Welcome

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WWW.PCB.ITS.DOT.GOV-STANDARDSTRAINING
A321b
Specifying Requirements for Traffic Management Systems Based on TMDD v3.0 Standard
Target Audience

- Engineering and planning staff
- Emergency management and public safety
- Traffic management center (TMC) and operations staff
- System developers
- Public and private sectors
- Coders
Instructor

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Curriculum Path (SEP)

- **I101** Using ITS Standards: An Overview
- **A101** Introduction to Acquiring Standards-based ITS Systems
- **A102** Introduction to User Needs Identification
- **A201** Details on Acquiring Standards-based ITS Systems
- **Understanding User Needs**
  - A311a NTCIP 1203
  - A313a NTCIP 1204 v03
  - A321a TMDD v3.0
- **A321b** Specifying Requirements for Traffic Management Systems Based on TMDD v3 Standard
Curriculum Path (Non-SEP)

I101 Using ITS Standards: An Overview

A101 Introduction to Acquiring Standards-based ITS Systems

A102 Introduction to User Needs Identification

A201 Details on Acquiring Standards-based ITS Systems

A202 Identifying and Writing User Needs When ITS Standards Do Not Have SEP Content

A103 Introduction to ITS Standards Requirements Development

A203 Writing Requirements When ITS Standards Do Not Have SEP Content

*A3xxa Understanding User Needs Based on NTCIP 12xx vxx Standard

*A3xxb Specifying Requirements Based on NTCIP 12xx vxx Standard

* Expected in year 2 training modules
Recommended Prerequisites

- I101  Using ITS Standards: An Overview
- A101  Introduction to Acquiring Standards-based ITS Systems
- A102  Introduction to User Needs Identification
- A201  Details on Acquiring Standards-based ITS Systems
- A321a Understanding User Needs for Traffic Management Systems Based on TMDD v3.0 Standard
Recommended Prerequisites (cont.)

Basic knowledge of the following areas is helpful:

- Intelligent Transportation Systems (ITS)
- Managing ITS deployment projects
- Government procurement processes
- Benefits of standards
- Systems Engineering Process (SEP)
- Traffic Management Centers (TMCs)
Learning Objectives

1. Discuss continuity with the TMDD user needs module Module A321a:
   - Structure of the standard
   - Role of NRTM

2. Understanding requirements

3. How to use Requirements Traceability Matrix (RTM) to specify standardized design concepts
Learning Objectives (cont.)

4. Discuss the use of requirements from the NRTM and RTM in the specification
5. How to extend TMDD v3.0 standard
6. Introduce the TMDD v3.0 Guide as a resource
Review of Module A321a

Key Areas

1. TMDD v3.0 standard supports system interface development for Center-to-Center Communications.

2. Structure provides definitions of user needs, requirements, and data concepts for specification.

3. Covers operational needs in 8 categories.

4. Teaches how to develop Needs to Requirements Traceability Matrix (NRTM) for a project.
What is a System Interface?

“a system interface is a shared boundary across which information is passed”
System Interface (SI) Implementation

SI Uses:
- Manage assets and other entities
- Manage information
- Monitor status
- Control devices
**System Interface Components**

**Description** of what the interface must do to support operations (address problem-situation)

**Written** in “shall” language, specific requirements to satisfy user needs (functionality)

Only standard-supplied design data concepts are used to fulfill requirements (each requirement is “designed”)

```
Learning Objective #1
```

```
User Needs

Requirements

Design Concepts
```

```
Description of what the interface must do to support operations (address problem-situation)

Written in “shall” language, specific requirements to satisfy user needs (functionality)

Only standard-supplied design data concepts are used to fulfill requirements (each requirement is “designed”)
```
User Needs and Requirements Supported

1. Connection Management
2. Support Authentication and Restrictions
3. Provide Information on Organization
4. Event Information Sharing
5. Provide Roadway Network
6. Provide Devices Inventory, Status, and Control
7. Share Data for Archiving
8. Accept Null Values

Defined in TMDD v3 Volume I
TMDD v3.0 Standardized Definitions

Volume I

126 User Needs

134 Requirements

NRTM

RTM

Volume II

600 Data Concepts

124 Dialogs

85 Messages

187 Data Frames

207 Data Elements

Interface Design
Preparing NRTM for the Project

Select User Needs from Section 2, Volume I based on the project’s operational needs

