

THALES



**PROJECT WA119
NATIONAL TRAFFIC INFORMATION SERVICE
TRANSFORMATION PROJECT**

EXTERNAL INTERFACE DESIGN DOCUMENT

Publish Services: NTIS Model

E18-PublishNTISModel

WA119-08-007-002-03-03-18 v3.00

18 January 2018

Originator's signature & date

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ISSUE RECORD

Issue	Date	Purpose
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V1.01	19/11/14	<p>Added HATRIS Sections to Model.</p> <p>Mark McMullen</p>
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APPROVAL RECORD

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**EXTERNAL INTERFACE DESIGN DOCUMENT
PUBLISH SERVICES: NTIS MODEL
E18-PUBLISHNTISMODEL**

1. Scope

1.1 Identification

This External Interface Design Document (EIDD) specifies the NTIS Model publishing interface between the National Traffic Information Service (NTIS) system and Subscriber systems. The document defines the characteristics of the interface in sufficient detail to provide a common understanding across the interface boundary.

The interface is uniquely identified within the NTIS system as E18-PublishNTISModel and referred to throughout this document, for brevity, as 'the interface'.

1.2 System Overview

The NTIS system is described in the NTIS SSDD [ref 3].

The NTIS system includes a Publish Services subsystem. The primary operation of the Publish Services subsystem is to publish real-time data to Subscribers and to provide a reference data set, in the form of the NTIS Model, for subscribers to relate the real-time data to the NTIS road network. Additionally, a daily payload of all network events and traffic data is published.

The E18-PublishNTISModel interface is a component of the Publish Services subsystem; responsible for publishing the NTIS static reference data set (NTIS Model) to Subscribers.

1.3 Document Overview

This document is based on the Interface Control Document Template [ref 14] and Interface Control Document Writing Guide [ref 15], components of the Thales Chorus 2.0 process management system. The document is tailored to accommodate NTIS-specific documentation guidelines.

The document is structured as follows:

- Section 1: Scope and introduction
- Section 2: References – documents and resources referenced from this document
- Section 3: Interface Overview – basic function and context of the interface
- Section 4: Interface Details – protocols, messages, operation and message sequences

Section 5: Message Definitions - message content listings and descriptions

Section 6: Qualification of the interface

Section 7: List of Annexes

Annex A: DATEXII v2.0 Schema - NTIS extensions

Annex B: Subscription Information - Subscriber options, system requirements and on-line resources

Annex C: NTIS Model Schematic - the NTIS Model illustrated schematically

Annex D: Internet addresses utilised by this interface

Annex E: Abbreviations and Glossary

1.4 Relationship to Other Documents

This EIDD documents the interface design based on the system requirements specified in the corresponding interface requirements specification [ref 5]. The EIDD is one of a suite of EIDDs describing the design of the external interfaces of the NTIS system.

2. References

The following table lists the documents and resources referenced from this document.

Ref	Title	Document ID/Reference	Originator
1	Traffic Information 2011 Taxonomy	V4.0 20/09/2010	HA
2	NTIS Test Strategy	WA119-08-008-001	Thales
3	System/Subsystem Design Description for NTIS	WA119-08-007-002-02-02-04	Thales
4	NTIS Infrastructure - Architecture Definition	WA119-08-007-008-01	Thales
5	NTIS E18 Publish NTIS Model External Interface Requirements Specification	WA119-08-006-03-02-18	Thales
6	NTIS External Interface Design Document Publish Services: DATD E33-PublishDATD	WA119-08-007-002-03-02-33	Thales
7	NTIS External Interface Design Document Publish Services: Email E46-EmailSubscribers	WA119-08-007-002-03-02-46	Thales
8	NTIS External Interface Design Document Publish Services: DATEXII Webservice E21-DATEXIISubscribers	WA119-08-007-002-03-02-21	Thales
9	TMU Handler Interface Specification	RFC01421	Serco
10	NTIS HATMS Gateway Service Functional Specification	Project ref: 1240/001 Document ref: FS007	IPL
11	NTIS Traffic Data Service Functional Specification	Project ref: 1240/001 Document ref: FS006	IPL
12	RFC01419 - JTMS Handler Interface Specification	IFS00001	Serco
13	Traffic Control Centre TAME Project	TCC-TAME-0006	Serco

	Data Extraction		
14	Chorus 2.0 Interface Control Document (ICD) Template	83510877-DDQ-GBR-EN-001	Thales
15	Chorus 2.0 Interface Control Document (ICD) Writing Guide	83511164-DDQ-GBR-EN-001	Thales
16	DATEXII website	http://www.datex2.eu	DG MOVE
17	DATEXII v2.0 Schema	No identifier, located at: http://www.datex2.eu/content/datex-ii-xml-schema-20	DG MOVE
18	IEEE 802.3 Standard for Ethernet	http://standards.ieee.org/about/get/802/802.3.html	IEEE
19	Transmission Control Protocol: DARPA Internet Program Protocol Specification	http://www.ietf.org/rfc/rfc793.txt	Network Working Group
20	Internet Protocol: DARPA Internet Program Protocol Specification (IPv4)	http://www.ietf.org/rfc/rfc791.txt	Network Working Group
21	Hypertext Transfer Protocol -- HTTP/1.1	http://www.w3.org/Protocols/rfc2616/rfc2616.html	Network Working Group
22	Extensible Markup Language (XML) 1.0 (Fifth Edition)	http://www.w3.org/TR/2008/REC-xml-20081126/	W3C
23	.ZIP File Format Specification	http://www.pkware.com/documents/APPNOTE/APPNOTE-6.3.0.TXT	PKWARE
24	The TLS Protocol Version 1.0	http://www.rfc-editor.org/rfc/rfc2246.txt	Network Working Group
25	NTIS External Interface Design Document Event Collection E35-EventsInput	WA119-08-007-002-03-02-35	Thales
26	World Geodetic System 1984 (WGS84).	http://www.dqts.net/wgs84.htm	DQTS
27	European Terrestrial Reference System 1989 (ETRS89)	http://www.euref.eu	EUREF
28	DATEXII Extension Guide	No identifier, located at:	DG MOVE

		http://www.datex2.eu/content/datex-ii-extension-guide	
29	NTIS External Interface Design Document MIDAS Catch-Up E49-MIDASCatchUp	WA119-08-007-002-03-02-49	Thales

3. Interface Overview

3.1 System Interfaces

Figure 3-1 illustrates the context of the interface (E18-PublishNTISModel) within the overall operation of the NTIS system.

The boundary of the interface is defined as the network interface on which the NTIS system sends and receives data to and from Subscriber systems.

The context diagram also includes the NTIS system external interfaces that are related to, or impact on, the function of this interface. The E<number>-<descriptor> ID is a unique external interface identifier within the NTIS system.

Note that the diagram omits any interface or external system that does not directly affect the Publish Services provided by the NTIS system.

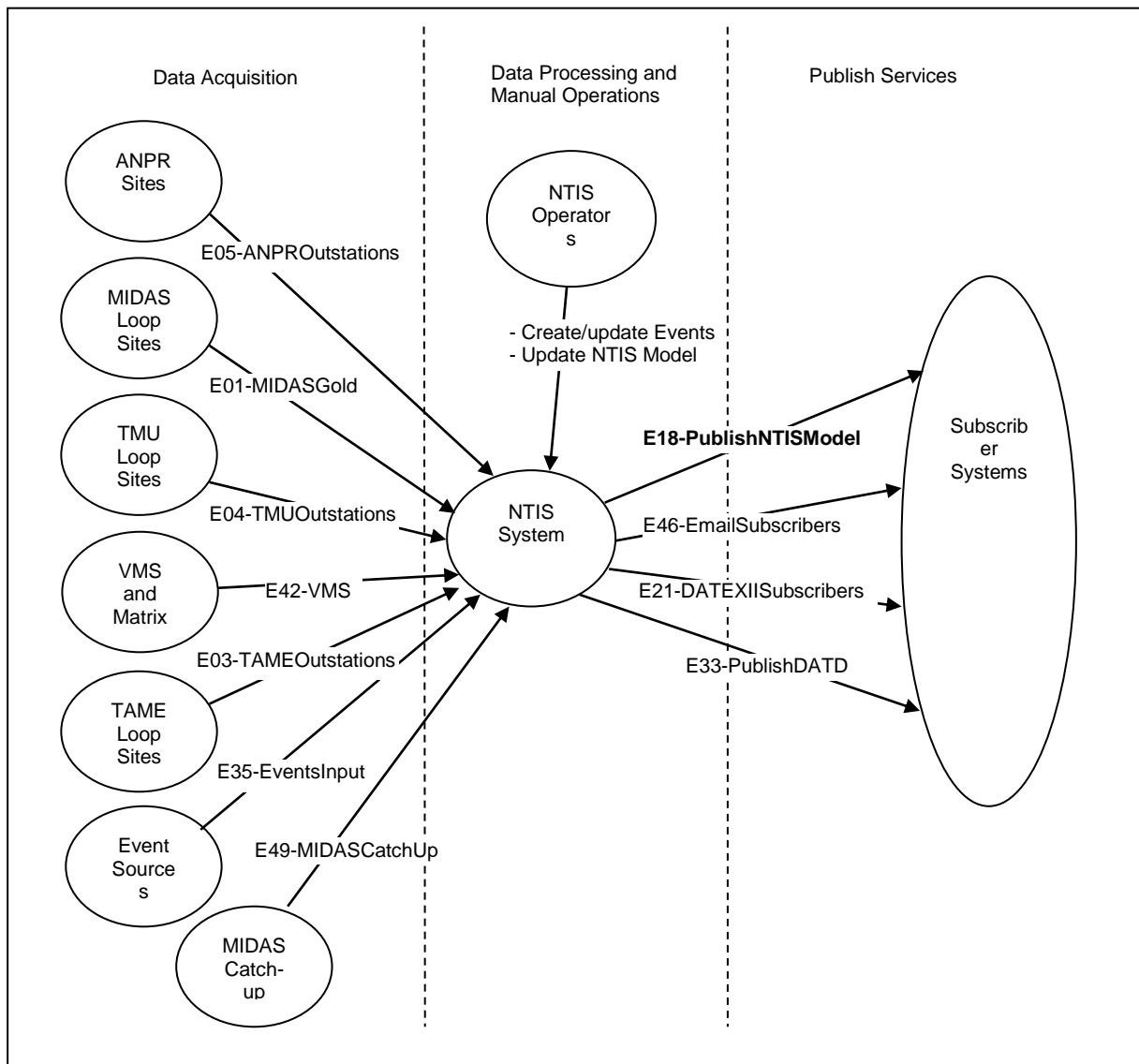


Figure 3-1 : Publish Services Context Diagram

Data Acquisition External Interfaces:

- E01-MIDASGold: the interface used to collect real-time traffic data from MIDAS Gold outstations. The interface is documented in [ref 11].
- E03-TAMEOutstations: the interface is used to collect daily traffic data from TAME outstations. The interface is documented in [ref 13].
- E04-TMUOutstations: the interface used to collect real-time traffic data from TMU outstations. The interface is documented in [ref 9].
- E05-ANPROutstations: the interface is used to collect real-time travel times from ANPR outstations. The interface is documented in [ref 12].
- E42-VMS: the interface is used to collect real-time VMS and Matrix Signal display status information. The interface is documented in [ref 10].
- E35-EventsInput : the interface is used to collect Events data and information from external sources. The interface is documented in [ref 25].
- E49-MIDASCatchUp : the interface is used to collect catch-up data from the MIDAS historical data repository [ref 29].

Publish Services External Interfaces:

- E21-DATEXIISubscribers: this interface is utilised to publish real-time data to Subscribers via a DATEXII-compliant [ref 16] web service. [ref 8].
- E46-EmailSubscribers: this interface is utilised to publish data via email and is documented in [ref 7].
- E33-PublishDATD: this interface is used to publish the Daily Aggregated Traffic Data (DATD) to Subscribers. The DATD interface and publication are detailed in [ref 6].

The data acquisition source systems and interfaces, and the facilities provided to operators, are outside the scope of this document and are only detailed in this document where this affects the functionality of the interface.

3.2 Description of the Interface between the NTIS System and Subscriber Systems

The interface is utilised to publish the NTIS Model to Subscriber systems via the internet.

The NTIS Model contains the reference data required for Subscribers to relate the data, published on the E21-DATEXIISubscribers interface [ref 8] and E33-PublishDATD interface [ref 6], to the road network, as defined by the NTIS system.

The NTIS Model comprises:

1. The Network Model: the Network Links and Nodes that make up the fundamental graph of the NTIS road network.
2. Layers of abstraction of the Network Links and Nodes, providing road/Link shapes and multiple-Link routes.
3. Assets: traffic monitoring and reporting roadside measurement sites, related to the Network Links within the NTIS Model,

The content, format and packaging of the published data are described in Section 5.

The interface employs the following on-request mechanisms to publish the NTIS Model:

1. A dedicated NTIS Model download website, providing Subscribers with a manual interface to the data. Subscribers can view, select and download a specific version of the NTIS Model.
2. A web service, providing Subscribers with an automated interface to the data. This service enables a simple HTTP Request, from a Subscriber system, to download the latest, current version of the NTIS Model.

Both mechanisms publish the same data package.

The URLs for NTIS web services and sites are listed in Section 7.4.

3.3 Description of the NTIS System

The NTIS system function and operations are described in the NTIS SSDD [ref 3].

3.4 Description of the Subscriber System

A Subscriber system is any system employed by a registered NTIS Publish Services Subscriber to receive published data. The Subscriber system must be capable interfacing to the web service or web site via the internet and host software capable of requesting and downloading the NTIS Model publication.

The interface messages and content are detailed in Section 4.3.

The NTIS system maintains a number of Subscription Options for each Subscriber. The Subscription Options relevant to this interface are detailed in Section 7.2.

4. Interface Details

4.1 Physical

The NTIS system exchanges data with Subscriber systems via the internet.

The physical interface comprises standard networking components and transport mechanisms and protocols. The system network components provide a virtualised connection to the internet in a single interface.

This infrastructure provides a transparent communication path for the interface that requires no direct management from the interface itself. Hence, the physical make-up of the interface is not detailed further in this document. The networking components and system infrastructure are described in detail in [ref 4].

A simplified schematic representation of the physical interface is illustrated below.

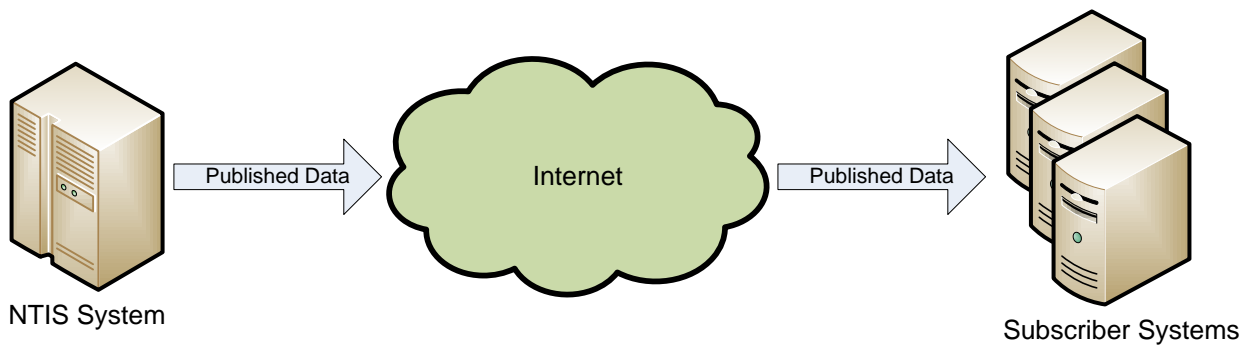


Figure 4-1 : Physical Interface Schematic

4.2 Interface Protocols

The interface employs the protocols and specifications listed below.

Network Layer	Protocol	Utilisation
Link	Ethernet [ref 18]	Utilised for all network communications by the NTIS system; refer to the system infrastructure document [ref 4].
Transport	TCP [ref 19]	
Internet	IPv4 [ref 20]	
Application	HTTP v1.1 [ref 21]	HTTP is utilised for all communications on the interface. HTTP is layered over TLS to enable secure HTTP (HTTPS) to be utilised between the NTIS system and Subscriber systems.
	TLS v1.0 [ref 24]	The Transport Layer Security protocol is utilised to implement the HTTPS data exchange for this interface. The TLS layer ensures that the data exchanged over the interface is encrypted and secure.
	XML v1.0 [ref 22]	DATEXII, utilised to format the data content, uses XML for data content formatting.
	DATEXII v2.0 Schema [ref 17]	The standard DATEXII schema is used to format the data content of the messages communicated over the interface. This interface applies Level B extensions to the standard schema; as listed in Section/appendix 7.1.
	.ZIP [ref 23]	Industry standard, interoperable file compression specification. The files that comprise the NTIS Model payload are ZIP-compressed to minimise the size of the publication.

Table 4-1 : Interface Protocols

4.3 Interface Messages/Data Exchange

4.3.1 Web Service

The web service utilises HTTP messages layered over TLS to provide a HTTPS data exchange. The standard TLS exchange, between the Subscriber and the NTIS systems, is transparent to the interface, and hence outside the influence or scope of this document. The messages listed in the following sections describe only the HTTP request and response messages.

4.3.1.1 NTIS Model Request Message

The NTIS Model Request Message is used by the Subscriber system to request the download of the latest, current NTIS Model publication from the NTIS system. The message utilises a HTTP GET request method.

