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**I n t r o d u c t i o n t o U s e r
N e e d s I d e n t i f i c a t i o n**



RITA Intelligent Transportation Systems
Joint Program Office

A102: Introduction to User Needs Identification

Table of Contents

Systems Engineering Process.....	3
Summary of Relevant Standards.....	4
Acronyms List.....	5
TMDD Website.....	7
Guide to Traffic Management Data Dictionary (TMDD).....	8
Guide to TMDD Standard v3.0 (Table of Contents).....	9
TMDD Volume 1: Concept of Operations and Requirements.....	10
TMDD Volume 1: Concept of Operations and Requirements (Table of Contents)	11
References.....	19

Systems Engineering Process

Systems engineering grew from the need to develop large-scale (predominantly defense) systems in a structured manner that progresses from concept to production to operation. There are numerous courses, seminars and training sessions offered by private and public entities (including NASA) that introduce and certify users in the practice of SEP.

Promoted by the United States Department of Transportation (US DOT) as an effective way to successfully develop and deploy Intelligent Transportation Systems (ITS), numerous guides and support mechanisms specific to the ITS industry have been developed, including:

- Systems Engineering Guidebook for ITS v3.0, US DOT, November 2009.
- International Council on Systems Engineering. [Systems Engineering Handbook Version 3.2](#). January 2010.
- Systems Engineering for ITS: An Introduction for Transportation Professionals, US DOT, January 2007.
- The National ITS Architecture which provides a common framework for planning, defining, and integrating intelligent transportation systems. A website hosting the National ITS Architecture has been developed and includes training courses and workshops such as:
 - Deploying the National Intelligent Transportation System (ITS) Architecture
 - Turbo Architecture Software Training
 - ITS Architecture Use and Maintenance Workshop
 - ITS Architecture Process Workshop
 - Systems Engineering for ITS Workshop
- Building Quality Intelligent Transportation Systems through Systems Engineering.
- Developing Functional Requirements for ITS Projects.
- Understanding Software Development: A Primer for ITS Public Sector Managers.
- A Guide to Configuration Management for Intelligent Transportation Systems.
- Technical Assistance
 - US DOT Peer-to-Peer Program
 - ITS Standards Field Support Team
- Training
 - ITS Dynamic Message Sign Standards Procurement Workshop
 - US DOT Professional Capacity Building Program for ITS
 - National Highway Institute ITS Training
 - University of Maryland's Consortium for ITS Training and Education (CITE)

Summary of Relevant Standards

Various organizations are involved in the development of ITS standards. A brief summary of the pertinent standards that may be referenced within this module include:

1. ASTM family of standards. Published on the ASTM International (originally known as the American Society for Testing and Materials) site, standard specifications for Archiving ITS-Generated Traffic Monitoring Data provides definitions of the data elements to be archived from ITS traffic management systems, their interrelationships, and the procedures and methodologies for collection and calculation of traffic statistics.
2. ATIS and ITIS. Society of Automotive Engineers (SAE) message set for Advanced Traveler Information Systems (ATIS) and International Traveler Information Systems (ITIS) phrase lists provide the messages and data elements that are exchanged among traveler information providers (data providers) and travelers (data consumers).
3. IEEE 1512© family of standards. Published by the Institute of Electrical and Electronics Engineers deal with information exchanges between public safety centers and traffic management centers.
4. LRMS series of standards. SAE Location Referencing Message Specification (LRMS) provides for the definition of the location references of ITS.
5. NTCIP family of standards. National Transportation Communications for ITS Protocol (NTCIP) communications standards (jointly developed by AASHTO, ITE, and NEMA) ensure interoperability of traffic control and ITS devices. Contains object definitions for numerous ITS devices including Actuated Traffic Signal Controllers, Dynamic Message Signs, Environmental Sensor Stations, Ramp Meter Control, Closed Circuit Television, etc.
6. TCIP family of standards. Transit Communications Interface Profiles (TCIP) family of standards published by the American Public Transportation Association provide a library of information exchange building blocks to allow transit agencies and transit suppliers to create standardized tailored interfaces.
7. TMDD and MS/ETMCC. Traffic Management Data Dictionary (TMDD) and Message Sets for External Traffic Management Center Communications (MS/ETMCC) standards were developed to support center-to-center communications. Published by ITE, owned jointly with the American Association of State Highway and Transportation Officials (AASHTO).