Example: Need to verify DMS status control

<table>
<thead>
<tr>
<th>UN ID</th>
<th>User Need</th>
<th>UN Selected</th>
<th>Req. ID</th>
<th>Req.</th>
<th>Conformance</th>
<th>Support</th>
<th>Other Req.</th>
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<tbody>
<tr>
<td>2.3.6.4.5</td>
<td>YES</td>
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<td>3.3.6.1.4.2</td>
<td></td>
<td>Mandatory</td>
<td>YES</td>
<td></td>
</tr>
</tbody>
</table>

Contents of Device Control Request Response

Allocate requirements as per the NRTM on page 174, Volume I
Achieving “Off-the-Shelf” Interoperability

Emphasis

- Specification **shall** only use:
  - Design solution specified in the standard for each user need and their allocated requirements
  - Proprietary solutions are not allowed
Summary of Learning Objective #1

- TMDD v3.0 standard supports development of a system interface for operational needs
- Centers implement system interface to achieve interoperability
Summary of LO #1 (cont.)

Module A321a teaches how to prepare project NRTM

Module A321b teaches how to prepare project RTM
Life Cycle Process

Where do Requirements/Data Concepts fit?

Requirements
Data Concepts
Understanding Requirements

- To satisfy some aspects of a user need, a requirement describes in detail:
  - What information is and how it is exchanged with an external center
  - What functionality is supported across the system interface
Example: Structure of a Requirement

Req. ID 3.3.6.1.5.1 (Volume I)

Req. Title Send DMS Control Response Upon Request

Description An owner center shall respond to an authorized external center requesting remote control of a DMS via a one-time control request with a message containing the status of the request.
Classification of Requirements

- **Mandatory (M)**: standard requirement for conformance:
  - e.g. 3.3.6.1.5.1 Send DMS Control Response Upon Request

- **Optional (O)**: user requirement for compliance

Both must be included in the project specification
Example: How Requirements are Allocated

10 requirements are allocated to one user need

<table>
<thead>
<tr>
<th>UN ID</th>
<th>User Need</th>
<th>UN Selected</th>
<th>Req. ID</th>
<th>Requirement</th>
<th>Conformance</th>
<th>Support</th>
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<td>3.3.6.5.4</td>
<td></td>
<td></td>
<td>Yes</td>
<td></td>
</tr>
</tbody>
</table>

**Note:** Project NRTM references Support column with YES
Example (cont.)

Requirements shown in column 5

3.3.6.1.4.2 Contents of Device Control Request Response (M)
An owner center shall send a device control request response to an external center.

3.3.6.1.4.2.1 Required Device Control Response Content (M)
3.3.6.1.4.2.2.1 Operator Identifier (O)
3.3.6.1.4.2.2.2 Operator Lock Identifier (O)
3.3.6.1.4.2.2.3 Owner Center Organization (O)
3.3.6.1.4.2.2.4 Operator Last Revised Date and Time (O)
3.3.6.1.5.1 Send Device Control Status Upon Request (M)
3.3.6.1.5.2 Contents of the Device Control Status Request (M)
3.3.6.1.5.3 Contents of Device Control Status Response (M)
3.3.6.5.4 Request DMS Control Status (M)
How is a Requirement Implemented?

Each requirement is fulfilled with a single design using data concepts from the RTM.

1. Standard provides a separate data concept for each requirement.
2. Project uses only data concept linked to the selected requirement.
Understanding Data Concepts (DCs)

Types of Data Concepts

1. **Dialogs**
   - sequence of message exchanges

2. **Messages**
   - information content being exchanged

3. **Data Frames**
   - grouping of data elements

4. **Data Elements**
   - basic units of data

Learning Objective #2

- 600 Data Concepts
- 124 Dialogs
- 85 Messages
- 187 Data Frames
- 207 Data Elements
ACTIVITY
What determines requirements for a system interface project?

