

NTCC TIH Publisher

1 Introduction

1.1 Overview

The Travel Information Highway (TIH) community publishes a set of Principles for exchanging travel information. The National Traffic Control Centre (NTCC) has a TIH Publisher conforming to these Principles to make Highways Agency data on the English trunk road network available to third parties.

This interface uses CORBA to deliver data over the Internet. The data is presented and described by an Interface Definition Language (IDL) file for use by the client during development.

TIH Principles primarily recommend XML services delivered using HTTP. Where these are for OTAP or DATEX II services, for instance, data is converted at source following the relevant schemas.

1.2 Purpose

This technical document gives details of the NTCC TIH services to help potential subscribers' engineers to develop an interface and start using the data.

If you are looking for a gentler introduction to the TIH concept and how it works, try the Travel Information Highway website (www.tih.org.uk) and, in particular, the *TIH Flyer* in the Marketing Information section.

If you have any questions that are not answered in this document, or you would like to discuss which service would best suit your needs, free advice is also available. See section 5 for details.

1.3 Table of Contents

1	Introduction	1
1.1	Overview	1
1.2	Purpose.....	1
1.3	Table of Contents.....	2
1.4	Abbreviations	3
2	TIH Receiver Design	4
3	Offered Services	5
3.1	CORBA Services	5
3.1.1	Enhanced Data Services	5
3.1.2	XML Client	11
3.1.3	UTMC	11
3.2	XML Services.....	11
3.2.1	OTAP.....	11
3.2.2	DATEX II.....	12
3.2.3	RSS	12
3.2.4	TPEG.....	12
3.3	Service Description	12
3.3.1	CORBA.....	12
3.3.2	XML	13
3.4	ORB Interoperability.....	14
4	Sizing Study	15
4.1	CORBA Services	15
4.1.1	XML Client	15
4.2	XML Services.....	15
4.2.1	DATEX II.....	15
4.2.2	OTAP.....	15
5	Help and Assistance	17
5.1	TIH Technical Authority.....	17
5.2	Helpdesk.....	17
5.3	Frequently Asked Questions.....	17

1.4 Abbreviations

AIL	Abnormal Indivisible Load
CCTV	Closed Circuit Television
COBS	Control Office Base System
CORBA	Common Object Request Broker Architecture
CSV	Comma Separated Values
DATEX II	Data Exchange 2 – European specifications for language independent exchange of traffic information
GZIP	GNU Zip
HTTP	Hyper Text Transfer Protocol
ID	Identifier (unique NTCC database reference)
IDL	Interface Definition Language
IIOP	Internet Inter-ORB Protocol
IOR	Interoperable Object Reference
IP	Internet Protocol
ITS	Intelligent Transportation Systems
MIDAS	Motorway Incident Detection and Automatic Signalling
NMCS2	National Motorway Communication System v2
NTCC	National Traffic Control Centre
ORB	Object Request Broker
OS	Ordnance Survey
OTAP	Open Travel data Access Protocol
PCO	Police Control Office
RCC	Regional Control Centre
RSS	Really Simple Syndication
SSL	Secure Sockets Layer
TCC CS	Traffic Control Centre Central System (referred to as TCC Instation software)
TCCI	Traffic Control Centre Interface
TCP	Transmission Control Protocol – A core protocol of the Internet Protocol suite
TIH	Travel Information Highway
TiS	Traffic Information Services (TiS) Limited
TPEG	Transport Protocol Experts Group
UML	Unified Modelling Language
URL	Uniform Resource Locator
UTMC	Urban Traffic Management and Control
VMS	Variable Message Sign
XML	Extensible Markup Language
XSLT	Extensible Stylesheet Language Transformation

2 TIH Receiver Design

If you want to design a client application to use the NTCC TIH Publisher, the following guides will be essential:

The **TIH Directory of Services** is located in the private section of the TIH website at www.tih.org.uk. Users must register to gain access to this area but this is free.

The Directory lists all of the data services available from the organisations that follow TIH Principles including IDLs for each CORBA service. Schema for each XML service and UML models for all services can be found by using the link to the ITS Metadata Registry or directly at www.itsregistry.org.uk.

