UK Public Transport Information - SIRI

SIRI VM & Data Matching

for exchanging UK location data within the Bus Open Data Digital Service and similar systems

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Contents

List of Figures

List of Tables

1 Introduction

1.1 Customer Expectation

The road network and therefore bus routes are inherently unstable - making it difficult to maintain reliable schedules for passengers. To mitigate this, real time information such as bus arrival times to each stop, can be used to update schedules - thereby increasing the perceived reliability of the system from a user perspective. Providing accurate real time information helps passengers better plan their trips and minimise waiting times – both of which contribute towards a better customer experience.

From an operator perspective the data used to create real time information can also be used to understand how the network is operating to enable improved schedules and operational efficiency.

Transport Focus regularly survey passengers to understand their priorities. In their September 2020[1] report on bus passengers' priorities for improvement, they identify a top ten of passenger priorities which is set out in the diagram below:

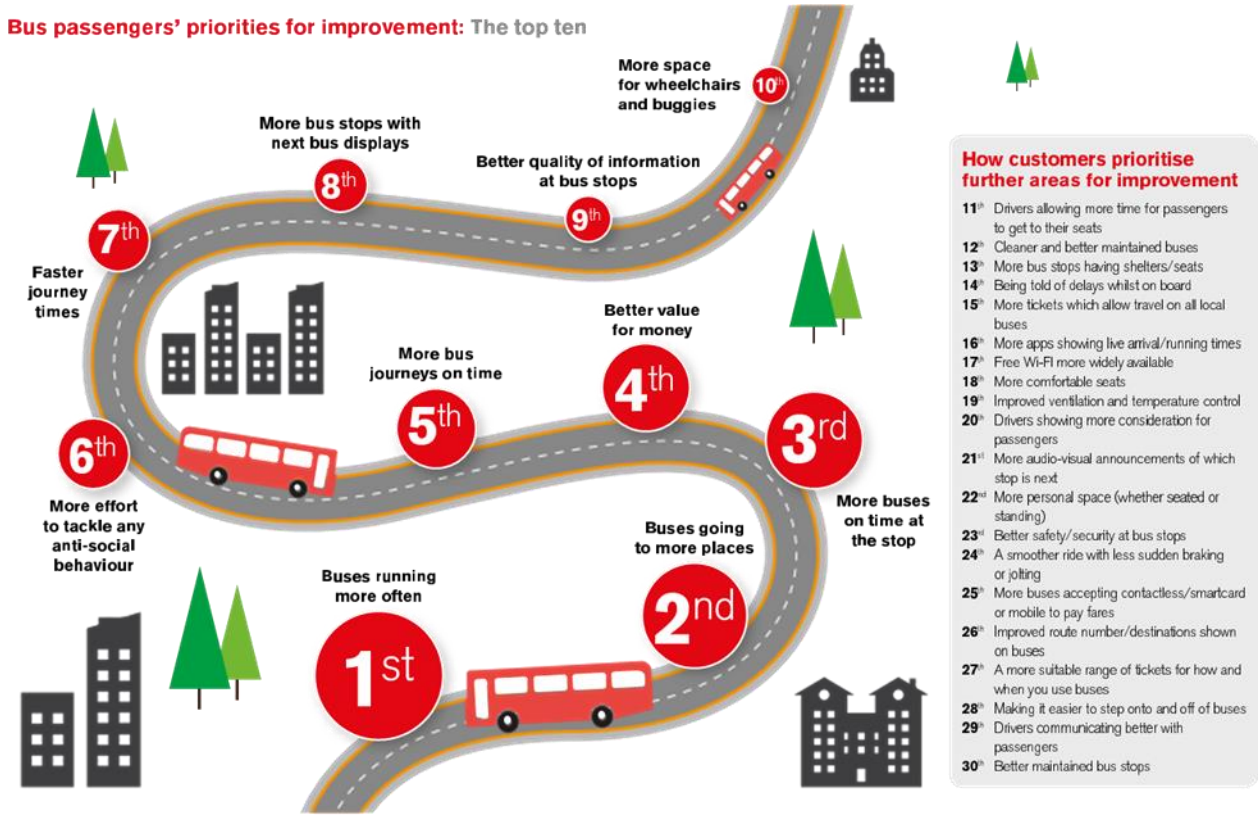

Figure 1 Extract from Transport Focus: Bus passengers' priorities for improvement, September 2020

Of the ten priorities identified, real time information can a have an impact on five:

- more buses on time at the stop;
- more bus journeys on time;
- faster journey times;

[1] https://www.transportfocus.org.uk/research-publications/publications/bus-passengers-priorities-for-improvement-2/

- more bus stops with next bus displays; and
- better quality of information at bus stops

Because real time information is so key to a customer's experience of buses it plays a significant role in the Bus Strategy- Bus Back Better with the expectation that operators and authorities will provide high quality information to customers taking advantage of central systems such as the Bus Open Data Service (BODS) wherever possible.