Message Header:

```
GET <target Request-URI> HTTP/1.1
Authorisation: Basic <username/password>
User-Agent: <Subscriber HTTP client>
Host: <target Host>
Accept: */*
```

Notes:

1. The header contents listed are a typical HTTP GET request as expected by the NTIS system; some details may differ, depending on the HTTP client and implementation employed by the Subscriber system.
2. The <username/password> included in the header, as an encrypted string, are the username and password specified for the Subscriber in the corresponding Subscription Options (refer to Section 7.2 for details). If the <username/password> does not match a registered Subscriber in the NTIS system, the request is rejected; refer to the response message, detailed below.
3. <target Host> is the NTIS service domain name. URLs hosted and serviced by the NTIS system are listed in Section 7.4.
4. The <target Request-URI> specifies the NTIS-hosted endpoint of the web service. The URI is as follows:

```
app/ntismodel/currentmodel
```

Message Body:

None.

4.3.1.2 NTIS Model Response Message

The response to the NTIS Model Request Message depends on whether the request was successfully serviced and, if not, what type of error condition was encountered. The following sections detail the successful response and the expected** error condition responses.

Note**: that is, those errors that are expected and handled purposefully by the NTIS system.

4.3.1.2.1 Success Condition

Message Header:

```
HTTP/1.1 200 OK
Date: <response message transmission date/time>
X-Server: <NTIS host name>
Content-Disposition: attachment;filename=<NTIS Model package
filename>
Content-Type: application/octet-stream
Content-Length: <message content size>
Vary: Accept-Encoding,User-Agent
```

Notes:

1. The header includes a reference to the file name of the NTIS Model package: *<NTIS Model package filename>*. The file naming convention for NTIS Model publications is described in Section 5.2.
2. *<message content size>* is the size, in bytes, of the attached NTIS Model package, as the NTIS Model package is the only content within the message.

Message Body:

```
<NTIS Model package>
```

Notes:

1. The body of the message contains a single item, the *<NTIS Model package>* file, as an attachment. The composition and contents of the NTIS Model package are detailed in Section 5.2.

4.3.1.2.2 Failure Conditions

4.3.1.2.2.1 Unauthorised Access

This response message is returned by the NTIS system if the *<username>* and *<password>* included in the request message do not validate against a known Subscriber in the NTIS system.

Message Header:

```
HTTP/1.1 403 Forbidden
Date: <response message transmission date/time>
X-Server: <NTIS host name>
```


Content-Type: text/plain;charset=ISO-8859-1
Content-Length: <message content size>
Vary: Accept-Encoding,User-Agent

Message Body:

The username and password supplied with the request are invalid - a matching Subscription could not be found in the system. Request rejected.

4.3.1.2.2 Package Not Found

This response message is returned by the NTIS system if the requesting <target Request-URI> is of the correct format, but a valid NTIS Model is not resident on the NTIS system.

Message Header:

HTTP/1.1 404 Not Found
Date: <response message transmission date/time>
X-Server: <NTIS host name>
Content-Type: text/plain;charset=ISO-8859-1
Content-Length: <message content size>
Vary: Accept-Encoding,User-Agent

Message Body:

The download request of the latest NTIS Model package has failed. There is no NTIS Model available on the system.

4.3.1.2.3 Request Too Frequent

This response message is returned by the NTIS system if the request originates from a Subscriber system too soon after a previous request. Refer to Section 4.4.4 for details of this operation.

Message Header:

HTTP/1.1 409 Conflict
Date: <response message transmission date/time>
X-Server: <NTIS host name>
Content-Type: text/plain;charset=ISO-8859-1
Content-Length: <message content size>
Vary: Accept-Encoding,User-Agent

Message Body:

The request for a NTIS Model download has been rejected. The minimum interval between NTIS Model downloads is <request timeout>. Please try again later.

Notes:

1. The request frequency timeout, *<request timeout>*, is a system configurable time and cannot be explicitly stated in this document. However, the timeout is included in the message body, as part of the error message.

4.3.2 Website

The website is designed to be accessed via a standard browser and hence utilises standard TLS and HTTP messages, the details of which are dependent on the browser and navigation of the site. Therefore, the individual messages utilised to access the website are not detailed in this document.

4.4 Interface Functionality

4.4.1 Overview

The NTIS system utilises static reference data to define the road network and associated assets, such as measurement equipment.

NTIS Model publications include all of the static network and asset reference data required to interpret the data published on the E21-DATEXIISubscribers interface [ref 8] and E33-PublishDATD interface [ref 6], and relate this data to the road network.

The NTIS Model is published through two mechanisms: a website and a web service.

4.4.2 Publication Creation

The NTIS system is capable of introducing a new version of the static network and asset reference data, in a single upgrade operation.

Whenever a new reference data set is introduced into the NTIS system, the relevant data is made available for publication. The newly-created NTIS Model package is immediately available for download on this interface:

1. The new NTIS Model is the version that is downloaded via the web service.
2. The new NTIS Model is added to the list of NTIS Model versions available via the website.

Refer to the Publication Operation section, below, for details of the website and web service.

4.4.3 Format and Content

The NTIS Model is published in a single package; to facilitate the download and subsequent management of the publication.

The data content of the published data adheres to the standard DATEXII v2.0 Schema [ref 17] with extensions applied specifically for the NTIS Publish Services interfaces (refer to Section 7.1).

This ensures consistency with the other Publish Services interfaces, specifically the E33-PublishDATD and E21-DATEXIISubscribers interfaces, and facilitates the utilisation of the NTIS Model to interpret the data received on these interfaces.

To adhere to both the DATEXII standards and XML protocols, the published data is split into a number of XML files. These files are packaged and compressed into a ZIP file: to enable a single-file download and reduce the impact on the bandwidth of the Subscriber system.

The published data package, including the component XML files and data content are detailed in Section 5.

4.4.4 Publication Operation

NTIS Model packages are published utilising 2 mechanisms: a dedicated website and a web service, both described in the following sections. The NTIS Model payload is identical in content and format for both publication mechanisms.

4.4.4.1 Web Service

The NTIS Model web service enables a Subscriber to request the latest NTIS Model package using a secure HTTP (HTTPS) request, submitted to the appropriate URL. The NTIS system includes the NTIS Model package in the HTTPS response.

To restrict unauthorised access, the request utilises simple HTTP authentication; a valid Subscriber username and password is required in the HTTPS request.

The web service downloads the latest published NTIS Model: that is, the network and asset model currently utilised by the NTIS system. The web service cannot be used to request downloads of previous versions of the NTIS Model. To download previous versions of the NTIS Model, Subscribers utilise the download website.

Refer to Section 4.3 for details of the request/response messages and content.

Note that the web service is intended primarily for, but is not limited to, automated systematic retrieval of NTIS Model publications.

4.4.4.1.1 Error Conditions

The following error conditions are expected and managed by the NTIS system:

1. The requested NTIS Model does not exist. Note that this condition can only occur if no publishable NTIS Model exists on the NTIS system.
2. Authentication failure - the username/password combination sent with the request is invalid.
3. The request has been made too soon after a previously successful request for an NTIS Model publication. The interface ensures that Subscribers do not request NTIS Model publications too frequently; the NTIS Model packages are very large and this protection mechanism ensures that system resources and bandwidth are not overloaded by excessively frequent requests. The timeout for repeated requests is a system configurable parameter and cannot be explicitly defined in this document.

Refer to Section 4.3 for details of the data contained in the request message and the response messages returned for these error conditions.

4.4.4.2 Website

The NTIS Model website enables a Subscriber to view, select and download a published NTIS Model package manually to a local machine.

To restrict unauthorised access, the website includes a login page; requiring the user to enter the username and password of the Subscription to gain access to the NTIS Model download page.

After gaining access to the download page, the Subscriber is presented with a list of NTIS Model versions. The Subscriber can then select a specific version of the NTIS Model and request that the package be downloaded to the local Subscriber machine.

A number of historic NTIS Model packages are retained for download. The number of packages to retain is a system configurable parameter and hence cannot be explicitly defined in this document. The current version of the NTIS Model is the package with the highest version number.

The website is intended for manual downloads and is designed to be accessed through a browser only. The login page cannot be bypassed and the supplied download facility cannot be accessed directly without navigating the login page. If direct access to the latest NTIS Model is required, then the web service should be used.

The address of the website is listed in Section 7.4.

4.4.5 Message Sequences

Note that this document does not describe the underlying TLS or TCP messages or message sequences; these are standard messages and data exchanges, transparent to the interface and outside the scope of this document.

4.4.5.1 Web Service

The interface employs a simple, single request/response transaction, initiated by the Subscriber system.

1. The Subscriber system issues a NTIS Model Request Message to the NTIS system to request the latest NTIS Model publication.
2. The NTIS system replies with a NTIS Model Response Message. The content of the message is dependent on the success/failure state on servicing the request:
 - a. Success: the current NTIS Model publication is included in the response message.
 - b. Failure: an appropriate error is returned with the response message.

Refer to Section 4.3 for details of the request/response messages.

4.4.5.2 Website

The website is designed to be accessed via a standard browser and hence utilises standard TLS and HTTP messages, the details of which are dependent on the browser and navigation of the site. Therefore, the individual messages and message sequences utilised to access the website are not detailed in this document.

4.5 Sequence Diagrams

The sequence diagram, below, illustrates the message sequence utilised by the interface; for both the website and web service publication mechanisms. The message sequences and the scenarios in which they are used are described in Section 4.4.5.

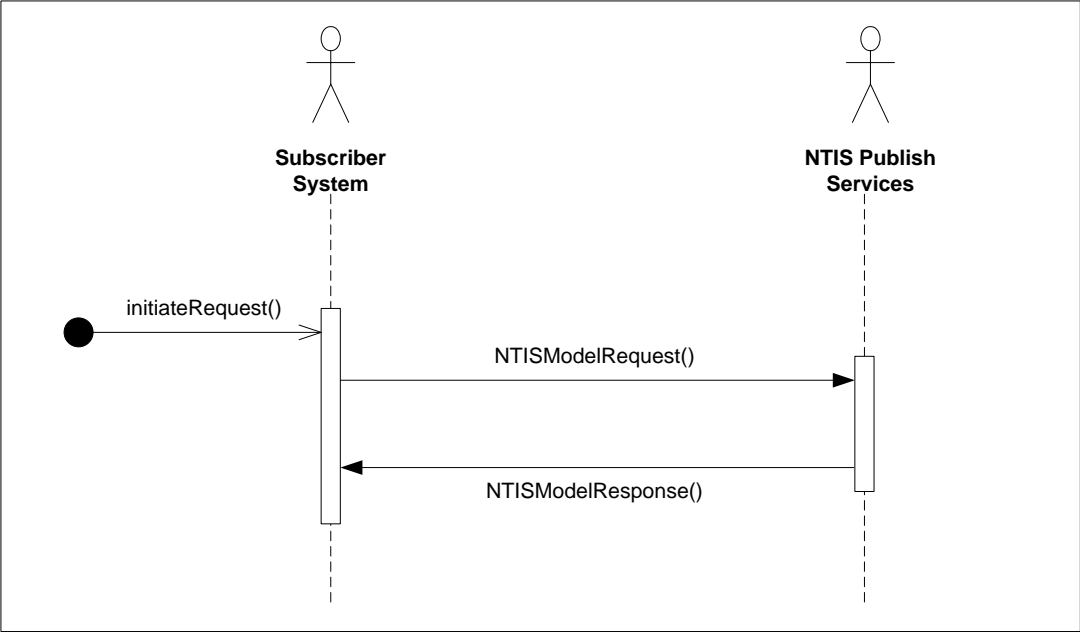


Figure 4-2 : NTIS Model Publication Sequence Diagram

5. Message Definitions

5.1 Message Transfer

Message transfer is automated by the standard network components and transport and data exchange protocols employed by the interface.

The request/response messages that are employed to perform the publication are detailed in Section 4.3.

5.2 Message Lists

This section details the data included in the NTIS Model publication included in the NTIS Model Response Message (Section 4.3).

The overall publication package and its components are described in Section 5.2.1, a description of the NTIS Model is include in Section 5.2.2 and the individual data items included in the component packages are detailed in Section 5.2.3.

5.2.1 Publication Package

The NTIS Model publication package comprises a single ZIP file, named:

NTISModel-*<yyyy>*-*<mm>*-*<dd>*-v*<version>*.zip

where *<yyyy>*, *<mm>* and *<dd>* are the year, month and date, respectively, of the date that the NTIS Model was packaged and made available for publication on this interface. The *<version>* is the number used by the NTIS system to uniquely identify a version of the NTIS Model.

The ZIP file comprises the following files:

File	DATEXII <i><payloadPublication></i> Type	Content
NTISModel-MeasurementSites- <i><id></i> .xml	<i>MeasurementSiteTablePublication</i>	ANPR Sites MIDAS Sites TAME Sites TMU Sites
NTISModel-PredefinedLocations- <i><id></i> .xml	<i>PredefinedLocationsPublication</i>	Alternate Routes ANPR Routes NTIS HATRIS Sections Network Links Network Nodes Network Link Shapes
NTISModel-VMSTables- <i><id></i> .xml	<i>VmsTablePublication</i>	Matrix Signal Assets VMS Assets

Note: <id> is the date/version identifier; identical to the <yyyy>-<mm>-<dd>-v<version> identifier of the containing NTIS Model ZIP file.

The data is split into the component files due to the constraints of XML (single top-level node) and DATEXII (only one <payloadPublication> type per <d2LogicalModel> element, which must be a top-level node).

Refer to the DATEXII schema definition [ref 17] for a description of the <d2LogicalModel> constructs and the different <payloadPublication> types.

The likely size of the main NTISModel-*<yyyy>-<mm>-<dd>-v<version>*.zip file will be up to 50MB.

The likely size of the fully unpacked contents of the ZIP file and its component files will be up to 2GB.

The content of the component files is detailed in the following sections.

5.2.2 The NTIS Model

The NTIS Model comprises the following types of data object:

Content Type	Data Object
Measurement Sites (Section 5.2.4)	ANPR Measurement Sites
	MIDAS Measurement Sites
	TAME Measurement Sites
	TMU Measurement Sites
Predefined Locations (Section 5.2.5)	Alternate Routes
	ANPR Routes
	NTIS HATRIS Sections
	Network Links
	Network Nodes
	Network Link Shapes
VMS / Matrix Assets (Section 5.2.6)	Matrix Signal Assets
	VMS Assets

The NTIS Model component objects, including the object relationships and references to the NTIS Model from real-time data are all illustrated in Section 7.3.

5.2.3 Publication Data

The following sub-sections detail the data content in each file included in the NTIS Model publication package.

Content detail common to all publication data:

1. Each file contains well-formed XML, adhering to the DATEXII schema [ref 17].
2. The XML content of each file comprises a single `<d2LogicalModel>` top-level element.
3. The published data adheres to the standard DATEXII schema [ref 17], with Level B extensions detailed in Section 7.1.
4. All latitude and longitude values included in the published data utilise the World Geodetic System 1984 (WGS84) coordinate system [ref 26]. The DATEXII schema [ref 17] specifies that latitude/longitude values utilise the European Terrestrial Reference System 1989 (ETRS89) [ref 27]. However, WGS84 is employed in publications as it is more commonly used in the UK and is a system familiar to Subscribers.
5. Unless otherwise stated in the published data description, time and date values are presented in the following ISO 8601-compliant format:

`<date>T<local time, to milliseconds><timezone>`

where `<timezone>` takes one of the following values and indicates the timezone offset that has been applied to UTC to generate the `<local time>`:

`'+01:00'` (BST)

`'Z'` (GMT)

Example:2013-04-26T10:24:31.071+01:00

Notes on interpreting XML listings:

Each section contains an XML listing detailing the data content of the publication. The key for the XML listing is as follows:

<code><element>text</element></code>	<i>text</i> is static and is included, as listed, in all published data.
<code><element>[text]</element></code>	<i>[text]</i> is variable in value and uniquely identifies a data item that is described in the Data Item Descriptions section, following the XML listing.
<code><!-- text --></code>	XML comment text is included to add in-line context or explanation to the XML listing. These comments are not included in the published data.
<code><!-- x N text --></code>	Indicates that the previous element can be repeated 'N' times (accompanied by a description in the <i>text</i>).

5.2.4 Measurement Sites

The following sub-sections detail the data contained in the *MeasurementSiteTablePublication* component of the published NTIS Model.