The **NTCC Project Network Model CSV** is supplied to all subscribers to the NTCC CORBA Services and a new copy is distributed each time there is a change in the Highways Agency's network of motorways and trunk roads. The file contains location references used within the NTCC and its CORBA Services and their text equivalents as understood by end users.

3 Offered Services

3.1 CORBA Services

NTCC CORBA services are available from a single IP address (195.188.249.181). In line with TIH Principles, IP Address Discrimination is not used.

The NTCC TIH Publisher supports both Callback and Blocked Pull communication methods. The ORB used by the TIH Publisher supports bi-directional operation enabling the same outgoing CORBA connection to receive callback objects, which is especially useful where firewalls are used. Basic Authentication is required with SSL encryption also supported.

The Naming Service, which provides connection reference objects to the Services, is available on Port 6544. The Callback services are received on Port 20240 and the Blocked Pull services through Port 20241. The following should be added to the connection request to obtain the Naming Service IOR:

```
-ORBInitRef NameService=corbaloc::195.188.249.181:6544/NameService
```

Callback and Blocked Pull connections will resolve the *NameService* object for “*ClientFactory*” and UTMC connections for “*UTMC::TCC/SessionManager*”. The object returned for Callback and Blocked Pull services will be *ClientObjectFactory* and the client will then call the method *CreateClient()* for an SSL encrypted connection or *CreateNamedClient()* to provide username and password.

3.1.1 Enhanced Data Services

The NTCC TIH Publisher provides four data services:

- Events
- VMS settings
- Matrix Signal settings
- Traffic data

The latest version of each of these is described more fully in the tables below with earlier versions registered at the ITS Metadata Registry (see Section 2). Latest versions will be registered in due course.

All dates and times are reported in the prevailing local time (BST or GMT as appropriate) using ISO8601 format.

Services also provide a ‘heartbeat’ object, transmitted at regular intervals in the absence of any other data to allow connections to be monitored.

The data is published using the “First In, First Out” rule. It should be emphasised that the quantity of data can be large when subscribing to traffic data services (see Section 4) and if the user cannot receive the data sufficiently quickly then the currency of the data will reduce.

3.1.1.1 Enhanced Event Service v2

Attribute	Data Type	Description
Event ID	Number	Unique Event identifier
Event Version	Number	Version of Event beginning at 1
Event Name	String	Unique Event identifier used by NTCC Operations staff
Event Type	Number	Enumeration of Roadworks, Accident, Weather, AIL, Other
Road Name	String	Road name
Direction	Number	Enumeration of Northbound, Southbound, Eastbound, Westbound, Clockwise, Anti-Clockwise, Roundabout, Multi-Directional Slip, Carriageway Connector
Primary Location	Number	Unique identifier of Primary Location Link
Extent Affected	Series of Numbers	Series representing Affected Link IDs
Extent Location	Series of Numbers	Series representing Location Link IDs
Latitude	Number	Latitude of mid-point of Primary Location Link
Longitude	Number	Longitude of mid-point of Primary Location Link
Input Time (Year, Month, Day, Hour, Minute, Second, Offset Hour, Offset Minute) Local time	Number Number Number Number Number Number Number Number	4 digit year Month of year 1-12 Day of month 1-31 Hour of day 0-23 Minute of hour 0-59 Second of minute 0-59 Hour offset from GMT Minute remainder from GMT
Start Time (Year, Month, Day, Hour, Minute, Second, Offset Hour, Offset Minute) Local time	Number Number Number Number Number Number Number Number	4 digit year Month of year 1-12 Day of month 1-31 Hour of day 0-23 Minute of hour 0-59 Second of minute 0-59 Hour offset from GMT Minute remainder from GMT
Anticipated End Time (Year, Month, Day, Hour, Minute, Second, Offset Hour, Offset Minute) Local time	Number Number Number Number Number Number Number Number	4 digit year Month of year 1-12 Day of month 1-31 Hour of day 0-23 Minute of hour 0-59 Second of minute 0-59 Hour offset from GMT Minute remainder from GMT
Remaining Capacity	Number	Percentage remaining road capacity