1.2 Scope

To achieve customers' expectations and the benefits of real time information is it is important that the necessary data is readily available and of good quality to enable easy processing.

The Bus Open Data programme, coming from the Bus Services Act 2017, places a requirement on all bus operators of local bus services across England to openly publish timetables, fares and location data for their registered services. This includes producing SIRI (VM) data containing their vehicles location as open data. While SIRI has been around for many years now, and is a mature standard, there are different ways in which data can be constructed within the standard.

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As part of the Bus Open Data Service (BODS) programme, the Department for Transport (DfT) has developed a SIRI (VM) profile to support BODS. The aim of this profile is to specify a consistent use of elements and a consistent way of using SIRI VM that will be used within BODS and which will lead to a higher quality data set and, at the same time, lower the barriers to entry by users new to SIRI.

This profile is set out in this document. Because it has a wider applicability than simply the BODS programme, the profile will be referred to as the public transport information SIRI VM profile. It will be abbreviated as the SIRI-VM-PTI profile, or simply SIRI-VM-PTI within this document.

1.3 Audience

This document is intended to be used by three groups of readers:

1) Suppliers of systems providing location data to BODS. To ensure they know what data is required, its format and content expected and how it needs to match route and timetable data.
2) Technical staff within bus operators who are responsible for ensuring system suppliers are providing compliant data. To ensure they know what data is required, its format and content expected and how it needs to match route and timetable data.
3) Developers and technical managers of data consumers. To ensure they know what data they can expect from BODS, its format and content and how it can be combined with PTI-TxC data to create customer information.

1.4 Abbreviations

AVL	Automated Vehicle Location
BODS	Bus Open Data Service. The DfT Bus Open Data Service programme emerging from Section 18 of the Bus Services Act 2017.
DfT	The UK Department for Transport.
GPS	Global Positioning Satellite

NaPTAN	National Public Transport Access Nodes, the database of bus stops and locations at which public transport can be accessed.
NOC	National Operator Code. A unique code, usually four characters, that identifies an operator or operating division of an operator and which should be consistent across all systems. This can be found in the NOC database owned and managed by Traveline.
SIRI	Service Interface Real-Time Information, as described in BS EN 15531 parts 1 to 3.
SIRI-VM-PTI	The SIRI UK Public Transport Information, set out in this document.
TXC	TransXChange. The UK *de facto* standard for timetable interchange.
TXC-PTI	The TXC Public Transport Information profile, set out in the document UK Public Transport Information Profile
XML	E**X**tensible **M**arkup **L**anguage. The technology used to encode TXC documents.

2 Data Standards

2.1 Relationship to SIRI

The SIRI-VM standard is the vehicle monitoring service, which allows for the exchange of real-time positions of public transport vehicles.

The service is designed to exchange vehicle monitoring information between control systems, and for this information to be distributed to journey planners, alert systems and displays that wish to process and match real-time positions based on structured elements.

While SIRI-VM is created as a business to business (B2B) protocol, it should be assumed that any textual information it contains will be displayed to end-users both through personal devices and public screens at stops and stations. This then demands care in the authoring of text that will be exchanged using SIRI-VM.

A SIRI-VM profile has been developed to support the Bus Open Data Service.

This profile fits within the general CEN SIRI-VM schema, which describes the rules for the XML document being used. The SIRI-VM schema covers the complete breadth of capability of SIRI-VM and is designed to be used in a many different workflows and to support different levels of detail in the data exchanged.

2.2 Validation

The profile describes the specific parts of the XML schema to be used in a particular implementation and includes which elements and attributes are mandatory in the exchanged data.

The supplied API feed will be validated against the Department for Transport SIRI-VM 2.0 (Q) Profile. Mandatory and optional elements contained within the profile will be captured and supplied to data consumers. Elements within the schema but outside the profile will not be captured by the service.

Validation of data against the SIRI-VM-PTI profile will take place in two stages:

1) Is the data schema-compliant? This is a straightforward check that checks that the data as submitted is compliant with the basic requirements of the SIRI 2.0q general schema. This is an in-built function of XML.

