On Demand Transportation GTFS-Flex v2

transportnsw.info October 2022

Acknowledgement of Country

Transport for NSW acknowledges the traditional custodians of the land on which we work and live.

We pay our respects to Elders past and present and celebrate the diversity of Aboriginal people and their ongoing cultures and connections to the lands and waters of NSW.

Many of the transport routes we use today – from rail lines, to roads, to water crossings – follow the traditional Songlines, trade routes and ceremonial paths in Country that our nation's First Peoples followed for tens of thousands of years.

Transport for NSW is committed to honouring Aboriginal peoples' cultural and spiritual connections to the lands, waters and seas and their rich contribution to society.

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Document control

Document owner	Customer Information Manager, Customer Strategy & Technology
Approved by	Customer Information Manager, Customer Strategy & Technology
Branch	Customer Strategy & Technology
Division	Connected Journeys

Versions

Version	Amendment notes
1.0	Original version released in October 2022

Related Documentation

Document	Location
GTFS specification	https://gtfs.org/schedule/
GTFS TfNSW Release Notes	https://opendata.transport.nsw.gov.au/documentation
GTFS-Flex v2	https://gtfs.org/extensions/

Definitions

Term	Definition
GTFS	The General Transit Feed Specification (GTFS) defines a common format for public transportation schedules and associated geographic information
GTFS-R	GTFS-Realtime is a feed specification that allows public transportation agencies to provide real-time updates about their fleet to application developers. It is an extension to GTFS
GTFS-Flex	GTFS-Flex v2 (GTFS for flexible transport) is a proposed extension to the General Transit Feed Specification. GTFS-Flex adds the capability to model various demand-responsive transportation (DRT) services to GTFS, which currently only models fixed-route public transportation. It is an extension to GTFS
Operator	Business contracted by TfNSW to operate a public transport service

1. Introduction

1.1. Purpose

The purpose of this document is to describe the structure and contents of the On Demand data feed supplied by NSW Transport for consumption and use by Transport for NSW systems and business units and application developers.

The On Demand data feed is in the form of a General Transit Feed Specification fileset, known as 'GTFS', and contains extension files that conform to the proposed GTFS-Flex v2 specification.

This document will note only the extensions to GTFS that create GTFS-Flex. This document will not duplicate existing documentation regarding the standard GTFS Schedule features; please refer to the GTFS specification and the GTFS TfNSW Release Notes from Open Data in the related documentation section for any GTFS-S information.

The intended audience of this document is application developers.

1.2. Background

The On Demand GTFS does not replace or supersede any of the NSW GTFS feeds, the On Demand GTFS rather provides service information specific to these On Demand services which are not included in the traditional service timetable NSW GTFS feeds.

On Demand services allow customers to book a flexible transport service. Bookings for services are dealt with directly by each On Demand Transport Operator using an app, online or by phone. The GTFS-Flex dataset contains service information that describe theoretical trips (not actual trips) that a customer may be able to book and are intended to raise awareness of the available services and direct the customer to the appropriate channel for booking the actual trip. These trips do not exist until a booking is made.

Due to the unscheduled nature of On Demand, special handling is required:

- Display an area zone (polygon),
- A hyperlink to the operator-specific content page on transportnsw.info website provided to the end user
- Product to be labelled as "On Demand" (where applicable)
- An On Demand icon used to designate the service (where applicable)
- A label/badge indicating that booking is required to use the service (where applicable

2. General Technical Notes

2.1. Single On Demand Fileset for all TfNSW On Demand services

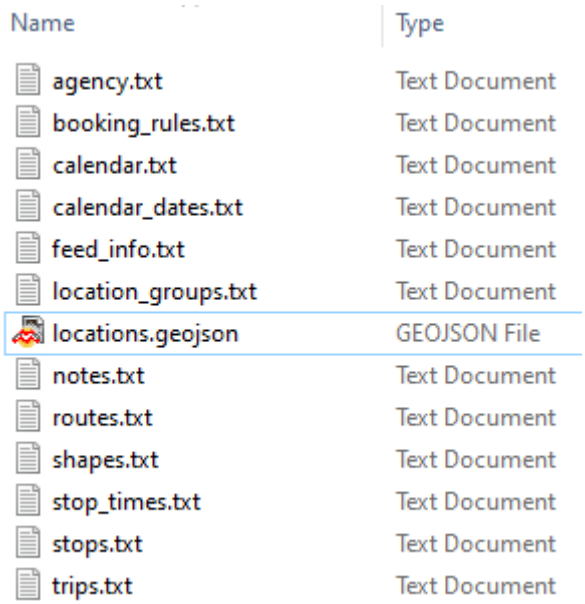
- A single On Demand GTFS Fileset is produced which contains routes and services from multiple operators (i.e., not a separate On Demand GTFS for each contract)
- The On Demand Fileset contains multiples Agencies in the agency.txt file, in order to accommodate all operators in the bundle
- The agency_id of the Operators in the agency.txt file is unique to On Demand and do not overlap with those in the conventional Bus GTFS fileset (i.e., Operators have been assigned a new agency_id for their On Demand services in the On Demand GTFS