Type your response in the chat room
Discuss

Do we select all 134 requirements? No

Do we select only mandatory ones? No

Do we select based on the project’s needs? Yes
## Example: Share Control of Devices

### 2.3.6.2 Need to Verify a DMS Control Status

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<tr>
<th>Req. ID</th>
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<tr>
<td>3.3.6.1.4.2.2.4</td>
<td>Operator Last Revised Date and Time</td>
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<tr>
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<td>3.3.6.1.5.2</td>
<td>Contents of the Device Control Status Request</td>
<td>M</td>
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<tr>
<td>3.3.6.1.5.3</td>
<td>Contents of Device Control Status Response</td>
<td>M</td>
</tr>
<tr>
<td>3.3.6.5.4</td>
<td>Request DMS Control Status</td>
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</tr>
</tbody>
</table>

**M-Mandatory  **  ** O-Optional**
Summary of Learning Objective #2

- Detailed requirements are listed in Section 3 of Volume I
- Mandatory requirements must be selected YES
- Each requirement is fulfilled with a single design using DCs in RTM
Requirements Traceability Matrix (RTM)

- Each requirement is traced to a single data concept type with Requirement ID
- RTM reduces design work
- Helps to achieve interoperability

<table>
<thead>
<tr>
<th>Requirement ID</th>
<th>Requirement Title</th>
<th>Dialog</th>
<th>Data Concept Name</th>
<th>DC Type</th>
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<tbody>
<tr>
<td></td>
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Volume I
Section 3

Volume II
Section 3
## Table 1: Requirements Testability Matrix (RTM)

<table>
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<th>Standards Clause</th>
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<td>dlCenterActiveVerificationUpdate</td>
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<td>3.3.17.3</td>
</tr>
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<td>3.3.1.2</td>
<td>Support Request-Response</td>
<td>2.4.1</td>
<td>Generic Request-Response Dialog</td>
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<td>3.3.1.2</td>
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<td>ITCIP 2304 and 2306 Message Patterns</td>
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<td>ITCIP 2304 and 2306 Message Patterns</td>
<td>dialog</td>
<td>2.3.4</td>
</tr>
</tbody>
</table>
Data Concepts Representation

Data Encoding Formats

- Abstract Syntax Notation 1 (ASN.1)
  Based on ISO 14817
- XML (extensive Markup Language)
  Based on SAE J2630 Schema

Note:
- Only one format is used in the project RTM
- For interoperability the same format must be used
Example
Data Element in ASN.1 Representation

**DEFINITION:** Current volume for the link expressed in vehicles per hour.

```
link-volume ITS-DATA-ELEMENT ::= {
  DESCRIPTIVE-NAME "Link.Link-volume:rt"
  ASN-NAME "Link-volume"
  ASN-OBJECT-IDENTIFIER { tmddDataElements 181 }
  DEFINITION "Current volume for the link expressed in vehicles per hour."
  DESCRIPTIVE-NAME-CONTEXT{"Manage Traffic"}
  DATA-CONCEPT-TYPE data-element
  STANDARD "TMDD"
  DATA-TYPE " Link-volume ::= INTEGER (1..100000)"
  "
  FORMAT "ASN.1 encoding"
  UNIT-OF-MEASURE "vehicles per hour"
  VALID-VALUE-RULE "see the ASN.1 DATA-TYPE"
}
```


Example Data Element in XML Representation

DEFINITION: Current volume for the link expressed in vehicles per hour.

```xml
<xs:simpleType name="Link-volume">
    <xs:restriction base="xs:unsignedInt">
        <xs:minInclusive value="1"/>
        <xs:maxInclusive value="100000"/>
    </xs:restriction>
</xs:simpleType>
```
Forward/Backward Traceability with RTM

Every requirement is traced in both directions
Beneficiaries of RTM

- The specification writer
  - Using RTM, details in the project specification what data concepts are to be implemented
- The user
  - Uses RTM as a checklist for the desired interoperability with others
  - Uses RTM as a checklist to reduce risk of failure to conform to the standard and comply with the specification
- The system integrator
- The supplier
  - Through RTM, gains details on the data concepts to be included in the implementation
ACTIVITY
What Are the Key Functions of a Project RTM?

Type your response in the chat room
Summarize RTM Functions

- Project RTM ties the requirements to data concepts and provides a reference to verify that all requirements are contained in the System Interface specification.
Summarize Conditions for Interoperability

Type your response in the chat room
Summary of Conditions for C2C Interoperability

1. Use project **NRTM** to choose the same set of user needs and associated requirements.
2. Use project **RTM** to use the standardized design concepts (solutions).
3. Use a common communication **protocol**.