Event Description	String	Description (disseminated Generic Default Plan)
Level of Disruption	Number	Enumeration of None, Moderate, Heavy, Unknown
Event Category	String	DATEX2 Category Code
Event Status	Number	Enumeration of New, Updated, Deleted
Active Start Time (Year, Month, Day, Hour, Minute, Second, Offset Hour, Offset Minute) Local time	Number Number Number Number Number Number Number Number	4 digit year Month of year 1-12 Day of month 1-31 Hour of day 0-23 Minute of hour 0-59 Second of minute 0-59 Hour offset from GMT Minute remainder from GMT
Active End Time (Year, Month, Day, Hour, Minute, Second, Offset Hour, Offset Minute) Local time	Number Number Number Number Number Number Number Number	4 digit year Month of year 1-12 Day of month 1-31 Hour of day 0-23 Minute of hour 0-59 Second of minute 0-59 Hour offset from GMT Minute remainder from GMT
Event Source	String	Event Information Supplier

3.1.1.2 Enhanced VMS Setting Service v2

Attribute	Data Type	Description
VMS ID	Number	Unique VMS Identifier
Address	String	Description of VMS equipment location
Latitude	Number	Latitude of VMS
Longitude	Number	Longitude of VMS
Displayed Message	Series of String	Current VMS message
VMS Type	Number	Enumeration of type_101, type_104, type_110, type_111
Timestamp	Number	4 digit year
(Year, Month, Day,	Number	Month of year 1-12
Hour, Minute,	Number	Day of month 1-31
Second, Offset Hour,	Number	Hour of day 0-23
Offset Minute)	Number	Minute of hour 0-59
Local time	Number	Second of minute 0-59
	Number	Hour offset from GMT
	Number	Minute remainder from GMT
Current Faults	Series of String	Current VMS faults
*Control Office ID	Number	Unique Control Office Identifier
Implementation Reason	String	VMS setting reason

* Control Office ID

10	North East RCC
20	North West RCC
30	Eastern RCC
40	West Midlands RCC
45	West Midlands ATM
50	East Midlands RCC
60	South West RCC
70	South East RCC
71	Dartford PCO

It should be noted that the ID reported will be that of the Control Office which reported the setting to NTCC via the TCCI and not necessarily that which originated the setting.

3.1.1.3 Enhanced Matrix Setting Service v2

Attribute	Data Type	Description
Matrix ID	Number	Unique Matrix Signal Identifier
Address	String	Description of Matrix equipment location
Latitude	Number	Latitude of Matrix Signal
Longitude	Number	Longitude of Matrix Signal
Aspect Displayed	String	Current Matrix aspect displayed
Timestamp	Number	4 digit year
(Year, Month, Day,	Number	Month of year 1-12
Hour, Minute,	Number	Day of month 1-31
Second, Offset Hour,	Number	Hour of day 0-23
Offset Minute)	Number	Minute of hour 0-59
Local time	Number	Second of minute 0-59
	Number	Hour offset from GMT
	Number	Minute remainder from GMT
Control Office ID	Number	Unique Control Office Identifier (see Section 3.1.1.2)
Implementation Reason	String	Matrix Signal setting reason
Implementation Reason Code	Number	Enumeration of UpdateInitialisation, Clear, PartClear, Accident, Congestion, RoadWorksConing, Obstruction, Debris, Incident, Animals, Pedestrians, LargeLoad, Unconfirmed, Fog, OncomingVehicle, Test, ClosuresDiversions, Visibility, Rain, Other, Ice, Wind, Security, TidalSetting

3.1.1.4 Enhanced Traffic Service v2

Attribute	Data Type	Description
Timestamp	Number	4 digit year
(Year, Month, Day,	Number	Month of year 1-12
Hour, Minute,	Number	Day of month 1-31
Second, Offset Hour,	Number	Hour of day 0-23
Offset Minute)	Number	Minute of hour 0-59
Local time	Number	Second of minute 0-59
	Number	Hour offset from GMT
	Number	Minute remainder from GMT
Link ID	Number	Unique identifier of Link
*Journey Time ¹	Number	Journey Time of Link in seconds
*Delay against Ideal	Number	Delay against Ideal conditions in seconds
*Delay against Expected	Number	Delay against profiled conditions in seconds
*Classified Flows (Category 1, 2, 3, 4)	Number	Number of vehicles of length <= 5.2 metres in vehicles per hour
	Number	Number of vehicles of length >5.2 and <=6.6 metres in vehicles per hour
	Number	Number of vehicles of length >6.6 and <=11.6 metres in vehicles per hour
	Number	Number of vehicles of length >11.6 metres in vehicles per hour
*Average speed	Number	Average speed of Link in Kilometres per hour
*Occupancy	Number	Percentage of time that detector is occupied by vehicles
Speed Limit	Number	Speed limit of Link in Miles per hour
*Total Flow	Number	Total number of vehicles on Link in vehicles per hour
Number of Lanes	Number	Number of lanes on Link

* Please note a value –1 indicates that data is not available and –2 indicates that data is not applicable for the Link.

