio Federal-Aid Highway Program Stewardship and Oversight Agreement between ODOT and FHWA establishes FHWA involvement on ITS projects.

It is anticipated that the SEA documentation will be prepared by the local agency or its consultant, for submission to the appropriate ODOT District, to be forwarded on to OTO. For ODOT projects, it is anticipated that the documentation will be prepared by the ODOT District for submittal to OTO.

Local agencies shall submit all appropriate documents to the appropriate ODOT District for review and approval per the existing project administration procedures. OTO will then coordinate with and forward submittals to FHWA per the Federal-aid Highway Program Stewardship and Oversight Agreement.

In addition, when the project is covered by a Regional ITS Architecture, the as-built Project Level ITS Architecture with any modifications noted, shall be submitted by the local agency to the appropriate MPO for updating the Regional ITS Architecture.

Contact OTO for preferred documentation formats. Forms 1396-1 and 1396-2 provide sample documents that can be used, including a simplified form for Emergency Vehicle Preemption projects. These forms are available on the OTO Forms web page. The forms may be modified as necessary. For signalized intersections within about 200 feet of a
highway rail intersection, additional work may be needed. A simplified form for Railroad Preemption projects is available from the OTO upon request.

Project documentation shall be retained by the District in their project files. For Low-Risk ITS Projects, a copy of the completed SERF shall be kept in the project files. For Low-Risk or Exempt Projects that affect multiple agencies, a copy of the Operations and Management Agreement shall be kept in the project files. For High-Risk ITS Projects, a project-specific Systems Engineering Analysis shall be kept in the project files.

ODOT shall designate the ITS applicability of every Federal-aid project on its web-based application for project management (currently Ellis). See Section 1301-4 for Ellis requirements.

If any uncertainty exists regarding design requirements, standards or forms, or other ITS requirements, the project sponsor should contact the District.

1301-4  Ellis Requirements for ITS Projects

ITS projects shall utilize one of the two following Ellis Project Report Codes as appropriate to document progress toward completion of the required CFR 940 documentation. The report codes should be created and updated throughout the project beginning at the time the project is scoped.

During PS&E approval of a project, Ellis will be referenced to determine if documentation is required. If an ITS project does not have the proper documentation, authorization for funding of the project could be delayed at PS&E.

Ellis Report Codes:
- CFR 940 Exempt ITS Project
- CFR 940 Low-Risk ITS Project
- CFR 940 High-Risk ITS Project
- N/A
1303 FREEWAY MANAGEMENT SYSTEMS ON ODOT-MAINTAINED HWYS.

1303-1 General

A primary goal of the Freeway Management System (FMS) is to provide reliable and timely travel information. This shall be achieved through the provision of route and segment-based travel times. Valid travel times are to be provided in real time, providing easily accessible information about delays.

Information dissemination will be accomplished using a variety of methods including:

- OHGO.com
- Dynamic Message Signs (DMS)
- Highway Advisory Radio (HAR)
- Ohio 511 telephone number
- Radio and television broadcasts (private-sector leveraging FMS information)

It is intended that ODOT’s statewide FMS deployment will provide full coverage of six of the metropolitan areas with full instrumentation and communication to a central Traffic Management Center (TMC), in accordance with the Regional Architecture prepared by the MPO in cooperation with ODOT and FHWA. The Regional Architectures are defined in the Detailed Project Plans, prepared under the direction of these same agencies.

See Chapter 1343 for information about the related C&MS sections and Supplemental Specifications.

The information provided herein is intended to provide designers all necessary details needed to develop a thorough plan for the ITS infrastructure.

1303-2 Traffic Management Center (TMC)

The ODOT’s Statewide Traffic Management Center (TMC) operates traffic management and traveler information systems on Ohio’s Interstates, other freeways, expressways and state highways. The mission of the TMC is to increase transportation safety, reduce congestion, and increase efficiency on Ohio’s state highways. Housed in ODOT’s Central Office building, the TMC monitors traffic in each of the State’s major metropolitan areas including Akron/Canton, Cincinnati, Cleveland, Columbus, Dayton/Springfield, and Toledo. TMC operators can control cameras and post traveler information messages to ODOT’s Dynamic Message Signs, Highway Advisory Radios, and to the OHGO website. The TMC operators can also act as liaisons between the Freeways Service Patrol and various other public agencies that respond to the scenes of vehicle incidents.

1303-3 Closed Circuit Television (CCTV)

CCTV cameras provide an opportunity for congestion and incident management verification. FMS areas function very efficiently with the use of CCTV cameras. They provide views of the highway system that can only be otherwise obtained by first hand viewers and provide a great amount of information to Traffic Management Center (TMC) operators. CCTV camera placement is expected to be at approximately 1-mile spacing to provide full coverage of the freeways. Cameras are usually located at interchanges which afford an opportunity to view not only the freeway mainline, but the ramps and cross routes as well. The viewing angle of the camera shall give preference to the freeway mainline with arterial coverage included to the extent possible. Each CCTV camera should be oriented so that minimal roadway is occluded. OTO prefers that a section in the middle of a ramp be chosen as the occluded area.

All CCTV cameras installed for use in the FMS shall be of the pan-tilt-zoom type. General area CCTV cameras shall be of the dome-type. CCTV cameras used in tunnels, trenches, or other areas where the cameras may have a high probability of being succumbed to moisture-spray
from vehicles shall be tunnel/wall-mount cameras and/or thermal imaging cameras. Both of these
cameras are referenced in the ODOT 809 Supplemental Specification.

The CCTV cameras are also in demand for use by local jurisdictions and other agencies, the
media, and the public (via the internet). The central video control system is designed to
accommodate external feeds of camera images. In cases where a non-internet connection is
used to access video feeds from the TMC, external users of the video will be required to sign a
CCTV License Agreement. There shall be no fee for use of ODOT FMS video although the users
must arrange for their own communication pathway to the TMC video server.

Information about operation of the CCTV cameras by TMC personnel, as well as remote access
by authorized users, will be available from OTO. This will include general rules for routine use of
the cameras such as limitations on zoom functions during incidents and scenes involving solely
private property. When CCTV cameras are being manipulated or are zoomed in to assist with an
incident, the video signal from the server is generally blocked. It may be necessary to disable the
video feed manually, or it may be an automatic software function, depending on the FMS
software version. Generally, CCTV camera images will be recorded for a period of three days and
then automatically overwritten.

When designing a CCTV site, the designer shall take note of the layout of the surrounding area
and make sure that the camera location has the following attributes:

1. Prior to adding a camera to any ODOT-maintained location, coordinate with the OTO to
   ensure the appropriate design layout is considered and performed.
2. CCTV will have good view of all roadways. CCTVs placed at curvatures in the road should be
   placed on the outside of curves so that both directions can be seen.
3. CCTVs located in interchanges should be centrally located so that both on ramps can be
   viewed. This will provide monitoring for future ramp metering.
4. CCTVs should be located on relatively flat ground for ease of work pad installation and site
   maintenance. If site conditions present at condition where flat ground is not accessible a
   sloped work pad should be installed. Details on the sloped work pad can be obtained from
   OTO.
5. CCTVs should be located in areas that provide adequate access for ITS maintenance
   operations. These locations shall provide a minimum of 250 feet of 12-foot wide shoulder to
   be utilized for deceleration and acceleration. In addition, all efforts shall be made to locate the
   cabinet and CCTV within 35 feet of maintenance vehicle accessible area.
6. Device locations shall be designed so that maintenance personnel do not have to cross
   ditches or streams, as these areas fill up with water during parts of the year and present a
   hindrance to ITS maintenance operations.

