TRAVELLER
INFORMATION
EXCHANGE

Transport Certification Australia

PROVIDER INTEGRATION GUIDE

An application of the National Telematics Framework

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EXECUTIVE SUMMARY

The Traveller Information Exchange (TIX) is an application of the *National Telematics Framework* that delivers the ability to exchange information between:

- Producers of information

  and

- Providers of information services

  for use by

- Consumers of information.

TIX allows for the collation and distribution of information published by Producers and makes it available to Providers in a standardised format.

This document describes the TIX architecture and interface specification in sufficient detail to allow Providers to understand, scope, and design the data components necessary to be able to draw aggregated information from TIX, and to deliver that information to Consumers.

The content of this document comprises:

- *Implementation Guide* – this section provides a description of the responsibilities and implementation requirements for Providers.

- *Reference Guides* – detailed description of the TIX data model and software interface applicable to Providers.

The content of this document is technical, and reflective of the target audience being those personnel with responsibility for system design and implementation.

Related documents:

- For an overview of TIX, refer to *Traveller Information Exchange Overview*.

- For implementation requirements for Providers with TIX, refer to *Traveller Information Exchange Producer Integration Guide*.

Contents

1 OVERVIEW

The Traveller Information Exchange (TIX) is an application of the *National Telematics Framework* that delivers the ability to exchange information between:

- Producers of information

  and

- Providers of information services

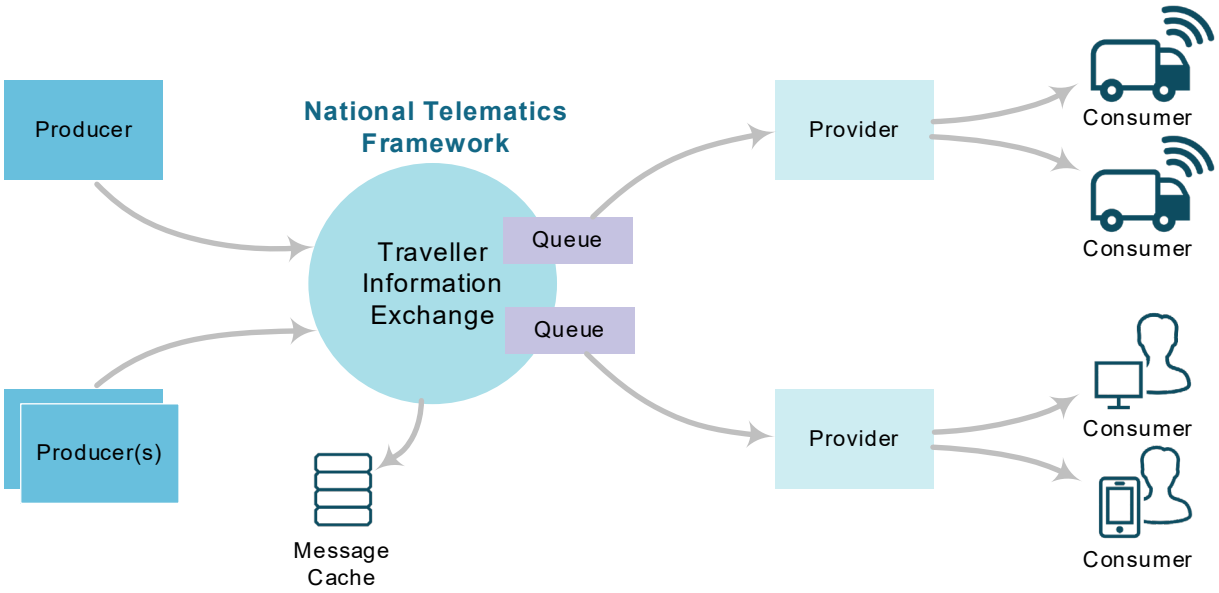
  for use by

- Consumers of information.

TIX allows for the collation and distribution of information published by Producers (in the form of messages) and makes it available to Providers in a standardised format.

Each message, generated by a Producer, describes the current status of some real-world event. Examples may include traffic congestion or road closures, weather phenomenon, port stevedore slot openings, rest area availability, etc. Each message is designed to be useful to its recipient, as it may influence an on-road decision related to a journey.

Figure 1: TIX Ecosystem



The diagram in Figure 1 shows the TIX ecosystem, noting that:

- TIX is an application of the *National Telematics Framework* and is hosted by Transport Certification Australia (TCA).

- TIX allows any information sources from any Producer to be utilised and made available. Providers receive that information in a standardised format.

- Producers make messages available to TIX. A Producer may already have an Application Programming Interface (API) to make their messages accessible (which can be used by TIX), or alternatively can utilise functionality of TIX to supply messages directly.

- Providers create one or message queues within TIX. Providers subscribe queues to messages made available by Producers through TIX, and can merge one or more sources of information from multiple Producers before distributing messages to Consumers who would have an interest in them (e.g. based on location, route, destination, time of day and/or other registered interest in the information).

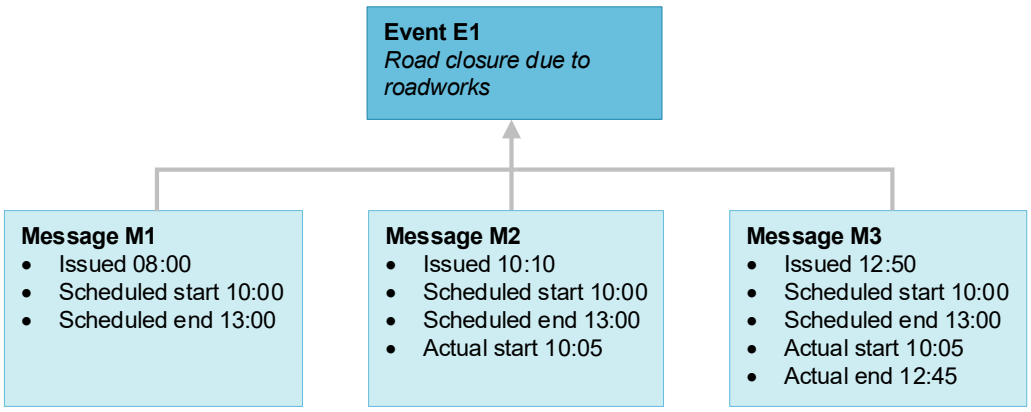
- Consumers are those for whom the information made available by the Producer may be relevant when making decisions related to their journeys. Consumers, utilising services enabled by Providers, choose which types of information to subscribe to in order to allow messages to be communicated through devices.

2 BACKGROUND

2.1 Business Domain Model

Underpinning TIX are the key concepts of events and messages and the relationship between them as illustrated in Figure 2.