2) Is the data SIRI-VM-PTI compliant? This is a programmatic check to ensure that the data meets the requirements of this profile, carried out by analysing the data in the SIRI.

The SIRI-VM-PTI profile is an additional set of constraints and clarifications that sit on top of SIRI v2.0q . While every care has been taken to ensure compliance with SIRI, this document will necessarily need to be read alongside the formal SIRI documentation available from CEN.

3 Data Requirements

3.1 Minimum Essential Data to avoid Non-Compliance

The following elements have been identified as critical for data consumers and failure to supply in the SIR-VM-PTI feed will result in being deemed to be non-compliant:

ProducerRef

ResponseTimestamp

Monitored-VehicleJourney

- RecordedAtTime
- ValidUntilTime
- LineRef
- DirectionRef
- OperatorRef
- Bearing
- VehicleJourneyRef
- VehicleLocation (Longitude, Latitude)
- VehicleRef

Note: VehicleJourneyRef shall be provided in the OperationalInfoGroup.

3.2 Partial Compliance Data

Failure to supply these fields in the SIR-VM-PTI feed will result in partial compliance, at date to be agreed, these will migrate to become minimum essential data to avoid non-compliance:

VehicleMonitoringDelivery (Vehicle activity)

- PublishedLineName
- OriginRef
- OriginName
- DestinationRef
- BlockRef

3.3 Full Compliant Data

To be Compliant with BODS requirements all fields listed above are required:

- ProducerRef
- ResponseTimestamp
- *VehicleMonitoringDelivery (Vehicle Activity)*
  - RecordedAtTime
  - ValidUntilTime
  - *MonitoredVehicleJourney*
    - LineRef
    - DirectionRef
    - PublishedLineName
    - OperatorRef
    - OriginRef
    - OriginName
    - DestinationRef
    - *JourneyProgress*
      - VehicleLocation (Longitude, Latitude)
      - Bearing
      - BlockRef
      - VehicleRef
      - VehicleJourneyRef

4 Data Matching

The more easily location data in SIRI VM format can be matched with the timetable data provided to BODS in TXC-PTI format the simpler it is for data consumers to produce high quality and accurate real time information to customers and for analysis through services such as the Analyse Bus Open Data Service, helping achieve the objectives of the Bus Strategy. To help achieve the matching of data it is key that in the SIRI-VM-PTI data feed where the is an equivalent field in the TXC-PTI the same content is used.

This table provides information on the expected content in each field and where there is an equivalent field in the TxC-PTI data. Where there is a TXC-PTI Match identified then the data in both the SIRI-VM-PTI and TXC-PTI fields MUST be an absolute match of text and formatting.

Table 1 Data Matching between SIRI-VM-PTI and TXC-PTI

SIRI Field *Location within SIRI message structure*	**Minimum Essential Data**	**Partial Compliance**	**Description of data**	**Source**	**TXC-PTI Match**	**Data Type**	**Example**	**Compliance check**
Bearing *ServiceDelivery/VehicleMonitoringDelivery/VehicleActivity/MonitoredVehicleJourney*	Y		Direction of Travel in degrees	GPS / AVL Equipment	-	float	123	Values are 0 to 359.9
LineRef	Y		Public facing service number. Unique within a document	TxC	LineName	String	L1, C, 955	

ServiceDelivery/VehicleMonitoringDelivery/VehicleActivity/MonitoredVehicleJourney								
MonitoredVehicleJourney *ServiceDelivery/VehicleMonitoringDelivery/VehicleActivity*	Y							
OperatorRef *ServiceDelivery/VehicleMonitoringDelivery/VehicleActivity/MonitoredVehicleJourney*	Y		Operators Public Facing Name	NOC	NationalOperatorCode	String	ACYM	Valid NOC Code
RecordedAtTime *ServiceDelivery/VehicleMonitoringDelivery/VehicleActivity*	Y		Time that the VM data was recorded (normally the time of VehicleLocation).	AVL Equipment	-	dateTime	2004-12-17T09:30:47-05:00	Valid Date and time
ResponseTimestamp *ServiceDelivery*	Y		Time the SIRI message was sent.	Backoffice or AVL Equipment	-	dateTime	2004-12-17T09:30:47-05:00	Valid Date and time
VehicleJourneyRef	Y		Unique identifier for current journey	Operator / Running Board	VehicleJourney Code	String	V45678	