Concerned centers must adhere to these conditions.
From Requirements to Data Concepts Using RTM

**First**, elect **requirements** that will satisfy project-selected user needs.  
(Using NRTM on pages 174-295, Volume I)

**Next**: use the **specified data concepts** for fulfilling elected requirements.  
(Using RTM on pages 580-635, Volume II)

Supplement pages 12-16 provides details
### Data Concepts Organization:
**Dialog - Message - Data Frame - Data Element**

**Example of CCTV Requirements Traced to DCs**

<table>
<thead>
<tr>
<th>Requirement ID</th>
<th>Requirement Title</th>
<th>Dialog Type</th>
<th>DC Type</th>
<th>Standards Clause</th>
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</table>
Generic Dialogs

Dialogs Describe a Sequence of Messages

- Types Dialogs:
  - 2.4.1 Request-Response Dialog
  - 2.4.2 Subscription Dialog
  - 2.4.3 Publication Dialog
Generic Dialog 2.4.1
Request-Response

- EC initiates the request to send information or a control message
- OC responds with a message
- Upon error OC returns an error message

M-Mandatory
Generic Dialog 2.4.2 Subscription

- EC initiates the subscription message
- Message is accepted by the OC
- Mandatory for generation of information updates receipt.
- Upon error, the OC shall return an error message.
Generic Dialog 2.4.3
Publication

- Upon acceptance of a subscription dialog, an OC shall provide information updates to an EC
- Upon error, the OC shall return an error message.

(publication message is same as a response)
Illustration of 2.4.1 Dialog

Display a New Message on a DMS

dIDMSControlRequest

deviceControlResponseMsg

messages

Major Accident
15 MI NB
ALT I-10 WB
Example of a Partially Populated RTM

Display a Message on a Remote DMS

dIDMSControlRequest

<table>
<thead>
<tr>
<th>Requirement ID</th>
<th>Requirement Title</th>
<th>Dialog</th>
<th>Data Concept Name</th>
<th>Data Concept Type</th>
<th>Standard Clause</th>
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<tr>
<td>3.3.6.1.4.1</td>
<td>Contents of Device Control Request Header</td>
<td>DeviceControlRequestHeader</td>
<td>data-frame</td>
<td>3.3.5.2</td>
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<td>3.3.6.1.4.1.1</td>
<td>Required Device Control Request Header Content</td>
<td>OrganizationInformation</td>
<td>data-frame</td>
<td>3.3.17.3</td>
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<td>2.4.1</td>
<td>dIDMSControlRequest</td>
<td>dialog</td>
<td>3.1.6.1</td>
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<tr>
<td>3.3.6.5.3.2</td>
<td>Contents of DMS Control Request</td>
<td>dMSControlRequestMsg</td>
<td>message</td>
<td>3.2.6.1</td>
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<td>DeviceControlRequestHeader</td>
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<td>3.3.5.2</td>
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<td>3.3.6.5.3.2.2.1</td>
<td>Beacon Control</td>
<td>ntcip:DmsMessageBeacon</td>
<td>data-element</td>
<td>NTCIP 1203:5.6.8.6</td>
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<tr>
<td>3.3.6.5.3.3</td>
<td>Contents of DMS Control Response</td>
<td>deviceControlResponseMsg</td>
<td>message</td>
<td>3.2.5.2</td>
<td></td>
</tr>
</tbody>
</table>

Selection of Data Concepts Using RTM: DMS Example-Exhibit 3.6
(Source: TMDD v3.0 Guide Based on TMDD v3.0 standard)
## Example: Dialog Traces to a Requirement

<table>
<thead>
<tr>
<th>Requirement ID</th>
<th>Requirement Title</th>
<th>Dialog</th>
<th>Data Concept Name</th>
<th>Data Concept Type</th>
<th>Standard Clause</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.3.6.5.3.1</td>
<td>Send DMS Control Response Upon Request</td>
<td>2.4.1</td>
<td>dIDMSControlRequest</td>
<td>dialog</td>
<td>3.1.6.1</td>
</tr>
</tbody>
</table>
Example: Messages Traces to a Dialog

<table>
<thead>
<tr>
<th>Requirement ID</th>
<th>Requirement Title</th>
<th>Dialog</th>
<th>Data Concept Name</th>
<th>Data Concept Type</th>
<th>Standard Clause</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.3.6.5.3.1</td>
<td>Send DMS Control Response Upon Request</td>
<td>2.4.1</td>
<td>didDMSControlRequest</td>
<td>dialog</td>
<td>3.1.6.1</td>
</tr>
</tbody>
</table>

**DEFINITION**

A request-response dialog that allows an EC to request an OC to perform a control action on an OC DMS.