Figure 2: Relationship Between Events and Messages



An event, generated by a Producer, represents a real-world occurrence – for example, a port closure or roadworks. Over time, each event will have a different status, and the information known about the event will change and be updated by the originating Producer. Events are not explicitly modelled or tracked within TIX, but rather are described by a sequence of messages.

Each individual message is immutable (i.e. it never changes), and the sequence of messages relating to a single event is correlated by a common event identifier. The status of an event is therefore described by the most recently issued message pertaining to that event, and consequently each message supersedes all previously issued messages pertaining to the same event.

2.2 Capability for Providers

A Provider is required to create one or more message queues, using the TIX RESTful API, and subscribe the queue(s) to messages that are relevant to Consumers for whom it provides an information delivery service. Once it receives messages, the Provider collates and stores those messages. The Provider distributes messages to its Consumers and ensures that messages are communicated to Consumers in a format that can be understood by them.

A Provider uses the TIX RESTful API to create message queues within TIX, subscribe queues to relevant messages, and receive messages from the message queues.

The integration requirements for Providers are discussed in detail in Section 4.

3 REFERENCES

Documents referenced in this Guide are referenced below:

a. Transport Certification Australia (TCA). 2018. *Traveller Information Exchange Overview*, Transport Certification Australia. Melbourne, Australia.

b. Transport Certification Australia (TCA). 2018. *Traveller Information Exchange Producer Integration Guide*, Transport Certification Australia. Melbourne, Australia.

4 IMPLEMENTATION GUIDE

The capability to be implemented by Providers is summarised below.

Figure 3: Capability Implementation Requirements for Providers

As shown in Figure 3, the capability encompasses five areas of functionality:

- *Subscribe* – using the TIX RESTful API, the Provider creates a message queue within TIX, subscribing this queue to messages that are relevant to its Consumers.
- *Receive Messages* – using the TIX RESTful API, the Provider receives messages from its message queue within TIX via a periodic pull mechanism.
- *Collate and Store Messages* – as messages are received from TIX, they are collated and stored. Collation refers to the discarding of duplicates, discarding of earlier (previous) messages for a given event, and discarding of messages that have expired.
- *Distribute Messages* – the Provider makes messages (or the events they describe) available to relevant Consumers.
- *Display Messages* – the Provider ensures that messages are communicated to the Consumers who have received messages in a format that can be understood by them.

4.1 Subscribe

Each Provider is assigned a unique Provider ID by the System Manager (TCA). Using this Provider ID as a namespace, the Provider is required to create and manage message queues:

- The full name of each queue is of the form {provider-id}.{queue-name}. For example, a Provider with Provider ID ‘ABC’ may have a queue named ‘ABC.all-my-messages’.
- Any time a queue is referenced without a leading Provider ID, the currently authenticated user ID is used as the Provider ID. For example, if user ‘ABC’ references queue ‘all-my-messages’, this is implicitly an access to ‘ABC.all-my-messages’.
- Users do not have visibility of the existence of queues owned by other users. For example, user ‘ABC’ cannot see the queue ‘XYZ.all-my-messages’.

Associated with each message queue is a subscription. This is a query that identifies those messages of interest to the Provider. Upon associating a subscription with a queue, the queue is filled with messages already held by TIX that meet the subscription’s query. As TIX receives new messages from Producers, these are added to each queue where they satisfy the subscription query associated with that queue.

Messages are removed from each queue where either:

- Their expiry date and time (as specified by the Producer) is reached; or
- A later message is received from the same Producer that pertains to the same event (as identified by event ID).

The Provider interacts with message queues and subscriptions using the TIX RESTful API, specifically:

PUT /queues/[{provider-id}.]{queue-name}
Creates a message queue with an associated subscription, or modifies the subscription associated with an existing message queue. The subscription is specified using query parameters.

DELETE /queues/[{provider-id}.]{queue-name}
Deletes a message queue and the associated subscription.

4.2 Receive Messages

The Provider receives messages by periodically (e.g. once per minute) reading previously unseen messages from each of its message queues. Previously seen messages are excluded from being read by the Provider using a mechanism that will ensure all messages are received at least once, but occasionally more than once:

- As each message is received by TIX it is time-stamped.
- TIX ensures that no message is added to any queue without all messages having an earlier or equal time stamp (and matching the subscription associated with the queue) also being added to the queue.
- For each read of the queue by the Provider, TIX returns an HTTP *Last-Modified* response header that reflects the most recent time stamp of any message returned by that read of the queue.
- For each read of the queue by the Provider, the Provider specifies an *If-Modified-Since* request header equal to the value of the *Last-Modified* header in the most recent and prior read. TIX will only return messages with a time-stamp after this *If-Modified-Since* header.

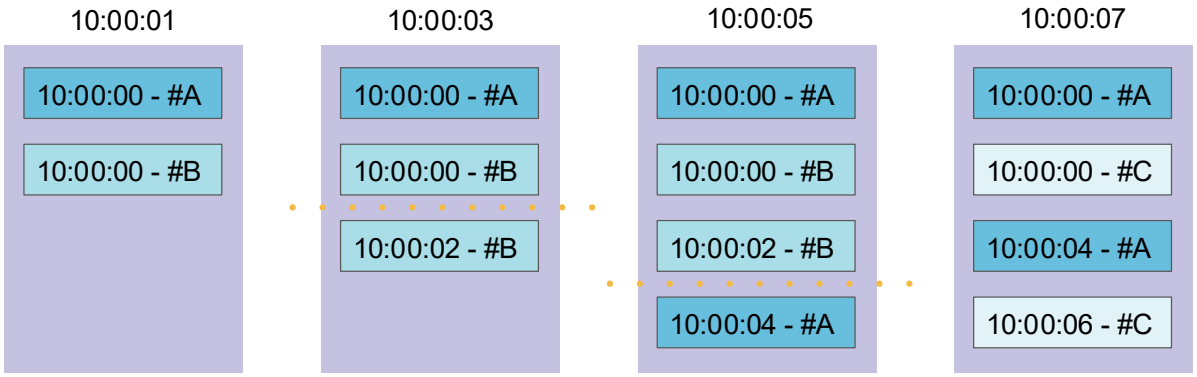
The Provider reads the messages on each message queue using the TIX RESTful API, specifically:

GET /queues/[{provider-id}.]{queue-name}/messages
If-Modified-Since: DDD, dd Mmm YYYY HH:MM:SS GMT

Reads messages on the specified queue that have a time stamp after the specified *If-Modified-Since* date and time (or all messages if this header is omitted).

If the subscription associated with a queue is modified, it is possible that a message with an earlier time stamp now matches the subscription, and thus the Provider should omit the *If-Modified-Since* header until such time that some messages have been read from the queue.