¹ Journey Times are determined between two network intersections (known as Journey Time Sections) which are serviced by Automatic Number Plate Recognition (ANPR) cameras. Journey Times are then apportioned to each Link within the Journey Time Section according to length of Link and speed limit. When there are delays due to an incident, for example, which does not affect all the Links in a section, the Link journey time may be an under-estimate or an over-estimate, depending on whether or not the Link is included in the extent of the incident. NTCC therefore proposes to phase out the reporting of Link-based Journey Times and will introduce a new service based on sections.

3.1.2 XML Client

This application has been developed using Borland's Visibroker for C++ ORB. It uses bi-directional encrypted communications using Callback to connect to NTCC. The application converts data services (described above) received by CORBA into XML format, either writing to a local disk or forwarding to a TCP/IP socket for silent processing.

This application can significantly reduce end-user development times.

3.1.3 UTMC

UTMC -10 was originally a DfT research project that produced a Technical Note containing a proposed specification for a UTMC common database. The results of all the research projects resulted in the official UTMC specification, currently TS003 and TS004.

NTCC expects demand for this service from Local Highway Authorities, many of which have made a substantial investment in UTMC-based systems. The UML model and IDLs are available from the ITS Metadata Registry and have been re-used but not reproduced by NTCC.

This service currently supports the following tables from the UTMC-10 specification.

- ACCIDENT_DEF
- EVENT_DEF
- LINK_DYNAMIC
- VMS_DEFINITION
- VMS_DEVICE_HISTORY
- INCIDENT_DEF
- ROADWORKS_DEF
- NETWORK_ZONE
- VMS_CONFIGURATION
- VMS_FAULTS

The traffic event tables (ACCIDENT_DEF, INCIDENT_DEF, EVENT_DEF and ROADWORKS_DEF) provide dates and times in local time (BST or GMT as appropriate) whilst all others are reported using GMT.

The traffic data table LINK_DYNAMIC contains columns CurrentFlow, ProfileFlow, AverageSpeed and LinkTravelTime² that will report NULL values where data for the Link is not available or not applicable.

The service also provides a 'heartbeat' object transmitted at regular intervals in the absence of any other data to ensure that connections can be monitored. Its table name is:

- TIH_HEARTBEAT

This service uses Basic Authentication and is received from port 20242.

3.2 XML Services

3.2.1 OTAP

This service supports OTAP v2 (incorporating TPEG-Loc location referencing) to provide facilities to receive Event information using an HTTP GET of XML from web servers connected to the Internet. The URL for this service is <http://otap.tistrafficinfo.com> with access credentials (Basic Authentication) provided on request.

Details of the specification can be found at <http://www.itsproj.com/otap> with the model registered at the ITS Metadata Registry (see Section 2).

² See previous note regarding Journey Times.

3.2.2 DATEX II

This service, operational during summer 2007, is the preferred service following TIH Principles and provides details of Events, VMS and Matrix Signal settings, and speeds, flows and journey times from web servers connected to the Internet. Due to its complexity, a separate User Guide (TCC-TIH-0049) is available from the TIH website.

Details of the specification can be found at <http://datex2.eu/>. A XSLT conversion tool from OTAP to DATEX II has been produced by WSP and SSL which can be provided free of charge. Details can be obtained using the contact details provided in section 5.

3.2.3 RSS

RSS provides a summary of Events and is aimed at end-users rather than for system-to-system interfaces. Details of supported services are available at <http://www.highways.gov.uk/traffic/11278.aspx>

3.2.4 TPEG

While tpegML follows TIH Principles, it is intended for delivery to end-users rather than for system-to-system interfaces. This service is currently being trialled.