ServiceDelivery/VehicleMonitoringDelivery/VehicleActivity/MonitoredVehicleJourney								
VehicleLocation (Lat, Long) I	Y		Location of vehicle	GPS / AVL Equipment	-	LocationStructure		
LongitudeType	Y		-180 to +180		-	decimal	-3.5417359	Values are -180 to 180
LatitudeType	Y		-90 to +90		-	decimal	50.4589615	Values are -90 to 90
ProducerRef *ServiceDelivery*	Y		reference that identifies producer of data	Backoffice or AVL Equipment	-	String	ItoWorld, Stagecoach	
DirectionRef *ServiceDelivery/VehicleMonitoringDelivery/VehicleActivity/MonitoredVehicleJourney*	Y		inbound/outbound, clockwise/anticlockwise	Operator	Direction from JourneyPattern	String	INBOUND	One of (from TxC list): inbound outbound inboundAndOutbound circular clockwise anticlockwise

BlockRef *ServiceDelivery/VehicleMonitoringDelivery/VehicleActivity/MonitoredVehicleJourney*		Y	Running board for the vehicle	Operator / Running Board	BlockNumber	String	115106	
PublishedLineName *ServiceDelivery/VehicleMonitoringDelivery/VehicleActivity/MonitoredVehicleJourney*		Y	the public identifier	Operator	LineName	String	Indigo, 23A	
ValidUntilTime *ServiceDelivery/VehicleMonitoringDelivery/VehicleActivity*	Y		Time until which message is valid	Backoffice or AVL Equipment	-	dateTime	2004-12-17T09:30:47-05:00	Valid Date and time
VehicleMonitoringDelivery (Vehicle activity) *ServiceDelivery*		Y			-			
DestinationRef *ServiceDelivery/VehicleMonitoringDelivery/VehicleActivity/MonitoredVehicleJourney*		Y	NaPTAN for the journey destination (last stop)	TxC	StopPointRef	String	370045098	Use same checks as for TxC-PTI for valid stop

OriginName *ServiceDelivery/VehicleMonitoringDelivery/VehicleActivity/MonitoredVehicleJourney*		Y	name of the origin stop the journey	CommonName from NaPTAN	-	String	High Street	
OriginRef *ServiceDelivery/VehicleMonitoringDelivery/VehicleActivity/MonitoredVehicleJourney*		Y	NaPTAN for the journey start (first stop)	TxC	StopPointRef	String	370045098	Use same checks as for TxC-PTI for valid stop
VehicleRef *ServiceDelivery/VehicleMonitoringDelivery/VehicleActivity/MonitoredVehicleJourney*	Y		Unique reference for the vehicle that is consistent.	Vehicle Equipment	-	String	SDVN-15306, YY12EFH	
DestinationName *ServiceDelivery/VehicleMonitoringDelivery/VehicleActivity/MonitoredVehicleJourney*		Y	Destination of the journey. Should match the destination blind on the front of the vehicle	TxC	DynamicDestinationDisplay or DestinationDisplay depending on what used for the journey.	String	Town Square	
Occupancy *ServiceDelivery/VehicleMonitoringDelivery/V*	Optional		Current occupancy of vehicle SIRI v2.0 implementation		-	String	full standingAvailable	

ehicleActivity/MonitoredVehicleJourney						seatsAvailable	

5 Updating Data

5.1 Update Frequency

The service accepts incremental updates of vehicle positions as per the SIRI specification.

The service is operating via the subscription mechanism defined in the SIRI specification and will aim to receive and consume SIRI-VM vehicle position updates at the frequency with which they are sent to the service.

The feed must supply updated data every 30 seconds minimum with higher frequencies (such as every 15 seconds) to a maximum 10 second frequency accepted.

5.2 Heartbeat

The service expects a ‘heartbeat’ to be sent every 30 seconds to confirm the operator’s SIRI server is functioning independently of any service deliveries. After multiple successive heartbeats are missed, the service will attempt to re-subscribe periodically until the SIRI-VM feed is resumed.

5.3 Consumer rate limit

The live vehicle data for all BODS operators is available to data consumers on a request/response basis as a single centralised response for all vehicles available. The response is compliant with the SIRI schema in this documentation.

The consumer can either request a filtered subset of data using the BODS application programming interface (API) or a national .zip of all data no more than every 5 seconds from the BODS platform.

It is important to note that consumers do not need to manage many different individual feeds to obtain vehicle data because the BODS service consumes and centralises this data to a single endpoint on behalf of the data consumer.

5.4 Time synchronisation and accuracy

To ensure the accuracy of data supplied and the ability to use the location data to provide high-quality information to customers, all equipment and services in the data chain must know the time accurately.