Figure 4: State of Sample Message Queue at Discrete Points in Time



Consider the diagram in Figure 4 where the content of a single message queue is shown at different and discrete points in time:

- At a time prior to 10:00:00 the Provider creates the queue, and subscribes the queue to messages pertaining to location A (#A) and location B (#B).
- At 10:00:01 the queue contains a message pertaining to location A (#A) and a message pertaining to location B (#B). The Provider reads this queue, receives the two messages, and notes the response header *Last-Modified* value of 10:00:00 (the time stamp on the most recent message on the queue).
- At 10:00:03 the queue contains an additional message pertaining to location B (#B). The provider reads this queue specifying a request header *If-Modified-Since* value of 10:00:00, receives one additional message, and notes the response header *Last-Modified* value of 10:00:02 (the time stamp on the most recent message on the queue).
- At 10:00:05 the queue contains an additional message pertaining to location A (#A). The provider reads this queue specifying a request header *If-Modified-Since* value of 10:00:02, receives one additional message, and notes the response header *Last-Modified* value of 10:00:04 (the time stamp on the most recent message on the queue).
- At 10:00:07 the Provider adjusts the queue's subscription to messages pertaining to location A (#A) and location C (#C). The queue is replenished with all relevant messages held by TIX, including both messages that have been seen before, and messages that have not been seen before. The Provider must omit the *If-Modified-Since* request header to ensure delivery of previously unseen messages (pertaining to location C), but this results in redelivery of previously seen messages (pertaining to location A).

It is the responsibility of the Consumer to discard duplicate messages in the event that they are received.

4.3 Collate and Store Messages

Upon receiving messages from TIX, the Provider must store those messages securely, and subsequently collate those messages such that:

- Individual messages that have previously been received by the Provider are discarded, noting that multiple delivery of messages can occur following an update to the subscription associated with the message queue;
- Earlier messages that pertain to the same event (as correlated by event ID) as a newly arrived message must be discarded, noting that when an event changes a new message is generated to describe the event in its new state; and
- Messages that have expired are discarded, noting that the Producer of each message specifies an expiry date and time after which the message should not be distributed or displayed (see Section 5 Data Model Reference Guide).

In summary, each message must be securely stored, and remains relevant until it is replaced by a later message pertaining to the same event, or it expires. Notwithstanding this, each message includes an optional 'Actual Event End Date Time', and the event does not need to be displayed to the Consumer beyond this date and time.

4.4 Distribute and Display Messages

As the Provider stores and collates messages, it is responsible for the distribution of the content of those messages to Consumers who have an interest in their subject matter.

For example, a Consumer may have an interest in information for a 10-kilometre radius around its current position.

The mechanism by which the Provider determines the relevance of each message to each Consumer is not prescribed, and the Provider can identify a solution that is appropriate to their own systems and procedures.

Beyond the mechanism used to determine the relevance of each message to each Consumer, the Provider must also identify a mechanism to communicate data to the Consumer in a format that can be understood by them.

For example, for Consumers in vehicles equipped with in-vehicle devices:

- The Provider may implement its own equivalent to the TIX queue and subscription mechanism within its back office, such that messages of interest are delivered to each Consumer. The device would then determine if, how and when to display each message to the driver, making intelligent decisions based upon the content of each message (e.g., expiry date and time, actual event end date and time).
- Alternatively, the Provider implements the capability to translate from messages to events within its back-office system, thus producing a list of current events of interest to each vehicle. Each device periodically downloads and displays this list of current events, somewhat like downloading and displaying a static web page.

Messages should not be distributed to the Consumer where they are expired, or where the 'Actual Event End' date and time encoded within them has passed.

4.5 Service Usage Agreement

TIX architecture and design can allow for varying levels of assurance related to the information provided.

For example, messages that are issued through TIX in good faith as advisory only may not be verified by either TCA or the Producer, and therefore would need to be covered by a disclaimer (provided by TCA) as a prerequisite to content distribution.

Access to the TIX RESTful API or user content is subject to the terms and conditions in Appendix C - Terms and Conditions.

5 DATA MODEL REFERENCE GUIDE

5.1 Message Data Model

TIX allows Providers to access messages that may be relevant to one or more Consumers. The inclusion of appropriate data elements in each message helps to ensure that Consumers receive only the messages that are relevant to them (for example, messages that may influence journey decisions). The inclusion of appropriate data elements maximises the value of that data to Consumers.

At a minimum, it is recommended that Producers generate the following data elements along with the core advisory message to enable message lifetime management and other filtering:

- Message name
- Priority
- Message text
- Scheduled and actual start time
- Scheduled and actual end time.

Other data elements, such as location of interest and other geospatial attributes may be included (and are strongly recommended), where appropriate, to maximise the value of data to Consumers.

Table 1 describes key elements of the TIX Message Data Model. Each entity is formally encoded as an XML schema (see Appendix A - XML Schema Reference), and both XML and JSON messages are constructed against these XML schemas. Example messages appear within the RESTful API reference (where relevant).

Table 1: TIX Message Data Model

Element	Description	Data Type	Use
`Message Id`	A unique message identifier assigned by (or on behalf of) the message source. Message IDs are not required to be ordered, just unique per Producer.	String	Required
`Issued`	The UTC date and time the message was generated at and by the source. Message order is defined by message date and time. Where multiple messages share the same message date and time, only one message can reference any given event.	DateTime	Required
`Expiry`	The UTC date and time after which the message should be discarded or ignored. A message cannot expire prior to the previous message for the same event. *Note: A message is also expired whenever a subsequent message is generated which refers to the same event.* *Note: The recommended expiry period is 4 hours, but longer expiry periods are appropriate for future events.*	DateTime	Required

Element	Description	Data Type	Use
`Producer Id`	The identity of the producer of the message. This is assigned by TCA.	String	Required
`Producer Name`	The name of the source of the message.	String	Required
`Event Id`	The identifier of the real-world event described by this message.	String	Required
`Event Code`	A unique code describing the event.	String	Required
`Event Name`	A short name describing the event (e.g. ROAD CLOSED).	String	Required
`Event Description`	A description of the event. This can be as expansive as required.	String	Optional
`Event Scheduled Start`	The local date and time (including UTC offset) when the event is scheduled to start (if known).	DateTime	Optional
`Event Scheduled End`	The local date and time (including UTC offset) when the event is scheduled to end (if known).	DateTime	Optional
`Event Actual Start`	The local date and time (including UTC offset) when the event started.	DateTime	Optional
`Event Actual End`	The local date and time (including UTC offset) when the event finished.	DateTime	Optional
`Event Severity`	The severity of the event. One of: ADVISORY, LOW, ROUTINE, HIGH, EMERGENCY	String	Required
`Location Point Latitude`	The location of the event described as a point comprising latitude and longitude.	Double	Optional
`Location Point Longitude`	The location of the event described as a point comprising latitude and longitude.	Double	Optional
`Location Circle Latitude`	The location of the event described as a circle comprising latitude, longitude and radius.	Double	Optional
`Location Circle Longitude`	The location of the event described as a circle comprising latitude, longitude and radius.	Double	Optional
`Location Circle Radius`	The location of the event described as a circle comprising latitude, longitude and radius.	Integer	Optional
`Location Box North`	The location of the event described as a box comprising North, West, South, East coordinates.	Double	Optional