The designer shall utilize Table 1397-4 to design CCTV sites using the appropriate pay items,
and including the appropriate Traffic Standard Construction Drawings (SCDs) and
Supplemental Specifications on the plan cover sheet. The following is a more descriptive listing
of the information provided in the table:

1. The appropriate CCTV Camera shall be chosen.
   a. For most installations along the freeway the 809E60000 CCTV IP-Camera System,
      Dome-Type shall be utilized.
   b. For installations where the camera is to be located inside a tunnel and/or wall-mounted
      the 809E60010, CCTV IP-Camera System, Type HD, Wall/Tunnel shall be utilized. This
      type of camera allows for dirt to be removed from the lens more easily and also tends to
      be less maintenance extensive in this type of installation.
2. The appropriate CCTV pole height shall be chosen.
   a. The standard installation requires the use of 70 foot concrete poles, utilizing pay item
      809E61000, CCTV Concrete Pole with Lowering Unit, 70 FT.
b. The use of 50 feet poles is not allowed unless directed by OTO. During the review process, OTO will review the plans and if necessary, may advise the designer to utilize item 809E61010, CCTV Concrete Pole with Lowering Unit, 50 FT in some locations.

3. The appropriate ITS cabinet type shall be chosen.
   a. The standard installation requires the use of ground-mounted cabinets, utilizing pay item 809E65000, ITS Cabinet – Ground Mounted.
   b. The use of ITS Cabinet – Pole Mounted is not allowed unless directed by OTO.

4. Appropriate grounding and power services shall be designed.
   a. For instances where one power service is providing power to multiple cabinets, item 809E65020, ITS Cabinet – Power Distribution Cabinet shall be utilized. This cabinet houses a load center with separate breakers for each cabinet and is also capable of housing smaller wall mount power transformers.

Also see Plan Note 1342-2 (TEM Section 1342-2).

1303-4 Communication

FMS communication systems are critical to successful operation. ODOT has determined that the most effective (high-level) system requirement for FMS communications is to mimic the ODOT network. Therefore, field device communications shall use Ethernet and other devices compatible with equipment routinely used by ODOT. The FMS network shall be separate from the ODOT network although there will be connectivity between the two systems. ODOT network interoperability is coordinated with the Network Operations Center of the ODOT Division of Information Technology (DoIT).

Fiber optic cable is the medium of choice although many “last-mile” and point-to-point applications require wireless or other forms of wire-line communications (e.g. T-1, POTS, Coax, CDMA). Communications redundancy in the field is desired and shall be designed accordingly. Redundancy in some areas will be limited until additional funding is available or new techniques are developed. TMC operational redundancy shall be provided via backup Buckeye Traffic Servers.

To facilitate standardized communication protocols, NTCIP-compliant devices will be used when possible. Field device communication represents a significant cost in the design, deployment and operation of an FMS. ODOT systems will use a hybrid of Ethernet-based fiber optic and wireless communications to maximize bandwidth for the least cost to support the field infrastructure. Connectivity is desired for remote operations and “pushing” video and data to a number of external users/agencies. The central software system shall be designed to provide flexibility in the provision of access by others outside the TMC and the FMS/ODOT networks. An internet connection to the FMS network will be the most effective means of providing access to the system.

When designing plans that include fiber optic cable as a communication method, figures shall be included to show how the fiber optic cable is to be terminated / spliced at each location. These figures include one figure per field cabinet (e.g., Figure 1398-2: Node Cabinet Assembly), one figure per splice enclosure (e.g., Figure 1398-3: Underground Splice Enclosure), and one figure showing a high-level splicing scheme for the entire project (e.g., Figure 1398-4: Fiber Backbone Splice Chart), and a high-level device communication plan for the entire project (e.g., Figure 1398-5: ITS Device Communication Diagram).

When designing projects for current or future ITS deployments, the designer shall incorporate infrastructure containing conduit and fiber optic cable. While it may not always be possible or feasible to install fiber optic cable with projects, all effort should be made to include conduit infrastructure so that fiber optic cable can be installed with minimal effort in the future. The following parameters shall be followed when installing communications infrastructure.
1. All median wall construction shall include two 4-inch multi-cell Schedule 40 conduits. Median wall pull boxes shall be installed at a maximum of 1000 feet apart and on each side of bridge structures. Refer to Plan Note 1342-11 (TEM Section 1342-11) for median junction box notes. Contact the Office of Traffic Operations for Typical Plan Drawings to be included in the plans.

2. Lateral crossings out of medians (barriers and grass) shall be installed at a maximum of every 4500 feet and at all interchanges for future and existing device communications, as well as slack storage locations. The lateral crossing shall include two 4-inch multi-cell Schedule 80 conduits. A 32-inch pull box shall be installed in the shoulder of each lateral crossing. Contact the Office of Traffic Operations for Typical Plan Drawings to be included in the plans.

3. Within metropolitan areas, conduit infrastructure buried in earth shall contain two 4-inch multi-cell conduits, and 32-inch pull boxes with maximum spacing of 500 to 750 feet (see Traffic SCDs ITS-14.10 and 14.11).

4. For multi-cell conduit refer to Plan Note 1342-7 (TEM Section 1342-7).

5. For fiber optic installations in long haul installations, such as on interstates between metropolitan areas, a combination of air-blown fiber and micro-duct pathway shall be utilized. Refer to ODOT Supplemental Specification 804/904 for details regarding this method.

6. For fiber optic installations on signalized corridors, where there is not ample right-of-way to install fiber optic cable traditionally, as specified in 3. above, air-blown/pushable fiber optic cable shall be installed by saw cutting the pavement and installing a micro-duct pathway.

7. All newly installed buried conduit shall contain tracer wire. If conduit is for future fiber optic cable, 20 feet of slack in each direction should be left in each pull box. This will allow for tracer wire to be run inside of fiber optic cable markers to be installed when fiber is installed. For tracer wire specifications, refer to Plan Note 1342-8 (TEM Section 1342-8) to be included in plans.

8. Fiber optic cable markers shall be used whenever fiber optic cable is installed. Refer to Plan Note 1342-9 (TEM Section 1342-9) for specification to be included in plans.

9. Device locations shall be designed so that maintenance personnel do not have to cross ditches or streams, as these areas fill up with water during parts of the year and present a hindrance to ITS maintenance operations.

10. Any conduit installed within 6 feet of guardrail shall be concrete-encased.

The following list outlines additional requirements:

1. For fiber optic design, the general rule of thumb is that any fiber cable having 48 strands or less should be routed through the cabinets and all splicing shall be performed in the cabinets. No splicing on this cable shall be performed in splice enclosures.

2. All fiber optic cables having more than 48 strands shall be spliced in pull boxes closest to the cabinet locations and drop cable shall be utilized to connect to the cabinet. The general practice is to use drop cable to connect to one buffer tube in each direction of the trunk cable and terminate the drop cable into the cabinet.

3. Locations identified as Node sites by the Office of Traffic Operations (OTO) during review will generally have more than one buffer tube terminated at them. The designer will be directed by OTO as to which fibers will terminate at which cabinets during review.

1303-5 Dynamic Message Signs (DMSs)

Dynamic Message Signs (DMSs) are a key component to an effective FMS. The installation of DMSs can help to reduce traffic congestion during incidents and will help to provide travelers with real time traffic information.
DMSs shall be installed at strategic locations on urban freeways to advise drivers of incidents and warn of congestion or stopped traffic. Generally, no alternate route will be specified, although the messages on the signs may suggest the use of alternate routes. When no particular incidents are worthy of mention, the default message, with travel time through key segments of the urbanized area, shall be displayed. Messages for DMSs shall be chosen from a DMS message library unless a different message is truly needed. If a different message is needed it shall be created by the appropriate party. When resources limit full deployment of DMSs in accordance with Detailed Project Plans and FMS design guidelines, first priority will be given to sites on routes inbound to a central business district, deferring outbound DMSs to subsequent phases. The design plans must be in accordance with the Detailed Project Plan.

When designing a DMS site, the designer shall take note of the layout of the surrounding area and make sure that the DMS location has the following attributes:

1. DMS shall be located at points in the roadway that allow for motorists to view the sign at the greatest distance away. Most DMS have a viewing distance of approximately 1,100 feet. DMS should be located in an area that provides a straight roadway for that distance.

2. DMS cabinets should be located on relatively flat ground for ease of work pad installation and site maintenance. If site conditions present a condition where flat ground is not accessible, a sloped work pad should be installed. Details on the sloped work pad can be obtained from SCD's.