2.2. Generation Triggers

GTFS Filesets are generated periodically, as updated timetable information is received from Operators

2.3. File Structure

Each fileset will be a 'ZIP' format compressed archive – a .zip file - containing 12 text files and a geojson file. Each text file within the .zip file is a comma delimited / comma separated format file with the ".txt" extension. For example:

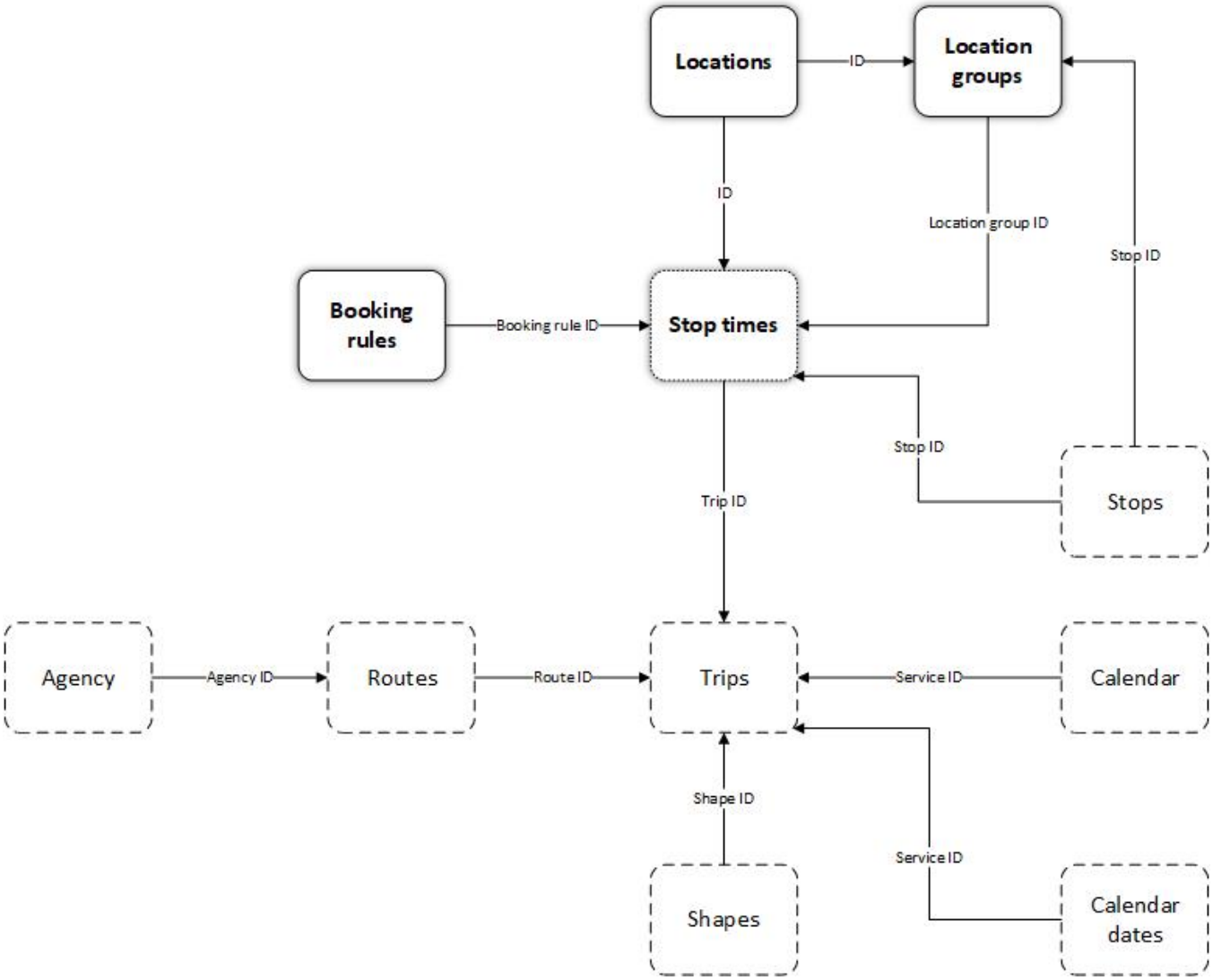


3. On Demand GTFS Timetable Feed

3.1. Overview

The following diagram provides a physical data model view of the relationship between the TfNSW GTFS-Flex v2 files. The additional extension files are:

- booking_rules.txt,
- location_groups, txt,
- locations.geojson
- additional fields in the existing stop_times.txt



The content of the additional files that transform GTFS into GTFS-Flex are discussed below

3.2. Booking Rules

This file provides information for the customer about how to book the service

Field name	Type	Required	Description
booking_rule_id	ID	Required	Identifies the rule.
booking_type	Enum	Required	Indicates how far in advance booking can be made. Valid options are: 0 - Real time booking. 1 - Up to same-day booking with advance notice. 2 - Up to prior day(s) booking.
prior_notice_duration_min	Integer	Conditionally Required	Minimum number of minutes before travel to make the request. Conditionally Required: - Required for booking_type=1. - Forbidden otherwise.
prior_notice_duration_max	Integer	Conditionally Forbidden	Maximum number of minutes before travel to make the booking request. Conditionally Forbidden: - Forbidden for booking_type=0 and booking_type=2. - Optional for booking_type=1.
prior_notice_last_day	Integer	Conditionally Required	Last day before travel to make the booking request. Example: “Ride must be booked 1 day in advance before 5PM” will be encoded as prior_notice_last_day=1. Conditionally Required: - Required for booking_type=2. - Forbidden otherwise.
prior_notice_last_time	Time	Conditionally Required	Last time on the last day before travel to make the booking request. Example: “Ride must be booked 1 day in advance before 5PM” will be encoded as prior_notice_last_time=17:00:00. Conditionally Required: - Required if prior_notice_last_day is defined. - Forbidden otherwise.