5.2.4.1 Data Content

```
<?xml version="1.0" encoding="UTF-8"?>
<d2lm:d2LogicalModel modelBaseVersion="2" xmlns:d2lm=http://datex2.eu/schema/2/2_0
  xmlns:xsi=http://www.w3.org/2001/XMLSchema-instance
  extensionName="NTIS Published Services" extensionVersion="2.0">
  <d2lm:exchange>
    <d2lm:supplierIdentification>
      <d2lm:country>gb</d2lm:country>
      <d2lm:nationalIdentifier>NTIS</d2lm:nationalIdentifier>
    </d2lm:supplierIdentification>
  </d2lm:exchange>
  <d2lm:payloadPublication lang="en" xsi:type="d2lm:MeasurementSiteTablePublication">
    <d2lm:feedDescription>
      <d2lm:values>
        <d2lm:value lang="en">NTIS Network and Asset Model - Measurement Sites and
Routes</d2lm:value>
        <d2lm:value lang="en">Version: [NTIS Model version]</d2lm:value>
        <d2lm:value lang="en">Creation Date: [creation date]</d2lm:value>
        <d2lm:value lang="en">Includes: MIDAS Measurement Site Data
(NTIS_MIDAS_Measurement_Sites)</d2lm:value>
        <d2lm:value lang="en">Includes: TMU Measurement Site Data
(NTIS_TMU_Measurement_Sites)</d2lm:value>
        <d2lm:value lang="en">Includes: ANPR Measurement Route Data
(NTIS_ANPR_Measurement_Sites)</d2lm:value>
        <d2lm:value lang="en">Includes: TAME Measurement Site Data
(NTIS_TAME_Measurement_Sites)</d2lm:value>
      </d2lm:values>
    </d2lm:feedDescription>
    <d2lm:feedType>NTIS Model - Measurement Sites</d2lm:feedType>
    <d2lm:publicationTime>[publication time]</d2lm:publicationTime>
    <d2lm:publicationCreator>
      <d2lm:country>gb</d2lm:country>
      <d2lm:nationalIdentifier>NTIS</d2lm:nationalIdentifier>
    </d2lm:publicationCreator>
    <d2lm:headerInformation>
      <d2lm:areaOfInterest>national</d2lm:areaOfInterest>
      <d2lm:confidentiality>restrictedToAuthoritiesTrafficOperatorsAndPublishers
</d2lm:confidentiality>
      <d2lm:informationStatus>real</d2lm:informationStatus>
    </d2lm:headerInformation>

    <!-- MIDAS Measurement Sites -->

    <d2lm:measurementSiteTable version="[NTIS Model version]"
      id="NTIS_MIDAS_Measurement_Sites">
      <d2lm:measurementSiteRecord version="[NTIS Model version]" id="[site id]">
        <d2lm:measurementEquipmentReference>[electronic address]
</d2lm:measurementEquipmentReference>
        <d2lm:measurementEquipmentTypeUsed>
          <d2lm:values>
            <d2lm:value>loop</d2lm:value>
          </d2lm:values>
        </d2lm:measurementEquipmentTypeUsed>
        <d2lm:measurementSiteIdentification>[geographic address]
</d2lm:measurementSiteIdentification>
        <d2lm:measurementSpecificCharacteristics index="0">
          <d2lm:measurementSpecificCharacteristics>
            <d2lm:specificLane>[lane #1]</d2lm:specificLane>
            <d2lm:specificMeasurementValueType>trafficSpeed
</d2lm:specificMeasurementValueType>
          </d2lm:measurementSpecificCharacteristics>
        </d2lm:measurementSpecificCharacteristics>
        <d2lm:measurementSpecificCharacteristics index="1">
          <d2lm:measurementSpecificCharacteristics>
            <d2lm:specificLane>[lane #1]</d2lm:specificLane>
            <d2lm:specificMeasurementValueType>trafficHeadway
</d2lm:specificMeasurementValueType>
          </d2lm:measurementSpecificCharacteristics>
        </d2lm:measurementSpecificCharacteristics>
      </d2lm:measurementSiteRecord>
    </d2lm:measurementSiteTable>
  </d2lm:payloadPublication>
</d2lm:d2LogicalModel>
```

```

    </d2lm:measurementSpecificCharacteristics>
  </d2lm:measurementSpecificCharacteristics>
<d2lm:measurementSpecificCharacteristics index="2">
  <d2lm:measurementSpecificCharacteristics>
    <d2lm:specificLane>[lane #1]</d2lm:specificLane>
    <d2lm:specificMeasurementValueType>trafficConcentration
  </d2lm:specificMeasurementValueType>
  </d2lm:measurementSpecificCharacteristics>
</d2lm:measurementSpecificCharacteristics>
<d2lm:measurementSpecificCharacteristics index="3">
  <d2lm:measurementSpecificCharacteristics>
    <d2lm:specificLane>[lane #1]</d2lm:specificLane>
    <d2lm:specificMeasurementValueType>trafficFlow
  </d2lm:specificMeasurementValueType>
    <d2lm:specificVehicleCharacteristics>
      <d2lm:lengthCharacteristic>
        <d2lm:comparisonOperator>lessThanOrEqualTo</d2lm:comparisonOperator>
        <d2lm:vehicleLength>5.2</d2lm:vehicleLength>
      </d2lm:lengthCharacteristic>
    </d2lm:specificVehicleCharacteristics>
  </d2lm:measurementSpecificCharacteristics>
</d2lm:measurementSpecificCharacteristics>
<d2lm:measurementSpecificCharacteristics index="4">
  <d2lm:measurementSpecificCharacteristics>
    <d2lm:specificLane>[lane #1]</d2lm:specificLane>
    <d2lm:specificMeasurementValueType>trafficFlow</d2lm:specificMeasurementValueType>
    <d2lm:specificVehicleCharacteristics>
      <d2lm:lengthCharacteristic>
        <d2lm:comparisonOperator>greaterThan</d2lm:comparisonOperator>
        <d2lm:vehicleLength>5.2</d2lm:vehicleLength>
      </d2lm:lengthCharacteristic>
      <d2lm:lengthCharacteristic>
        <d2lm:comparisonOperator>lessThanOrEqualTo</d2lm:comparisonOperator>
        <d2lm:vehicleLength>6.6</d2lm:vehicleLength>
      </d2lm:lengthCharacteristic>
    </d2lm:specificVehicleCharacteristics>
  </d2lm:measurementSpecificCharacteristics>
</d2lm:measurementSpecificCharacteristics>
<d2lm:measurementSpecificCharacteristics index="5">
  <d2lm:measurementSpecificCharacteristics>
    <d2lm:specificLane>[lane #1]</d2lm:specificLane>
    <d2lm:specificMeasurementValueType>trafficFlow</d2lm:specificMeasurementValueType>
    <d2lm:specificVehicleCharacteristics>
      <d2lm:lengthCharacteristic>
        <d2lm:comparisonOperator>greaterThan</d2lm:comparisonOperator>
        <d2lm:vehicleLength>6.6</d2lm:vehicleLength>
      </d2lm:lengthCharacteristic>
      <d2lm:lengthCharacteristic>
        <d2lm:comparisonOperator>lessThanOrEqualTo</d2lm:comparisonOperator>
        <d2lm:vehicleLength>11.6</d2lm:vehicleLength>
      </d2lm:lengthCharacteristic>
    </d2lm:specificVehicleCharacteristics>
  </d2lm:measurementSpecificCharacteristics>
</d2lm:measurementSpecificCharacteristics>
<d2lm:measurementSpecificCharacteristics index="6">
  <d2lm:measurementSpecificCharacteristics>
    <d2lm:specificLane>[lane #1]</d2lm:specificLane>
    <d2lm:specificMeasurementValueType>trafficFlow</d2lm:specificMeasurementValueType>
    <d2lm:specificVehicleCharacteristics>
      <d2lm:lengthCharacteristic>
        <d2lm:comparisonOperator>greaterThan</d2lm:comparisonOperator>
        <d2lm:vehicleLength>11.6</d2lm:vehicleLength>
      </d2lm:lengthCharacteristic>
    </d2lm:specificVehicleCharacteristics>
  </d2lm:measurementSpecificCharacteristics>
</d2lm:measurementSpecificCharacteristics>
<!-- Note: if only one Flow value is supplied (this can occur if not
enough loops are available to determine vehicle-specific measurements)
the following, uncategorized, Flow is used in place of the previous
vehicle length-specific Flow values: -->
<d2lm:measurementSpecificCharacteristics index="7">
  <d2lm:measurementSpecificCharacteristics>
    <d2lm:specificLane>[lane #1]</d2lm:specificLane>
    <d2lm:specificMeasurementValueType>trafficFlow</d2lm:specificMeasurementValueType>
  </d2lm:measurementSpecificCharacteristics>
</d2lm:measurementSpecificCharacteristics>

```

```

<!-- x N - all the elements above (index 0-7) are for a single lane -
  These elements are repeated (here) for each lane reported by the MIDAS site,
  with continuing increments of the index number -->
<d21m:measurementSiteLocation xsi:type="d21m:Point">
  <d21m:locationForDisplay>
    <d21m:latitude>[site lat]</d21m:latitude>
    <d21m:longitude>[site long]</d21m:longitude>
  </d21m:locationForDisplay>
  <d21m:pointAlongLinearElement>
    <d21m:linearElement xsi:type="d21m:LinearElementByCode">
      <d21m:linearElementReferenceModel>NTIS_Network_Links
    </d21m:linearElementReferenceModel>
    <d21m:linearElementReferenceModelVersion>[NTIS Model version]
    </d21m:linearElementReferenceModelVersion>
    <d21m:linearElementIdentifier>[link id]</d21m:linearElementIdentifier>
  </d21m:linearElement>
  <d21m:distanceAlongLinearElement xsi:type="d21m:DistanceFromLinearElementStart">
    <d21m:distanceAlong>[site distance along link]</d21m:distanceAlong>
  </d21m:distanceAlongLinearElement>
</d21m:pointAlongLinearElement>
</d21m:measurementSiteLocation>
</d21m:measurementSiteRecord>
<!-- x N - one instance for each MIDAS Measurement Site in the NTIS Model -->
</d21m:measurementSiteTable>

<!-- TMU Measurement Sites -->

<d21m:measurementSiteTable version="[NTIS Model version]" id="NTIS_TMU_Measurement_Sites">
  <d21m:measurementSiteRecord version="[NTIS Model version]" id="[site id]">
    <d21m:measurementEquipmentTypeUsed>
      <d21m:values>
        <d21m:value>loop</d21m:value>
      </d21m:values>
    </d21m:measurementEquipmentTypeUsed>
    <d21m:measurementSiteIdentification>[port address]
  </d21m:measurementSiteIdentification>
  <d21m:measurementSpecificCharacteristics index="0">
    <d21m:measurementSpecificCharacteristics>
      <d21m:specificLane>allLanesCompleteCarriageway</d21m:specificLane>
      <d21m:specificMeasurementValueType>trafficSpeed
    </d21m:specificMeasurementValueType>
    </d21m:measurementSpecificCharacteristics>
  </d21m:measurementSpecificCharacteristics>
  <d21m:measurementSpecificCharacteristics index="1">
    <d21m:measurementSpecificCharacteristics>
      <d21m:specificLane>allLanesCompleteCarriageway</d21m:specificLane>
      <d21m:specificMeasurementValueType>trafficHeadway
    </d21m:specificMeasurementValueType>
    </d21m:measurementSpecificCharacteristics>
  </d21m:measurementSpecificCharacteristics>
  <d21m:measurementSpecificCharacteristics index="2">
    <d21m:measurementSpecificCharacteristics>
      <d21m:specificLane>allLanesCompleteCarriageway</d21m:specificLane>
      <d21m:specificMeasurementValueType>trafficConcentration
    </d21m:specificMeasurementValueType>
    </d21m:measurementSpecificCharacteristics>
  </d21m:measurementSpecificCharacteristics>
  <d21m:measurementSpecificCharacteristics index="3">
    <d21m:measurementSpecificCharacteristics>
      <d21m:specificLane>allLanesCompleteCarriageway</d21m:specificLane>
      <d21m:specificMeasurementValueType>trafficFlow</d21m:specificMeasurementValueType>
      <d21m:specificVehicleCharacteristics>
        <d21m:lengthCharacteristic>
          <d21m:comparisonOperator>lessThanOrEqualTo</d21m:comparisonOperator>
          <d21m:vehicleLength>5.2</d21m:vehicleLength>
        </d21m:lengthCharacteristic>
      </d21m:specificVehicleCharacteristics>
    </d21m:measurementSpecificCharacteristics>
  </d21m:measurementSpecificCharacteristics>
  <d21m:measurementSpecificCharacteristics index="4">
    <d21m:measurementSpecificCharacteristics>
      <d21m:specificLane>allLanesCompleteCarriageway</d21m:specificLane>
      <d21m:specificMeasurementValueType>trafficFlow</d21m:specificMeasurementValueType>
      <d21m:specificVehicleCharacteristics>
        <d21m:lengthCharacteristic>
          <d21m:comparisonOperator>greaterThan</d21m:comparisonOperator>

```

```

        <d21m:vehicleLength>5.2</d21m:vehicleLength>
    </d21m:lengthCharacteristic>
    <d21m:lengthCharacteristic>
        <d21m:comparisonOperator>lessThanOrEqualTo</d21m:comparisonOperator>
        <d21m:vehicleLength>6.6</d21m:vehicleLength>
    </d21m:lengthCharacteristic>
    </d21m:specificVehicleCharacteristics>
</d21m:measurementSpecificCharacteristics>
</d21m:measurementSpecificCharacteristics>
<d21m:measurementSpecificCharacteristics index="5">
    <d21m:measurementSpecificCharacteristics>
        <d21m:specificLane>allLanesCompleteCarriageway</d21m:specificLane>
        <d21m:specificMeasurementValueType>trafficFlow</d21m:specificMeasurementValueType>
        <d21m:specificVehicleCharacteristics>
            <d21m:lengthCharacteristic>
                <d21m:comparisonOperator>greaterThan</d21m:comparisonOperator>
                <d21m:vehicleLength>6.6</d21m:vehicleLength>
            </d21m:lengthCharacteristic>
            <d21m:lengthCharacteristic>
                <d21m:comparisonOperator>lessThanOrEqualTo</d21m:comparisonOperator>
                <d21m:vehicleLength>11.6</d21m:vehicleLength>
            </d21m:lengthCharacteristic>
        </d21m:specificVehicleCharacteristics>
    </d21m:measurementSpecificCharacteristics>
</d21m:measurementSpecificCharacteristics>
<d21m:measurementSpecificCharacteristics index="6">
    <d21m:measurementSpecificCharacteristics>
        <d21m:specificLane>allLanesCompleteCarriageway</d21m:specificLane>
        <d21m:specificMeasurementValueType>trafficFlow</d21m:specificMeasurementValueType>
        <d21m:specificVehicleCharacteristics>
            <d21m:lengthCharacteristic>
                <d21m:comparisonOperator>greaterThan</d21m:comparisonOperator>
                <d21m:vehicleLength>11.6</d21m:vehicleLength>
            </d21m:lengthCharacteristic>
        </d21m:specificVehicleCharacteristics>
    </d21m:measurementSpecificCharacteristics>
</d21m:measurementSpecificCharacteristics>
<!-- Note: if only one Flow value is supplied (this can occur if not
    enough loops are available to determine vehicle-specific measurements)
    the following, uncategorized, Flow is used in place of the previous
    vehicle length-specific Flow values: -->
<d21m:measurementSpecificCharacteristics index="7">
    <d21m:measurementSpecificCharacteristics>
        <d21m:specificLane>allLanesCompleteCarriageway</d21m:specificLane>
        <d21m:specificMeasurementValueType>trafficFlow</d21m:specificMeasurementValueType>
    </d21m:measurementSpecificCharacteristics>
</d21m:measurementSpecificCharacteristics>
<d21m:measurementSiteLocation xsi:type="d21m:Point">
    <d21m:locationForDisplay>
        <d21m:latitude>[site lat]</d21m:latitude>
        <d21m:longitude>[site long]</d21m:longitude>
    </d21m:locationForDisplay>
    <d21m:pointAlongLinearElement>
        <d21m:linearElement xsi:type="d21m:LinearElementByCode">
            <d21m:linearElementReferenceModel>NTIS_Network_Links
        </d21m:linearElementReferenceModel>
        <d21m:linearElementReferenceModelVersion>[NTIS Model version]
        </d21m:linearElementReferenceModelVersion>
        <d21m:linearElementIdentifier>[link id]</d21m:linearElementIdentifier>
    </d21m:linearElement>
    <d21m:distanceAlongLinearElement xsi:type="d21m:DistanceFromLinearElementStart">
        <d21m:distanceAlong>[site distance along link]</d21m:distanceAlong>
    </d21m:distanceAlongLinearElement>
    </d21m:pointAlongLinearElement>
</d21m:measurementSiteLocation>
</d21m:measurementSiteRecord>
<!-- x N - one instance for each TMU Measurement Site in the NTIS Model -->
</d21m:measurementSiteTable>

<!-- ANPR Measurement Sites -->

<d21m:measurementSiteTable version="[NTIS Model version] "
    id="NTIS_ANPR_Measurement_Sites">
    <d21m:measurementSiteRecord version="[NTIS Model version] "
        id="ANPR_Measurement_Site_[route id]">
        <d21m:measurementEquipmentTypeUsed>