Acronyms

The following acronyms are used throughout the Training Module and Student Supplement:

Acronym	Description
AASHTO	American Association of State Highway and Transportation Officials
ASC	Actuated Traffic Signal Controller
APTA	American Public Transportation Association
ATC	Advanced Transportation Controller
ATIS	Advanced Traveler Information Systems
ASTM	American Society for Testing and Materials
C2C	Center to Center
C2F	Center to Field
CCTV	Closed Circuit Television
CITE	Consortium for ITS Training and Education
DMS	Dynamic Message Sign
DSRC	Dedicated Short-Range Communications
ELMS	Electrical and Lighting Management Systems
ESS	Environmental Sensor Systems
FHWA	Federal Highway Administration
FMS	Field Master Stations
IEEE	Institute of Electrical and Electronics Engineers
ITE	Institute of Transportation Engineers
ITIS	International Traveler Information Systems
ITS	Intelligent Transportation System
LCS	Lane Control Signals
LRMS	Location Referencing Message Specification
MIB	Management Information Base
MS/ETMCC	Message Sets for External Traffic Management Center Communications
MULTI	Mark-Up Language for Transportation Information
NDDOT	North Dakota Department of Transportation
NEMA	National Electrical Manufacturers Association
NHI	National Highway Institute
NRTM	Needs to Requirements Traceability Matrix (same as PRL)

Acronym	Description
NTCIP	National Transportation Communications for ITS Protocol
PRL	Protocol Requirements List (same as NRTM)
RTM	Requirements Traceability Matrix
SAE	Society of Automotive Engineers
SCP	Signal Control and Prioritization
SDO	Standards Development Organization
SEP	Systems Engineering Process
SSM	Signal System Locals
SMU	Signal Monitor Unit
TCIP	Transit Communications Interface Profiles
TMC	Traffic Management / Monitoring Center
TMDD	Traffic Management Data Dictionary
TSS	Transportation Sensor Systems
US DOT	United States Department of Transportation
VDOT	Virginia Department of Transportation
VTTI	Virginia Tech Transportation Institute
XML	eXtensible Markup Language

Traffic Management Data Dictionary (TMDD)

TMDD Website

The screenshot shows the website for the Institute of Transportation Engineers (ITE). The main heading is "Traffic Management Data Dictionary (TMDD) and Message Sets for External Traffic Management Center Communications (MS/ETMCC)". Below this, there are two paragraphs of text describing the TMDD standards and their development. A "Version History Table" is also present, listing two versions: 3.0 and 2.1.

Navigation Menu:

- BOOKSTORE
- EMPLOYMENT CENTER
- TECHNICAL INFORMATION
- PROFESSIONAL DEVELOPMENT
- DIRECTORIES
- MEETINGS
- SEARCH ITE

Left Sidebar:

- > HOME
- > JOIN ITE TODAY!
- > ABOUT ITE
- > ITE COUNCILS
- > MEMBERS ONLY
- > MARKETING
- > LOGIN
- > LOGOUT
- > PAY DUES
- > CHECKOUT

Main Content:

Traffic Management Data Dictionary (TMDD) and Message Sets for External Traffic Management Center Communications (MS/ETMCC)

The Traffic Management Data Dictionary (TMDD) Standards were developed to support center-to-center communications as part of the regional deployment of ITS in order for centers to cooperate in the management of a corridor, arterial, incident mitigation, event management, etc. Hence the TMDD provides the dialogs, message sets, data frames, and data elements to manage the shared use of these devices and the regional sharing of data and incident management responsibility. As a result, the TMDD standards often reference elements of the NTCIP standards, but deal with the devices at a higher level of abstraction.

Version 3 represents a significant upgrade from Version 2.1 and includes a Concept-of-Operation and Requirements which allow an agency to identify their center-to-center needs and requirements, and use the tables to select the appropriate dialogs and messages for the exchanges between centers. The focus on the TMDD (Traffic Management Data Dictionary) standard is exchanges that support shared use of ITS devices (e.g. Dynamic Message Signs, Traffic Controllers), sharing of roadway network status (e.g. traffic conditions), and shared management and monitoring of various types of traffic incidents/events. The standard is available in 2 volumes: Volume 1 contains the Concept-of-Operations and Functional Requirements, while Volume 2 contains the Dialogs and Message content. In addition to the printed documents, the design content is also available in zip files as XML and WSDL and as XMLSpy output in HTML format (Reference the elements in Step No. 14). The TMDD guide will be updated within the next few months.

