

## Appendix A: Special Considerations for Rail Transit

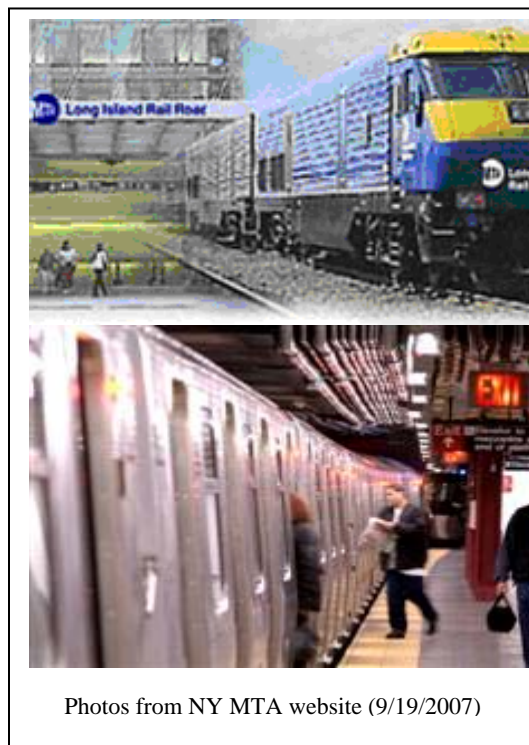
### In This Document

- ▶ Learn how to apply the Schedule Data Profile to Rail Transit;
- ▶ Understand the special features identified in the SDP that support Commuter Rail and Subway services.

### Rail Concepts in the Schedule Data Profile

Although the SDP primarily draws on terminology used by bus operators, the Schedule Data Profile applies to multiple modes of public transit including commuter rail. However, because rail has unique characteristics, the application of the SDP for rail is slightly different than it is for bus. This section describes an approach for modeling rail transit using the SDP.

From a rail transit perspective the SDP focuses on services for rail customers. Personnel and equipment control and operations schedules are not part of the modeling constructs. (Note: The SDP supports elements for bus equipment scheduling, and these terms, e.g., block, may be confusing to rail operators because the meaning is different for bus and rail.)



Photos from NY MTA website (9/19/2007)

This section is divided into two parts. The *first section* discusses special features and models applied to rail, particularly commuter rail schedules and facilities. The section describes differences between scheduling rail and bus services through examples of how a rail operator may apply the elements to model its passenger assets and services. The *second section* provides a cross-reference of key SDP data concepts and their common rail equivalents in summary format. In addition, it is formatted to provide “quick search” guidance for rail operators on how to apply the SDP data concepts to rail equivalents.

### A-1: Special Features for Rail

Although rail and bus schedules are used by patrons in a similar way, schedule generation is different between the two modes, and rail facilities are more complex than bus stops and even most bus terminals. Applying the complex elements of rail to the SDP Transit Facility data concept is discussed in Section 8 on Transit Facilities Data Concept. This section focuses on rail schedule characteristics specifically Route, Service and Transit Path data concepts.

Rail schedules are driven by the constraints imposed by the rail alignment while the SDP models customer-focused schedules. Another difference between rail and bus is that a rail “vehicle” is composed of multiple cars with passenger portals on both sides of the conveyance. These characteristics require additional fields, as well as require different interpretations of other elements within SDP service and network branches. Each related element will be described

below. Note that child and embedded elements are indented to show the hierarchy of the SDP XML Schema organization.

### Agency Registration Branch Elements

The AgencyRegistration Branch includes one data concept that is impacted by Rail Transit-Route. Issues related to the Route element and its child “mode” are discussed in this section.

*Route:* The route is a transit convention used to group similar service together. In the case of rail, some agencies group service by destination or along a line or branch. To that end, the same trip or “train” may appear in several Public Timetables because the service stops before the service branches to the destination points. For example, LIRR may include Train 2702 in both its Montauk and Port Jefferson branch timetables. One may consider each train its own route-pattern-trip tuple. Unfortunately, merging those three concepts into one is not practical when a rail system provides several hundred service options.

*Data Concept Approach:* Based on the SDP functional requirements, a trip or train has a unique relationship with a route. This is a relationship that cannot be adapted or broken. The SDP requirements meet customer service needs. To that end, rail operators should use Route to describe service schedules. Each trip must still be related to a single Route, indexed by an identifier and denoted with a publically recognized name. The SDP RouteGrouping concept (see Section 10) should be used to associate a trip to multiple routes, for example, when building public timetables that associate several trains with multiple branches or lines.

*Mode:* The Route element contains a field for “mode”. The enumeration values used for Mode come from the National Transit Database (NTD) mode list. The typical designation is “HR” (heavy rail) for subway and “CR” (commuter rail) for commuter rail. An example of a commuter rail enumeration is included in the Long Island Rail Road XML document excerpt below.