```

```

    <d2lm:values>
      <d2lm:value>ANPR</d2lm:value>
    </d2lm:values>
  </d2lm:measurementEquipmentTypeUsed>
  <d2lm:measurementSiteLocation xsi:type="d2lm:ItineraryByReference">
    <d2lm:predefinedItineraryReference version="[NTIS Model version]"
      targetClass="PredefinedItinerary" id="ANPR_Route_[route id]"/>
  </d2lm:measurementSiteLocation>
</d2lm:measurementSiteRecord>
<!-- x N - one instance for each ANPR Measurement Site in the NTIS Model -->
</d2lm:measurementSiteTable>

<!-- TAME Measurement Sites -->

<d2lm:measurementSiteTable version="[NTIS Model version]"
  id="NTIS_TAME_Measurement_Sites">

  <!-- Volumetric Sites -->

  <d2lm:measurementSiteRecord version="[NTIS Model version]" id="[site id]">
    <d2lm:measurementEquipmentTypeUsed>
      <d2lm:values>
        <d2lm:value>loop</d2lm:value>
      </d2lm:values>
    </d2lm:measurementEquipmentTypeUsed>
    <d2lm:measurementSiteIdentification>[equipment id]
  </d2lm:measurementSiteIdentification>
  <!-- Total flow measurement -->
  <d2lm:measurementSpecificCharacteristics index="0">
    <d2lm:measurementSpecificCharacteristics>
      <d2lm:specificLane>allLanesCompleteCarriageway</d2lm:specificLane>
      <d2lm:specificMeasurementValueType>trafficFlow</d2lm:specificMeasurementValueType>
    </d2lm:measurementSpecificCharacteristics>
  </d2lm:measurementSpecificCharacteristics>
  <!-- Site Location -->
  <d2lm:measurementSiteLocation xsi:type="d2lm:Point">
    <d2lm:locationForDisplay>
      <d2lm:latitude>[site lat]</d2lm:latitude>
      <d2lm:longitude>[site long]</d2lm:longitude>
    </d2lm:locationForDisplay>
    <d2lm:pointAlongLinearElement>
      <d2lm:linearElement xsi:type="d2lm:LinearElementByCode">
        <d2lm:linearElementReferenceModel>NTIS_Network_Links
      </d2lm:linearElementReferenceModel>
      <d2lm:linearElementReferenceModelVersion>[NTIS Model version]
      </d2lm:linearElementReferenceModelVersion>
      <d2lm:linearElementIdentifier>[link id]</d2lm:linearElementIdentifier>
    </d2lm:linearElement>
    <d2lm:distanceAlongLinearElement xsi:type="d2lm:DistanceFromLinearElementStart">
      <d2lm:distanceAlong>[site distance along link]</d2lm:distanceAlong>
    </d2lm:distanceAlongLinearElement>
  </d2lm:pointAlongLinearElement>
  </d2lm:measurementSiteLocation>
</d2lm:measurementSiteRecord>
<!-- x N for each Volumetric TAME Measurement Site -->

  <!-- Classified Sites -->

  <d2lm:measurementSiteRecord version="[NTIS Model version]" id="[site id]">
    <d2lm:measurementEquipmentTypeUsed>
      <d2lm:values>
        <d2lm:value>loop</d2lm:value>
      </d2lm:values>
    </d2lm:measurementEquipmentTypeUsed>
    <d2lm:measurementSiteIdentification>[equipment id]
  </d2lm:measurementSiteIdentification>
  <!-- Total flow measurement -->
  <d2lm:measurementSpecificCharacteristics index="0">
    <d2lm:measurementSpecificCharacteristics>
      <d2lm:specificLane>allLanesCompleteCarriageway</d2lm:specificLane>
      <d2lm:specificMeasurementValueType>trafficFlow</d2lm:specificMeasurementValueType>
    </d2lm:measurementSpecificCharacteristics>
  </d2lm:measurementSpecificCharacteristics>
  <!-- Vehicle Length-categorised flow measurements -->
  <d2lm:measurementSpecificCharacteristics index="1">
    <d2lm:measurementSpecificCharacteristics>

```

```

<d2lm:specificLane>allLanesCompleteCarriageway</d2lm:specificLane>
<d2lm:specificMeasurementValueType>trafficFlow</d2lm:specificMeasurementValueType>
<d2lm:specificVehicleCharacteristics>
  <d2lm:lengthCharacteristic>
    <d2lm:comparisonOperator>lessThanOrEqualTo</d2lm:comparisonOperator>
    <d2lm:vehicleLength>5.2</d2lm:vehicleLength>
  </d2lm:lengthCharacteristic>
</d2lm:specificVehicleCharacteristics>
</d2lm:measurementSpecificCharacteristics>
</d2lm:measurementSpecificCharacteristics>
<d2lm:measurementSpecificCharacteristics index="2">
  <d2lm:measurementSpecificCharacteristics>
    <d2lm:specificLane>allLanesCompleteCarriageway</d2lm:specificLane>
    <d2lm:specificMeasurementValueType>trafficFlow</d2lm:specificMeasurementValueType>
    <d2lm:specificVehicleCharacteristics>
      <d2lm:lengthCharacteristic>
        <d2lm:comparisonOperator>greaterThan</d2lm:comparisonOperator>
        <d2lm:vehicleLength>5.2</d2lm:vehicleLength>
      </d2lm:lengthCharacteristic>
      <d2lm:lengthCharacteristic>
        <d2lm:comparisonOperator>lessThanOrEqualTo</d2lm:comparisonOperator>
        <d2lm:vehicleLength>6.6</d2lm:vehicleLength>
      </d2lm:lengthCharacteristic>
    </d2lm:specificVehicleCharacteristics>
  </d2lm:measurementSpecificCharacteristics>
</d2lm:measurementSpecificCharacteristics>
<d2lm:measurementSpecificCharacteristics index="3">
  <d2lm:measurementSpecificCharacteristics>
    <d2lm:specificLane>allLanesCompleteCarriageway</d2lm:specificLane>
    <d2lm:specificMeasurementValueType>trafficFlow</d2lm:specificMeasurementValueType>
    <d2lm:specificVehicleCharacteristics>
      <d2lm:lengthCharacteristic>
        <d2lm:comparisonOperator>greaterThan</d2lm:comparisonOperator>
        <d2lm:vehicleLength>6.6</d2lm:vehicleLength>
      </d2lm:lengthCharacteristic>
      <d2lm:lengthCharacteristic>
        <d2lm:comparisonOperator>lessThanOrEqualTo</d2lm:comparisonOperator>
        <d2lm:vehicleLength>11.6</d2lm:vehicleLength>
      </d2lm:lengthCharacteristic>
    </d2lm:specificVehicleCharacteristics>
  </d2lm:measurementSpecificCharacteristics>
</d2lm:measurementSpecificCharacteristics>
<d2lm:measurementSpecificCharacteristics index="4">
  <d2lm:measurementSpecificCharacteristics>
    <d2lm:specificLane>allLanesCompleteCarriageway</d2lm:specificLane>
    <d2lm:specificMeasurementValueType>trafficFlow</d2lm:specificMeasurementValueType>
    <d2lm:specificVehicleCharacteristics>
      <d2lm:lengthCharacteristic>
        <d2lm:comparisonOperator>greaterThan</d2lm:comparisonOperator>
        <d2lm:vehicleLength>11.6</d2lm:vehicleLength>
      </d2lm:lengthCharacteristic>
    </d2lm:specificVehicleCharacteristics>
  </d2lm:measurementSpecificCharacteristics>
</d2lm:measurementSpecificCharacteristics>
<!-- Vehicle Speed-categorised flow measurements -->
<d2lm:measurementSpecificCharacteristics index="5">
  <d2lm:measurementSpecificCharacteristics>
    <d2lm:specificLane>allLanesCompleteCarriageway</d2lm:specificLane>
    <d2lm:specificMeasurementValueType>trafficFlow</d2lm:specificMeasurementValueType>
    <d2lm:specificVehicleCharacteristics>
      <d2lm:vehicleCharacteristicsExtension> <!-- NTIS extension -->
        <d2lm:vehicleCurrentCharacteristics>
          <d2lm:speedCharacteristic>
            <d2lm:comparisonOperator>lessThan</d2lm:comparisonOperator>
            <d2lm:vehicleSpeed>[vehicle speed]</d2lm:vehicleSpeed>
          </d2lm:speedCharacteristic>
        </d2lm:vehicleCurrentCharacteristics>
      </d2lm:vehicleCharacteristicsExtension>
    </d2lm:specificVehicleCharacteristics>
  </d2lm:measurementSpecificCharacteristics>
</d2lm:measurementSpecificCharacteristics>
<d2lm:measurementSpecificCharacteristics index="6">
  <d2lm:measurementSpecificCharacteristics>
    <d2lm:specificLane>allLanesCompleteCarriageway</d2lm:specificLane>
    <d2lm:specificMeasurementValueType>trafficFlow</d2lm:specificMeasurementValueType>
    <d2lm:specificVehicleCharacteristics>

```



```

    <d21m:vehicleCharacteristicsExtension> <!-- NTIS extension -->
      <d21m:vehicleCurrentCharacteristics>
        <d21m:speedCharacteristic>
          <d21m:comparisonOperator>greaterThanOrEqualTo</d21m:comparisonOperator>
          <d21m:vehicleSpeed>[vehicle speed]</d21m:vehicleSpeed>
        </d21m:speedCharacteristic>
        <d21m:speedCharacteristic>
          <d21m:comparisonOperator>lessThan</d21m:comparisonOperator>
          <d21m:vehicleSpeed>[vehicle speed]</d21m:vehicleSpeed>
        </d21m:speedCharacteristic>
      </d21m:vehicleCurrentCharacteristics>
    </d21m:vehicleCharacteristicsExtension>
  </d21m:specificVehicleCharacteristics>
</d21m:measurementSpecificCharacteristics>
</d21m:measurementSpecificCharacteristics>
<!-- x N : one instance for each speed category. See General Notes for details -->
<!-- Note that the index number increments by 1 for each measurement type -->
<d21m:measurementSpecificCharacteristics index="18">
  <d21m:measurementSpecificCharacteristics>
    <d21m:specificLane>allLanesCompleteCarriageway</d21m:specificLane>
    <d21m:specificMeasurementValueType>trafficFlow</d21m:specificMeasurementValueType>
    <d21m:specificVehicleCharacteristics>
      <d21m:vehicleCharacteristicsExtension> <!-- NTIS extension -->
        <d21m:vehicleCurrentCharacteristics>
          <d21m:speedCharacteristic>
            <d21m:comparisonOperator>greaterThanOrEqualTo</d21m:comparisonOperator>
            <d21m:vehicleSpeed>[vehicle speed]</d21m:vehicleSpeed>
          </d21m:speedCharacteristic>
        </d21m:vehicleCurrentCharacteristics>
      </d21m:vehicleCharacteristicsExtension>
    </d21m:specificVehicleCharacteristics>
  </d21m:measurementSpecificCharacteristics>
</d21m:measurementSpecificCharacteristics>
<!-- Site Location -->
<d21m:measurementSiteLocation xsi:type="d21m:Point">
  <d21m:locationForDisplay>
    <d21m:latitude>[site lat]</d21m:latitude>
    <d21m:longitude>[site long]</d21m:longitude>
  </d21m:locationForDisplay>
  <d21m:pointAlongLinearElement>
    <d21m:linearElement xsi:type="d21m:LinearElementByCode">
      <d21m:linearElementReferenceModel>NTIS_Network_Links
    </d21m:linearElementReferenceModel>
    <d21m:linearElementReferenceModelVersion>[NTIS Model version]
    </d21m:linearElementReferenceModelVersion>
    <d21m:linearElementIdentifier>[link id]</d21m:linearElementIdentifier>
  </d21m:linearElement>
  <d21m:distanceAlongLinearElement xsi:type="d21m:DistanceFromLinearElementStart">
    <d21m:distanceAlong>[site distance along link]</d21m:distanceAlong>
  </d21m:distanceAlongLinearElement>
</d21m:pointAlongLinearElement>
</d21m:measurementSiteLocation>
</d21m:measurementSiteRecord>
<!-- x N for each Classified TAME Measurement Site -->
</d21m:measurementSiteTable>

</d21m:payloadPublication>
</d21m:d2LogicalModel>

```

5.2.4.2 General Notes

1. The publication includes all measurement sites in the NTIS Model.
2. The publication utilises the NTIS-specific extensions to the DATEXII schema. The *extensionName* and *extensionVersion* attributes are added to the `<d21m:d2LogicalModel>` element to specify that this message utilises NTIS Publish Services-specific extensions to the base DATEXII schema. Refer to Section 7.1 for details.

3. Locations. All measurement sites contain location information to enable the site to be related to the road network through the Predefined Locations (Section 5.2.5) defined in the NTIS Model.
 - a. MIDAS, TMU and TAME measurement sites data contains the following location information:
 - i. The Network Link [link id] and the distance along the Link [site distance along link] on which the site is located. This enables the site to be precisely located on the road network defined by the NTIS Model.
 - ii. A point location, specified in lat/long coordinates - [site lat]/[site long]. This geo-location is primarily intended for display purposes; to position the site on a visual map, or similar.
 - b. ANPR measurement sites are not single-location sites. ANPR measurements are taken from one ANPR site to another, along a unique, predefined route. The ANPR Measurement sites refer to a single ANPR Route defined in the Predefined Locations component of the NTIS Model.
4. Site Measurements: the publication includes details of all the site measurements that can be reported by a particular type site: MIDAS, TAME or TMU. The real-time data published on the DATEXII Webservice [ref 8] includes a measurement value and a reference to the [site id] and the *measurementSpecificCharacteristics index* in the NTIS Model. In this way, the real-time data can be relatively compact; with all the contextual information about the measured value retained in the NTIS Model.
5. MIDAS measurements:
 - a. MIDAS measurements apply to a particular lane; as specified by the [lane #n] data item. There are no 'complete carriageway' measurements.
 - b. Measurements: The following specific measurement characteristics are defined for MIDAS sites:
 - i. Average speed.
 - ii. Average headway.
 - iii. Average occupancy (concentration).
 - iv. Total flow: the flow of all vehicles measured by the site.
 - v. Length-specific flow: flow values categorised into the following vehicle lengths, specified in metres:
 - $L \leq 5.2$
 - $5.2 < L \leq 6.6$
 - $6.6 < L \leq 11.6$
 - $11.6 < L$

In some cases, such as when a loop detector has failed, only the Total flow is reported, as categorised flows cannot be calculated by the site.

6. TMU measurements:

- a. All TMU measurements apply to the complete carriageway; there are no lane-specific data measurements.
- b. Measurements: the specific measurements reported by TMU sites are identical to those for MIDAS sites, above.

7. TAME measurements:

- a. There are 2 types of TAME measurement sites:
 - i. Classified, providing a total vehicular flow value plus a number of categorised flow values, based on: a) vehicle length and b) vehicle speed.
 - ii. Volumetric, providing a single total flow value.
- b. All TAME measurements apply to the complete carriageway; there are no lane-specific data measurements.
- c. The following specific measurement characteristics are defined for TAME sites:

- i. Total flow (all sites): the flow of all vehicles measured by the site.
- ii. Length-specific flow (Classified sites only): flow values categorised into the following vehicle lengths, specified in metres:

$L \leq 5.2$
 $5.2 < L \leq 6.6$
 $6.6 < L \leq 11.6$
 $11.6 < L$

- iii. Vehicle-specific flow (Classified sites only): flow values categorised into the following speed ranges, specified in km/h, with mph values in (brackets):

$S < 16.09$ (10)
 16.09 (10) $\leq S < 24.14$ (15)
 24.14 (15) $\leq S < 32.19$ (20)
 32.19 (20) $\leq S < 40.23$ (25)
 40.23 (25) $\leq S < 48.28$ (30)
 48.28 (30) $\leq S < 56.32$ (35)
 56.32 (35) $\leq S < 64.37$ (40)
 64.37 (40) $\leq S < 72.42$ (45)
 72.42 (45) $\leq S < 80.47$ (50)
 80.47 (50) $\leq S < 88.51$ (55)
 88.51 (55) $\leq S < 96.56$ (60)
 96.56 (60) $\leq S < 112.65$ (70)
 112.65 (70) $\leq S < 128.75$ (80)
 128.75 (80) $\leq S$

- iv. Note: the speed ranges configured at the site are in empirical units of mph, this publication adheres to DATEXII and hence the speed values are converted to km/h.
- d. The standard DATEXII schema does not accommodate categorising site measurements by vehicle speed. Hence, an extension is added to the `<d2lm:specificVehicleCharacteristics>` element (annotated in the XML listing, above) to include a speed range characteristic. Extensions to the DATEXII schema, for the NTIS Model publication, are listed in Section 7.1.

5.2.4.3 Data Item Descriptions

5.2.4.3.1 Package Header and Common Data Items

Data Item	Description
[creation date]	The date and time that the NTIS Model was initially created. Format: <dd>-<mm>-<yyyy>, e.g. 26-01-2014
[NTIS Model version]	Version of the published NTIS Model against which this message is published. Format: <major version>.<minor version>, e.g. "17.0"
[publication time]	The time and date that the message was published by the NTIS system.

5.2.4.3.2 MIDAS Measurement Sites

Data Item	Description
[electronic address]	Text identifying the electronic address of the measurement site. The electronic address defines an identifier for communicating with the site. This is the identifier assigned to the MIDAS equipment/site by the HA. The ID is not guaranteed to be unique within the NTIS Model; the unique identification of a site is specified by the [site id] data item. Note: this is not the outstation identifier; a MIDAS outstation may control multiple sites/equipment. Example: 024/2/123/210
[geographic address]	Text identifying the geographic address of the site. The geographic address is specified by the HA and describes the physical location of the site on the road network. Note that the address is not guaranteed to be unique: the outstation located at this address may control more than one measurement sites. Example: M25/4883J

Data Item	Description
[lane #n]	The identifier of the lane for which the measurement applies. MIDAS sites report measurements that are specific to a single lane of the carriageway. Note: the lane identifier can also include the hard shoulder.
[link id]	The unique ID of the Network Link, as contained in the Predefined Locations component of the NTIS Model (Section 5.2.5), on which the site is located. Refer to the General Notes section for details.
[site distance along link]	The distance along the Network Link, specified by the [link id] data item, that the site is located. The value is specified in metres. Refer to the General Notes section for details.
[site id]	The unique ID of the measurement site; used to reference the site in the published NTIS Model.
[site lat]/[site long]	The point location of the site, specified in latitude/longitude coordinates. Refer to the General Notes section for details.