3. DMS should be located in areas that provide adequate access for ITS maintenance operations. These locations shall provide a minimum of 250 feet of 12-foot wide shoulder to be utilized for deceleration and acceleration. In addition, all efforts shall be made to locate the cabinet and DMS within 35 feet of maintenance vehicle accessible area.

4. Device locations shall be designed so that maintenance personnel do not have to cross ditches or streams, as these areas fill up with water during parts of the year and present a hindrance to ITS maintenance operations.

5. All DMS require 120/240 VAC power service and typically require up to 90 amps by the manufacturer.

The designer shall utilize Table 1397-5a or 1397-5b to design DMS sites using the appropriate pay items, and including the appropriate standard drawings and Supplemental Specifications on the plan cover sheet. Table 1397-6 provides similar information for Destination DMS (DDMS) installations. The following list outlines additional requirements:

1. The appropriate DMS Type shall be chosen.
   a. For most installations along the freeway the 809E63000, DMS Full-Size Walk-In shall be utilized.
   b. For Queue Warning System installations, the standard installation requires a smaller sign than typically used for freeway DMS. The appropriate sign pay item is 809E63001, DMS Front Access.

2. The appropriate mount type shall be chosen.
   a. Truss Mount is typically chosen when the roadway is more than 3 lanes in the direction of the DMS and the placement of the DMS is needed over the inside lanes. This mount is also used when little to no shoulder is available for the placement of a pedestal mount sign. The truss will need to be sized accordingly for the location.
      i. The related pay item for the catwalk is 630E70051, Catwalk, DMS Truss, As Per Plan and Plan Note 1342-10 (TEM Section 1342-10).
      ii. The DMS Truss pay items are 630E70001, 630E70021, 630E70041 for the various lengths of trusses.
      iii. Truss foundation pay items are 630E70070, Concrete Barrier Median Overhead Sign Support Foundation, DMS Truss and 630E70080, Overhead Sign Support...
b. Pedestal mounted signs are generally used more often and are usually less expensive and affect traffic less when installation is being performed.
   i. The related pay item for the catwalk is 630E70061, Catwalk, DMS Pedestal, As Per Plan.
   ii. The DMS pedestal pay item is 630E70045, Overhead Sign Support, DMS Pedestal, As Per Plan.
   iii. The pay item for the foundation is 630E84511, Rigid Overhead Sign Support Foundation, As Per Plan. Plans should also include Plan Note 1342-10 (TEM Section 1342-10).

3. The appropriate ITS cabinet type shall be chosen.
   a. The standard installation requires the use of ground-mounted cabinets, utilizing pay item 809E65000, ITS Cabinet – Ground Mounted.
   b. The use of ITS Cabinet – Pole Mounted is not allowed unless directed by OTO.

4. Appropriate grounding and power services shall be designed.
   a. For instances where one power service is providing power to multiple cabinets, item 809E65020, ITS Cabinet – Power Distribution Cabinet shall be utilized. This cabinet houses a load center with separate breakers for each cabinet and is also capable of housing smaller wall mount power transformers.

Also see Plan Note 1342-3 (TEM Section 1342-3).

1303-6 Vehicle Detection or SFRD

For an FMS, the conventional form of vehicle detection is side-fired radar detector (SFRD) with algorithms which manipulate the detector to develop speed, volume and occupancy or density. This data can be used for both the calculation of travel times and incident identification. In many states, the use of fixed-point detection for incident detection has proved to be costly and ineffective. Various types of detectors have been implemented with varying degrees of success. Numerous installations are likely to use other technologies such as video image detection, and acoustic detection for acquiring traffic flow information. The current practice for obtaining travel-time information is through the use of Doppler radar along urban Interstate and Interstate look-alike routes as well as cellular phone GPS data for all other types of routes.

Various technologies are available to provide travel times. The incidents are verified and travel times can be corroborated using CCTV.

The main use of SFRD is for ramp metering. The detectors provide traffic data to both the local ramp meter and central software, and allow for dynamic ramp metering along corridors and localized traffic-responsive ramp metering at spot locations.

When designing a SFRD site, the designer shall take note of the layout of the surrounding area and make sure that the SFRD location has the following attributes:

1. SFRDs are typically located 500 feet or more downstream of the merge point on new ramp meter installations.
2. SFRDs are typically located near existing or proposed ITS cabinets with network communications.
3. SFRDs should be located in areas that provide adequate access for ITS maintenance operations. These locations shall provide a minimum of 250 feet of 12-foot wide shoulder to be utilized for deceleration and acceleration. In addition, all efforts shall be made to locate the cabinet and SFRD within 35 feet of maintenance vehicle accessible area.
4. Device locations shall be designed so that maintenance personnel do not have to cross ditches or streams, as these areas fill up with water during parts of the year and present a hindrance to ITS maintenance operations.

The designer shall use Table 1397-7 to design SFRD sites using the appropriate pay items, and including the appropriate standard drawings and Supplemental Specifications on the plan cover sheet. The following list outlines additional requirements:

1. The appropriate SFRD Type shall be included.
   a. For all installations, pay item 809E68900, Side-Fired Radar Detector shall be included in the plans.

2. The appropriate mount type shall be chosen.
   a. Typically SFRD’s are mounted to steel poles with break-away bases.
   b. The proper pay items are 625E10491, Light Pole, Conventional, Each, As Per Plan and 625E14501, Light Pole Foundation, As Per Plan.

3. The appropriate ITS cabinet type shall be chosen.
   a. The standard installation requires the use of ground-mounted cabinets, utilizing pay item 809E65000, ITS Cabinet – Ground Mounted.
   b. The use of ITS Cabinet – Pole Mounted is not allowed unless directed by OTO.

4. Appropriate grounding and power services shall be designed.
   a. For instances where one power service is providing power to multiple cabinets, item 809E65020, ITS Cabinet – Power Distribution Cabinet shall be utilized. This cabinet houses a load center with separate breakers for each cabinet and is also capable of housing smaller wall-mount power transformers.

Also see Plan Note 1342-4 (TEM Section 1342-4).

1303-7 Highway Advisory Radio (HAR)

Highway Advisory Radio (HAR) is an element to the FMS which, if utilized properly, can provide a great public benefit. The HAR system provides near-real time information on the freeway system during operational hours. When systems are unattended, other valuable traveler information will be broadcast such as construction activities on-going or special events that may impact traffic.

It is essential that the HAR is reliable 24/7 and provides accurate, timely information. Similar to DMS system, when no particular incident or congestion-related information is applicable, the HAR will provide an accurate and timely announcement of that fact. The HAR shall be automated so that when travel times increase a pre-determined amount for a particular section of roadway, the HAR will provide travel-time information for that particular section of roadway only.

When designing an HAR site, the designer shall take note of the layout of the surrounding area and make sure that the HAR location has the following attributes:

1. HAR are typically located at major interchanges and/or in areas that can be identified as separate quadrants of a major urban area.
2. HAR should be located in areas that provide adequate access for ITS maintenance operations. These locations shall provide a minimum of 250 feet of 12-foot wide shoulder to be utilized for deceleration and acceleration. In addition, all efforts shall be made to locate the cabinet and HAR within 35 feet of maintenance vehicle accessible area.
3. Device locations shall be designed so that maintenance personnel do not have to cross ditches or streams, as these areas fill up with water during parts of the year and present a hindrance to ITS maintenance operations.
4. HAR Flashing Beacons are located on major routes around each HAR Transmitter Site. The purpose of a flashing beacon site is to provide the AM frequency for motorists to tune to for
traffic information and to provide a method of alerting motorists of important traffic messages through the use of flashing LED beacons.

The designer shall use Table 1397-8 to design HAR sites using the appropriate pay items, and including the appropriate standard drawings and Supplemental Specifications on the plan cover sheet. The following list outlines additional requirements:

1. The appropriate HAR Type shall be included.
   a. For all HAR installations, pay item 809E64000, Highway Advisory Radio (HAR) Assembly shall be used.
   b. For all HAR Flashing Beacons, Pay item 809E64010, Highway Advisory Radio (HAR) Flashing Beacon System shall be used.