Version History Table

Version No.	Standard Name	Overall Status Under Development / Published / Superseded Version	Date Approved
3.0	Traffic Management Data Dictionary (TMDD) and Message Sets for External Traffic Management Center Communications (MS/ETMCC)	Published	11/20/08
2.1	Traffic Management Data Dictionary (TMDD) and Message Sets for External Traffic Management Center Communications (MS/ETMCC)	Published	

Figure 1 - TMDD Website: <http://www.ite.org/standards/tmdd>

Guide to
Traffic Management Data Dictionary (TMDD)
Standard v3.0 for
Traffic Management Center-to-Center Communications

DRAFT 6.4.1

May 17, 2010

Figure 2 - Guide to TMDD Standard v3.0

CHAPTER 1 INTRODUCTION	1
1.1 PURPOSE OF THE GUIDE	1
1.2 TARGET AUDIENCE FOR THIS GUIDE	1
1.3 THE PURPOSE OF THE TMDD STANDARD	1
1.4 THE SCOPE OF THE TMDD STANDARD	2
1.5 DATA CONCEPTS DEFINITIONS	4
1.6 SYSTEM INTERFACE SUPPORTS TRAFFIC MANAGEMENT	5
1.7 TMDD STANDARD V3.0 DEVELOPMENT	7
1.8 BACKWARD COMPATIBILITY	8
1.9 TMDD AND INTEROPERABILITY	9
1.10 GUIDE ORGANIZATION	9
1.11 KEY QUESTIONS WITH INFORMATION REFERENCES	10
CHAPTER 2 TMDD STANDARD STRUCTURE	11
2.1 CHAPTER PURPOSE	11
2.2 STANDARD ORGANIZATION	11
2.3 TMDD V3.0 STANDARD SECTIONS	12
2.4 USER NEEDS	13
2.5 REQUIREMENTS	14
2.6 NEEDS TO REQUIREMENTS TRACEABILITY MATRIX (NRTM)	15
2.7 REQUIREMENTS TRACEABILITY MATRIX (RTM)	16
2.8 CONDITIONS FOR CONFORMANCE TO THE TMDD STANDARD	18
2.9 WHAT IF A NEED IS NOT FOUND IN THE TMDD STANDARD?	18
2.10 CHAPTER SUMMARY	19
CHAPTER 3 WRITING SYSTEM INTERFACE SPECIFICATION USING TMDD	21
3.1 CHAPTER PURPOSE	21
3.2 METHODOLOGY FOR WRITING SYSTEM INTERFACE SPECIFICATION	21
3.3 MAPPING TMDD STANDARD TO V MODEL STEPS	22
3.4 CHAPTER SUMMARY	29
CHAPTER 4 TMDD IMPLEMENTATION	30
4.1 CHAPTER PURPOSE	30
4.2 TMDD IMPLEMENTATION	30
4.3 UNDERSTANDING DIALOGS	31
4.4 UNDERSTANDING ASN.1 DATA CONCEPTS	36
4.5 UNDERSTANDING C2C XML DATA CONCEPTS	39
4.6 APPLICATION LEVEL PROTOCOLS	44
4.7 CHAPTER SUMMARY	45

Figure 3 - Guide to TMDD Standard v3.0 - Table of Contents (page iv)

An Balloted Standard of the TMDD Steering Committee

By AASHTO and ITE

Document Number ___

**TMDD Standard for Traffic Management Center-to-Center
Communications**

Volume 1: Concept of Operations and Requirements

Figure 4 - TMDD Volume 1: Concept of Operations and Requirements

TMDD Volume 1: Concept of Operations and Requirements (Table of Contents)