3.3 Service Description

NTCC has installed a Traffic Control Centre Interface (TCCI) at each of the Police Control Offices and Regional Control Centres in order to interface with the various subsystems of the Control Office Base System (COBS). This equipment provides access to CCTV, MIDAS traffic data and High Occupancy Alerts (HIOCC), the ability to set VMS and also to receive VMS and Matrix Signal settings via the Message Sign and Signals Subsystems.

3.3.1 CORBA

3.3.1.1 Server start-up

When the TIH Publisher is started at NTCC, any existing CORBA connections will be dropped. The Naming Service is restarted followed by the application software to manage CORBA connections and provide services. The software providing Callback, Blocked Client Pull and UTMC services repopulates the Naming Service with an object reference to each service.

3.3.1.2 Client start-up

When a client successfully connects to NTCC it will receive the initial state of all objects it is subscribed to. If an object has been recently created in the NTCC database it will be described as NEW by setting the *EventStatus* attribute with *Event_New* (or by setting the action attribute as *INSERT* for UTMC) and subsequently referred to as *Event_Update* (or *UPDATE* for UTMC) once modified. When the initial state has been provided, all modifications will be pushed or made available to be pulled (as *UPDATE*), as they become available. When objects cease to be current they are published as *Event_Delete* (or *DELETE* for UTMC).

3.3.1.3 Data description

The data provided by NTCC's Callback and Blocked Pull services will be objects of type 'Any'. Each object will be: an Event; a VMS setting; a Matrix Signal setting; Traffic data or a Heartbeat as specified in the published IDLs.

3.3.1.4 Update frequency and packaging

The packaging of CORBA data has several configurable settings. The most important are:

- Call back – Server buffers 1 object and waits 0 seconds before flushing queue. Number of objects and wait period configurable at the server
- Blocked Client Pull – Server packages max 1000 objects
- UTMC – Server returns max 1000 rows per message

3.3.1.5 Faults

If a client does not keep up with the data being made available by the TIH Publisher, the data is queued at the server. If the age of the data exceeds a configurable time period (currently 1000 seconds), the client connection is terminated.

If the TCCI link fails to a PCO or RCC, the current state of all devices connected to the TCCI is republished by NTCC on reconnection.

3.3.2 XML

3.3.2.1 Access

The OTAP service currently publishes Event information for England as five separate types with the following URLs:

- Unplanned - <http://otap.tistrafficinfo.com/England/UnplannedEvent/content.xml>
- Current Planned - <http://otap.tistrafficinfo.com/England/CurrentPlanned/content.xml>
- Future Planned - <http://otap.tistrafficinfo.com/England/FuturePlanned/content.xml>
- Current Roadworks - <http://otap.tistrafficinfo.com/England/CurrentRoadworks/content.xml>
- Future Roadworks - <http://otap.tistrafficinfo.com/England/FutureRoadworks/content.xml>

In each case, the schema for the content file can be found at <http://otap.tistrafficinfo.com/Schemas/Publication.xsd>, the schema for the metadata file is at <http://otap.tistrafficinfo.com/Schemas/metadata.xsd>. All other schemas can be found at <http://otap.tistrafficinfo.com/Schemas/>.

3.3.2.2 Update frequency

Update frequencies for each OTAP Event type are:

- Unplanned = 5 mins
- Current Planned = 4 hours
- Future Planned = 12 hours
- Current Roadworks = 4 hours
- Future Roadworks = 12 hours

A metadata.xml file is provided for each URL (as per the specification) to indicate the time of last update and next scheduled update of the content files.

It is possible for Events to appear in more than one folder as it becomes active and moves from Future to Current. Absence of Event details in a XML file denotes its clearance.

The OTAP service supports the HTTP 1.1 'If-Modified-Since' request header which provides a response if the data has changed since the date supplied in the request but otherwise returns a '304 Not Modified' response.

3.4 ORB Interoperability

The ORB used in the NTCC TIH Publisher is Borland Visibroker for C++. This configuration has been tested thoroughly with the following ORBs and programming languages in client applications to ensure interoperability:

- SunORB – Requires Sun Java v1.4 or higher
- JacORB - Java
- OMNIORB – C++
- MTDORB – Delphi
- ACEORB – C++

4 Sizing Study

The storage requirements for TIH Receivers will depend on the method used to receive data and the programming languages used for development.