2. The appropriate ITS cabinet type shall be chosen.
   a. The standard installation requires the use of ground-mounted cabinets, utilizing pay item 809E65000, ITS Cabinet – Ground Mounted.
   b. The use of ITS Cabinet – Pole Mounted is not allowed unless directed by OTO.

3. Appropriate grounding and power services shall be designed.
   a. For instances where one power service is providing power to multiple cabinets, Item 809E65020, ITS Cabinet – Power Distribution Cabinet shall be utilized. This cabinet houses a load center with separate breakers for each cabinet and is also capable of housing smaller wall-mount power transformers.

More information on HAR signing is available in Section 206-5. Also see Plan Note 1342-5 (TEM Section 1342-5).

1303-8 Travel Time

Travel times are calculated along segments of Ohio roadways using various sources of speed data. These travel times are then displayed on DMS, HAR, 511, and the OHGO website as a means of communicating to the public the expected travel time to and from select destinations. All travel time calculations are generated by the Office of Traffic Operations (OTO).

1303-9 Road Weather Information System (RWIS)

A Road Weather Information System (RWIS) is comprised of Environmental Sensor Stations (ESS) in the field, a communication system for data transfer, and central systems to collect field data from numerous ESS. These stations measure atmospheric, pavement and/or water level conditions for flood information. Central RWIS hardware and software are used to process observations from ESS to develop forecasts, and display or disseminate road weather information in a format that can be easily interpreted. RWIS data are used by road operators and maintenance staff to support decision making.

There are three types of road weather information: atmospheric data, pavement data and floodwater level data. Atmospheric data include air temperature and humidity, visibility distance, wind speed and direction, precipitation type and rate, cloud cover, tornado or waterspout occurrence, lightning, storm cell location and track, as well as air quality. Pavement data include pavement temperature, pavement freezing point, pavement condition (e.g., wet, icy, flooded), pavement chemical concentration, and subsurface conditions (e.g., soil temperature). Water level data include stream, river and lake levels near roads, as well as tide levels (i.e., hurricane storm surge).

Transportation managers utilize weather warning systems and websites to disseminate road weather information to travelers in order to influence their decisions. This information allows travelers to make choices about travel mode, departure time, route selection, vehicle type and equipment, and driving behavior. In Ohio, RWIS provides information on current conditions and assists with forecasting for snow, ice control and removal, flooding, etc. Information is available at
the OHGO website. RWIS combined with forecasts provides District maintenance staff with the best information for snow and ice control. This information allows Districts to most efficiently allocate resources including snow plows, and salt and brine applications.

1303-10  Ramp Metering

Ramp Metering is another key FMS component (see O MUTCD Chapter 4H). Its basic function can help to greatly reduce traffic congestion in FMS areas and result in more efficient travel. There are several modes of ramp meter operation, including the following:

- Corridor-based Traffic-Responsive (using mainline and ramp traffic flow data from upstream and downstream stations).
- Local Traffic-Responsive (activated by mainline congestion or speeds at the ramp location).
- Pre-timed (Time-of-Day).
- Manual (locally through controller front display).
- Downloadable (from the TMC) ramp timing changes.

Properly timed and operating ramp meters help the mainline to maintain steady flow, resulting in less mainline rear-end crashes, while adding a few less severe crashes on ramps.

Ramp Metering is currently provided in the following metropolitan areas:

- Columbus District 6 currently operational with new installations underway
- Cincinnati District 8 currently operational with new installations underway

Ramp Metering may be provided in the following metropolitan areas as conditions warrant:

- Toledo District 2
- Akron/Canton District 4
- Dayton District 7
- Cleveland District 12

Special design considerations are needed for non-standard ramps or ramps with inadequate storage capacities or acceleration lengths. Nonstandard ramps will be metered on a case-by-case basis, although system-wide metering is the intent. Ramp Design Guidelines which provide law enforcement pads are included in the ODOT L&D Manual. In all cases, it will be necessary to provide surveillance of the ramp meters through CCTV cameras or other means to ensure congestion is not aggravated by the metered condition.

When designing a Ramp Metering site, the designer shall take note of the layout of the surrounding area and make sure that the Ramp Meter location has the following attributes:

1. Ramp Meters are typically located along major corridors located in major metropolitan areas.
2. Ramp Meters should be located in areas that provide adequate access for ITS maintenance operations. These locations shall provide a minimum of 250 feet of 12-foot wide shoulder to be utilized for deceleration and acceleration. In addition, all efforts shall be made to locate the cabinet within 35 feet of a maintenance vehicle accessible area. Ramp meter cabinets should also be located in areas where the ramp meter signal heads are clearly visible to verify the proper operation of the meter at the Stop Line.
3. Device locations shall be designed so that maintenance personnel do not have to cross ditches or streams, as these areas fill up with water during parts of the year and present a hindrance to ITS maintenance operations.

The designer shall use Table 1397-9 to design ramp metering installations using the appropriate pay items, and including the appropriate standard drawings and Supplemental Specifications on the plan cover sheet. The following list outlines additional requirements:
1. The appropriate Ramp Metering items shall be included.
   a. For all new ramp metering, pay item 809E67000, Ramp Metering System.
   b. If training is requested, pay item 809E67050, Ramp Metering Training shall be included.

2. The appropriate ITS cabinet type shall be chosen.
   b. The standard installation requires the use of ground-mounted cabinets, utilizing pay item 809E65000, ITS Cabinet – Ramp Meter.
   c. For instances where one power service is providing power to multiple cabinets, item 809E65020, ITS Cabinet – Power Distribution Cabinet shall be utilized. This cabinet houses a load center with separate breakers for each cabinet and is also capable of housing smaller wall mount power transformers.

Also see Plan Note 1342-6 (TEM Section 1342-6).

1303-11 Traffic Incident Management

Traffic incident management is addressed in Chapter 608.

1303-12 Variable Speed Limits

ORC Section 4511.21(H)(3) allows the Director to establish a Variable Speed Limit that is different from the established speed limit for weather conditions, traffic incidents and congestion that occur on all or portions of I-670, I-275 and I-90 (at the intersection with I-71 and continuing to the Ohio-Pennsylvania border).

Contact ODOT Traffic Operations for additional information.

1303-13 Hard Shoulder Running

Contact ODOT Traffic Operations for information regarding Hard Shoulder Running.
1340 Design Information

1340-1 General

The L&D Manual Volumes 1 and 3 and Chapter 140 provide general background regarding design information for ODOT projects, including the three-stage review process typically used for traffic control plans. Additional design information has been provided in this Chapter, including checklists for Stage 2 and 3 submittals (see Section 1340-2). See Chapter 1303 for design information related to specific types of ITS projects; Plan Notes are addressed in Chapter 1342; Chapter 443 provides a listing of related C&MS Items; and Chapter 1395 provides information about the Traffic Operations Handbook and the Traffic Authorized Product (TAP) List.

For information about traffic signal design requirements, see TEM Part 4. Designers working on signal design projects should also utilize the files and guidance provided in the Signal Design Reference Packet. See Chapter 495 for additional information regarding the reference packet.

1340-2 Stage 1, 2 and 3 Plan Submittals

The following information has been provided here as checklists for Stage 1, 2 and 3 plan submittals.

1. Stage 1 Plan Requirements:
   a. Base plan drawn to scale of 1:40 and it shall include roadway base lines in Traffic Surveillance Section.
   b. Existing ITS infrastructure identified and shown in plans. Existing plan sets can be obtained by either contacting the District Project Manager or by emailing Cen.ITS.Lab@dot.ohio.gov.
   c. Temporary plan for communications infrastructure during construction.
   d. Project overview map (similar to Figure 1398-5), excluding any field devices.

2. Stage 2 Plan Requirements:
   a. Proposed new locations for ITS devices
   b. Proposed location and path of new communication lines. Provide new service addresses if applicable.
   c. Power service locations with coordinated work order and / or service addresses.
   d. Underground conduit and pull boxes.
   e. Legend for symbols used.
   f. Fiber termination drawings, if applicable. See Figures 1398-2, 1398-3, 1398-5 and 1398-5, with proposed field devices, for sample diagrams.
   g. Right-of-Way lines.
   h. Standard Construction Drawings on cover sheet.
   i. Supplemental Specifications on cover sheet.