1 DOCUMENT INTRODUCTION.....	1
1.1 Purpose	1
1.2 Background	1
1.3 Center-to-Center and ETMCC Terms.....	2
1.4 Acronyms	4
1.5 References.....	5
1.5.1 Normative References	5
1.5.2 Informative References.....	6
1.6 Conformance Statement	6
1.6.1 Extensions	7
1.7 Backward Compatibility	8
1.8 Document Organization.....	8
2 CONCEPT OF OPERATIONS FOR TRAFFIC MANAGEMENT CENTER-TO-CENTER COMMUNICATIONS	9
2.1 Scope	9
2.2 User Classes	11
2.2.1 Data User.....	11
2.2.2 Operations User.....	12
2.3 Needs	12
2.3.1 Need for Connection Management.....	12
2.3.1.1 Verify Connection Active	12
2.3.1.2 Need to Support Requests	12
2.3.1.3 Need to Support Subscriptions.....	12
2.3.1.4 Need to Support Error Handling	12
2.3.2 Need to Support Authentication and Restrictions	13
2.3.2.1 Need to Specify Restrictions	13
2.3.2.2 Need to Authenticate the Source of Messages	13
2.3.3 Need to Provide Information on Organizations, Centers, and Contacts	13
2.3.4 Need to Share Event Information.....	13
2.3.4.1 Need For An Index of Events	14
2.3.4.2 Need to Correlate an Event with Another Event.....	14
2.3.4.3 Need to Provide Free Form Event Descriptions.....	14
2.3.4.4 Need to Provide Free Form Event Names	14
2.3.4.5 Need to Provide Multilingual Event Descriptions.....	14
2.3.4.6 Need for Current Event Information	14
2.3.4.7 Need for Planned Event Information	14
2.3.4.8 Need for Forecast Event Information	15
2.3.4.9 Need to Share the Log of a Current Event	15
2.3.4.10 Need to Reference a URL.....	15
2.3.4.11 Need to Filter Events	15
2.3.4.11.1 Need to Filter Event Recaps.....	15
2.3.4.11.2 Need to Filter Event Updates	15
2.3.5 Need to Provide Roadway Network Data	15
2.3.5.1 Need for Roadway Network Inventory.....	16
2.3.5.1.1 Need for Node Inventory	16
2.3.5.1.2 Need for Link Inventory	16

Figure 5 - TMDD Volume 1 - Table of Contents (page vi)

2.3.5.1.3	Need for Route Inventory	16
2.3.5.2	Need to Share Node, Link and Route Status	16
2.3.5.2.1	Need to Share Node State	16
2.3.5.2.2	Need to Share Link State	16
2.3.5.2.3	Need to Share Route State	16
2.3.5.3	Need to Share Link Data	16
2.3.5.4	Need to Share Route Data	16
2.3.5.5	Need to Maintain English Units	17
2.3.6	Need to Provide Control of Devices	17
2.3.6.1.1	Need to Share Detector Inventory	18
2.3.6.1.2	Need Updated Detector Inventory	18
2.3.6.1.3	Need to Share Detector Status	18
2.3.6.1.4	Need for Detector Metadata	18
2.3.6.1.5	Need for Detector Data Correlation	18
2.3.6.1.6	Need for Detector Data Sharing	18
2.3.6.1.7	Need for Detector History	18
2.3.6.2	Need to Share CCTV Camera Status and Control	19
2.3.6.2.1	Need to Share CCTV Device Inventory	19
2.3.6.2.2	Need to Share Updated CCTV Device Inventory	19
2.3.6.2.3	Need to Share CCTV Device Status	19
2.3.6.2.4	Need to Control a Remote CCTV Device	19
2.3.6.2.5	Need to Verify CCTV Control Status	20
2.3.6.2.6	Need to Cancel CCTV Control Requests	20
2.3.6.3	Need to Share Video Switch Status and Control	20
2.3.6.3.1	Need to Share Video Switch Inventory	20
2.3.6.3.2	Need to Share Updated Video Switch Inventory	20
2.3.6.3.3	Need to Share Video Switch Status	20
2.3.6.3.4	Need to Control a Remote Video Switch	21
2.3.6.3.5	Need to Verify Video Switch Control Status	21
2.3.6.3.6	Need to Cancel Video Switch Control Requests	21
2.3.6.4	Need to Share DMS Status and Control	21
2.3.6.4.1	Need to Share DMS Inventory	21
2.3.6.4.2	Need to Share Updated DMS Inventory	21
2.3.6.4.3	Need to Share DMS Status	21
2.3.6.4.4	Need to Display a Message on a Remote DMS	22
2.3.6.4.5	Need to Verify DMS Control Status	22
2.3.6.4.6	Need to View DMS Message Queue	22
2.3.6.4.7	Need to Cancel DMS Message Requests	22
2.3.6.4.8	Need to Share DMS Message Appearance	22
2.3.6.4.9	Need to Share DMS Message Inventory	22
2.3.6.4.10	Need to Share DMS Font Table	23
2.3.6.5	Need to Share Environment Sensor Data	23
2.3.6.5.1	Need to Share ESS Inventory	23
2.3.6.5.2	Need to Share Updated ESS Inventory	23
2.3.6.5.3	Need to Share ESS Device Status	23
2.3.6.5.4	Need to Share ESS Environmental Observations	24
2.3.6.5.5	Need to Share ESS Environmental Observation Metadata	24
2.3.6.5.6	Need to Receive a Qualified ESS Report	24
2.3.6.5.7	Need to Share ESS Organizational Metadata	24
2.3.6.6	Need to Share Lane Closure Gate Control	24
2.3.6.6.1	Need to Share Gate Inventory	24