prior_notice_start_day	Integer	Conditionally Forbidden	Earliest day before travel to make the booking request. Example: “Ride can be booked at the earliest one week in advance at midnight” will be encoded as prior_notice_start_day=7. Conditionally Forbidden: - Forbidden for booking_type=0. - Forbidden for booking_type=1 if prior_notice_duration_max is defined. - Optional otherwise.
prior_notice_start_time	Time	Conditionally Required	Earliest time on the earliest day before travel to make the booking request. Example: “Ride can be booked at the earliest one week in advance at midnight” will be encoded as prior_notice_start_time=00:00:00.

Field name	Type	Required	Description
			Conditionally Required: - Required if prior_notice_start_day is defined. - Forbidden otherwise.
prior_notice_service_id	ID referencing calendar. service_id	Conditionally Forbidden	Indicates the service days on which prior_notice_last_day or prior_notice_start_day are counted. Example: If empty, prior_notice_start_day=2 will be two calendar days in advance. If defined as a service_id containing only business days (weekdays without holidays), prior_notice_start_day=2 will be two business days in advance. Conditionally Forbidden: -Optional if booking_type=2. - Forbidden otherwise.
message	Text	Optional	Message to riders utilizing service at a stop_time when booking on-demand pickup and drop off. Meant to provide minimal information to be transmitted within a user interface about the action a rider must take to utilize the service.
pickup_message	Text	Optional	Functions in the same way as message but used when riders have on-demand pickup only.
drop_off_message	Text	Optional	Functions in the same way as message but used when riders have on-demand drop off only.
phone_number	Phone number	Optional	Phone number to call to make the booking request.
info_url	URL	Optional	URL providing information about the booking rule.
booking_url	URL	Optional	URL to an online interface or app where the booking request can be made.