3. Stage 3 Plan Requirements:
   a. General Notes.
   b. Estimated quantities.
   c. Special details.
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1342 PLAN NOTES

1342-1 General

Typical Plan Notes have been consolidated here for convenience in preparing plans. The number used for the Plan Note will be the same as the Section number. When a Plan Note revises the material or contractor requirements from that which is specified in the C&MS, both the note and the bid item will be “as per plan.” Where there are design instructions pertaining to a specific note, they are listed at the end of the note. These notes may be modified to further define the conditions of a project or maintaining agency.

In keeping with traditional format of Plan Notes, various format changes are used here that are not typical throughout the TEM, e.g., the terms Contractor and Engineer are capitalized.

1342-2 CCTV Installations

The Contractor shall furnish and install this item according to ODOT Supplemental Specification 809, as well as any Standard Construction Drawings noted on the plans.

Designer Note: See Table 1397-4 for additional information.

1342-3 Dynamic Message Sign Installations

The Contractor shall furnish and install this item according to ODOT Supplemental Specification 809, as well as any Standard Construction Drawings noted on the plans.

Designer Note: See Table 1397-5a, 1397-5b or 1397-6 for additional information.

1342-4 Vehicle Detection Installations

The Contractor shall furnish and install this item according to ODOT Supplemental Specification 809, as well as any Standard Construction Drawings noted on the plans.

Designer Note: See Table 1397-7 for additional information.

1342-5 Highway Advisory Radio Installations

The Contractor shall furnish and install this item according to ODOT Supplemental Specification 809, and Traffic Standard Construction Drawings ITS-20.10.

Designer Note: See Table 1397-8 for additional information.

1342-6 Ramp Metering Installations

The Contractor shall furnish and install this item according to ODOT Supplemental Specification 809, as well as any Standard Construction Drawings noted on the plans.

Designer Note: See Table 1397-9 for additional information.

1342-7 Items 625E25740 and 625E25750: Conduit 4" Multi-Cell Schedule 40 & Schedule 80, 725.20

Description

This conduit is intended for the use in underground situations requiring more than one single conduit. This includes the main conduit raceway along the freeway, connection from pull boxes to the road side cabinets and for runs of conduit for multiple purposes, e.g., at ramp
meter installations, for loop lead-in cable, signals cable for ramp meter displays, signal cable for ramp meter signing flashers & illumination and power. The contractor shall plug all unused cells with conduit caps to assure air and water integrity of each individual innerduct.

Materials

The traffic surveillance raceway shall consist of a factory-assembled system of four (4) innerducts assembled within a protective outer duct. The innerducts shall be nominal 1.25 inch inside diameter, Type DB pvc per NEMA TC-8 with a bell insertion depth of 1.75 inches minimum. The outer duct shall be nominal 4 inch (inside diameter), Schedule 40 pvc. Carlon type Schedule 40 and 80 or approved equivalent.

The coupling shall be designed in a manner to permit easy field assembly. The coupling shall be marked or keyed in a manner to ensure the innerducts are properly aligned, any color codes are continued and the adjoining section is inserted to the proper depth in the bell. All keys and/or markings shall be visible after assembly to allow the inspection of each joint for proper assembly before burial. The sealing system shall be designed to assure air integrity of each individual innerduct and water integrity of the entire system.

Where innerduct(s) within a multi-cell duct are to remain empty, one ¼-inch nylon rope shall be installed in each of the open innerducts, the rope will remain to be used for a future cable installation. Also, each innerduct shall be plugged to maintain the air and water integrity. In addition, the outer duct shall be capped to maintain the air and water integrity of the entire system. For multi-cell duct installed in median walls, all ropes and plugs shall be installed prior to any concrete placement.

Installed in trench

Installation will be in 30-inch deep trench, except as noted on the plans.

All joints will be joined according to the manufacturer’s recommendations, in order to provide an air-tight enclosure of the interior ducts and a water-tight enclosure of the outer duct. All multi-cell conduit installed outside of the roadway in trench shall be Schedule 40 unless directed by the ODOT engineer to use Schedule 80 for use in well-traveled vehicular areas.

Installed under roadway

Installation will be at least 30 inches deep jacked or drilled under pavement, except as noted on the plans.

All joints will be joined according to the manufacturer’s recommendations, in order to provide an air-tight enclosure of the interior ducts and a water-tight enclosure of the outer duct. All multi-cell conduit installed under the roadway shall be Schedule 80.

Installed within 6 feet of guardrail

Installation will be at least 30 inches deep trench and encased in concrete.

All joints will be joined according to the manufacturer’s recommendations, in order to provide an air-tight enclosure of the interior ducts and a water-tight enclosure of the outer duct. All multi-cell conduit installed under the roadway shall be Schedule 80.

Method of measurement

The conduit will be measured by the amount of conduit in feet furnished and installed of each type Schedule 40 or 80 measured from center-to-center of pull boxes, foundation, etc., and will include all fittings and appurtenances, joints, bends, grounds and concrete encasement where specified.

The trench will be measured by the number of feet of trench completed as per C&MS 625.21.

Basis of payment

The payment for these items will be made for the accepted liner foot quantities at the contract bid price.
1342-8 Tracer Wire

Tracer wire shall be installed in one of the multi-cell innerducts in all conduit runs. Tracer wire shall be no smaller than #12 AWG wire. The wire shall be HDPE insulated, orange in color, and constructed of copper clad steel. Approximately 10 feet of slack of the tracer wire shall be left inside the adjacent pull boxes connecting the conduit runs. In situations where a Type fiber optic cable marker is to be installed in conjunction with the tracer wire, the tracer wire shall be run through the marker and connected to terminals at the top of the marker.

Payment for all tracer wire shall be included in the bid item for the fiber optic cable pay item.

1342-9 Fiber Optic Cable Marker

Fiber optic cable markers shall be installed as directed by the ODOT engineer and/or at every pull box containing fiber optic cable and shall be one of two types:

TYPE 1 – COTTMARK 511, FRICK FLEXPOST, OR CARSONITE CURV-FLEX MARKER
TYPE 2 – COTT BIGFINK, FRICK TESTPOST, OR RHINODOME TEST STATION

The fiber optic cable markers shall be 6 feet in length and shall be securely placed in the ground at a depth of 2 feet. Care shall be taken during installation not to damage any underground conduit in the vicinity. The Contractor shall use a Type 2 marker when the path of the fiber crosses underneath a roadway and when capable shall place a marker on both sides of the roadway at crossing. The Contractor shall connect tracer wire to terminal at top of Type 2 marker. Type 1 markers shall only be placed on straight fiber runs between pull boxes in the shoulder, and the Contractor shall be limited to the use of Type 1 markers so that a Type 2 marker shall be placed between any two Type 1 markers. Type 1 markers shall not be placed in succession down a fiber path. The markers shall be orange in color and shall have the following information located on the upper portion of the marker in a readable format:

WARNING
CONTACT OUPS 48 HRS BEFORE DIGGING
(NAME OF OWNING AGENCY) FIBER OPTIC CABLE
(OWNING AGENCY CONTACT #)

Payment for all fiber optic cable markers shall be included in the bid item for the fiber optic cable pay item.

1342-10 DMS & DDMS Support Structures

The Contractor shall furnish shop drawings to the Project Engineer for approval. The drawings shall be stamped by a Professional Engineer from the manufacturer. The item shall not be released for construction until approved by the Office of Traffic Operations.

Designer Note: See Table 1397-5 and Table 1397-6 for additional information.

1342-11 Item 625E29931 Median Junction Box, As Per Plan

The Contractor shall supply the median pull box that meets the following specifications:

- Shall be of type polymer-concrete
- Size: 17 inches (height) x 30 inches (length)
- Minimum wall thickness: 0.5 inch
- Minimum lid thickness: 2 inches
- ANSI tier 22 rating with a minimum design load of 22,000 pounds
- Lid shall be marked “Traffic.”
The median junction box shall be secured in the median barrier wall using dowels. (non-shrink grout may be used when necessary).