#### **XML Excerpt of Route (example #1 from LIRR)**

```
<Route>
  <routeID>DUNOBY</routeID>
  <routeName>Oyster Bay</routeName>
  <mode>CR</mode>
  ...
</Route>
```

An example of a subway mode is listed below:

#### **XML Excerpt of Route (example #2 from NYCT Rail)**

```
<Route>
  <routeID>4</routeID>
  <routeName>Line 4</routeName>
  <mode>HR</mode>
  ...
</Route>
```

The mode is designated on a route by route basis because some agencies provide multi-modal services.

### Service Branch Elements

The Service Branch includes one major data concept that is impacted by Rail Transit- Trip. Issues related to the Trip element and several children including “tripTimeList” are discussed in this section.

*Trip:* The trip is defined as “A one way scheduled movement of a transit vehicle between starting and ending locations. Each trip is an instance of a pattern where service is provided for a route in a given direction.” The “train” is similar to a trip. The tripName was inserted as a child element to specifically support a rail concept. The XML Excerpt for Trip is from the Metro North Railroad XML document.

*tripName:* When the tripID is not the same as the train number, the tripName should be used as the primary train number. For example, LIRR uses the primary train number as the tripName while the tripID is a unique sequential index. In the MNR example below, the primary train number is used for both the tripID and the tripName.

#### **XML Excerpt of Trip (from MNR)**

```
<Trip>
  <tripID>1231</tripID>
  <routeID>3</routeID>
  <patternID>5</patternID>
  <dayType>weekday</dayType>
  <tripName>1231</tripName>
  <tripType>1</tripType>
  <timeBegin>29520</timeBegin>
  <timeEnd>31920</timeEnd>
  <locationBegin>112</locationBegin>
  <locationEnd>1</locationEnd>
  ...
</Trip>
```

There are other child elements that are applied in a slightly different way to support rail concepts. These include the locationBegin and locationEnd pair, and tripTimeList (TripTime data concept).

*locationBegin (locationEnd):* The begin and end location of the trip should designate the origin station to the destination station. The general guidelines specify that the locationBegin and locationEnd should exactly match the events included in the pattern. The application of this business rule is relaxed for rail. The issues related to matching trip begin/end to pattern origin/destination pairs are discussed in more detail below under the Transit Network Branch Elements section.

*tripTimeList (embedded set of **TripTime** elements):* The tripTimeList is an ordered set of TripTime elements. The TripTime element is the point at which service is measured. In

the case of transit, each *TripTime* is a point where service is delivered to the customer as at a stop at station. Because operations and crewing are not part of the SDP, the trip timing points should include only station stops where patrons may alight or board the train. There are other concepts embedded in the *TripTime* element that specifically supports customers navigating the rail service.

*timeType*: The *timeType* defines the event as the *beginTrip*, *endTrip*, arrival or departure time.

*tripEventType*: The *tripEventType* may identify key information about service at a stop such as side or cars where boarding/alighting are allowed. Some information may be provided as a note if no downstream application uses the information in an algorithm. An example of this is shown in the excerpt below where `<notes> 2</notes>` may be referenced as: “All patrons alighting from the train at South Ferry should board one of the first four cars due to platform construction.” In this example, a trip planning application may attach the note to the trip plan. If the boarding information triggered an alert to the rider when he boarded the train, then the information would need to be specified as a *tripEventType*. See Section 5 for more information on creating a Note reference.

#### XML Excerpt of *tripTimeList* (from NYCT Rail)

```
<tripTimeList>
  <tripTime>3600</tripTime>
  <tripEventType>AlightBoard</tripEventType>
  <timeType>arrival</timeType>
  <locationID>140</locationID>
  <platformNo>0A</platformNo>
  <notes>2</notes>
</tripTimeList>
```

*platformNo*: The *platformNo* element was inserted to provide more detailed information to the rail patron on the location of the boarding/alighting location; (the element may also be used to designate a bus bay). In the excerpt above, the *platformNo* is 0A.

*seqNo*: Although the sequence number is not needed to order the *tripTimes* (the time value is an ascending integer), a *seqNo* should still be inserted that matches the Pattern event. Specifically, the *TripTime* *seqNo* should match the associated event *seqNo* (*TransitEventPoint.seqNo*) found in the Pattern eventList. The Pattern eventList, as discussed in the Transit Network Branch Elements, catalogs all the stops for each unique branch (origin-destination pair and all intermediate stops irrespective of skipped stops). The rationale for ensuring the mapping between the Trip times and Pattern events relates to the needs of a few applications that build an unambiguous mapping between the two set of points. When the Pattern eventList exactly matches the associated *TripTimeList*, then matching the *seqNo* is not necessary.