3.3. Locations

This file provides information about the locations where pick up or drop off is possible

Field name	Type	Required	Description
- type	Required	String	"FeatureCollection" of locations.
- features	Required	Array	Collection of "Feature" objects describing the locations.
- type	Required	String	"Feature"
- id	Required	String	Location ID belonging to the same namespace as stops.stop_id. Therefore, it is forbidden to define an id from locations.geojson with the same value as a stops.stop_id. By default, every id from locations.geojson belongs to a location_groups.location_group_id of the same value.
- properties	Required	Object	Location property keys.
- stop_name	Optional	String	Indicates the name of the location as displayed to riders.
- stop_desc	Optional	String	Meaningful description of the location to help orient riders.
- zone_id	Conditionally Required	String	Identifies the fare zone for a stop. Conditionally required: - Required if fare_rules.txt is defined. -Optional otherwise.
- stop_url	Optional	URL	URL of a web page about the location. If provided, the URL should be different from the agency.agency_url and the routes.route_url field values.
- geometry	Required	Object	Geometry of the location.
- type	Required	String	Must be of type: - "Point" - "MultiPoint" - "Linestring" - "MutiLineString" - "Polygon" - "MultiPolygon"
- coordinates	Required	Array	Geographic coordinates (latitude and longitude) defining the geometry of the location.

3.4. Location Groups

This file provides information about the groups of locations where pick up or drop off is possible

Field name	Type	Required	Description
location_group_id	ID	Required	Identifies a location group. A location group is a group of stops or GeoJSON locations that together indicate locations where a rider may request pickup or drop off. By default, every stop_id and id from locations.geojson belongs to a location_group_id of the same value. Therefore, it is forbidden to define a location_group_id with the same value as a stop_id or id from locations.geojson. Multiple entries in location_groups.txt can have the same location_group_id.
location_id	ID referencing stops.stop_id or id from locations.geojson	Optional	Identifies a stop or location belonging to the location group.
location_group_name	Text	Optional	Name of the location group. Must be defined either once, or exhaustively for a single location_group_id.

3.5. Stop times

The additional fields in this file indicates the time periods the service is available information about the groups of locations where pick up or drop off is possible

Field name	Type	Required	Description
stop_id	ID referencing stops.stop_id, location_groups.location_group_id, or id from locations.geojson	Required	Identifies the serviced stop. All stops serviced during a trip must have a record in stop_times.txt. Referenced locations must be stops, not stations or station entrances. A stop may be serviced multiple times in the same trip, and multiple trips and routes may service the same stop. If service is on demand, a GeoJSON location or location group can be referenced: - id from locations.geojson - location_groups.location_group_id
stop_sequence	Non-negative integer	Required	Order of stops for a particular trip. The values must increase along the trip but do not need to be consecutive. *Example: The first location on the trip could have a stop_sequence=1, the second location on the trip could have a stop_sequence=23, the third location could have a stop_sequence=40, and so on.* Travel within the same location group or GeoJSON location requires two records in stop_times.txt with the same stop_id and consecutive values of stop_sequence.
arrival_time	Time	Conditionally Required	Arrival time at a specific stop for a specific trip on a route. If there are not separate times for arrival and departure at a stop, enter the same value for arrival_time and departure_time.

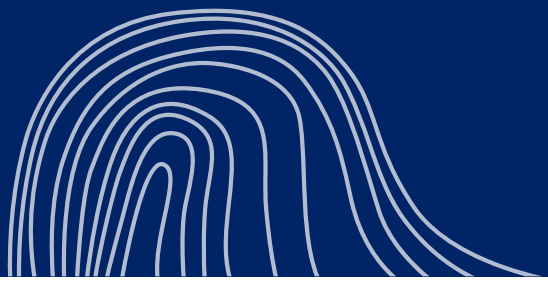
Field name	Type	Required	Description
			Scheduled stops where the vehicle strictly adheres to the specified arrival and departure times are timepoints. If this stop is not a timepoint, it is recommended to provide an estimated or interpolated time. If this is not available, arrival_time can be left empty. Further, indicate that interpolated times are provided with timepoint=0. If interpolated times are indicated with timepoint=0, then time points must be indicated with timepoint=1. Provide arrival times for all stops that are timepoints. Conditionally Required: - Required for the first and the last stop in a trip. - Forbidden when stop_times.start_pickup_drop_off_window or stop_times.end_pickup_drop_off_window are defined.
departure_time	Time	Conditionally Required	Departure time from a specific stop for a specific trip on a route. If there are not separate times for arrival and departure at a stop, enter the same value for arrival_time and departure_time. See the arrival_time description for more details about using timepoints correctly. The departure_time field should specify time values whenever possible, including non-binding estimated or interpolated times between timepoints. Conditionally Required: - Required for the first and the last stop in a trip. - Forbidden when stop_times.start_pickup_drop_off_window or stop_times.end_pickup_drop_off_window are defined.
start_pickup_drop_off_window	Time	Conditionally Required	Time that on-demand service becomes available in a GeoJSON location, location group or stop. Conditionally Required: - Required if stop_times.stop_id refers to location_groups.location_group_id or id from locations.geojson. - Forbidden if stop_times.arrival_time or stop_times.departure_time are defined.
end_pickup_drop_off_window	Time	Conditionally Required	Time that on-demand service ends in a GeoJSON location, location group or stop. Conditionally Required: - Required if stop_times.stop_id refers to location_groups.location_group_id or id from locations.geojson. - Forbidden if stop_times.arrival_time or stop_times.departure_time are defined.
pickup_type	Enum	Conditionally Forbidden	Indicates pickup method. Valid options are: 0 or empty - Regularly scheduled pickup. 1 - No pickup available. 2 - Must phone agency to arrange pickup. 3 - Must coordinate with driver to arrange pickup. Conditionally Forbidden: - pickup_type=0 forbidden for stop_times.stop_id referring to location_groups.location_group_id or id from locations.geojson. - pickup_type=3 forbidden for location_groups.location_gro