1342-12 Utilities

**Designer Note:** Include ODOT, Office of Technical Services, Traffic Monitoring section as a utility owner anytime there is pavement milling or any excavation work within the vicinity of our permanent count stations, also known as ATR's and WIM's. Please utilize Utility Note G102A1; below is our contact info:

Traffic Monitoring Section ODOT, 1980 West Broad Street, Columbus, Ohio 43223

Ed Newmeyer (District 2, 3, 12) 614-204-0914  
Daren Dalton (District 5, 6, 9, 10) 614-204-0291 or 614-275-1382  
Dan Diddle (District 4, 11) 614-560-9541  
Bryan Stanifer (District 1, 7, 8) 614-204-0971  
Sandra Mapel (Field Operations) 614-644-0391

1342-13 Protection of Traffic Monitoring Equipment

Prior to beginning any pavement activities or any excavation activities between __[insert station or log points]__ and __[insert station or log point]__ the contractor, the project engineer, and a representative from the owner will coordinate a time for the owner/maintaining agency to disconnect the equipment. Following the disconnection by the owner, the contractor will be allowed to perform their pavement activities, including pavement removal. The remove loops and sensors become the property of the contractor.

*(Add the following portion for projects that also include excavation activities)*

During the meeting, the owner/maintaining agency will identify equipment locations. Do not disturb pull boxes, controllers, cabinets, poles and conduits. Any damage will be the responsibility of the contraction and repairs must be accepted by the owner.

**Designer Note:** For use on resurfacing, minor rehabilitation, and bridge projects within 300 feet of a permanent traffic count station.

**Projects of special concern** – Those that involve a concrete median installation - either as part of a widening that converts the grass median to concrete or a project that replaces the existing concrete median. We need to include specific details for including a median pullbox, and occasionally conduits to allow us to reinstall loops and detectors following the construction of roadway and median work. In general, we handle reinstallation of our specialized equipment via a separate contract with certified material contractors including warranty clauses. **Sometimes we request certain underground work be included with major pavement rehabs and median changes as part of a pavement project.**

Early project coordination is key – please contact Sandra Mapel (614-644-0291, Sandra.Mapel@dot.ohio.gov) for site specific details and needs.
1343 SPECIFICATIONS

ODOT specifications for the furnishing and installation of Intelligent Transportation System (ITS) equipment are contained in the following C&MS sections, Supplemental Specifications and Supplement. Also, see Chapter 443 for information about specifications related to traffic signal equipment.

631 and 731 Sign Lighting and Electrical Signs

Supplemental Specifications 804 and 904 address Fiber Optic Cable and Components. All construction projects where installation, relocation, and/or splicing of fiber optic cable is involved need to reference ODOT Supplemental Specifications 804 and 904.

Supplemental Specification 809 addresses Intelligent Transportation System (ITS) Devices and Components. All construction projects involving ITS or any item listed in Chapter 1303 needs to reference ODOT Supplemental Specification 809. The 809 Supplemental Specification has a section for each item and describes the work that needs to be performed for each item. The 809 specification also refers the contractors to the Traffic Authorized Product List.

Supplement 1077 covers the prequalification procedure for Dynamic Message Signs.

The C&MS, Supplemental Specifications and Supplements, may be viewed on-line.
1395 REFERENCE RESOURCES

1395-1 General

Various other reference resources that may be useful have been noted in *Chapters 193 and 194*.

1395-2 Traffic Operations Handbook

The Office of Traffic Operations (OTO) has developed a set of material specifications located in the *Traffic Operations Handbook*. The intent of these specifications is to provide a standard set of specifications that are required for equipment and material manufacturers to meet for inclusion on the Traffic Authorized Product (TAP) list.

The specifications in the *Traffic Operations Handbook* are not intended to be used in construction plans and any specifications that are incorporated into construction plans will be deleted by comment during the plan review process. Any specifications that are not currently located in the C&MS or *Supplemental Specifications* will be provided by ODOT during the plan review process.

1395-3 Traffic Authorized Product (TAP) List

The Traffic Authorized Product (TAP) List was developed due to technology changing at a rapid pace and the need to keep the ODOT ITS products up to date. The TAP was developed for the sole use of the contractors and its purpose is to remove any misinterpretation of specifications during the time of construction. References to the TAP should not be included in the plans.
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The following forms are available only on the [Office of Traffic Operations (OTO) website](https://www.oto.gov).

### 1396-1 ITS Form

As noted in [Subsection 1301-3.2, Form 1396-1](#), may be used and modified as necessary for completing the Systems Engineering Analysis.

### 1396-2 ITS Form for Emergency Vehicle Preemption (EVP)

As noted in [Subsection 1301-3.2, Form 1396-2](#), is an abbreviated Minor ITS Form available for use in documenting the SEA for Emergency Vehicle Preemption projects.

### 1396-3 Systems Engineering Review Form (SERF)

As noted in [Subsection 1301-3.1, Form 1396-3](#), may be used for a project to gain programmatic approval of meeting the requirements set forth under [23 CFR 940](#).
1397 TABLES INDEX

1397-1 Exempt, Low-Risk and High-Risk ITS Projects

As noted in Subsection 1301-1.2, Table 1397-1 presents examples of Exempt, Low-Risk or High-Risk ITS projects.

1397-2 ITS User Services

Table 1397-2 presents a list of all the ITS User Services available.

1397-3 Regional ITS Architecture in Ohio

As noted in Subsections 1301-2.2, 1301-2.4, and 1301-2.5, Table 1397-3 presents a list of the locations with MPO’s in Ohio, and the MPO websites.

1397-4 Closed Circuit Television (CCTV) Installations

As noted in Section 1303-3, Table 1397-4 provides a matrix outlining the process and references needed in designing CCTV pole installations.

1397-5 Dynamic Message Sign (DMS) Installations

As noted in Section 1303-5, Table 1397-5 provides a matrix of information needed in designing DMS installations.

1397-6 Destination Dynamic Message Sign (DDMS) Installations

As noted in Section 1303-5, Table 1397-6 provides a matrix of information needed in designing DDMS installations.

1397-7 Vehicle Detection Installations

As noted in Section 1303-6, Table 1397-7 provides a matrix of information needed in designing vehicle detection installations.

1397-8 Highway Advisory Radio (HAR) Installations

As noted in Section 1303-7, Table 1397-8 provides a matrix of information needed in designing HAR installations.

1397-9 Ramp Metering Installations

As noted in Section 1303-10 Table 1397-9 provides a matrix of information needed in designing ramp metering installations.
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<table>
<thead>
<tr>
<th>Exempt</th>
<th>Low-Risk</th>
<th>High-Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Changes and/or upgrades to an existing traffic signal system, including signal timing revisions, additional phases (vehicle or pedestrian) or detector installation.</td>
<td>• Closed loop arterial traffic signal system.</td>
<td>• New freeway management systems (FMS).</td>
</tr>
<tr>
<td>• Routine maintenance and operation of an existing ITS system.</td>
<td>• Centrally controlled arterial traffic signal system.</td>
<td>• Traffic signal systems that requires integration with other systems, e.g. FMS or RWIS.</td>
</tr>
<tr>
<td>• Expansion of an existing traffic signal, ITS or freeway management system (FMS) that does not change or add to the original needs and requirements of the system. This type of project does not change any existing hardware, software or interfaces. It simply adds equipment (DMS, DDMS, HAR, CCTV, RWIS, etc.), software, locations or intersections to an existing system. The new equipment and software must be compatible with the existing.</td>
<td>• Highway Rail/Traffic Signal pre-emption.</td>
<td>• Ramp meter systems that require integration with adjacent traffic signal system(s).</td>
</tr>
<tr>
<td>• Installation of an isolated traffic signal. This is a single traffic signal, not connected to any type of external signal control, nor likely to be connected in the future due to its isolation.</td>
<td>• Traffic signal system with Emergency Vehicle Pre-emption.</td>
<td>• Regional traffic signal system (as opposed to an arterial traffic signal system) that as the potential to affect geographic areas outside of the maintaining agency.</td>
</tr>
<tr>
<td>• Installation of traffic signals which are part of a Time-Based Coordinated system.</td>
<td>• Traffic signal system with Transit Priority.</td>
<td>• Regional transit systems.</td>
</tr>
<tr>
<td>• Installation of traffic signals which are part of a hardwired or wireless interconnected system that is locally controlled, i.e. where the timing patterns are controlled by the local controller and not by centrally controlled software.</td>
<td>• Ramp Meter system.</td>
<td>• Any Low-Risk project that provides additional functionality than what is covered in the approved Functional Requirements document for that project category.</td>
</tr>
<tr>
<td>• Installation of cameras that are not functionally integrated into other types of systems; for example, cameras solely for the purpose of traffic data collection or surveillance cameras.</td>
<td>• Adaptive Traffic Signal Control system.</td>
<td>• Any project that requires new or unproven hardware, software or interfaces.</td>
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<td>• Any project for which functional requirements and operations &amp; management procedures have not been documented.</td>
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<td>• Any project not considered Exempt or Low-Risk under the Programmatic Agreement.</td>
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</table>
Table 1397-2. ITS User Services