Figure 6 - TMDD Volume 1 - Table of Contents (page vii)

2.3.6.6.2	Need to Share Updated Gate Inventory	24
2.3.6.6.3	Need to Share Gate Status	25
2.3.6.6.4	Need to Control a Remote Gate Control Device	25
2.3.6.6.5	Need to Verify Gate Control Request Status	25
2.3.6.6.6	Need to Cancel Gate Control Device Requests	25
2.3.6.6.7	Need to Share Gate Control Schedule	25
2.3.6.7	Need to Share Highway Advisory Radio (HAR) Status and Control	25
2.3.6.7.1	Need to Share HAR Inventory	25
2.3.6.7.2	Need to Share Updated HAR Inventory	26
2.3.6.7.3	Need to Share HAR Device Status	26
2.3.6.7.4	Need to Control a Remote HAR Device	26
2.3.6.7.5	Need to Verify HAR Control Request Status	26
2.3.6.7.6	Need to View HAR Message Queue	26
2.3.6.7.7	Need to Cancel HAR Control Requests	26
2.3.6.7.8	Need to Share HAR Schedule	26
2.3.6.7.9	Need to Share HAR Messages	27
2.3.6.8	Need to Share Lane Control and Status	27
2.3.6.8.1	Need to Share Controllable Lanes Inventory	27
2.3.6.8.2	Need to Share Updated Controllable Lanes Inventory	27
2.3.6.8.3	Need to Share Controllable Lanes Status	27
2.3.6.8.4	Need to Control a Remote Lane Control Device	27
2.3.6.8.5	Need to Verify Lane Control Device Control Status	27
2.3.6.8.6	Need to Cancel Lane Control Device Control Requests	28
2.3.6.8.7	Need to Share Controllable Lanes Schedule	28
2.3.6.9	Need to Share Ramp Meter Status and Control	28
2.3.6.9.1	Need to Share Ramp Meter Inventory	28
2.3.6.9.2	Need to Share Updated Ramp Meter Inventory	28
2.3.6.9.3	Need to Share Ramp Meter Status	28
2.3.6.9.4	Need to Control a Remote Ramp Meter Device	28
2.3.6.9.5	Need to Verify Ramp Meter Control Request Status	29
2.3.6.9.6	Need to Cancel Ramp Meter Control Requests	29
2.3.6.9.7	Need to View Ramp Metering Plan Queue	29
2.3.6.9.8	Need to Share Ramp Metering Schedule	29
2.3.6.9.9	Need to Share Ramp Metering Plans	29
2.3.6.10	Need to Share Traffic Signal Control and Status	29
2.3.6.10.1	Need to Share Signal System Inventory	29
2.3.6.10.2	Need to Share Updated Signal System Inventory	30
2.3.6.10.3	Need to Share Intersection Status	30
2.3.6.10.4	Need to Control a Remote Traffic Signal Controller	30
2.3.6.10.5	Need to Verify Traffic Signal Controller Control Request Status	30
2.3.6.10.6	Need to View Traffic Signal Controller Plan Queue	30
2.3.6.10.7	Need to Cancel Traffic Signal Controller Control Requests	30
2.3.6.10.8	Need to Share Controller Timing Patterns	30
2.3.6.10.9	Need to Filter Controller Timing Patterns	31
2.3.6.10.10	Need to Share Controller Schedule	31
2.3.6.10.11	Need to Share Turning Movement and Intersection Data	31
2.3.6.10.12	Need to Share Time Synchronization Information	31
2.3.6.10.13	Need to Monitor Signal Operations	31
2.3.6.10.14	Need to Share Section Status	31
2.3.6.10.15	Need to Control a Section	31
2.3.6.10.16	Need to Verify Section Plan Status	32