Element	Description	Data Type	Use
Location Box West	The location of the event described as a box comprising North, West, South, East coordinates.	Double	Optional
Location Box South	The location of the event described as a box comprising North, West, South, East coordinates.	Double	Optional
Location Box East	The location of the event described as a box comprising North, West, South, East coordinates.	Double	Optional
Location Direction Code	The direction of travel affected by this event. One of: NORTH, SOUTH, WEST, EAST, ANY	String	Optional
Location Road Ids	The location of the event described by a set of road identifiers	n x String	Optional
Location POI Ids	The location of the event described by a set of point of interest identifiers.	n x String	Optional
Location Description	A description of the event location.	String	Optional
Location Road Name	The location of the event described by road name(s).	String	Optional
Location Locality	The locality (e.g. suburb, town) in which the event exists.	String	Optional
Location State	The state or territory in which the event exists specified as a capitalised and accepted abbreviation (e.g. ACT, NSW, NT, QLD, SA, TAS, VIC, WA).	String	Optional
Contact Web	A web address to contact for further information.	String	Optional
Contact Phone	A phone number to contact for further information.	String	Optional
Contact Description	A textual description of context details for further information.	String	Optional
Timestamp	A sequencing time stamp assigned by TIX upon receipt.	DateTime	Optional

Each message implicitly has one of the following statuses:

- *Active and Scheduled* – the message has not expired, but the event described by the message has not yet started (the ACTUAL START date and time is not populated);
- *Active and Current* – the message has not expired, and the event described by the message has started (ACTUAL START date and time is populated) but has not ended (ACTUAL END date and time is populated);
- *Active and Closed* – the message has not expired, and the event described by the message has ended (ACTUAL END date and time is populated); or
- *Expired* – the message's EXPIRY date and time is in the past, indicating that the event is in the past, and is no longer of interest to Consumers.

5.2 Queue Data Model

The TIX Queue Data Model is as documented in Table 2.

Table 2: TIX Queue Data Model

Element	Description	Data Type	Use
`Queue Name`	The fully-scoped name of the queue.	String	Required
`Message Count`	The number of messages currently on the queue. This will include any messages that are expired, but not yet removed from the queue.	Integer	Required
`Message Count Day`	The number of messages added to the queue since the start of the UTC day.	Integer	Required
`Message Count Hour`	The number of messages added to the queue since the start of the UTC hour.	Integer	Required
`Min Timestamp UTC`	The earliest time stamp of any message on the queue.	DateTime	Optional
`Max Timestamp UTC`	The latest time stamp of any message on the queue.	DateTime	Optional
`Min Expiry UTC`	The earliest expiry of any message on the queue.	DateTime	Optional
`Max Expiry UTC`	The latest expiry of any message on the queue.	DateTime	Optional
`Last Read UTC`	The date and time of the most recent read of the queue.	DateTime	Optional
`Read Count Day`	The number of reads of the queue since the start of the UTC day.	Integer	Required
`Read Count Hour`	The number of reads of the queue since the start of the UTC hour.	Integer	Required
`Updated UTC`	When the queue status was most recently updated.	DateTime	Required

Queue data is reset whenever the queue is updated, and upon server start-up.

6 RESTFUL API REFERENCE GUIDE

6.1 Authentication and Authorisation

All invocations of the TIX RESTful API must be authenticated to the TIX server. Authentication is currently via the BASIC authentication mechanism using a user name and password. To protect the confidentiality of TIX credentials, all access is protected via Transport Layer Security (TLS).

Access to RESTful APIs is controlled on the basis of the authenticated user.

6.2 Resource Identifiers (URLs)

All RESTful API URLs are relative to the following base URL:

```
https://tis.tca.gov.au/tis/rest
```

6.3 Messages API

The TIX RESTful API comprises the resources and operations as detailed in Table 3.

Table 3: TIX Messages API

Resource	Operation

GET /messages	Retrieves a list of unexpired messages from TIX:
	• The following query parameters are supported:
	  ○ producer=<producer-id>,<producer-id>,…
	• The request header *If-Modified-Since* can be used to restrict the results to messages with a time stamp after a given point in time.
	• The response header *Last-Modified* is set to time stamp of the message most recently received by TIX. This value should be submitted as the *If-Modified-Since* header in the subsequent GET operation (to achieve reliable messaging).
	• The response can be encoded as XML or JSON in accordance with the *Accept* request header:
	  ○ Accept: application/xml
	  ○ Accept: application/json (for JSON – default)
	• Expired messages are not retrieved.
	• Messages pertaining to the same event are not collapsed (i.e., only the most recent is returned).
	• Returns status codes:
	  ○ 200 OK – if message data is returned
	  ○ 204 No Content – if no message data is found
	  ○ 304 Not Modified – if the *If-Modified-Since* request header was specified, and no new data exists
	  ○ 403 Forbidden – if the caller does not have authorisation to retrieve messages

Consider the following example of the GET /messages API:

```
GET /tis/rest/messages?producer=ABC HTTP/1.1
Authorization: Basic dGlzYWRtaW46UGFzcy0xMjM=
Accept: application/json
If-Modified-Since: Sun, 29 Oct 2017 20:00:15 GMT

HTTP/1.1 200
Last-Modified: Sun, 29 Oct 2017 21:25:15 GMT
Content-Type: application/json
Content-Length: 603

{
  "message" : [ {
    "messageId" : "0000015f6a06425e02",
    "issued" : "2017-10-29T21:25:15Z",
    "producerId" : "ABC",
    "producerName" : "Alphabet Operations",
    "expiry" : "2017-10-29T22:25:15Z",
    "event" : {
      "eventId" : "0000015f69f0599001",
      "eventCode" : "0",
      "name" : "danger",
      "description" : "ROADWORKS\nPORT BEACH RD\nMANOORA\nROUNDABOUT\nUSE\nCAUTION",
      "actualStart" : "2017-10-30T05:01:15+08:00",
      "actualEnd" : "2017-10-30T05:25:15+08:00",
      "severityCode" : "ROUTINE"
    },
    "timestamp" : "2017-10-29T21:25:15Z"
  } ]
}
```

Where multiple messages exist, these would be returned in the ‘messages’ array within the above JSON structure.