To find detailed information relating to each of the User Services below, visit http://www.iteris.com/itsarch/ and select “User Services” from the navigation bar at the top of the screen.

<table>
<thead>
<tr>
<th>Travel and Traffic Management</th>
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<tbody>
<tr>
<td>1.1 Pre-trip Travel Information</td>
</tr>
<tr>
<td>1.2 En-route Driver Information</td>
</tr>
<tr>
<td>1.3 Route Guidance</td>
</tr>
<tr>
<td>1.4 Ride Matching And Reservation</td>
</tr>
<tr>
<td>1.5 Traveler Services Information</td>
</tr>
<tr>
<td>1.6 Traffic Control</td>
</tr>
<tr>
<td>1.7 Incident Management</td>
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<tr>
<td>1.8 Travel Demand Management</td>
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<tr>
<td>1.9 Emissions Testing And Mitigation</td>
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<tr>
<td>1.10 Highway Rail Intersection</td>
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<table>
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<th>Public Transportation Management</th>
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<tr>
<td>2.1 Public Transportation Management</td>
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<tr>
<td>2.2 En-route Transit Information</td>
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<tr>
<td>2.3 Personalized Public Transit</td>
</tr>
<tr>
<td>2.4 Public Travel Security</td>
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<thead>
<tr>
<th>Electronic Payment</th>
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<td>3.1 Electronic Payment Services</td>
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<th>Commercial Vehicle Operations</th>
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<tbody>
<tr>
<td>4.1 Commercial Vehicle Electronic Clearance</td>
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<tr>
<td>4.2 Automated Roadside Safety Inspection</td>
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<tr>
<td>4.3 On-board Safety And Security Monitoring</td>
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<tr>
<td>4.4 Commercial Vehicle Administrative Processes</td>
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<tr>
<td>4.5 Hazardous Material Security And Incident Response</td>
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<tr>
<td>4.6 Freight Mobility</td>
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<tr>
<th>Emergency Management</th>
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<tr>
<td>5.1 Emergency Notification And Personal Security</td>
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<td>5.2 Emergency Vehicle Management</td>
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<tr>
<td>5.3 Disaster Response And Evacuation</td>
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Table 1397-2. ITS User Services (Continued)

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<th>Advanced Vehicle Safety Systems</th>
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<td>6.1 Longitudinal Collision Avoidance</td>
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<td>6.2 Lateral Collision Avoidance</td>
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<tr>
<td>6.3 Intersection Collision Avoidance</td>
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<tr>
<td>6.4 Vision Enhancement For Crash Avoidance</td>
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<tr>
<td>6.5 Safety Readiness</td>
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<tr>
<td>6.6 Pre-crash Restraint Deployment</td>
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<td>6.7 Automated Vehicle Operation</td>
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<th>Maintenance and Construction Management</th>
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<tr>
<td>8.1 Maintenance And Construction Operations</td>
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Table 1397-3. Regional ITS Architecture in Ohio  
(Also see TEM Section 1301-2.)

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<tr>
<th>Region</th>
<th>Regional ITS Architecture</th>
<th>MPO: AMATS (Akron Metropolitan Area Transportation Study)</th>
<th>MPO Website:</th>
<th>MPO: SCATS (Stark County Area Transportation Study)</th>
<th>MPO Website:</th>
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<td>Akron/Canton</td>
<td><a href="http://www.consystec.com/ohio/akron/akronintro.htm">akronintro.htm</a></td>
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<td>MPO Website: <a href="http://www.ci.akron.oh.us/AMATS">AMATS</a></td>
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<td>MPO: SCATS (Stark County Area Transportation Study)</td>
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<td>MPO Website: <a href="http://www.co.stark.oh.us/internet/HOME.DisplayPage?v_page=rpc">SCATS</a></td>
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<td>Cincinnati/Northern Kentucky</td>
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<td>Cleveland</td>
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<td>MPO Website: <a href="http://www.noaca.org">NOACA</a></td>
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<td>Regional ITS Architecture: <a href="http://www.morpc.org/transportation/highway/Architecture.asp">Architecture.asp</a></td>
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<td>MPO Website: <a href="http://www.morpc.org">MORPC</a></td>
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<td>MPO: MVRPC (Miami Valley Regional Planning Commission)</td>
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<td>MPO Website: <a href="http://www.tmacog.org">TMACOG</a></td>
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Table 1397-4. CCTV Installations
(Also see TEM Section 1303-3.)

<table>
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<tr>
<th>Task</th>
<th>Prior Approval Needed</th>
<th>Item Description</th>
<th>Related Supplemental Specification</th>
<th>Item Master</th>
<th>Traffic SCD No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Choose CCTV Camera</td>
<td></td>
<td>CCTV IP-Camera System, Dome-Type</td>
<td>809.05.A</td>
<td>809E60000</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>CCTV IP-Camera System, Type HD, Wall/Tunnel</td>
<td>809.05.B</td>
<td>809E60010</td>
<td></td>
</tr>
</tbody>
</table>

If dome type camera is to be mounted on pole, choose pole height.

| Choose Pole Height            | *                     | CCTV Concrete Pole with Lowering Unit, 50 FT           | 809                                  | 809E61010   | **ITS-12.10**   |
|                               |                       | CCTV Concrete Pole with Lowering Unit, 70 FT           | 809.06.A                            | 809E61000   | **ITS-12.10**   |

| Choose Cabinet Type           | *                     | *Pole Mount                                            | 809.09.B                            | 809E65010   | **ITS-11.10**   |
|                               |                       | Ground Mount                                           | 809.09.A                            | 809E65000   | **ITS-10.10**   |

| Choose Work Pad               |                       | Controller Work Pad, As Per Plan                       | 633E67200                           |             |                 |

| Choose Grounding              |                       | Ground Rod, As Per Plan                                | 625E32001                           |             |                 |

| Choose Power Service          |                       | Underground                                            | 809                                  | 625E34000   | **ITS-15.10**   |
|                               |                       | Aerial                                                 | 809                                  | 625E34000   | **ITS-15.11**   |

| Use if directed by ODOT       |                       | ITS Cabinet-Power Distribution Cabinet (PDC)          | 809E65020                           |             |                 |

* Approval must be obtained from Office of Traffic Operations (OTO)
Table 1397-5a. Full-Size Walk-In Dynamic Message Sign (DMS) Installations  
(Also see TEM Section 1303-5.)

<table>
<thead>
<tr>
<th>Task</th>
<th>Prior Approval Needed</th>
<th>Item Description</th>
<th>Related Supplemental Specification</th>
<th>Item Master</th>
<th>Traffic SCD No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Choose DMS Type</td>
<td></td>
<td>DMS- Full-Size Walk-In</td>
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<td>ITS-30.11</td>
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<td>Ground Mount</td>
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<tr>
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<td>Controller Work Pad, As Per Plan</td>
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* Approval must be obtained from Office of Traffic Operations (OTO)
Table 1397-5b. Front Access Dynamic Message Sign (DMS) Installations
(Also see TEM Section 1303-5.)