Figure 7 - TMDD Volume 1 - Table of Contents (page viii)

2.3.6.10.17	Need to View Section Plan Queue	32
2.3.6.10.18	Need to Cancel Traffic Signal Section Control Requests	32
2.3.6.10.19	Need to Share Section Timing Pattern Schedule	32
2.3.7	Need to Share Data for Archiving	32
2.3.7.1	Need for Traffic Monitoring Data	32
2.3.7.1.1	Need for Direct Measurements of Traffic Flow and Conditions	32
2.3.7.1.2	Need for Original Source Data for Traffic Monitoring Measurements	32
2.3.7.1.3	Need for Processed Traffic Monitoring Data	33
2.3.7.1.4	Need for Data Collection System Metadata	33
2.3.7.1.5	Need for Processing Documentation Metadata	33
2.3.7.1.6	Need for Roadway Characteristics Data	33
2.3.7.1.7	Need for Event Data	33
2.3.8	Need to Accept Null Values	33
3	REQUIREMENTS	34
3.1	Introduction	34
3.2	Mandatory and Optional Data	34
3.3	Detailed Requirements	34
3.3.1	Connection Management	34
3.3.1.1	Exchange Center Active Verification	34
3.3.1.1.1	Send Center Active Verification Upon Request	34
3.3.1.1.2	Publish Center Active Verification Information	35
3.3.1.1.3	Subscribe to Center Active Verification Information	35
3.3.1.1.4	Contents of the Center Active Verification Request	35
3.3.1.1.5	Contents of the Center Active Information	35
3.3.1.2	Support Request-Response	35
3.3.1.3	Support Subscription-Publication	36
3.3.1.3.1	Support Periodic Updates	36
3.3.1.3.2	Support Event-Driven Updates	36
3.3.1.4	Support Error Handling Report	36
3.3.1.4.1	Contents of the Error Report	36
3.3.2	Support Authentication and Restrictions	36
3.3.2.1	Support Authentication	36
3.3.2.1.1	Contents of Authentication Information	37
3.3.2.2	Support Restrictions	37
3.3.2.2.1	Contents of Restrictions Information	37
3.3.2.2.2	Required Restriction Information Content	37
3.3.3	Provide Information on Organizations, Centers and Contacts	37
3.3.3.1	Send Organization Information Upon Request	37
3.3.3.2	Publish Organization Information	37
3.3.3.3	Subscribe to Organization Information	38
3.3.3.4	Contents of the Organization Information Request	38
3.3.3.4.1	Required Organization Information Request Content	38
3.3.3.4.2	Optional Organization Information Request Content	38
3.3.3.5	Contents of the Organization and Centers Information	38
3.3.3.5.1	Required Organization Information Content	38
3.3.3.5.2	Optional Organization Information Content	38
3.3.4	Events Information Sharing	41
3.3.4.1	Send Event Information Upon Request	41
3.3.4.2	Publish Event Information	41
3.3.4.3	Subscribe to Event Information	41

Figure 8 - TMDD Volume 1 - Table of Contents (page ix)