**3.1.6.1 XML REPRESENTATION**

```xml
<operation xmlns="http://schemas.xmlsoap.org/wsdl/
name="DidDMSControlRequest">
<input message="tns:MSG_DMSControlRequest"/>
<output message="tns:MSG_DeviceControlResponse"/> <fault
name="errorReport" message="tns:MSG_ErrorReport"/>
</operation>
```
Tracing Messages in ASN.1 Representation

3.1.6.1.3  ASN.1 REPRESENTATION

DIDMControlRequest ITS-INTERFACE-DIALOGUE ::= {
  DESCRIPTIVE-NAME "ExternalCenter->DIDMControlRequest->OwnerCenter"
  ASN-NAME "DIDMControlRequest"
  ASN-OBJECT-IDENTIFIER { tmddDialogs 22 }
  URL "R-R.gif"
  DEFINITION "A request-response dialog that allows an external center to request an owner center to perform a control action on an owner center's dynamic message sign."
  DESCRIPTIVE-NAME-CONTEXT {"Manage Traffic"}
  ARCHITECTURE-REFERENCE { "traffic control coordination" }
}
ARCHITECTURE-NAME {"U.S. National ITS Architecture"}
ARCHITECTURE-VERSION {"6.0"}
DATA-CONCEPT-TYPE interface-dialogue
STANDARD "TMDD"
REFERENCED-MESSAGES {
  { tmddMessages 22 }, -- Input
  { tmddMessages 18 }, -- Output
  { tmddMessages 10 } -- Fault
}
REFERENCED-OBJECT-CLASSES {
  { tmddObjectClasses ownerCenter(18) },
  { tmddObjectClasses externalCenter(9) }
}
Verification of Requirements

1. Requirements are complete
2. Requirements are traced to DCs through RTM
Verification of Requirements (cont.)

3. Requirements are met at all stages
4. System verification and acceptance

“Declare Victory”
you have built the right thing… user needs are met
you have built the thing right… requirements are met
Achieving Off-the-Shelf Interoperability

- Centers must choose:
  - Same data-encoding format for data representation: ASN.1 or XML
  - Specify same user needs, requirements, and data concepts
  - Deploy a common communication protocol
Information on Standards

Standards for System Interface Implementation

- TMDD v3.0 standard
  (Available at http://www.ite.org/standards/distribution.asp)

- Application Protocols
  NTCIP 2306 C2C XML OR NTCIP 2304 C2C DATEX
  (Available at www.ntcip.org/library)
Summary of Learning Objective #4

- RTM provides design-data concepts for each requirement
- Dialogs allow conversation-messaging with each other
- RTM is used for tracing every DC to each requirement
- Centers must use same DCs for interoperability
Extending TMDD Standard

- TMDD Standard can be extended using rules in Section 1.6.1, Volume I
- Anyone considering such an extension should contact ITE for further consultation
- Consult TMDD v3.0 Guide

Example: Student Supplement page 26
Conformance

- Specification shall include all mandatory and selected optional user needs
- Specification shall include mandatory and optional selected requirements for all project needs (mandatory/selected optional)
- Must use all data concepts for a selected requirement by RTM
- Consult T101 course for details
What is the Purpose of the Guide?

- Companion to the TMDD v3.0 Standard
- Summarizes key parts of the standard
- Guides on specification preparation
- Provides guidance on system interface implementation
- Published July 2011 by ITE
  (Available at http://www.ite.org/standards/distribution.asp)
# Key Questions Addressed by the Guide