Note: the use of the GET /messages is inefficient, and queues should be used in preference to GET /messages for other than ad hoc requirements.

6.4 Queues API

The TIX RESTful API comprises the resources and operations as detailed in Table 4.

Table 4: TIX Queues API

Resource	Operation
GET /queues	Returns the status of all queues that are visible to the authenticated user: • Returns ○ 200 OK – normal case.

PUT /queues
/[{provider-id}.]{name}
	Creates or updates a queue and associated subscription:
	• The Provider ID is as assigned by the System Manager, and defaults to the authenticated user's ID. Each authenticated user will be authorised to access only their own Provider ID.
	• Queue names comprise only letters, numbers, underscores and dashes, and are case insensitive
	• Query parameters are as per GET /messages (see above)
	• After any PUT operation, the queue is replenished from the full set of messages held by TIX. As previously unwanted messages may now be added to the queue, the next GET /messages operation should omit the *If-Modified-Since* header, and be prepared to de-duplicate messages retrieved for the second (or subsequent) time.
	• Returns
	  ○ 204 No Content – if the queue is created successfully
	  ○ 404 Not Found – if the caller does not have authorisation to see (and so create) the queue.

GET /queues
/[{provider-id}.]{name}
	Returns the status of the specified queue:
	• notes as per GET /queues/[{provider-id}.]{name}
	• Returns
	  ○ 200 OK – normal case
	  ○ 404 Not Found – if the caller does not have authorisation to see the queue.

DELETE /queues
/[{provider-id}.]{name}
	Deletes a queue and associated subscription:
	• notes as per GET /queues/[{provider-id}.]{name}
	• Returns
	  ○ 204 No Content – if the queue is deleted successfully
	  ○ 404 Not Found – if the caller does not have authorisation to see (and so delete) the queue.

Resource	Operation
GET /queues /[{provider-id}.]{name} /messages	Retrieves messages from the queue: • The response can be encoded as XML or JSON in accordance with the Accept request header as per GET /messages • No query parameters are supported • The *Last-Modified* and *If-Modified-Since* headers operate as per GET /messages • Returns status codes: ○ 200 OK – if message data is returned ○ 204 No Content – if no message data is found ○ 304 Not Modified –if the *If-Modified-Since* request header was specified, and no new data exists ○ 403 Forbidden – if the caller does not have authorisation to retrieve messages.

Consider the following interaction. Firstly, a queue is created using PUT /queues, with an associated subscription to only receive messages from a Producer with an identifier of 'ABC':

```
PUT /tis/rest/queues/abc-messages?producer=ABC HTTP/1.1
Host: 192.168.2.130:8080
Authorization: Basic dGlzYmJ4OlBhc3MtMTIz
User-Agent: curl/7.51.0

HTTP/1.1 204
```

The status of the queue can now be obtained using GET /queues/[{provider-id}.]{name}:

```
GET /tis/rest/queues/abc-messages HTTP/1.1
Accept: application/json

HTTP/1.1 200
Content-Type: application/json
Content-Length: 381

{
  "name" : "user.abc-messages",
  "messageCount" : 1,
  "messageCountDay" : 1,
  "messageCountHour" : 1,
  "minTimestampUtc" : "2017-10-30T04:11:46Z",
  "maxTimestampUtc" : "2017-10-30T04:11:46Z",
  "minExpiryUtc" : "2017-10-30T05:11:45Z",
  "maxExpiryUtc" : "2017-10-30T05:11:45Z",
  "readCountDay" : 0,
  "readCountHour" : 0,
  "updatedUtc" : "2017-10-30T04:31:36.164Z"
}
```

Similarly, the status of all messages visible to the user can be obtained using GET /queues:

```
GET /tis/rest/queues HTTP/1.1
Accept: application/json

HTTP/1.1 200
Content-Type: application/json
Content-Length: 1178

{
  "messages" : {
    "messageCount" : 1,
    "messageCountDay" : 1,
    "messageCountHour" : 1,
    "minExpiryUtc" : "2017-10-30T05:11:45Z",
    "maxExpiryUtc" : "2017-10-30T05:11:45Z",
    "lastReadUtc" : "2017-10-30T04:31:15.659Z",
    "readCountDay" : 2,
    "readCountHour" : 2,
    "updatedUtc" : "2017-10-30T04:32:48.007Z"
  },
  "queue" : [ {
    "name" : "user.abc-messages",
    "messageCount" : 1,
    "messageCountDay" : 1,
    "messageCountHour" : 1,
    "minTimestampUtc" : "2017-10-30T04:11:46Z",
    "maxTimestampUtc" : "2017-10-30T04:11:46Z",
    "minExpiryUtc" : "2017-10-30T05:11:45Z",
    "maxExpiryUtc" : "2017-10-30T05:11:45Z",
    "readCountDay" : 0,
    "readCountHour" : 0,
    "updatedUtc" : "2017-10-30T04:32:48.007Z"
  }]
}
```

The following shows a similar call, but with an XML content encoding:

```
GET /tis/rest/queues HTTP/1.1
Authorization: Basic dGlzYmJ4OlBhc3MtMTIz
Accept: application/xml

HTTP/1.1 200
Content-Type: application/xml
Content-Length: 1195

<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<queueStatusList xmlns="http://tca.gov.au/schemas/traffic/queue/2017-09">
    <messages>
        <messageCount>1</messageCount>
        <messageCountDay>1</messageCountDay>
        <messageCountHour>1</messageCountHour>
        <minExpiryUtc>2017-10-30T05:11:45Z</minExpiryUtc>
        <maxExpiryUtc>2017-10-30T05:11:45Z</maxExpiryUtc>
        <lastReadUtc>2017-10-30T04:31:15.659Z</lastReadUtc>
        <readCountDay>2</readCountDay>
        <readCountHour>2</readCountHour>
        <updatedUtc>2017-10-30T04:50:47.876Z</updatedUtc>
    </messages>
</queueStatusList>
```

Finally, the queue can be deleted using DELETE /queues/[{provider-id}.]{name}:

```
DELETE /tis/rest/queues/abc-messages HTTP/1.1
Authorization: Basic dGlzYmJ4OlBhc3MtMTIz

HTTP/1.1 204
```

Usage of GET /queues/[{provider-id}.]/{name}/messages for extraction of messages is identical to GET /messages; this includes use of *If-Modified-Since* and *Last-Modified* headers.