5.2.4.3.3 TMU Measurement Sites

Data Item	Description
[link id]	The unique ID of the Network Link, as contained in the Predefined Locations component of the NTIS Model (Section 5.2.5), on which the site is located. Refer to the General Notes section for details.
[port address]	Text identifying the port address of the measurement site. The port address defines an identifier for communicating with the site. The identifier is assigned to the TMU equipment/site by the HA. The ID is not guaranteed to be unique within the NTIS Model; the unique identification of a site is specified by the [site id] data item. Note: this is not the outstation identifier; a TMU outstation may control multiple sites/equipment. Example: 6510/1
[site distance along link]	The distance along the Network Link, specified by the [link id] data item, that the site is located. The value is specified in metres. Refer to the General Notes section for details.
[site id]	The unique ID of the measurement site; used to reference the site in the published NTIS Model.

Data Item	Description
[site lat]/[site long]	The point location of the site, specified in latitude/longitude coordinates. Refer to the General Notes section for details.

5.2.4.3.4 ANPR Measurement Sites

Data Item	Description
[route id]	The unique ID of the ANPR route to which a measurement applies. It should be noted that this is not a single location 'measurement site'; the measurements reported by ANPR cameras are journey times between 2 ANPR sites. The ANPR route, to which the [route id] refers, is defined as a unique route between 2 ANPR sites. The ANPR routes are specified in the Predefined Locations component of the NTIS Model (Section 5.2.5).

5.2.4.3.5 TAME Measurement Sites

Data Item	Description
[equipment id]	The equipment/site identifier, specified as a numeric string. This is the identifier assigned to the TAME equipment/site by the HA. This ID is not guaranteed to be unique within the NTIS Model; the unique identification of a site is specified by the [site id] data item. Note: this is not the outstation identifier; a TAME outstation may control multiple sites/equipment. Example: 30360383
[link id]	The unique ID of the Network Link, as contained in the Predefined Locations component of the NTIS Model (Section 5.2.5), on which the site is located. Refer to the General Notes section for details.
[site distance along link]	The distance along the Network Link, specified by the [link id] data item, that the site is located. The value is specified in metres. Refer to the General Notes section for details.
[site id]	The unique ID of the measurement site; used to reference the site in the published NTIS Model.
[site lat]/[site long]	The point location of the site, specified in latitude/longitude coordinates. Refer to the General Notes section for details.

Data Item	Description
[vehicle speed]	<p>This data item is used to specify the bounds of the speed categories for which flow values are measured by the site. Refer to the General Notes section for details.</p> <p>The values are specified in km/h.</p>

5.2.5 Predefined Locations

The following sub-sections detail the data contained in the *PredefinedLocationsPublication* component of the published NTIS Model.

5.2.5.1 Data Content

```
<?xml version="1.0" encoding="UTF-8"?>
<d2lm:d2LogicalModel modelBaseVersion="2" xmlns:d2lm=http://datex2.eu/schema/2/2_0
  xmlns:xsi=http://www.w3.org/2001/XMLSchema-instance
  extensionName="NTIS Published Services" extensionVersion="2.0">
  <d2lm:exchange>
    <d2lm:supplierIdentification>
      <d2lm:country>gb</d2lm:country>
      <d2lm:nationalIdentifier>NTIS</d2lm:nationalIdentifier>
    </d2lm:supplierIdentification>
  </d2lm:exchange>
  <d2lm:payloadPublication lang="en" xsi:type="d2lm:PredefinedLocationsPublication">
    <d2lm:feedDescription>
      <d2lm:values>
        <d2lm:value lang="en">NTIS Network and Asset Model - Predefined Locations</d2lm:value>
        <d2lm:value lang="en">Version: [NTIS Model version]</d2lm:value>
        <d2lm:value lang="en">Creation Date: [creation date]</d2lm:value>
        <d2lm:value lang="en">Includes: Alternate Routes (NTIS_Alternate_Route_*)</d2lm:value>
        <d2lm:value lang="en">Includes: ANPR Routes (NTIS_ANPR_Route_*)</d2lm:value>
        <d2lm:value lang="en">Includes: HATRIS Sections (NTIS_HATRIS_Section_*)</d2lm:value>
        <d2lm:value lang="en">Includes: Link shapes (NTIS_Link_Shape_*)</d2lm:value>
        <d2lm:value lang="en">Includes: Network Links (NTIS_Network_Links)</d2lm:value>
        <d2lm:value lang="en">Includes: Network Nodes (NTIS_Network_Nodes)</d2lm:value>
      </d2lm:values>
    </d2lm:feedDescription>
    <d2lm:feedType>NTIS Model - Predefined Locations</d2lm:feedType>
    <d2lm:publicationTime>[publication time]</d2lm:publicationTime>
    <d2lm:publicationCreator>
      <d2lm:country>gb</d2lm:country>
      <d2lm:nationalIdentifier>NTIS</d2lm:nationalIdentifier>
    </d2lm:publicationCreator>
    <d2lm:headerInformation>
      <d2lm:areaOfInterest>national</d2lm:areaOfInterest>
      <d2lm:confidentiality>restrictedToAuthoritiesTrafficOperatorsAndPublishers</d2lm:confidentiality>
      <d2lm:informationStatus>real</d2lm:informationStatus>
    </d2lm:headerInformation>

    <!-- Alternate Routes -->

    <d2lm:predefinedLocationContainer xsi:type="d2lm:PredefinedItinerary"
      version="[NTIS Model version]" id="NTIS_Alternate_Route_[alt route id]">
      <d2lm:predefinedItineraryName>
        <d2lm:values>
          <d2lm:value lang="en">From: [alt route origin]</d2lm:value>
          <d2lm:value lang="en">To: [alt route destination]</d2lm:value>
        </d2lm:values>
      </d2lm:predefinedItineraryName>
      <d2lm:predefinedLocation index="0">
        <d2lm:predefinedLocation version="[NTIS Model version]" id="[alt route id]_0">
          <d2lm:location xsi:type="d2lm:LocationByReference">
            <d2lm:predefinedLocationReference version="[NTIS Model version]"
              targetClass="PredefinedLocation" id="[link id]"/>
          </d2lm:location>
        </d2lm:predefinedLocation>
      </d2lm:predefinedLocation>
    </d2lm:predefinedLocationContainer>
    <!-- x N - the route is made up of 1 or more Network Links -->
    <!-- Note: the index and [alt route id] suffix increment by 1 for each location -->
  </d2lm:payloadPublication>

  <!-- ANPR Routes -->

  <d2lm:predefinedLocationContainer xsi:type="d2lm:PredefinedItinerary"
    version="[NTIS Model version]" id="ANPR_Route_[ANPR route id]">
    <d2lm:predefinedItineraryName>
      <d2lm:values>
```



```

    <d2lm:value lang="en">ANPR Route [ANPR route id]</d2lm:value>
  </d2lm:values>
</d2lm:predefinedItineraryName>
<d2lm:predefinedLocation index="0">
<!-- ANPR start site -->
  <d2lm:predefinedLocation version="[NTIS Model version]"
    id="ANPR_Route_[ANPR route id]_0">
    <d2lm:location xsi:type="d2lm:Point">
      <d2lm:locationForDisplay>
        <d2lm:latitude>[ANPR site lat - start]</d2lm:latitude>
        <d2lm:longitude>[ANPR site long - start]</d2lm:longitude>
      </d2lm:locationForDisplay>
      <d2lm:pointAlongLinearElement>
        <d2lm:linearElement xsi:type="d2lm:LinearElementByCode">
          <d2lm:linearElementReferenceModel>NTIS_Network_Links
          </d2lm:linearElementReferenceModel>
          <d2lm:linearElementReferenceModelVersion>[NTIS Model version]
          </d2lm:linearElementReferenceModelVersion>
          <d2lm:linearElementIdentifier>[link id - start]
          </d2lm:linearElementIdentifier>
        </d2lm:linearElement>
        <d2lm:distanceAlongLinearElement xsi:type="d2lm:DistanceFromLinearElementStart">
          <d2lm:distanceAlong>[distance along link - start]</d2lm:distanceAlong>
        </d2lm:distanceAlongLinearElement>
      </d2lm:pointAlongLinearElement>
    </d2lm:location>
  </d2lm:predefinedLocation>
</d2lm:predefinedLocation>
<d2lm:predefinedLocation index="1">
<!-- Intermediate Network Link(s) -->
  <d2lm:predefinedLocation version="[NTIS Model version]"
    id="ANPR_Route_[ANPR route id]_1">
    <d2lm:location xsi:type="d2lm:LocationByReference">
      <d2lm:predefinedLocationReference version="[NTIS Model version]"
        targetClass="PredefinedLocation" id="[link id - intermediate]"/>
    </d2lm:location>
  </d2lm:predefinedLocation>
</d2lm:predefinedLocation>
<!-- x N - for each intermediate Network Link in the route; in order of traversal -->
<!-- Note: the index and [ANPR route id] suffix increment by 1 for each location -->
<d2lm:predefinedLocation index="[index]">
  <d2lm:predefinedLocation version="[NTIS Model version]"
    id="ANPR_Route_[ANPR route id]_[index]">
    <!-- ANPR end site -->
    <d2lm:location xsi:type="d2lm:Point">
      <d2lm:locationForDisplay>
        <d2lm:latitude>[ANPR site lat - end]</d2lm:latitude>
        <d2lm:longitude>[ANPR site long - end]</d2lm:longitude>
      </d2lm:locationForDisplay>
      <d2lm:pointAlongLinearElement>
        <d2lm:linearElement xsi:type="d2lm:LinearElementByCode">
          <d2lm:linearElementReferenceModel>NTIS_Network_Links
          </d2lm:linearElementReferenceModel>
          <d2lm:linearElementReferenceModelVersion>[NTIS Model version]
          </d2lm:linearElementReferenceModelVersion>
          <d2lm:linearElementIdentifier>[link id - end]</d2lm:linearElementIdentifier>
        </d2lm:linearElement>
        <d2lm:distanceAlongLinearElement xsi:type="d2lm:DistanceFromLinearElementStart">
          <d2lm:distanceAlong>[distance along link - end]</d2lm:distanceAlong>
        </d2lm:distanceAlongLinearElement>
      </d2lm:pointAlongLinearElement>
    </d2lm:location>
  </d2lm:predefinedLocation>
</d2lm:predefinedLocation>
</d2lm:predefinedLocationContainer>
<!-- x N - one instance for each ANPR Route defined in the Network Model -->

<!-- NTIS HATRIS Sections -->

<d2lm:predefinedLocationContainer xsi:type="d2lm:PredefinedItinerary"
  version="[NTIS Model version]" id="NTIS_HATRIS_Section_[HATRIS section id]">
  <d2lm:predefinedItineraryName>
    <d2lm:values>
      <d2lm:value lang="en">NTIS HATRIS Section [HATRIS section id]</d2lm:value>
    </d2lm:values>
  </d2lm:predefinedItineraryName>

```

```

<d21m:predefinedLocation index="0">
  <d21m:predefinedLocation version="[NTIS Model version]" id="[HATRIS section id]_0">
    <d21m:location xsi:type="d21m:LocationByReference">
      <d21m:predefinedLocationReference version="[NTIS Model version]"
        targetClass="PredefinedLocation" id="[link id]"/>
    </d21m:location>
  </d21m:predefinedLocation>
</d21m:predefinedLocation>
<!-- x N - the section is made up of 1 or more Network Links -->
<!-- Note: the index and [HATRIS section id] suffix increment by 1 for each location -->
</d21m:predefinedLocationContainer>
<!-- x N - one instance for each HATRIS Section defined on the Network -->

<!-- Network Link Shapes -->

<d21m:predefinedLocationContainer
  xsi:type="d21m:PredefinedItinerary" version="[NTIS Model version]"
  id="NTIS_Link_Shape_[link id]">
  <d21m:predefinedItineraryName>
    <d21m:values>
      <d21m:value lang="en">Shape for Network Link [link id]</d21m:value>
    </d21m:values>
  </d21m:predefinedItineraryName>
  <d21m:predefinedLocation index="0">
    <d21m:predefinedLocation version="[NTIS Model version]" id="[link id]_0">
      <d21m:location xsi:type="d21m:Point">
        <d21m:pointByCoordinates>
          <d21m:pointCoordinates>
            <d21m:latitude>[link point lat]</d21m:latitude>
            <d21m:longitude>[link point long]</d21m:longitude>
          </d21m:pointCoordinates>
        </d21m:pointByCoordinates>
      </d21m:location>
    </d21m:predefinedLocation>
  </d21m:predefinedLocation>
  <!-- x N - one instance for each point location in the Network Link -->
  <!-- Note: the index and [link id] suffix increment by 1 for each location -->
</d21m:predefinedLocationContainer>
<!-- x N - one instance for each Link in the Network -->

<!-- Network Links -->

<d21m:predefinedLocationContainer xsi:type="d21m:PredefinedNonOrderedLocationGroup"
  version="[NTIS Model version]" id="NTIS_Network_Links">
  <d21m:predefinedLocation version="[NTIS Model version]" id="[link id]">
    <d21m:predefinedLocationName>
      <d21m:values>
        <d21m:value lang="en">[link location description]</d21m:value>
      </d21m:values>
    </d21m:predefinedLocationName>
    <d21m:location xsi:type="d21m:Linear">
      <d21m:supplementaryPositionalDescription>
        <d21m:locationDescriptor>[link location type]</d21m:locationDescriptor>
        <d21m:affectedCarriagewayAndLanes>
          <d21m:carriageway>[link carriageway]</d21m:carriageway>
          <d21m:lane>allLanesCompleteCarriageway</d21m:lane>
          <d21m:lengthAffected>[link length]</d21m:lengthAffected>
        </d21m:affectedCarriagewayAndLanes>
      </d21m:supplementaryPositionalDescription>
      <d21m:linearWithinLinearElement>
        <d21m:directionBoundOnLinearSection>[link direction]
        </d21m:directionBoundOnLinearSection>
        <d21m:linearElement xsi:type="d21m:LinearElement">
          <d21m:roadNumber>[road number]</d21m:roadNumber>
          <d21m:linearElementNature>road</d21m:linearElementNature>
        </d21m:linearElement>
        <d21m:fromPoint xsi:type="d21m:DistanceFromLinearElementReferent">
          <d21m:distanceAlong>0</d21m:distanceAlong>
          <d21m:fromReferent>
            <d21m:referentIdentifier>[node id - start]</d21m:referentIdentifier>
            <d21m:referentType>roadNode</d21m:referentType>
          </d21m:fromReferent>
        </d21m:fromPoint>
        <d21m:toPoint xsi:type="d21m:DistanceFromLinearElementReferent">
          <d21m:distanceAlong>0</d21m:distanceAlong>
          <d21m:fromReferent>

```

```

        <d2lm:referentIdentifier>[node id - end]</d2lm:referentIdentifier>
        <d2lm:referentType>roadNode</d2lm:referentType>
    </d2lm:fromReferent>
</d2lm:toPoint>
<d2lm:linearWithinLinearElementExtension>
    <d2lm:staticCapacity>
        <d2lm:exitPointStaticCapacity>[capacity - exit]</d2lm:exitPointStaticCapacity>
        <d2lm:midPointStaticCapacity>[capacity - mid]</d2lm:midPointStaticCapacity>
    </d2lm:staticCapacity>
</d2lm:linearWithinLinearElementExtension>
</d2lm:linearWithinLinearElement>

<d2lm:TpegAreaDescriptor>
    <d2lm:TpegDescriptor>
        <d2lm:tepegAreaDescriptorType xsi:type="
d2lm:TpegLoc03AreaDescriptorSubTypeEnum">countyName</d2lm:tepegAreaDescriptorType>
        <d2lm:values>
            <d2lm:value lang="en">[county]</d2lm:value>
        </d2lm:values>
        <d2lm:tepegAreaDescriptorType xsi:type="
d2lm:TpegLoc03AreaDescriptorSubTypeEnum">areaName</d2lm:tepegAreaDescriptorType>
        <d2lm:values>
            <d2lm:value lang="en">[area team]</d2lm:value>
        </d2lm:values>
        <d2lm:tepegAreaDescriptorType xsi:type="
d2lm:TpegLoc03AreaDescriptorSubTypeEnum">regionName</d2lm:tepegAreaDescriptorType>
        <d2lm:values>
            <d2lm:value lang="en">[regional control centre]</d2lm:value>
        </d2lm:values>
    </d2lm:TpegDescriptor>
</d2lm:TpegAreaDescriptor>
<d2lm:supplementaryPositionalDescriptionExtension>
    <d2lm:TpegFramedPoint>
        <d2lm:tepegFramedPointLocationType>framedPoint</d2lm:tepegFramedPointLocationType>
        <d2lm:to xsi:type="TpegJunction">
            <d2lm:TpegPoint>
                <d2lm:name>[downstream junction]</d2lm:name>
                <d2lm:otherName>[place name associated with exit
junction]</d2lm:otherName>
            <d2lm:ilc>
                <d2lm:values>
                    <d2lm:value>[intercept road associated with exit junction]</d2lm:value>
                </d2lm:values>
                <tepegIlcPointDescriptorType>tepegIlcName2</tepegIlcPointDescriptorType>
            </d2lm:ilc>
        </d2lm:TpegPoint>
    </d2lm:to>
    <d2lm:from xsi:type="TpegJunction">
        <d2lm:TpegPoint>
            <d2lm:name>[upstream junction]</d2lm:name>
        </d2lm:TpegPoint>
    </d2lm:from>
</d2lm:TpegFramedPoint>
</d2lm:supplementaryPositionalDescriptionExtension>
</d2lm:location>
</d2lm:predefinedLocation>
<!-- x N - one instance for each Link in the Network -->
</d2lm:predefinedLocationContainer>

<!-- Network Nodes -->

<d2lm:predefinedLocationContainer xsi:type="d2lm:PredefinedNonOrderedLocationGroup"
version="[NTIS Model version]" id="NTIS_Network_Nodes">
    <d2lm:predefinedLocation version="[NTIS Model version]" id="[node id]">
        <d2lm:location xsi:type="d2lm:Point">
            <d2lm:pointByCoordinates>
                <d2lm:pointCoordinates>
                    <d2lm:latitude>[node lat]</d2lm:latitude>
                    <d2lm:longitude>[node long]</d2lm:longitude>
                </d2lm:pointCoordinates>
            </d2lm:pointByCoordinates>
        </d2lm:location>
    </d2lm:predefinedLocation>
    <!-- x N - one instance for each Node in the Network -->
</d2lm:predefinedLocationContainer>