3.3.4.4	Contents of Event Information Request	41
3.3.4.4.1	Required Event Information Request Content	41
3.3.4.4.2	Optional Event Message Header Information	41
3.3.4.4.3	Event Information Request Filter Content	41
3.3.4.5	Contents of the Event Information	43
3.3.4.6	Required Event Information Content	43
3.3.4.6.1	Event Message Header	43
3.3.4.6.2	Event Reference	43
3.3.4.6.3	Event Element Details	44
3.3.4.6.4	Event Headline	53
3.3.4.7	Optional Event Information Content	53
3.3.4.7.1	Project Reference	53
3.3.4.7.2	Event Indicator	54
3.3.4.7.3	Event Comments	54
3.3.4.7.4	Event Reports	55
3.3.4.7.5	Other References	55
3.3.4.7.6	URL References	56
3.3.4.8	Action Logs	57
3.3.4.8.1	Send Action Logs Upon Request	57
3.3.4.8.2	Publish Action Log Information	57
3.3.4.8.3	Subscribe to Action Log Information	57
3.3.4.8.4	Contents of Action Log Information	57
3.3.4.9	Event Index	57
3.3.4.9.1	Send Event Index Information Upon Request	57
3.3.4.9.2	Publish Event Index Information	57
3.3.4.9.3	Subscribe to Event Index Information	57
3.3.4.9.4	Contents of the Event Index Information	58
3.3.4.9.5	Required Event Index Information Content	58
3.3.4.9.6	Optional Event Index Information Content	58
3.3.5	Provide Roadway Network Data	58
3.3.5.1	Share Traffic Network Information	58
3.3.5.1.1	Contents of the Traffic Network Information Request	58
3.3.5.2	Share Node Information	59
3.3.5.2.1	Share Node Inventory Information	59
3.3.5.2.2	Share Node Status Information	60
3.3.5.3	Share Link Information	61
3.3.5.3.1	Share Link Inventory Information	62
3.3.5.3.2	Share Link Status Information	64
3.3.5.4	Share Route Information	68
3.3.5.4.1	Share Route Inventory Information	68
3.3.5.4.2	Share Route Status Information	69
3.3.6	Provide Device Inventory, Status and Control	72
3.3.6.1	Generic Devices	72
3.3.6.1.1	Share Device Information	72
3.3.6.1.2	Share Device Inventory Header Information	74
3.3.6.1.3	Share Device Status Header Information	75
3.3.6.1.4	Device Control Request Header Information	76
3.3.6.1.5	Verify Device Control Request Status	78
3.3.6.1.6	Cancel Control Requests for Remote Devices	78
3.3.6.1.7	Device Priority Queue Header Information	79
3.3.6.2	Traffic Detectors	80

Figure 9 - TMDD Volume 1 - Table of Contents (page x)

3.3.6.2.1	Share Detector Inventory Information	80
3.3.6.2.2	Share Detector Status Information	82
3.3.6.2.3	Share Detector Data Information	83
3.3.6.2.4	Share Detector Maintenance History	85
3.3.6.3	CCTV	87
3.3.6.3.1	Share CCTV Inventory Information	87
3.3.6.3.2	Share CCTV Status Information	88
3.3.6.3.3	Control Requests For Remote CCTV Devices	90
3.3.6.3.4	Request CCTV Control Status	90
3.3.6.3.5	Cancel Control Requests for CCTV	90
3.3.6.4	Video Switches	90
3.3.6.4.1	Share Video Switch Inventory Information	90
3.3.6.4.2	Share Video Switch Status Information	91
3.3.6.4.3	Control Requests for Remote Video Switch Devices	92
3.3.6.4.4	Request Video Switch Control Status	93
3.3.6.4.5	Cancel Control Requests for Remote Video Switches	93
3.3.6.5	Dynamic Message Signs	93
3.3.6.5.1	Share DMS Inventory Information	94
3.3.6.5.2	Share DMS Status Information	96
3.3.6.5.3	Control Requests for Remote DMS Devices	97
3.3.6.5.4	Request DMS Control Status	97
3.3.6.5.5	Cancel Control Requests for Remote DMSs	97
3.3.6.5.6	Share DMS Message Appearance	97
3.3.6.5.7	Share DMS Message Table	98
3.3.6.5.8	Share DMS Font Table	100
3.3.6.5.9	Share DMS Priority Queue Information	101
3.3.6.6	Environment Sensors	101
3.3.6.6.1	Share ESS Inventory Information	102
3.3.6.6.2	Share ESS Status Information	103
3.3.6.6.3	Share ESS Observation Data Information	104
3.3.6.6.4	Share ESS Metadata	104
3.3.6.7	Lane Closure Gates	114
3.3.6.7.1	Share Gate Inventory Information	114
3.3.6.7.2	Share Gate Status Information	115
3.3.6.7.3	Control Requests for Remote Gates	115
3.3.6.7.4	Request Gate Control Status	116
3.3.6.7.5	Cancel Control Requests for Remote Gates	116
3.3.6.7.6	Share Gate Schedule	116
3.3.6.8	Highway Advisory Radio	117
3.3.6.8.1	Share HAR Inventory Information	117
3.3.6.8.2	Share HAR Status Information	118
3.3.6.8.3	Control Requests for Remote Highway Advisory Radios	119
3.3.6.8.4	Request HAR Control Status	119
3.3.6.8.5	Cancel Control Requests for Remote HAR	119
3.3.6.8.6	Share HAR Schedule	119
3.3.6.8.7	Share HAR Messages	120
3.3.6.8.8	Share HAR Priority Queue Information	121
3.3.6.9	Lane Control Signals	122
3.3.6.9.1	Share LCS Inventory Information	122
3.3.6.9.2	Share LCS Status Information	122
3.3.6.9.3	Control Requests for Remote Lane Control Devices	123