APPENDIX A - XML SCHEMA REFERENCE

A.1 Message XML Schema

This XML schema is used to describe messages that can be submitted to TIX (produced) or read from TIX (subscribed).

```
<?xml version="1.0" encoding="UTF-8"?>
<xsd:schema xmlns:xsd="http://www.w3.org/2001/XMLSchema"
   targetNamespace="http://tca.gov.au/schemas/traffic/message/2017-09"
xmlns:tns="http://tca.gov.au/schemas/traffic/message/2017-09"
   elementFormDefault="qualified">


   <!--
    ! Describes a geographical point at a given latitude and longitude.
    -->
   <xsd:complexType name="GeoPointType" >
      <xsd:sequence>
            <xsd:element name="latitude" type="xsd:double" />
            <xsd:element name="longitude" type="xsd:double" />
      </xsd:sequence>
   </xsd:complexType>


   <!--
    ! Describes a geographical circle centred at a given latitude and longitude.
    -->
   <xsd:complexType name="GeoCircleType" >
      <xsd:sequence>
            <xsd:element name="latitude" type="xsd:double" />
            <xsd:element name="longitude" type="xsd:double" />
            <xsd:element name="radius" type="xsd:int" />
      </xsd:sequence>
   </xsd:complexType>


   <!--
    ! Describes a geographical box.
    -->
   <xsd:complexType name="GeoBoxType" >
      <xsd:sequence>
            <xsd:element name="north" type="xsd:double" />
            <xsd:element name="west" type="xsd:double" />
            <xsd:element name="south" type="xsd:double" />
            <xsd:element name="east" type="xsd:double" />
      </xsd:sequence>
   </xsd:complexType>


   <!--
    ! Possible directions of travel affected by the event (e.g., northbound, southbound). The
    ! value 'ALL' is used where all directions of travel are affected, and the field is left
    ! blank where direction of travel is not known.
    -->
   <xsd:simpleType name="TravelDirectionEnum">
      <xsd:restriction base="xsd:string">
         <xsd:enumeration value="NORTH"/>
         <xsd:enumeration value="SOUTH"/>
         <xsd:enumeration value="WEST"/>
         <xsd:enumeration value="EAST"/>
         <xsd:enumeration value="ALL"/>
      </xsd:restriction>
   </xsd:simpleType>
```

```
<!--
 ! Describes a location via a number of mechanisms:
 ! * optionally a point comprising latitude and longitude
 ! * optionally a bounding circle or a bounding box
 ! * optionally a sequence of STREET_LINE identifiers
 ! * optionally a sequence of Point Of Interest (POI) identifiers.
 ! * optionally a description of the location
 ! * optionally road name(s)
 ! * optionally locality name
 ! * optionally state or territory
 -->
<xsd:complexType name="LocationType" >
   <xsd:sequence>
      <xsd:choice minOccurs="0">
         <xsd:element name="point" type="tns:GeoPointType" />
         <xsd:element name="boundingCircle" type="tns:GeoCircleType" />
         <xsd:element name="boundingBox" type="tns:GeoBoxType" />
      </xsd:choice>
      <xsd:element name="directionCode" type="tns:TravelDirectionEnum" minOccurs="0" />
      <xsd:element name="streetLineId" type="xsd:string" minOccurs="0" maxOccurs="unbounded" />
      <xsd:element name="poiId" type="xsd:string" minOccurs="0" maxOccurs="unbounded" />
      <xsd:element name="description" type="xsd:string" minOccurs="0" />
      <xsd:element name="roadName" type="xsd:string" minOccurs="0" />
      <xsd:element name="locality" type="xsd:string" minOccurs="0" />
      <xsd:element name="state" type="xsd:string" minOccurs="0" />
   </xsd:sequence>
</xsd:complexType>


<!--
 ! Possibly severity levels for messages.
 -->
<xsd:simpleType name="SeverityEnum">
   <xsd:restriction base="xsd:string">
      <xsd:enumeration value="ADVISORY"/>
      <xsd:enumeration value="LOW"/>
      <xsd:enumeration value="ROUTINE"/>
      <xsd:enumeration value="HIGH"/>
      <xsd:enumeration value="EMERGENCY"/>
   </xsd:restriction>
</xsd:simpleType>


<!--
 ! Describes a 'real-world' event. Each such event is desdribed by multiple messages.
 -->
<xsd:complexType name="EventType" >
   <xsd:sequence>
      <xsd:element name="eventId" >
         <xsd:simpleType><xsd:restriction base="xsd:string">
            <xsd:minLength value="1" />
            <xsd:maxLength value="128" />
         </xsd:restriction></xsd:simpleType>
      </xsd:element>
      <xsd:element name="eventCode" >
         <xsd:simpleType><xsd:restriction base="xsd:string">
            <xsd:minLength value="1" />
            <xsd:maxLength value="128" />
         </xsd:restriction></xsd:simpleType>
      </xsd:element>
      <xsd:element name="name" >
         <xsd:simpleType><xsd:restriction base="xsd:string">
            <xsd:minLength value="1" />
            <xsd:maxLength value="64" />
         </xsd:restriction></xsd:simpleType>
      </xsd:element>
      <xsd:element name="description" type="xsd:string" minOccurs="0" />
      <xsd:element name="scheduledStart" type="xsd:dateTime" minOccurs="0" />
      <xsd:element name="scheduledEnd" type="xsd:dateTime" minOccurs="0" />
      <xsd:element name="actualStart" type="xsd:dateTime" minOccurs="0" />
      <xsd:element name="actualEnd" type="xsd:dateTime" minOccurs="0" />
```

```
        <xsd:element name="severityCode" type="tns:SeverityEnum" />
        <xsd:element name="location" type="tns:LocationType" minOccurs="0" />
        <xsd:element name="contactWeb" type="xsd:anyURI" minOccurs="0" />
        <xsd:element name="contactPhone" type="xsd:string" minOccurs="0" />
        <xsd:element name="contactDescription" type="xsd:string" minOccurs="0" />
      </xsd:sequence>
   </xsd:complexType>


   <!--
    ! A message that describes an event.
    -->
   <xsd:complexType name="MessageType" >
      <xsd:sequence>
         <xsd:element name="messageId" >
            <xsd:simpleType><xsd:restriction base="xsd:string">
               <xsd:minLength value="1" />
               <xsd:maxLength value="128" />
            </xsd:restriction></xsd:simpleType>
         </xsd:element>
         <xsd:element name="issued" type="xsd:dateTime" />
         <xsd:element name="producerId" >
            <xsd:simpleType><xsd:restriction base="xsd:string">
               <xsd:minLength value="1" />
               <xsd:maxLength value="16" />
            </xsd:restriction></xsd:simpleType>
         </xsd:element>
         <xsd:element name="producerName" >
            <xsd:simpleType><xsd:restriction base="xsd:string">
               <xsd:minLength value="1" />
               <xsd:maxLength value="256" />
            </xsd:restriction></xsd:simpleType>
         </xsd:element>
         <xsd:element name="expiry" type="xsd:dateTime" />
         <xsd:element name="event" type="tns:EventType" />
      </xsd:sequence>
      <xsd:attribute name="timestamp" type="xsd:dateTime" use="optional" />
   </xsd:complexType>


   <xsd:complexType name="MessageListType" >
      <xsd:sequence>
         <xsd:element name="message" type="tns:MessageType" minOccurs="0" maxOccurs="unbounded" />
      </xsd:sequence>
   </xsd:complexType>


   <xsd:element name="message" type="tns:MessageType" />


   <xsd:element name="messageList" type="tns:MessageListType" />


</xsd:schema>
```