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<th>Task</th>
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<th>Traffic SCD No.</th>
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<td>TC-41.10</td>
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<tr>
<td>Choose Beam Connection</td>
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<td>Breakaway Structural Beam Connection</td>
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<td></td>
<td>TC-41.10</td>
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<tr>
<td>Choose Foundation</td>
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<td>630E84500</td>
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<td>TC-41.10</td>
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<tr>
<td>Choose Cabinet Type</td>
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<td></td>
<td>Ground Mount</td>
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<td>809E65000</td>
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</tr>
<tr>
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<td>Controller Work Pad, As Per Plan</td>
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<td>Contact OTO</td>
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<tr>
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<td>ITS-50.10</td>
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<td>Underground</td>
<td>809.02</td>
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<td>ITS-15.10</td>
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<td>ITS-15.11</td>
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* Approval must be obtained from Office of Traffic Operations (OTO)
Table 1397-6. Destination Dynamic Message Sign (DDMS) Installations
(Also see TEM Section 1303-5.)

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<th>Related Supplemental Specification</th>
<th>Item Master</th>
<th>Traffic SCD No.</th>
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<td>Choose DDMS Type</td>
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<td>DDMS, Freeway-Three-Line</td>
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<td>DDMS, Arterial-Two-Line</td>
<td>809E63040</td>
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<td>DDMS Arterial-Three-Line</td>
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<td>Define Sign Size</td>
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<td>Sign, Ground Mounted Extrusheet, As Per Plan</td>
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<tr>
<td>Define Sign Mounting</td>
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<td>Sign Erected, Extrusheet, As Per Plan</td>
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<tr>
<td>Choose Beam</td>
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<td>Ground Mounted Structural Beam Support, W-??x??</td>
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<td>TC-41.10</td>
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<tr>
<td>Choose Beam Connection</td>
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<td>Breakaway Structural Beam Connection</td>
<td>630E09000</td>
<td>TC-41.10</td>
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<tr>
<td>Choose Foundation</td>
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<td>Ground Mounted Structural Beam Support Foundation</td>
<td>630E84500</td>
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<tr>
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<td>Controller Work Pad, As Per Plan</td>
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<td>Contact OTO</td>
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<tr>
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<td>*Pole Mount</td>
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<td>ITS-50.10</td>
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<tr>
<td>Choose Power Service</td>
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<td>Underground</td>
<td>809.02</td>
<td>625E34000</td>
<td>ITS-15.10</td>
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<tr>
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<td></td>
<td>Aerial</td>
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<td>625E34000</td>
<td>ITS-15.11</td>
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<tr>
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<td>ITS Cabinet-Power Distribution Cabinet (PDC)</td>
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</table>

* Approval must be obtained from Office of Traffic Operations (OTO)
Table 1397-7. Vehicle Detection (SFRD) Installations
(Also see TEM Section 1303-6.)

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<th>Tasks</th>
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<td>Side-Fired Radar Detector</td>
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<td>Choose Foundation</td>
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<td>Light Pole Foundation, As Per Plan</td>
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<td></td>
<td>Ground Mount</td>
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<td>809E65000</td>
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<td>Choose Power Service</td>
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<td>Aerial</td>
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<td>ITS-15.11</td>
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<tr>
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* Approval must be obtained from Office of Traffic Operations (OTO)
Table 1397-8. Highway Advisory Radio (HAR) Installations
(Also see TEM Section 1303-7.)

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<td>HAR Flashing Beacon System</td>
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<td>Controller Work Pad, As Per Plan</td>
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<td>633E67200</td>
<td>Contact OTO</td>
</tr>
<tr>
<td>Define Sign Size</td>
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<td>Sign, Ground Mounted Extrusheet, As Per Plan</td>
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<td>630E80201</td>
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</tr>
<tr>
<td>Define Sign Mounting</td>
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<td>Sign Erected, Extrusheet, As Per Plan</td>
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<td>Choose Beam</td>
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<td>Ground Mount</td>
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<td>809E65000</td>
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<tr>
<td>Choose Grounding</td>
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<td>Ground Rod, As Per Plan</td>
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<td>625E32001</td>
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<tr>
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<td>Underground</td>
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* Approval must be obtained from Office of Traffic Operations (OTO)
Table 1397-9. Ramp Metering Installations
(Also see TEM Section 1303-10.)

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<td>Choose Training</td>
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<td>Ramp Metering Training</td>
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<td>Ground Rod, As Per Plan</td>
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<tr>
<td>Choose Power Service</td>
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<td>Underground</td>
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<td>625E34000</td>
<td>ITS-15.10</td>
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</table>

* Approval must be obtained from Office of Traffic Operations (OTO)
1398 FIGURES INDEX

1398-1 Project Development Process (PDP)

As noted in Section 1301-3.1, Figure 1398-1 is a graphical representation of the Project Development Process (PDP).

1398-2 Fiber Optics Termination Diagram (Node Cabinet Assembly)

As noted in Section 1303-4, Figure 1398-2 is a sample representation of what shall be included in plan sets for all fiber optic design on ODOT projects dealing with Intelligent Transportation Systems (ITS) or Signal Systems.

1398-3 Fiber Optics Termination Diagram (Underground Splice Enclosure)

As noted in Section 1303-4, Figure 1398-3 is a sample representation of what shall be included in plan sets for all fiber optic design on ODOT projects dealing with Intelligent Transportation Systems (ITS) or Signal Systems.

1398-4 Fiber Optics Termination Diagram (Fiber Backbone Splice Chart)

As noted in Section 1303-4, Figure 1398-4 is a sample representation of what shall be included in plan sets for all fiber optic design on ODOT projects dealing with Intelligent Transportation Systems (ITS) or Signal Systems.

1398-5 ITS Device Communication Diagram

As noted in Section 1303-4, Figure 1398-5 is a sample representation of what shall be included in plan sets for all fiber optic design on ODOT projects dealing with Intelligent Transportation Systems (ITS) or Signal Systems.
Figure 1398-1. Project Development Process (PDP)
(Also see TEM Section 1301-3.1.)

ODOT’s Project Development Process (PDP) – Phased Approach

PDP Project Paths

Path 1 projects are defined as "simple" transportation improvements generated by traditional maintenance and preventative maintenance. They involve minor structure and roadway improvements work with no ROW/utility impacts. These are typically CE Level 1 documents.

Path 2 projects also involve minor structure and roadway work. Some examples may include culvert and bridge replacement/reconstruction, reconstructing a temporary roadway, or resurfacing and addition of turn lanes/shoulders. These projects include minor ROW acquisition and are typically CE Level 1 documents.

Path 3 projects involve a higher level of complexity than projects in Path 2 or 1. They typically include minor realignments, roadway and structure work including, intersection improvement, and minor ROW acquisition. These are typically CE Level 1 documents.

Path 4 projects involve complex roadway and structure work that may add capacity. They typically have multiple alternatives. Projects may include highway widening, new alignments in suburban or rural settings, interchange changes, or multiple intersections. These projects are typically CE Level 2 documents.

Path 5 projects have the highest level of complexity and typically add capacity. They involve projects that may be new capacity-adding projects. These projects are typically CE Level 3 or higher documents. These projects are typically CE Level 3 or higher documents.

Revised July 17, 2015
October 23, 2002 13-49
Figure 1398-2. Fiber Optics Termination Diagram
(Node Cabinet Assembly)
(Also see TEM Section 1303-4.)
Figure 1398-3. Fiber Optics Termination Diagram (Underground Splice Enclosure) (Also see TEM Section 1303-4.)
Figure 1398-4. Fiber Optics Termination Diagram
(Fiber Backbone Splice Chart)
(Also see TEM Section 1303-4.)
Figure 1398-5. ITS Device Communication Diagram
(Courtesy of HNTB, Ohio)
(Also see TEM Section 1303-4.)
Figure 1398-5. ITS Device Communication Diagram (continued)