<table>
<thead>
<tr>
<th>Question</th>
<th>Guide Chapter</th>
<th>Guide Section</th>
<th>TMDD Standard Volume</th>
<th>TMDD Standard Section</th>
</tr>
</thead>
<tbody>
<tr>
<td>What is the purpose of this guide?</td>
<td>1</td>
<td>1.1</td>
<td>-</td>
<td>-</td>
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<tr>
<td>What is the scope of the TMDD Standard v3.0?</td>
<td>1</td>
<td>1.2</td>
<td>I</td>
<td>1.1</td>
</tr>
<tr>
<td>What are the key parts of the standard?</td>
<td>2</td>
<td>2.2</td>
<td>I</td>
<td>1.8</td>
</tr>
<tr>
<td>Is TMDD v3.0 backward compatible?</td>
<td>1</td>
<td>1.9</td>
<td>I</td>
<td>1.7</td>
</tr>
<tr>
<td>What are the conditions for conformance to the TMDD standard?</td>
<td>2</td>
<td>2.7</td>
<td>I</td>
<td>1.6</td>
</tr>
<tr>
<td>What is conformance? How is it different than compliance?</td>
<td>2</td>
<td>2.7</td>
<td>I</td>
<td>1.6</td>
</tr>
<tr>
<td>What if my needs are not met by the TMDD?</td>
<td>2</td>
<td>2.8</td>
<td>I</td>
<td>1.6.1</td>
</tr>
<tr>
<td>Which additional standards do I need to implement TMDD?</td>
<td>4</td>
<td>4.2.1-4.2.2</td>
<td>I</td>
<td>1.2</td>
</tr>
<tr>
<td>How can I prepare my specification for C2C system interface?</td>
<td>4</td>
<td>4.3</td>
<td>I</td>
<td>2,3</td>
</tr>
<tr>
<td>How does TMDD trace to the National ITS Architecture?</td>
<td>4</td>
<td>4.3.1</td>
<td>I</td>
<td>4</td>
</tr>
<tr>
<td>Where can I find TMDD design content?</td>
<td>4</td>
<td>4.3.5</td>
<td>II</td>
<td>2,3,4</td>
</tr>
<tr>
<td>Where can I find information on other ITS standards?</td>
<td>Ref. Tables</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>How was the TMDD standard developed?</td>
<td>1</td>
<td>1.8</td>
<td>I</td>
<td>-</td>
</tr>
<tr>
<td>How can I get TMDD v3.0 standard files?</td>
<td>References</td>
<td>II</td>
<td>2.0</td>
<td></td>
</tr>
</tbody>
</table>
What Have We Learned?

- Standard Structure:
  - Volume I:
    - ConOps/user needs
    - Requirements
    - NRTM
  - Volume II:
    - Data Concepts
    - RTM

Learning Objective #1
Continuity with A321a
What Have We Learned? (cont.)

- **TMDD Capabilities:**
  - Enables interoperability among centers
  - Serves traffic management domain:
    - We can exchange event information
    - Share ITS field devices
    - Share roadway information
    - Data gathering
What Have We Learned? (cont.)

Learning Objective #2

Using NRTM:

- NRTM traces requirements to user needs:
  - Learned to map operational needs to user needs listed in the standard
  - Learned how to prepare a project NRTM
What Have We Learned? (cont.)

Learning Objective #3

Using RTM:

- Learned how RTM traces requirements to data concepts
  - Data concepts are the building blocks for system interface design
  - How to prepare a project RTM
What Have We Learned? (cont.)

Learning Objective #3,4

- Project NRTM and RTM are required
- Interoperability is dependent on specification that uses same data concepts, requirements, and user needs
- Agencies desiring interoperability must select a common protocol (e.g., NTCIP 2306 XML)
What Have We Learned? (cont.)

Learning Objective #5

- How to extend the standard using rules

Learning Objective #6

- TMDD v3.0 Guide helps in system interface specification preparation and implementation
Recommended References

1. A321b Student Supplement
2. TMDD v3.0 Guide, July 2011
   http://www.ite.org/standards/distribution.asp
3. The NTCIP Guide v04, October 2008
4. Systems Engineering Guidebook for ITS
   FHWA-Caltrans, v3.0 2009
5. Systems Engineering for Intelligent Transportation Systems, FHWA, 2007
TMDD Sequence

- Modules A321a +A321b +T321 will complete the curriculum path for the TMDD v3.0 standard
- T321: Applying Your Test Plan to the TMDD Standard
  - Proposed for second-year PCB program
  - Module will cover:
    - Test plans, test design specifications, test cases, and test procedures
Questions to Consider

1. Which matrix standardizes relationships between requirements and design concepts?
2. What are the minimum conditions to achieve interoperability using TMDD v3.0 standard?