```

5.2.5.2 General Notes

1. The publication includes all predefined locations in the NTIS Model; including the objects that make up the base network graph of the road network.
2. The publication utilises the NTIS-specific extensions to the DATEXII schema. The *extensionName* and *extensionVersion* attributes are added to the <d2lm:d2LogicalModel> element to specify that this message utilises NTIS Publish Services-specific extensions to the base DATEXII schema. Refer to Section 7.1 for details.
3. Network objects and relationships. The following types of network objects are included in the publication:
 - a. Alternate Route: the route comprises an ordered list of references to the Network Links that make up the route. Alternate Routes are used to specify a Strategic Response for an Event; the route ID [alt route id] is referenced in real-time Event Data publications [ref 8].
 - b. NTIS HATRIS Section: the section comprises an ordered list of references to the Network Links that make up the section. NTIS HATRIS Sections form a layer of abstraction utilised to map real-time traffic data to the road network; and hence the component Network Links; primarily used by the HATRIS system to map Traffic Master data to the NTIS Model..
 - c. ANPR Route: ANPR measurements are associated with a unique route between 2 ANPR sites, rather than a specific, single location. Hence, each ANPR Route is defined by:
 - i. The location of the ANPR site at the start of the route:
 - The Network Link [link id - start] and the distance along the Link [distance along link - start] on which the site is located. This enables the site to be precisely located on the road network defined by the NTIS Model.
 - A point location, specified in lat/long coordinates - [ANPR site lat - start]/[ANPR site long - start]. This geo-location is primarily intended for display purposes; to position the site on a visual map, or similar.
 - ii. Multiple intermediate Network Links, defining the route from the start ANPR site to the end ANPR site. The list of Links is ordered and contains references to Network Link [link id - intermediate] objects in the NTIS Model.
 - iii. The location of the ANPR site at the end of the route (a per the ANPR site at the start of the route).

ANPR Routes are referenced from ANPR Measurement Sites (Section 5.2.4) using the [ANPR route id]. There is a 1:1 mapping of routes to sites in the NTIS Model.

- d. Network Link Shape: the shape contains an ordered list of lat/long coordinates, to define the shape of a Network Link. The Network Link Shape object refers to the associated Network Link [link id]. The NTIS Model includes a Network Link Shape for each Network Link, on a 1:1 mapping.
- e. Network Link: Network Links make up the basis for the fundamental graph of the road network contained in the NTIS Model.
 - i. Each Link represents a portion of a carriageway on the network. As the Link is associated with a carriageway, as opposed to a road, each Link is unidirectional. Data specified for each Network Link includes information about the location: road number, direction, road/location type and so on.
 - ii. Network Links are the primary reference set for locating real-time data on the road network, either directly (e.g. real-time Processed Traffic Data references a Link ID) or indirectly (e.g. MIDAS Traffic Data references a MIDAS site ID which, in turn, references a Network Link - see Section 5.2.4).
 - iii. A Network Link is bounded by Network Nodes; a start Node and an end Node. The Network Link object references the 2 Nodes - [node id - start] and [node id - end]. Multiple Network Links may use the same Node as a start/end position; joining Links together to form a network graph. The combination of Nodes and Links within the NTIS Model, and the fact that Links are unidirectional, enables the network graph to be navigable.
 - iv. A Network Link has location information attached, i.e. the county, the HE area team responsible for maintaining the link and the HE RCC which manage the link at a local level.
 - v. The Network Link is bounded by an upstream and a downstream junction. The downstream junction may have a placename or intercept road, or both, associated with it.
- f. Network Node: Nodes are used to join Network Links. They are specified in the NTIS Model as a single point location, using a lat/long coordinate.

5.2.5.3 Data Item Descriptions

5.2.5.3.1 Package Header and Common Data Items

Data Item	Description
-----------	-------------

Data Item	Description
[creation date]	The date and time that the NTIS Model was initially created. Format: <dd>-<mm>-<yyyy>, e.g. 26-01-2014
[NTIS Model version]	Version of the published NTIS Model against which this message is published. Format: <major version>.<minor version>, e.g. "17.0"
[publication time]	The time and date that the message was published by the NTIS system.

5.2.5.3.2 Alternate Routes

Data Item	Description
[alt route id]	The unique ID of the alternate route.
[alt route origin]	Textual description of the origin of the alternate route.
[alt route destination]	Textual description of the destination of the alternate route.
[link id]	The unique ID of a Network Link within the alternate route. The route comprises 1 or more Network Links.

5.2.5.3.3 ANPR Routes

Data Item	Description
[ANPR route id]	The unique ID of the ANPR route.
[ANPR site lat - start] / [ANPR site long - start]	The point location of the ANPR site that defines the start of the ANPR route, specified in latitude/longitude coordinates. Refer to the General Notes section for details.
[ANPR site lat - end] / [ANPR site long - end]	The point location of the ANPR site that defines the end of the ANPR route, specified in latitude/longitude coordinates. Refer to the General Notes section for details.
[distance along link - start]	The distance along the [link id - start] Network Link that the ANPR site is located. The distance is specified in metres, Refer to the General Notes section for details.
[distance along link - end]	The distance along the [link id - end] Network Link that the ANPR site is located. The distance is specified in metres, Refer to the General Notes section for details.
[link id - start]	The ID of the Network Link on which the ANPR site that defines the start of the ANPR route resides. Refer to the General Notes section for details.

Data Item	Description
[link id - intermediate]	The ID of an intermediate Network Link that is located on the ANPR route between the start and end ANPR sites. Refer to the General Notes section for details.
[link id - end]	The ID of the Network Link on which the ANPR site that defines the end of the ANPR route resides. Refer to the General Notes section for details.

5.2.5.3.4 NTIS HATRIS Sections

Data Item	Description
[HATRIS section id]	The unique ID of the NTIS HATRIS Section.
[link id]	The unique ID of a Network Link within the NTIS HATRIS Section. The NTIS HATRIS Section comprises 1 or more Network Links.

5.2.5.3.5 Network Link Shapes

Data Item	Description
[link id]	A reference to the Network Link to which this shape data applies.
[link point lat] / [link point long]	A point location that specifies a geographic location on the Network Link, specified in latitude/longitude coordinates. The Network Link shape is defined by a series of ordered lat/long coordinates.

5.2.5.3.6 Network Links

Data Item	Description
[capacity - exit]	The Static Link Capacity of the Network Link at the end (exit point) of the Link, specified in vehicles/hour.
[capacity - mid]	The Static Link Capacity of the Network Link at the mid-point of the Link, specified in vehicles/hour.
[link id]	The unique ID of the Network Link.
[link carriageway]	The type of carriageway on which the Network Link is located.
[link direction]	The direction of the carriageway on which the Network Link is located.
[link length]	The length of the Network Link, specified in metres. The length value accommodates the shape of the Network Link: that is, it is the physical length of the Link not a straight Node-to-Node measure.

Data Item	Description
[link location description]	Textual description of the location of the Network Link. Example: A23 northbound within the B2115 junction
[link location type]	The type of road location on which the Network Link is located.
[node id - start]	The ID of the Network Node that defines the start of the Network Link.
[node id - end]	The ID of the Network Node that defines the end of the Network Link.
[road number]	Textual representation of the road number, as defined by the HA, on which the Network Link resides. Example: A194
[county]	The county that the link is located in.
[area team]	The HE area team name that manage the link
[regional control centre]	The HE regional control centre (RCC) responsible for managing the link.
[downstream junction]	The downstream junction section in which the network link resides.
[upstream junction]	The upstream junction section in which the network link resides.
[place name associated with exit junction]	The place name associated with the exit slip/junction.
[intercept road associated with exit junction]	The name of the road that intercepts the junction associated with the exit slip/junction.

5.2.5.3.7 Network Nodes

Data Item	Description
[node id]	The unique ID of the Network Node.
[node lat] / [node long]	The point location of the Network Node, specified as latitude/longitude coordinates.

5.2.6 VMS/Matrix Units

The following sub-sections detail the data contained in the *VmsTablePublication* component of the published NTIS Model.

5.2.6.1 Data Content

```
<?xml version="1.0" encoding="UTF-8"?>
<d21m:d2LogicalModel modelBaseVersion="2" xmlns:d21m=http://datex2.eu/schema/2/2\_0
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
  <d21m:exchange>
    <d21m:supplierIdentification>
      <d21m:country>gb</d21m:country>
      <d21m:nationalIdentifier>NTIS</d21m:nationalIdentifier>
    </d21m:supplierIdentification>
  </d21m:exchange>
  <d21m:payloadPublication xsi:type="d21m:VmsTablePublication" lang="en">
    <d21m:feedDescription>
      <d21m:values>
        <d21m:value lang="en">NTIS Network and Asset Model - VMS Tables</d21m:value>
        <d21m:value lang="en">Version: [NTIS Model version]</d21m:value>
        <d21m:value lang="en">Creation Date: [creation date]</d21m:value>
        <d21m:value lang="en">Includes: VMS Units Asset Data (NTIS_VMS_Units)</d21m:value>
        <d21m:value lang="en">Includes: Matrix Units Asset Data
(NTIS_Matrix_Units)</d21m:value>
      </d21m:values>
    </d21m:feedDescription>
    <d21m:feedType>NTIS Model - VMS Tables</d21m:feedType>
    <d21m:publicationTime>[publication time]</d21m:publicationTime>
    <d21m:publicationCreator>
      <d21m:country>gb</d21m:country>
      <d21m:nationalIdentifier>NTIS</d21m:nationalIdentifier>
    </d21m:publicationCreator>
    <d21m:headerInformation>
      <d21m:areaOfInterest>national</d21m:areaOfInterest>
      <d21m:confidentiality>restrictedToAuthoritiesTrafficOperatorsAndPublishers
</d21m:confidentiality>
      <d21m:informationStatus>real</d21m:informationStatus>
    </d21m:headerInformation>

    <!-- VMS Units -->

    <d21m:vmsUnitTable id="NTIS_VMS_Units" version="[NTIS Model version]">
      <d21m:vmsUnitRecord id="[unit id]" version="[NTIS Model version]">
        <d21m:numberOfVms>1</d21m:numberOfVms>
        <d21m:vmsUnitIdentifier>[geographic address]</d21m:vmsUnitIdentifier>
        <d21m:vmsUnitElectronicAddress>[electronic address]</d21m:vmsUnitElectronicAddress>
        <d21m:vmsRecord vmsIndex="0">
          <d21m:vmsRecord>
            <d21m:vmsDescription>
              <d21m:values>
                <d21m:value lang="en">[unit type description]</d21m:value>
              </d21m:values>
            </d21m:vmsDescription>
            <d21m:vmsType>[unit type]</d21m:vmsType>
            <d21m:vmsTypeCode>[unit type code]</d21m:vmsTypeCode>
            <d21m:vmsTextDisplayCharacteristics>
              <d21m:maximumNumberOfCharacters>[max chars]</d21m:maximumNumberOfCharacters>
              <d21m:maximumNumberOfRows>[max lines]</d21m:maximumNumberOfRows>
            </d21m:vmsTextDisplayCharacteristics>
            <d21m:vmsLocation xsi:type="d21m:Point">
              <d21m:locationForDisplay>
                <d21m:latitude>[unit lat]</d21m:latitude>
                <d21m:longitude>[unit long]</d21m:longitude>
              </d21m:locationForDisplay>
              <d21m:pointAlongLinearElement>
                <d21m:linearElement xsi:type="d21m:LinearElementByCode">
                  <d21m:linearElementReferenceModel>NTIS_Network_Links
</d21m:linearElementReferenceModel>
                  <d21m:linearElementReferenceModelVersion>[NTIS Model version]
</d21m:linearElementReferenceModelVersion>
                  <d21m:linearElementIdentifier>[link id]</d21m:linearElementIdentifier>
                </d21m:linearElement>
              </d21m:pointAlongLinearElement>
            </d21m:vmsLocation>
          </d21m:vmsRecord>
        </d21m:vmsRecord>
      </d21m:vmsUnitRecord>
    </d21m:vmsUnitTable>
  </d21m:payloadPublication>
</d21m:d2LogicalModel>
```

```

        <d21m:distanceAlongLinearElement
            xsi:type="d21m:DistanceFromLinearElementStart">
            <d21m:distanceAlong>[unit distance along link]</d21m:distanceAlong>
        </d21m:distanceAlongLinearElement>
    </d21m:pointAlongLinearElement>
</d21m:vmsLocation>
</d21m:vmsRecord>
</d21m:vmsRecord>
</d21m:vmsUnitRecord>
<!-- x N - one instance for each VMS unit on the NTIS network -->
</d21m:vmsUnitTable>

<!-- Matrix Units -->

<d21m:vmsUnitTable id="NTIS_Matrix_Units" version="17.0">
    <d21m:vmsUnitRecord id="D2509501F9027952E0433CC411ACA994" version="17.0">
        <d21m:numberOfVms>1</d21m:numberOfVms>
        <d21m:vmsUnitIdentifier>[geographic address]</d21m:vmsUnitIdentifier>
        <d21m:vmsUnitElectronicAddress>[electronic address]</d21m:vmsUnitElectronicAddress>
        <d21m:vmsRecord vmsIndex="0">
            <d21m:vmsRecord>
                <d21m:vmsDescription>
                    <d21m:values>
                        <d21m:value lang="en">[unit type description]</d21m:value>
                    </d21m:values>
                </d21m:vmsDescription>
                <d21m:vmsType>[unit type]</d21m:vmsType>
                <d21m:vmsTypeCode>[unit type code]</d21m:vmsTypeCode>
                <d21m:vmsLocation xsi:type="d21m:Point">
                    <d21m:locationForDisplay>
                        <d21m:latitude>[unit lat]</d21m:latitude>
                        <d21m:longitude>[unit long]</d21m:longitude>
                    </d21m:locationForDisplay>
                    <d21m:pointAlongLinearElement>
                        <d21m:linearElement xsi:type="d21m:LinearElementByCode">
                            <d21m:linearElementReferenceModel>NTIS_Network_Links
                                </d21m:linearElementReferenceModel>
                            <d21m:linearElementReferenceModelVersion>[NTIS Model version]
                                </d21m:linearElementReferenceModelVersion>
                            <d21m:linearElementIdentifier>[link id]</d21m:linearElementIdentifier>
                        </d21m:linearElement>
                        <d21m:distanceAlongLinearElement
                            xsi:type="d21m:DistanceFromLinearElementStart">
                            <d21m:distanceAlong>[unit distance along link]</d21m:distanceAlong>
                        </d21m:distanceAlongLinearElement>
                    </d21m:pointAlongLinearElement>
                </d21m:vmsLocation>
            </d21m:vmsRecord>
        </d21m:vmsRecord>
    </d21m:vmsUnitRecord>
<!-- x N - one instance for each Matrix unit on the NTIS system -->
</d21m:vmsUnitTable>

</d21m:payloadPublication>
</d21m:d2LogicalModel>

```

5.2.6.2 General Notes

1. The publication includes the static reference data for all VMS and Matrix units in the NTIS Model.
2. The real-time VMS/Matrix state data published on the DATEXII Webservice [ref 8] includes a reference to the appropriate unit [unit id]. From the display data received in real time and the reference data in this publication, it is possible to determine the visual display of the unit.

3. The VMS/Matrix unit reference data contains location information; to enable the unit to be related to the road network through the Predefined Locations (Section 5.2.5) defined in the NTIS Model. Location data:
 - a. The Network Link [link id] and the distance along the Link [unit distance along link] on which the unit is located. This enables the unit to be precisely located on the road network defined by the NTIS Model.
 - b. A point location, specified in lat/long coordinates - [unit lat]/[unit long]. This geo-location is primarily intended for display purposes; to position the unit on a visual map, or similar.

5.2.6.3 Data Item Descriptions

5.2.6.3.1 Package Header and Common Data Items

Data Item	Description
[creation date]	The date and time that the NTIS Model was initially created. Format: <dd>-<mm>-<yyyy>, e.g. 26-01-2014
[electronic address]	Text identifying the electronic address of the VMS/Matrix unit. The electronic address defines an identifier for communicating with the unit. The electronic address is specified by the HA. The ID is not guaranteed to be unique within the NTIS Model; the unique identification of a unit is specified by the [unit id] data item. Example: 024/2/123/210
[geographic address]	Text identifying the geographic address of the VMS or Matrix unit. The geographic address is specified by the HA and describes the physical location of the unit on the road network. Note that this value may not be unique as more than one unit may reside at the same geographical location. Example: M25/4883J
[link id]	The unique ID of the Network Link, as contained in the Predefined Locations component of the NTIS Model (Section 5.2.5), on which the unit is located. Refer to the General Notes section for details.
[NTIS Model version]	Version of the published NTIS Model against which this message is published. Format: <major version>.<minor version>, e.g. "17.0"
[publication time]	The time and date that the message was published by the NTIS system.