A.2 Queue XML Schema

This XML schema is used to describe the status of the TIX message cache and the TIX queues.

```
<?xml version="1.0" encoding="UTF-8"?>
<xsd:schema xmlns:xsd="http://www.w3.org/2001/XMLSchema"
   targetNamespace="http://tca.gov.au/schemas/traffic/queue/2017-09"
xmlns:tns="http://tca.gov.au/schemas/traffic/queue/2017-09"
   elementFormDefault="qualified">


   <xsd:complexType name="MessagesStatusType" >
      <xsd:sequence>
         <xsd:element name="messageCount" type="xsd:int" />
         <xsd:element name="messageCountDay" type="xsd:int" />
         <xsd:element name="messageCountHour" type="xsd:int" />
         <xsd:element name="minTimestampUtc" type="xsd:dateTime" minOccurs="0" />
         <xsd:element name="maxTimestampUtc" type="xsd:dateTime" minOccurs="0" />
         <xsd:element name="minExpiryUtc" type="xsd:dateTime" minOccurs="0" />
         <xsd:element name="maxExpiryUtc" type="xsd:dateTime" minOccurs="0" />
         <xsd:element name="lastReadUtc" type="xsd:dateTime" minOccurs="0" />
         <xsd:element name="readCountDay" type="xsd:int" />
         <xsd:element name="readCountHour" type="xsd:int" />
         <xsd:element name="updatedUtc" type="xsd:dateTime" />
      </xsd:sequence>
   </xsd:complexType>


   <xsd:complexType name="QueueStatusType" >
      <xsd:complexContent>
         <xsd:extension base="tns:MessagesStatusType">
            <xsd:sequence>
               <xsd:element name="name" type="xsd:string" />
            </xsd:sequence>
         </xsd:extension>
      </xsd:complexContent>
   </xsd:complexType>


   <xsd:complexType name="QueueStatusListType" >
      <xsd:sequence>
         <xsd:element name="messages" type="tns:MessagesStatusType" minOccurs="0" />
         <xsd:element name="queue" type="tns:QueueStatusType" minOccurs="0" maxOccurs="unbounded" />
      </xsd:sequence>
   </xsd:complexType>


   <xsd:element name="queueStatus" type="tns:QueueStatusType" />

   <xsd:element name="queueStatusList" type="tns:QueueStatusListType" />

</xsd:schema>
```

APPENDIX B - TCA REST AREA DATASET (RAD) SUPPORT

The Producer XRA has been configured within TIX to distribute TCA Rest Area Dataset (RAD) data. Providers are able to make this data available to drivers of heavy vehicles to assist with trip planning. Significant features of RAD and its integration into TIX include:

- Each RAD data record describes a physical rest area. When that rest area is decommissioned or closed, the RAD data record is retired. When significant changes need to be made to the RAD data record (e.g. latitude, longitude), the RAD data record is retired, and a replacement RAD data record is created.
- Each RAD data record nominally maps to a TIX event, and that TIX event is described by a sequence of TIX messages that share the same TIX Event ID.
- Each TIX message that describes a RAD data record expires after approximately 7 days. A random function is used to ensure that all RAD-related TIX messages do not expire simultaneously, and so do not need to be replaced simultaneously.
- TIX automatically generates a replacement message for each RAD-related TIX message that is about to expire. Replacement TIX messages are also generated where a RAD data record has been updated or retired. Where a RAD data record has been retired, the replacement TIX message will have the Event Actual End field populated.
- TIX will allocate a new TIX Event ID to describe a single physical rest area where the most recent and prior TIX message describing the rest area has already expired (e.g. due to a TIX outage). A new TIX Event ID will also be allocated where the RAD data record has been retired and replaced with a new RAD data record.

Table 5 describes the mapping of rest area data from the RAD data model to the TIX data model. As TIX does not have explicit data elements to describe specific rest area features (e.g. bins, shade, shelter, number of bays), this data is described in natural language rather than explicitly encoded (e.g. “Has 4 bays, table, shelter, toilet”).

Table 5: Mapping to TIX Data Model from RAD Data Model

TIX Element	RAD Field Mapping	Comments
`Message Id`	TIX-assigned	
`Issued`	TIX-assigned	
`Expiry`	TIX-assigned	Approximately 7 days beyond the date and time of message issue
`Producer Id`	“XRA”	Value configured by TIX administrator
`Producer Name`	“TCA Rest Area Dataset”	Value configured by TIX administrator
`Event Id`	TIX-assigned	
`Event Code`	“TCA:1”	Value configured by TIX administrator
`Event Name`	“REST AREA”	Value configured by TIX administrator

TIX Element	RAD Field Mapping	Comments
Event Description	<rest area comments> + ". Has " + <rest area features>	A composite string that includes the RAD Comments field and a string describing the features of the rest area (e.g. number of bays, bins, shade, shelter, water, lighting, toilets)
Event Actual Start	TIX-assigned	Date and time that the first message for this event was issued
Event Actual End	TIX-assigned	Date and time that the most recent message for this event was issued, but only populated with the rest area data record has been retired
Event Severity	"ROUTINE"	
Location Point Latitude	<rest area latitude>	
Location Point Longitude	<rest area longitude>	
Location Direction Code	<rest area direction of travel>	
Location POI Ids	"XRA:" + <rest area ID> and <rest area source> + ":" + <rest area source ID>	This field contains two values: • the RAD ID, prefixed by "XRA:" • the RAD Source ID, prefixed by the RAD Source (e.g. "DTEI:1234")
Location Description	<rest area name> + <rest area location>	
Location Road Name	<rest area road>	
Location Locality	<rest area locality>	
Location State	<rest area state>	
Contact Description	<rest area licence attribution>	DateTime
Timestamp	TIX-assigned	