4.1 CORBA Services

The IDL for each Service describes the data types defined for each data item available from NTCC. The IDLs are language independent, so the size of data objects transmitted using IOP will be constant. However, end-user storage requirements will be language dependant as, for example, an integer may require 4 bytes in one language and 8 bytes in another.

As a guide, the size of Event objects with IOP overheads will be, on average, 1000 bytes and others approximately 500 bytes.

On connection, the NTCC Publisher will push all current objects to the TIH Receiver. As a guide, this will include around 8000 matrix signal settings, 7500 links reporting traffic data, 2000 VMS settings and 200 Events.

Traffic data will continue to be provided at a rate of approximately 7500 data objects every 5 minutes.

Event objects will continue to be provided as new events are generated and all object types updated as changes occur.

For CORBA services, some geographic filtering of subscriptions is possible at the server end, which may help to reduce the quantity of data received.

4.1.1 XML Client

The XML Client can be configured to write files onto a local disk or it can be configured to output to a socket. This client will generate approx 500 bytes for each VMS, Matrix Signal setting and Traffic Data object and, on average, about 1000 bytes for each Event. If saving XML files to disk, storage requirements will also depend on the cluster size of the disk.

4.2 XML Services

4.2.1 DATEX II

The following table lists the information products provided, their update frequencies and estimated payload file size.

Information Product	Premier Update Frequency	Standard Update Frequency	Estimated Payload Size
Current Roadworks	2 minutes	10 minutes	1 M bytes
Future Roadworks	6 hours	6 hours	2 M bytes
Current Planned Events	2 minutes	10 minutes	10 K bytes
Future Planned Events	6 hours	6 hours	200 K bytes
Unplanned Events	2 minutes	10 minutes	50 K bytes
Variable Message Signs	2 minutes	10 minutes	3 M bytes
Matrix Signals	2 minutes	10 minutes	9 M bytes
Traffic Data	5 minutes	10 minutes	30 M bytes
Predefined Locations	On occurrence within 5 minutes	On occurrence within 5 minutes	25 M bytes

4.2.2 OTAP

NTCC events are published in the following information products, each listed with the update frequency and approximate payload file size: GZIP compression is supported.

Product	Estimated Size
Unplanned Events	50 K bytes
Planned Events – Current	10 K bytes
Planned Events – Future	200 K bytes
Roadworks – Current	1 M bytes
Roadworks – Future	2 M bytes

Note: Planned Events include sports events, entertainment events (such as big exhibitions and concerts) but exclude roadworks. Unplanned Events include accidents, congestion, emergency roadworks, etc.

5 Help and Assistance

NTCC can provide help and advice to anyone wishing to subscribe to the data services and would encourage everyone considering this approach to discuss their requirements with us before embarking on development. Individual subscriptions can also be created to tailor the data to the users' needs where required.

5.1 TIH Technical Authority

The TIH Technical Authority should be approached, through the helpdesk, for assistance when interfacing to NTCC.

Subscriptions will be set up on an individual basis and all access to NTCC data will be recorded. Specific connection details and user credentials will be provided as part of the subscription process.

5.2 Helpdesk

24-hour support is available from the NTCC Helpdesk on 0121 245 4688 or by email to helpdesk@tistrafficinfo.com.

5.3 Frequently Asked Questions

1. Compiling my Java code throws an error. Is there a problem with the IDLs?

There is a bug in Sun's Java Development Kit v1.4.2_10, which does not handle structures in IDLs that use data types more than once, but v1.4.2_11 and 1.4.2_12 have been tested successfully on Windows and Linux.

2. How do I relate NTCC network Links to actual locations?

The NTCC Project Network Model is supplied as a CSV file and provides Ordnance Survey Grid References for the start and end of each Link. Further static data identifying WGS84 locations and upstream/downstream junctions can be provided if required.

3. What are the commercial arrangements – is the data free of charge?

NTCC has produced an Acceptable Use and Operational Policy describing the conditions of use, which is available from the TIH website.

4. The XML Client appears to be producing output with incorrect dates – what is wrong?

The client contains a registry setting to configure the current timezone. It is hoped that this will be removed in future versions of the client so that it reacts automatically to daylight saving changes.

The registry key is:

HKEY_LOCAL_MACHINE\SOFTWARE\Serco\Tcc\TIHClient\TimeType = bst (or gmt)