Field name	Type	Required	Description
			up_id or locations.geojson that are not a single "LineString". - Optional otherwise.
drop_off_type	Enum	Conditionally Forbidden	Indicates drop off method. Valid options are: 0 or empty - Regularly scheduled drop off. 1 - No drop off available. 2 - Must phone agency to arrange drop off. 3 - Must coordinate with driver to arrange drop off. Conditionally Forbidden: - drop_off_type=0 forbidden for stop_times.stop_id referrin g to location_groups.location_group_id or id from locations.ge ojson. - Optional otherwise.
mean_duration_factor and mean_duration_offset	Float	Conditionally Forbidden	Together, mean_duration_factor and mean_duration_offset allow an estimation of the duration a rider's trip will take, in minutes, using the on-demand service in a GeoJSON location or location group. Data consumers are expected to use mean_duration_factor and mean_duration_offset to make the following calculation: MeanTravelDuration = mean_duration_factor × DrivingDuration + mean_duration_offset Where DrivingDuration is the time it would take in a car to travel the distance being calculated for the on-demand service, and MeanTravelDuration is the calculated average time one expects to travel the same trip using the on-demand service. The MeanTravelDuration may be calculated for the time and the day of the trip to take into account traffic; in other words the consumer is expected to know that DrivingDuration is dynamic. Producers should thus provide values that reflect increases in DrivingDuration due to additional pickups and drop offs beyond that of the passenger. A downtown TNC will likely always have a mean_duration_factor of 1, with or without traffic, since it goes with the flow. But a shared service can have a factor of 2 or more if many additional pickups and drop offs are expected. mean_duration_offset can be utilized to increase travel times of shorter trips relatively more than times for longer trips. While traveling through undefined space between GeoJSON locations or location groups, it is assumed that: MeanTravelDuration = DrivingDuration Conditionally Forbidden: - Forbidden if stop_times.stop_id does not refer to a location_groups.location_group_id or an id from locations.geojson. - Optional otherwise.
safe_duration_factor and safe_duration_offset	Float	Conditionally Forbidden	Together, safe_duration_factor and safe_duration_offset all ow an estimation of the longest amount of time a rider can expect the on-demand service in a GeoJSON location or location group may require, in minutes, for 95% of trips. Data consumers are expected to

Field name	Type	Required	Description
			use safe_duration_factor and safe_duration_offset to make the following calculation: SafeTravelDuration = safe_duration_factor × DrivingDuration + safe_duration_offset Where DrivingDuration is the time it would take in a car to travel the distance being calculated for the on-demand service, and SafeTravelDuration is the longest amount of time a rider can expect the on-demand service in a GeoJSON location or location group may require. Conditionally Forbidden: - Forbidden if stop_times.stop_id does not refer to a location_groups.location_group_id or an id from locations.geojson. - Optional otherwise.

4. GTFS-R

Real time (GTFS-R) is not provided by TfNSW for On Demand services, however many of the operators provide real-time tracking through the smartphone booking apps which the customers download and install. Therefore, real-time and customer notifications vary by operator but are not provided directly by TfNSW



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