The following is a sample set of RAD data records encoded as TIX messages:


```
{"message": [
    {
        "messageId": "INF000864/20181203222546",
        "issued": "2018-12-03T22:25:46Z",
        "producerId": "XRA",
        "producerName": "TCA Rest Area Dataset",
        "expiry": "2018-12-10T16:51:51Z",
        "event": {
            "eventId": "INF000864/20181203222546",
            "eventCode": "TCA:1",
            "name": "REST AREA",
            "description": "Access also from 5m from main rail line. Has 4 bays,
               bin, shade, sealed surface.",
            "actualStart": "2018-12-03T22:25:46Z",
            "severityCode": "ROUTINE",
            "location": {
                "point": {
                    "latitude": -34.72614,
                    "longitude": 146.69713
                },
                "directionCode": "SOUTH",
                "poiId": [
                    "XRA:INF000864",
                    "INF:195.0"
                ],
                "description": "Rest Area 2km north of Charles Rd. Grong Grong .",
                "roadName": "NEWELL",
                "locality": "NSW"
            }
        },
        "timestamp": "2018-12-03T22:25:51Z"
    },
    {
        "messageId": "DTEI000012/20181203222546",
        "issued": "2018-12-03T22:25:46Z",
        "producerId": "XRA",
        "producerName": "TCA Rest Area Dataset",
        "expiry": "2018-12-10T11:32:43Z",
        "event": {
            "eventId": "DTEI000012/20181203222546",
            "eventCode": "TCA:1",
            "name": "REST AREA",
            "description": "Has toilet, water, sealed surface",
            "actualStart": "2018-12-03T22:25:46Z",
            "severityCode": "ROUTINE",
            "location": {
                "point": {
                    "latitude": -37.72585,
                    "longitude": 140.79131
                },
                "poiId": [
                    "XRA:DTEI000012",
                    "DTEI:14419"
                ],
                "roadName": "RIDDOCH HIGHWAY",
                "locality": "SA"
            },
```

```
            "contactDescription": "Creative Commons - Attribution 3.0 Australia
               License, © State of South Australia (Department of Planning,
               Transport and Infrastructure) 2016"
        },
        "timestamp": "2018-12-03T22:25:51Z"
    },
    {
        "messageId": "TMR000343/20181203222546",
        "issued": "2018-12-03T22:25:46Z",
        "producerId": "XRA",
        "producerName": "TCA Rest Area Dataset",
        "expiry": "2018-12-10T14:19:19Z",
        "event": {
            "eventId": "TMR000343/20181203222546",
            "eventCode": "TCA:1",
            "name": "REST AREA",
            "description": "small bitumen HV rest area. Has table, shelter,
               toilet, water.",
            "actualStart": "2018-12-03T22:25:46Z",
            "severityCode": "ROUTINE",
            "location": {
                "point": {
                    "latitude": -21.9731,
                    "longitude": 142.662
                },
                "poiId": [
                    "XRA:TMR000343",
                    "TMR:479"
                ],
                "description": "Ayshire Hills - 66km NW Winton",
                "locality": "QLD"
            },
            "contactDescription": "Creative Commons - Attribution 3.0 Australia
               License, © State of Queensland (Department of Transport and Main
               Roads) 2016"
        },
        "timestamp": "2018-12-03T22:25:51Z"
    }
]}
```


Use the Producer ID ‘XRA’ to filter rest area data.

APPENDIX C - TERMS AND CONDITIONS

The following terms and conditions apply for the use of Traveller Information Exchange (TIX) content or access to the TIX RESTful API.

C.1 Background

The Traveller Information Exchange ("TIX") provides an exchange for information sourced from various information providers, which can deliver public benefits and deliver value to consumers.

C.2 User Acknowledgements

Please note that TCA does not carry out any quality assurance review or "certification" of the information that is available through TIX. TIX serves as a "conduit" through which information from various sources, some "open source", can be accessed by users. TCA is not a producer of information contained in TIX. TCA accepts no liability for the accuracy, completeness, availability or timeliness of information accessed through TIX. **Use of all information accessed through TIX is strictly at the risk of the user**.

Where TIX users publish or make TIX content available to other parties through any means, the TIX user shall accept responsibility for informing downstream data users of the general nature of the TIX content, and that use of this content is at their own risk.

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National Heavy Vehicle Rest Area Data

Note that the national heavy vehicle rest area ("HVRA") dataset contains both formal and informal rest areas. Formal rest areas includes only locations identified, maintained and managed by the relevant state road agency.

HVRA Dataset is for Guidance Only

As a user, you acknowledge that the HVRA dataset is provided by TCA to you in good faith but to be used a general guide only, without liability on the part of TCA for its accuracy, completeness or overall integrity. You acknowledge and accept that actual traffic and road conditions may change unexpectedly and may differ materially from those provided/described in the HVRA dataset as a result of circumstances including but not limited to changes in traffic density, weather conditions, traffic incidents or closure of sites for maintenance or other reasons. You further acknowledge that the HVRA dataset is not collected on a regular or set basis, being collected from time to time.

Use of HVRA Dataset is At Your Own Risk

As a user, you acknowledge that your use, reliance or publication of the HVRA dataset is entirely at your own risk.

No Liability

As a user, you acknowledge that in no event will TCA or its officers and agents be liable to you (or to any third party) for any damage, loss, cost, expense, injury or other liability that arises out of or in connection with the use of the HVRA dataset, including without limitation any indirect, special, incidental, punitive or consequential loss, liability or damage of any kind.

Indemnity

As a user, you covenant and agree with TCA that you assume sole and entire responsibility for, and indemnify TCA and its officers and agents from, any and all claims, liabilities, losses, expenses, responsibility and damages by reason of any claim, proceedings, action, liability or injury arising out use of the HVRA dataset by you (or by any third party).

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Port Of Fremantle Content is for Guidance Only

As a user, you acknowledge that the Port of Fremantle Content ("Content") is provided to TCA by Fremantle Port Authority (FPA), and by TCA to you, in good faith, but to be used a general guide only, without liability on the part of either TCA or FPA for the accuracy, completeness or overall integrity of the Content. You acknowledge and accept that actual traffic conditions in the Port of Fremantle may change unexpectedly and may differ materially from those provided/described in the Content as a result of circumstances including but not limited to changes in weather conditions, traffic incidents and delays in the reporting of traffic conditions. You further acknowledge that the Content is not collected on a regular or set basis, being collected from time to time.

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Release

As a user, you agree that neither TCA nor FPA will, under any circumstances whatsoever, be liable to you (or to any third party) for any claim for special, incidental, exemplary or consequential loss or damage or for any loss of profit or loss of use caused by or arising from any act or omission of TCA or of FPA in connection with the use by you (or any third party) of the Content, whether such claim is based in contract, warranty, tort, strict liability, indemnity or otherwise.

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