Data Item	Description
[unit distance along link]	The distance along the Network Link, specified by the [link id] data item, that the unit is located. The value is specified in metres. Refer to the General Notes section for details.
[unit id]	The unique ID of the VMS/Matrix unit; used to reference the unit in the published NTIS Model.
[unit lat]/[unit long]	The point location of the site, specified in latitude/longitude coordinates. Refer to the General Notes section for details.
[unit type]	The general type of the unit, as defined by the DATEXII <i>VmsTypeEnum</i> enumerate. For Matrix units, this value is always set to 'matrixSign'.
[unit type code]	A numeric value specifying the make/model/type of the VMS/Matrix unit, as defined by the HA.
[unit type description]	A textual description of the make/model/type of the VMS/Matrix unit. Example: 3x18 VMS

5.2.6.3.2 VMS Units

Data Item	Description
[max chars]	A positive integer value specifying the maximum number of textual characters, per line, that the VMS unit supports.
[max lines]	A positive integer value specifying the maximum number of lines of text that the VMS unit supports.

5.2.6.3.3 Matrix Units

No Matrix unit-specific data items.

5.3 Byte Ordering Policy

The interface utilises standard interoperable transport and application layer protocols; no specific byte ordering policy is required.

6. Qualification

The interface is designed to meet the system requirements specified in [ref 5].

The validation and testing of this and all other system interfaces are described in the NTIS Test Strategy [ref 2].

7. List of Annexes

7.1 Annex A - DATEXII v2.0 Schema: Extensions

This section details the NTIS Publish Services-specific extensions required to the standard DATEXII v2.0 Schema [ref 17] to publish the NTIS Model on this interface.

The extensions are all backwardly-compatible Level B Extensions, as defined in the DATEXII extension guide [ref 28].

7.1.1 Measurement Site Data

A new extension type is added to the schema to include the new *VehicleCurrentCharacteristics* type; utilised to contain current vehicle characteristics for traffic data measurements:

```
<xs:complexType name="_VehicleCharacteristicsExtensionType">
  <xs:sequence>
    <xs:element name="vehicleCurrentCharacteristics"
      type="D2LogicalModel:VehicleCurrentCharacteristics" minOccurs="0" />
    <xs:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded" />
  </xs:sequence>
</xs:complexType>
```

The standard DATEXII *VehicleCharacteristics* type is modified to use the new extension type (modification grey):

```
<xs:complexType name="VehicleCharacteristics">
  <xs:annotation>
    <xs:documentation>The characteristics of a vehicle, e.g. lorry of gross weight greater than 30 tonnes.</xs:documentation>
  </xs:annotation>
  <xs:sequence>
    ...
    <xs:element name="vehicleCharacteristicsExtension"
      type="D2LogicalModel:VehicleCharacteristicsExtensionType" minOccurs="0" />
  </xs:sequence>
</xs:complexType>
```

A new complex type is created to contain the current vehicle characteristics:

```
<xs:complexType name="VehicleCurrentCharacteristics">
  <xs:annotation>
    <xs:documentation>The characteristics of a vehicle related to its current, possibly transient/dynamic, status (as opposed to its static characteristics).</xs:documentation>
  </xs:annotation>
  <xs:sequence>
    <xs:element name="speedCharacteristic" type="D2LogicalModel:SpeedCharacteristic"
      minOccurs="0" maxOccurs="unbounded" />
  </xs:sequence>
</xs:complexType>
```

A new complex type is created to contain the current speed characteristics of vehicles sampled/used for the measurement:

```
<xs:complexType name="SpeedCharacteristic">
  <xs:annotation>
    <xs:documentation>The current speed characteristics of a vehicle.</xs:documentation>
  </xs:annotation>
  <xs:sequence>
    <xs:element name="comparisonOperator" type="D2LogicalModel:ComparisonOperatorEnum"
      minOccurs="1" maxOccurs="1">
      <xs:annotation>
        <xs:documentation>The operator to be used in the vehicle characteristic comparison operation.</xs:documentation>
      </xs:annotation>
    </xs:element>
  </xs:sequence>
</xs:complexType>
```

```

</xs:element>
<xs:element name="vehicleSpeed" type="D2LogicalModel:KilometresPerHour"
  minOccurs="1" maxOccurs="1">
  <xs:annotation>
    <xs:documentation>The current speed of the vehicle.</xs:documentation>
  </xs:annotation>
</xs:element>
<xs:element name="speedCharacteristicExtension" type="D2LogicalModel:_ExtensionType"
  minOccurs="0" />
</xs:sequence>
</xs:complexType>

```

7.1.2 Static Link Capacity

A new extension type is added to the schema to include the new *StaticCapacity* type; utilised to specify the capacity (in vehicles per hour) for a Network Link:

```

<xs:complexType name="_LinearWithinLinearElementExtensionType">
  <xs:sequence>
    <xs:element name="staticCapacity" type="D2LogicalModel:StaticCapacity" minOccurs="0" />
    <xs:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded" />
  </xs:sequence>
</xs:complexType>

```

The standard D2EXII *LinearWithinLinearElement* type is modified to use the new extension type (modification grey):

```

<xs:complexType name="LinearWithinLinearElement">
  <xs:annotation>
    <xs:documentation>A linear section along a linear element where the linear element is either a part of or the whole of a linear object (i.e. a road), consistent with ISO 19148 definitions. </xs:documentation>
  </xs:annotation>
  <xs:sequence>
    ...
    <xs:element name="linearWithinLinearElementExtension"
      type="D2LogicalModel:_LinearWithinLinearElementExtensionType" minOccurs="0" />
  </xs:sequence>
</xs:complexType>

```

A new complex type is created to specify the Static Link Capacity values for both the end/exit and mid-point of the Network Link:

```

<xs:complexType name="StaticCapacity">
  <xs:annotation>
    <xs:documentation>The Static Capacity of the linear section within a linear element. Static Capacity is defined as the maximum flow of vehicles that all lanes of a section of carriageway can accommodate if no other events or conditions are affecting the traffic flow.</xs:documentation>
  </xs:annotation>
  <xs:sequence>
    <xs:element name="exitPointStaticCapacity" type="D2LogicalModel:VehiclesPerHour"
      minOccurs="0" maxOccurs="1">
      <xs:annotation>
        <xs:documentation>The Static Capacity at the exit point of the linear section within the linear element.</xs:documentation>
      </xs:annotation>
    </xs:element>
    <xs:element name="midPointStaticCapacity" type="D2LogicalModel:VehiclesPerHour"
      minOccurs="0" maxOccurs="1">
      <xs:annotation>
        <xs:documentation>The Static Capacity at the mid point of the linear section within the linear element.</xs:documentation>
      </xs:annotation>
    </xs:element>
  </xs:sequence>
</xs:complexType>

```


7.2 Annex B – Subscription Information

7.2.1 Subscriber System

To receive data published on the interface, the Subscriber system is required to adhere to the following criteria:

1. The consumer is a registered Subscriber to the NTIS Published Services. A username and password are required to authenticate publication requests on this interface.
2. Internet access: the Subscriber system has network access to the internet.
3. Client software: the Subscriber system is able to employ:
 - a. A standard browser to access the NTIS Model Download website.
 - b. Software to issue HTTPS requests and manage the returned NTIS Model package via the web service.

Any registered Subscriber to the NTIS Published Services can access the interface to download the NTIS Model publication.

7.2.2 Subscription Options

The following Subscription Options are utilised by the NTIS system to enable publication of data to Subscribers on this interface.

Option	Values	Description
Username	A string, containing 5-20 characters, utilising only lowercase letters [a-z] and numeric characters [0-9]	<p>The username of the Subscriber. The username is required, along with Subscription password, to authenticate requests on this interface.</p> <p>The name is unique within the list of Subscribers maintained by the NTIS system.</p> <p>The username is a mandatory Subscription Option, required to register for NTIS Published Services.</p>
Password	A string, containing 8-12 characters, comprising the following character sets: a-z, A-Z, and 0-9.	<p>The password of the Subscriber. The password is required, along with Subscription username, to authenticate requests on this interface.</p> <p>The password is a mandatory Subscription Option, required to register for NTIS Published Services.</p>

7.2.3 On-line Resources

A number of on-line resources are available to Subscribers on the Traffic England website:

<http://www.trafficengland.com/subscribers>

General Information: information regarding the facilities and services provided by the NTIS Publish Services component.

Subscription Requests: a facility is provided to request a new Subscription or a modification to an existing Subscription.

7.3 Annex C - NTIS Model Schematic

The following figures illustrate the objects contained in the NTIS Model, the relationships between them and the methods real-time data publications [ref 8] use to refer to the NTIS Model components.

Note that the schematics are intended to provide an understanding of the composition of the NTIS Model and relationships between object types. Hence, the Figures are simplified, to an extent and do not include all attributes associated with each object.