Figure 10 - TMDD Volume 1 - Table of Contents (page xi)

3.3.6.9.4	Request LCS Control Status	123
3.3.6.9.5	Cancel Control Requests for Remote LCS.....	124
3.3.6.9.6	Share LCS Schedules.....	124
3.3.6.10	Ramp Meter	124
3.3.6.10.1	Share Ramp Meter Inventory Information	125
3.3.6.10.2	Share Ramp Meter Status Information	126
3.3.6.10.3	Control Requests for Remote Ramp Meters.....	129
3.3.6.10.4	Request Ramp Meter Control Status.....	130
3.3.6.10.5	Cancel Control Requests for Remote Ramp Meter	130
3.3.6.10.6	Share Ramp Meter Schedule	130
3.3.6.10.7	Share Ramp Metering Plan Information	132
3.3.6.10.8	Share Ramp Meter Priority Queue Information	133
3.3.6.11	Traffic Signal Controllers.....	133
3.3.6.11.1	Share Signal Inventory Information	133
3.3.6.11.2	Share Intersection Status Information	136
3.3.6.11.3	Control Requests for Remote Traffic Signals	140
3.3.6.11.4	Request Signal Control Status	141
3.3.6.11.5	Cancel Control Requests for Remote Traffic Signals.....	141
3.3.6.11.6	Share Traffic Signal Timing Pattern Schedule.....	141
3.3.6.11.7	Share Signal Timing Pattern Information.....	142
3.3.6.11.8	Share Section Status Information	144
3.3.6.11.9	Control Requests for Remote Signal Sections	146
3.3.6.11.10	Request Section Control Status	148
3.3.6.11.11	Cancel Control Requests for Remote Signal Sections.....	148
3.3.6.11.12	Share Section Timing Pattern Schedule	148
3.3.6.11.13	Share Signal Control Priority Queue Information	149
3.3.6.11.14	Share Section Control Priority Queue Information	150
3.3.7	Share Archive Data.....	151
3.3.7.1	Share Traffic Monitoring Data for Data Archiving.....	151
3.3.7.1.1	Share Traffic Monitoring Data Inventory Information.....	151
3.3.7.2	Share Processing Documentation Metadata	153
3.3.7.2.1	Send Processing Documentation Metadata Information Upon Request.....	153
3.3.7.2.2	Contents of the Processing Documentation Metadata Information Request.....	154
3.3.7.2.3	Contents of the Processing Documentation Metadata Information	154
3.3.8	Accept Null Values.....	155
4	TRACEABILITY TO THE NATIONAL ITS ARCHITECTURE	156
4.1	TMDD Trace to Market Packages	156
4.1.1	Network Surveillance (ATMS01).....	157
4.1.2	Traffic Information Dissemination (ATMS06)	158
4.1.3	Regional Traffic Operations (ATMS07)	159
4.1.4	Traffic Incident Management (ATMS08).....	160
4.1.5	Road Weather Data Collection (MCO3)	161
4.1.6	Roadway Maintenance and Construction (MCO7)	162
4.1.7	ITS Data Mart (AD1).....	163
4.1.8	Emergency Call-Taking and Dispatch (EMD1).....	164
4.1.9	Emergency Routing (EMD2).....	165
4.1.10	Disaster Response and Recovery (EMD8).....	166
4.1.11	Broadcast Traveler Information (ATIS01)	167

Figure 11 - TMDD Volume 1 - Table of Contents (page xii)

4.2	TMDD Trace to Architecture Flows	167
5	NEEDS TO REQUIREMENTS TRACEABILITY MATRIX.....	171
5.1	User Need ID and User Needs Columns.....	171
5.2	User Need Selected?	171
5.3	Requirements ID and Requirements Columns.....	171
5.4	Conformance Column	171
5.4.1	Status Symbols.....	171
5.4.2	Conditional Status Notation	172
5.5	Support.....	173
5.6	Other Requirements Column.....	173

Figure 12 - TMDD Volume 1 - Table of Contents (page xiii)

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