To achieve this, all components that are included in the production and processing of SIRI data should be regularly synchronised with an accurate time service. This could be, for example, using a global positioning system (GPS) for a ticket machine or tracking device and a reliable internet time service for servers.

All timestamps are stated in UTC (Coordinated Universal Time). The use of UTC avoids problems with the changeover to and from British Summer Time.

It is recommended that time is synchronised at least once per day to ensure time is known to a 1 second accuracy.

6 Data Matching for Production of Real Time Information

Validation of data and compliance with the SIRI-VM-PTI profile is important to ensure that the data can easily be used to produce a predicted or calculated arrival time of bus at a bus stop.

To achieve a predication the scheduled arrival time and current location and past movements of the bus are required. This required data from the timetables and location data services of BODS to be combined and if the data is not supplied in the correct formats then combining of the data is much harder and the quality of information available to the customer will be reduced.

VehicleJourneyRef is the key field for matching as this allows a 1:1 match to be easily made reducing errors in matching scheduled and live data and increasing the number of predictions that can be provided to customers.

Where VehicleJourneyRef can be matched between SIRI and TransXChange the recommended matching strategy is:

OperatorRef

LineRef

VehicleJourneyRef

BlockRef

The use of BlockRef allows future journeys for the same vehicle to be identified and cross journey predictions produced. Where BlockRef is not provided it is not possible produce cross journey predictions, which reduces the information available to customers at the start of a journey as without knowing the future journeys a vehicle is going to make, predictions for a given journey can only start to be produced once that journey has started. This means customers at the first few stops on a journey may not see predicted times, only scheduled which if a bus is running late may be removed from the display or app before the vehicles arrives meaning customers will have no confidence in the information provided and will be less likely to want to use buses in future.

In December 2021 only a small proportion of BODS location data and timetable data can be matched using the above simple strategy, this remains the recommended matching strategy because as data compliance improves more journeys will become matchable.

Where VehicleJourneyRef does not match with VehicleJourneyCode in TxC-PTI then an alternative matching strategy will need to be used, there are a number of different strategies that may need to be used with different Operators data, one suggested approach which is often successful is:

OperatorRef

LineRef

Direction

Origin Ref

DestinationRef

VehicleJourneyRef to the scheduled journey <DepartureTime> in TxC-PTI as where journey numbers are not implemented it is probable the driver will sign on to the ticket machine using the start time.

7 Example SIRI Delivery

```
<Siri xmlns="http://www.siri.org.uk/siri" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="http://www.siri.org.uk/siri http://www.siri.org.uk/schema/2.0/xsd/siri.xsd" version="2.0">
    <ServiceDelivery>
        <ResponseTimestamp>2021-11-16T10:27:43.117880+00:00</ResponseTimestamp>
        <ProducerRef> trentbarton </ProducerRef>
        <VehicleMonitoringDelivery>
            <ResponseTimestamp>2021-11-16T10:27:43.117880+00:00</ResponseTimestamp>
            <RequestMessageRef>ba0f0f5f-b128-4643-9dc6-09170860d0d4</RequestMessageRef>
            <ValidUntil>2021-11-16T10:32:43.117880+00:00</ValidUntil>
            <ShortestPossibleCycle>PT5S</ShortestPossibleCycle>
            <VehicleActivity>
                <RecordedAtTime>2021-11-16T10:27:17+00:00</RecordedAtTime>
                <ItemIdentifier>c0fe01b0-002b-42d2-b307-8bce5392466b</ItemIdentifier>
                <ValidUntilTime>2021-11-16T10:32:43.153210</ValidUntilTime>
                <MonitoredVehicleJourney>
                    <LineRef>i4</LineRef>
                    <DirectionRef>outbound</DirectionRef>
                    <PublishedLineName>i4</PublishedLineName>
                    <OperatorRef>BRTB</OperatorRef>
                    <DestinationRef>1090BSTN06</DestinationRef>
                    <VehicleLocation>
                        <Longitude>-1.366558</Longitude>
```

```
                                        <Latitude>52.90623</Latitude>
                                    </VehicleLocation>
                                    <Bearing>250.0</Bearing>
                                    <BlockRef>N202</BlockRef>
                                    <VehicleJourneyRef>100947</VehicleJourneyRef>
                                    <VehicleRef>134_-_YX68_ULF</VehicleRef>
                                </MonitoredVehicleJourney>
                            </VehicleActivity>
                        </VehicleMonitoringDelivery>
                    </ServiceDelivery>
</Siri>
```