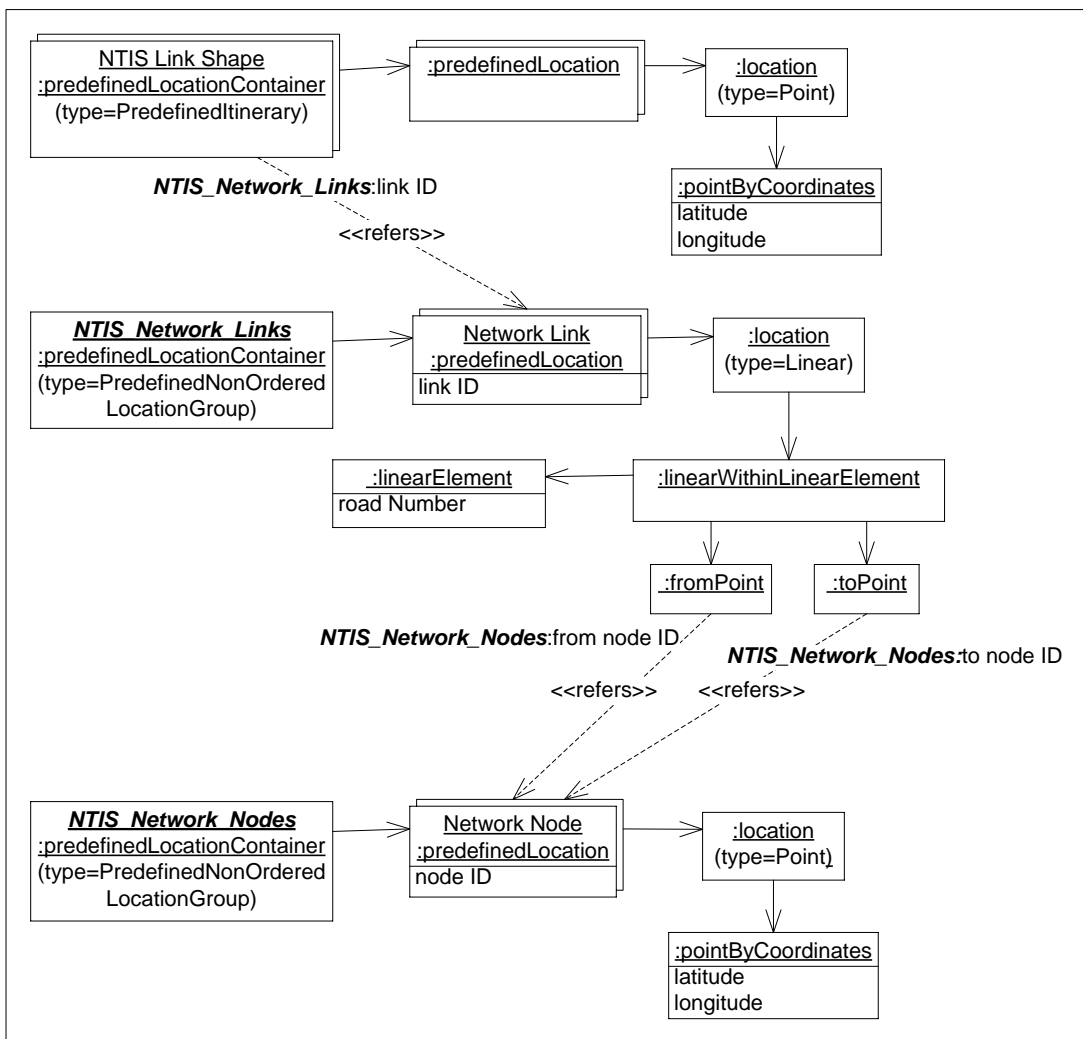


Figure 7-1 : Network Links and Nodes Object Diagram

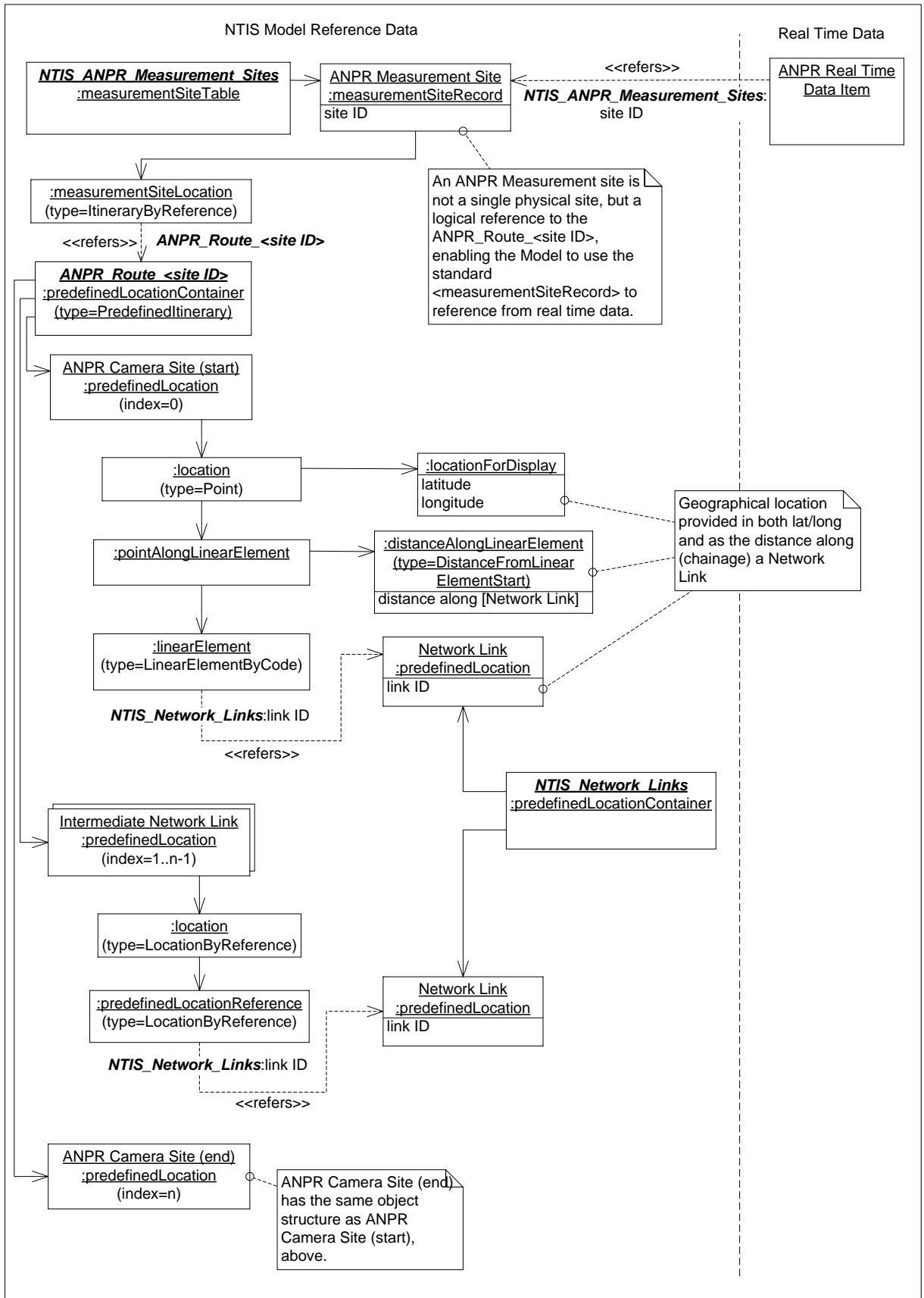


Figure 7-2 : ANPR Measurement Sites Object Diagram

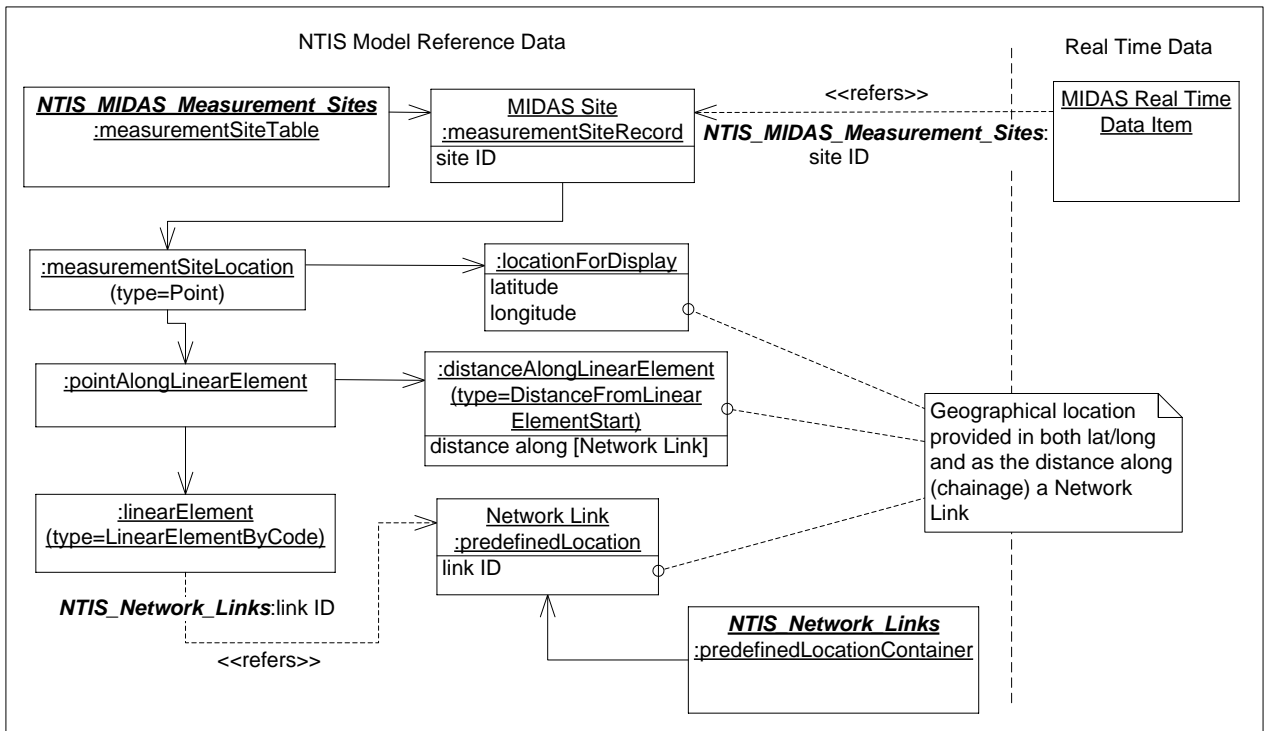


Figure 7-3 : MIDAS Measurement Sites Object Diagram

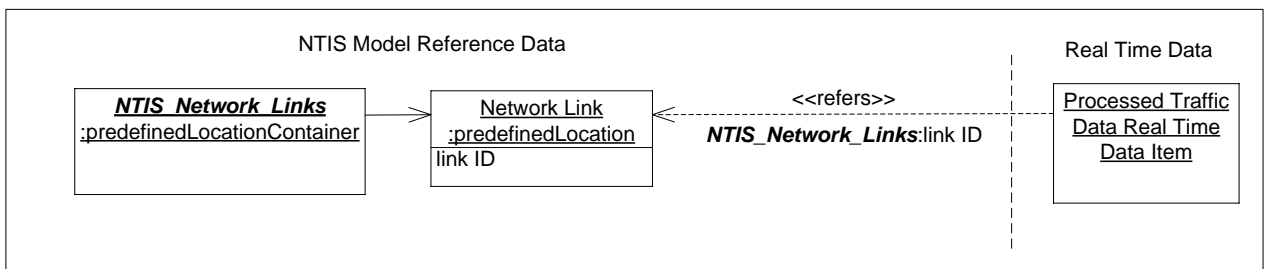


Figure 7-4 : Processed Traffic Data Object Diagram

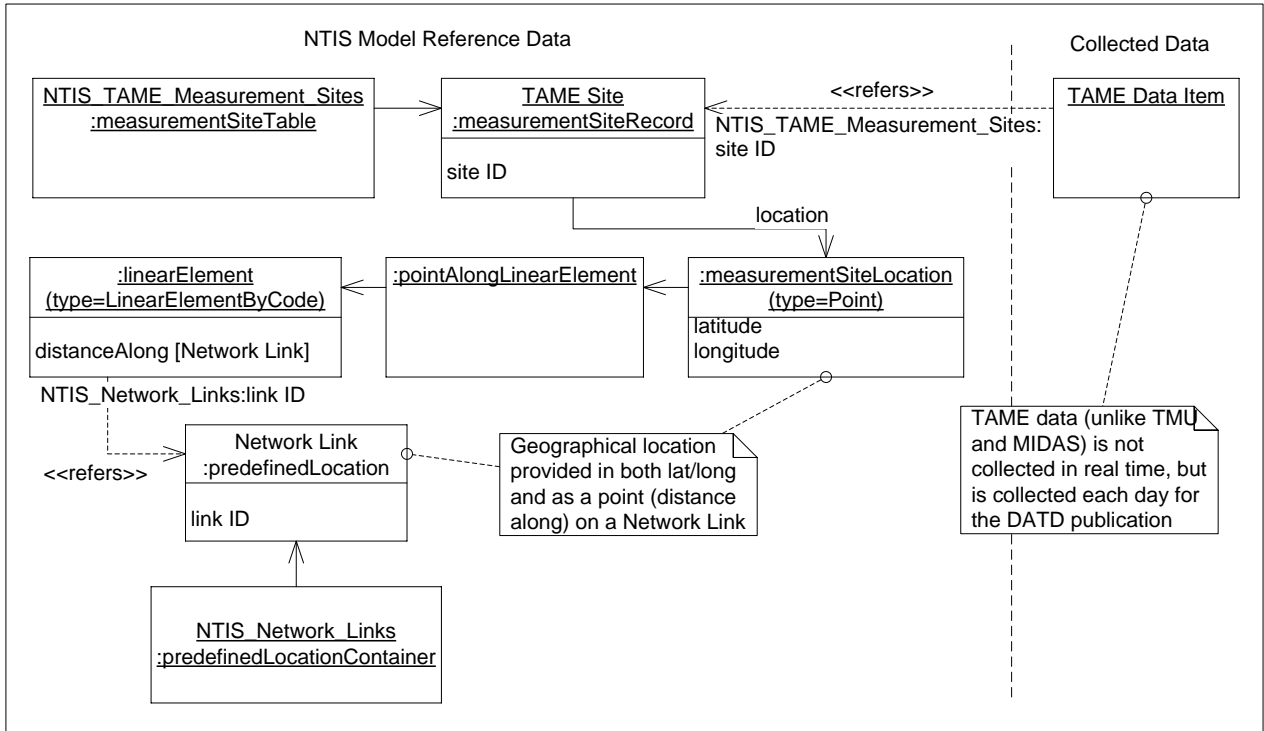


Figure 7-5 : TAME Measurement Sites Object Diagram

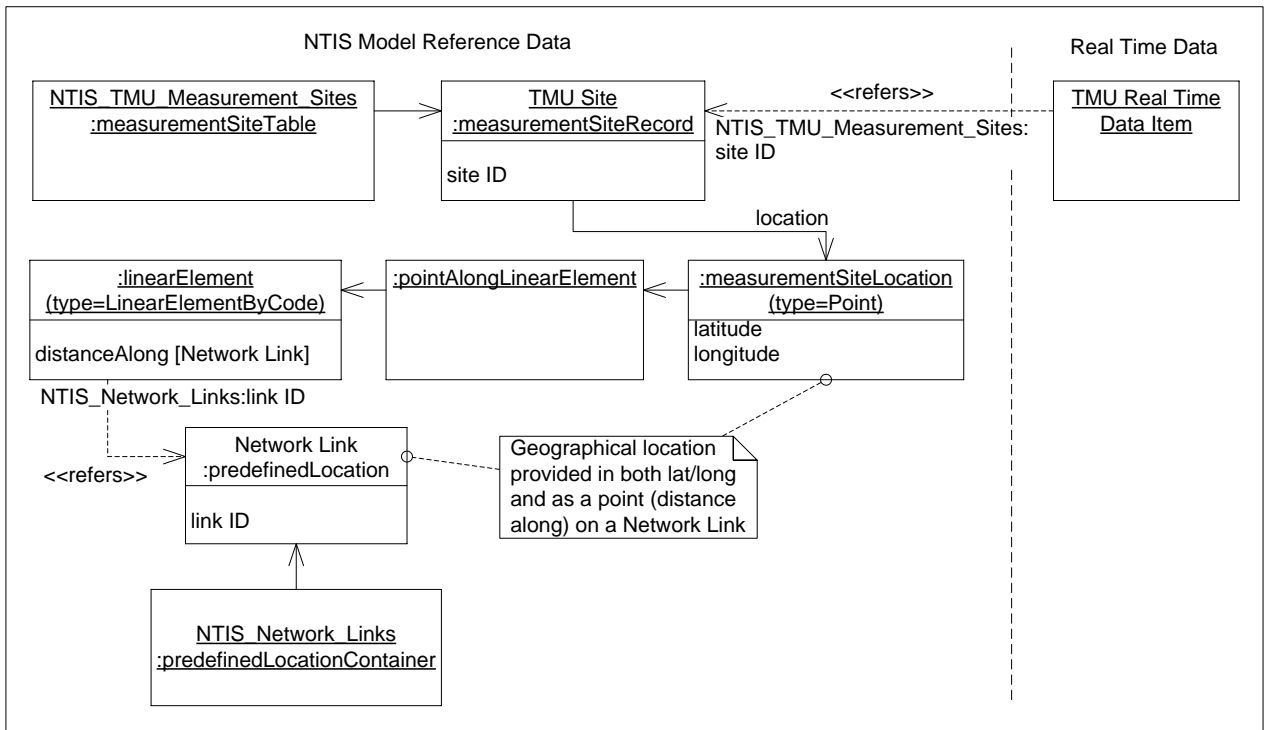


Figure 7-6 : TMU Measurement Sites Object Diagram

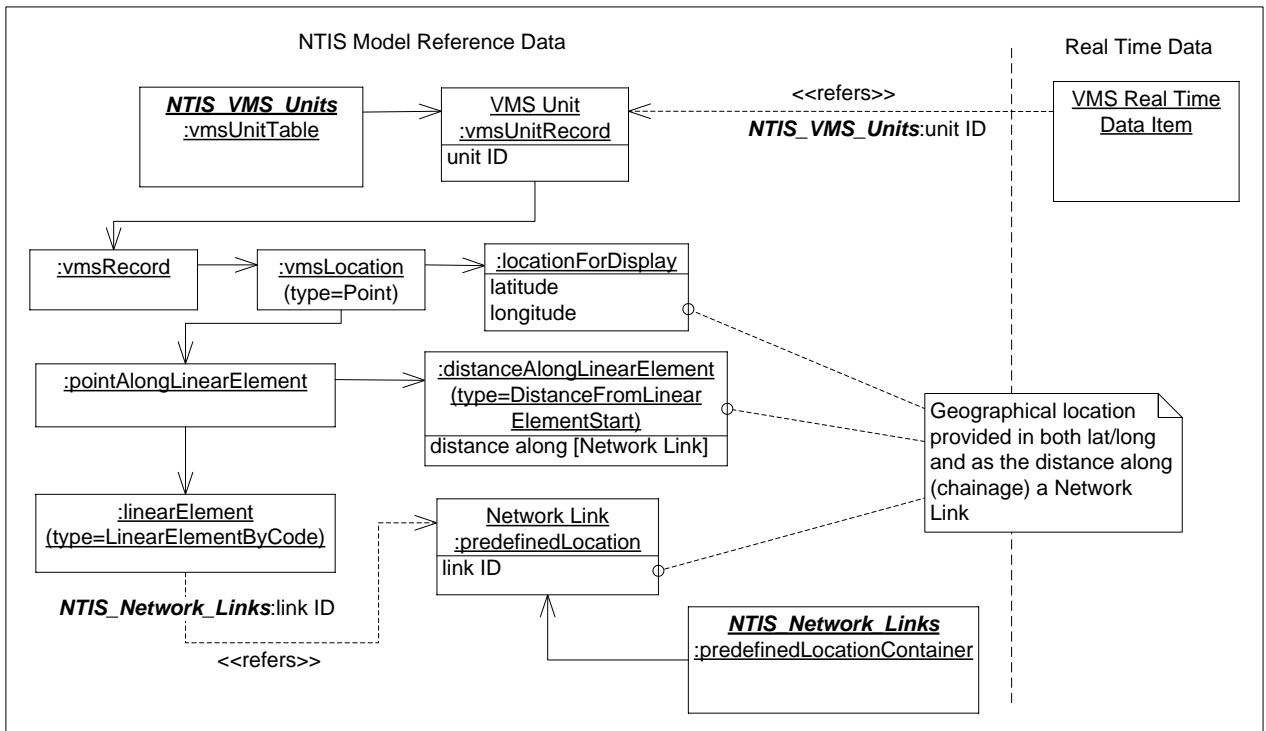


Figure 7-7 : VMS and Matrix Units Object Diagram

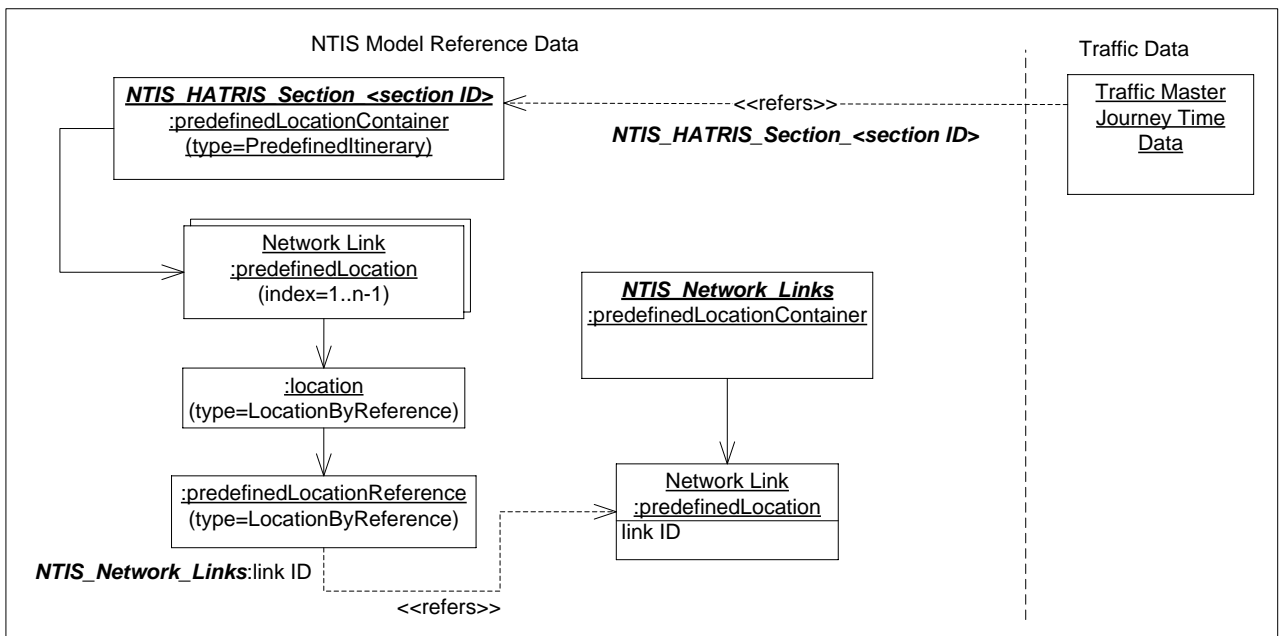


Figure 7-8 : Traffic Master Data and NTIS HATRIS Sections Object Diagram

7.4 Annex D – Internet Addresses

Internet Address	Description
https://trafficengland.info/subscriberportal	<p>The URL utilised by Subscribers to access the download website via a browser.</p> <p>Note: the website is employed to download both NTIS Model and DATD [ref 6] data files.</p>
https://trafficengland.info/app/ntismodel/currentmodel	<p>The URL utilised by Subscribers to access the web service to download the current version of the NTIS Model.</p>

7.5 Annex E – Abbreviations and Glossary

Industry-standard and HA terms and abbreviations used within this document are listed in the HA Taxonomy [ref 1].

Terms and abbreviations specific to this document, or not included in the Taxonomy, are listed below.

Term	Description
DATD	Daily Aggregated Traffic Data. A daily accumulation of traffic and road network event data, packaged and published to Subscribers.
DATEXII	European-wide 2 nd generation Data Exchange specification for traffic information. Official website: http://www.datex2.eu
DG MOVE	European Commission Directorate-General for Mobility and Transport. The body that oversees the DATEXII specification.
EIDD	External Interface Design Document. A Thales document for describing an external system interface.
EIRS	External Interface Requirements Specification. A Thales document for defining the requirements of an external system interface.
HATRIS	Highways Agency Traffic Information System. Official website: https://www.hatris.co.uk
HTTP	Hyper Text Transfer Protocol
HTTPS	Secure HTTP. Not a protocol in itself, it describes the layering of HTTP over a SSL or TLS security and encryption protocol.
Published Data Type	Published data is categorised into discrete Published Data Types. The different types of data are published in separate messages and are processed and managed separately by the system.
Static Link Capacity	The capacity of a Network Link, measured in vehicles per hour, when no dynamic external influences (such as a network Event) are affecting the flow of traffic.
Subscriber	An individual, organisation or body that has registered to receive published data. The term is also applied to the system utilised by the Subscriber to receive published data.
SSDD	System/Subsystem Design Document. A Thales document for describing the function and overall design of a system.
TLS	Transport Layer Security. A standard protocol for security and encryption of internet messaging.