For example, in the MNR XML excerpts below, the Trip timePointList seqNo matches the Pattern eventList seqNo for the routeID 3, patternID 5.

**XML Excerpt of Matching seqNos in tripTimeList (embedded in Trip) and transitPointEvent (embedded in Pattern) (from MNR)**

```
<tripTimeList>
  <tripTime>25620</tripTime>
  <timeType>beginTrip</timeType>
  <locationID>108</locationID>
  <platformNo>3</platformNo>
  <seqNo>108000</seqNo>
  <notes>S</notes>
</tripTimeList>

<transitPointEvent>
  <locationID>108</locationID>
  <seqNo>108000</seqNo>
  <ptEventType>1</ptEventType>
</transitPointEvent>
```

### Transit Network Branch Elements

The Transit Network Branch includes two data concepts, Pattern and Transit Path, both impact Rail Transit. Issues related to the Pattern element and several children including “eventList” are discussed in this section. In addition, how the TransitPath may be used to describe the rail alignment or physical track descriptions used by rail is discussed in this section.

*Pattern:* Service for many commuter rail as well as commuter bus operators differs for every trip. Look across a timetable of stops on a line and you will find few similar trips, not like the frequency of service offered by a local or regional bus routes. Conceptually, a one-to-one relationship between pattern and trip (train) exists. So there are two ways to handle Pattern.

*Data Concept Approach #1:* Create a unique Pattern for every Train so there is a one-to-one relationship between Pattern and Train (Trip). Although a simple solution, this makes for a larger file of potentially redundant information.

*Data Concept Approach #2:* Create a unique Pattern for every Route (branch or line) by Route Direction (for every non-branching origin-destination pair). The sequence numbers for each event in the Pattern eventList should then match the Trip tripTimeList records. The match will directly associate each Trip tripTime to the specific stop along the Pattern. As a consequence, the Trip tripTimes are mapped to specific Pattern events without ambiguity if stops are skipped or the Trip is implemented as a short turn. The rules to ensure that there is an unambiguous mapping between Trip “trip times” and Pattern events is discussed in the Trip section above.

When service is frequent with few variations and many recurrent trips, such as subway service, then the Pattern description should follow the same convention as bus service.

*origin – destination:* Similar to Trip’s locationBegin – locationEnd pair, the origin – destination pair should be the first and last station in the Pattern. Non-revenue locations should not be included unless patrons (or crew) board/alight at those locations.

*eventList* (embedded set of TransitPointEvent elements): The eventList is an embedded set of one or more TransitPointEvent elements. The eventList is a linearly ordered set of locations that describe the physical path and events that occur at that point along the Pattern. In the case of rail, the path is “logical,” not the actual track over which the train travels. Although any event type may be included, the customer-focused purpose of the eventList is to include the locations where passengers may board or alight the train.

*trackNo:* The trackNo is the track known by the public at the station, not necessarily the track index or identifier used internally to manage track assets.

*stopID:* This element should be used to identify the platform, if known.

*distanceFromOrigin:* This element refers to the Pattern origin element.

*ptEventType* [eventType\_cd]: Similar to tripTimeType, this enumerated type is used to specify local event types. The SDP XML Schema does not currently list enumerated type values except for “1” timing point and “2” other. To that end, new types may be added as a unique numeric value set by local users. The value of the local code set should be submitted with the XML document (see *SDP Guidance Document Part 3*). More than one ptEventType may be included in the XML Document. In the invented XML excerpt below, the last station on Line 1, the South Ferry station (locationID = 37), opens its doors on the right hand side (ptEventType = 4), and has a shortened platform due to construction (ptEventType value “15” indicates that the platform is shortened). The “5” indicates that all patrons alighting at South Ferry should be in one of the first four cars. This enables downstream applications to use these values to logically process the information.

#### **XML Excerpt of transitPointEvent (adapted from NYCT Rail)**

```
<transitPointEvent>
  <locationID>37</locationID>
  <seqNo>37000</seqNo>
  <ptEventType>1</ptEventType>
  <ptEventType>4</ptEventType>
  <ptEventType>15</ptEventType>
</transitPointEvent>
```

*TransitPath*: The TransitPath element is used to describe transit network elements that may not be described by a transportation network model (such as a map database). Tracks, paths through parking lots, depots and transit only lanes are not typically represented in commercial or even public-funded transportation networks. The TransitPath may also be used to describe paths that are associated with operational performance significance, for example, peak load segment, running time segments, route segments that are the building blocks for Patterns. For rail, the TransitPath may be used to represent the physical description of the track network. The representation is consistent with several spatial data formats.

Additional information on TransitPath guidance may be found in Section 6.2. Note, the TransitPath may also be used to “patch” a map database when “private” or “non-commercial” streets and alignments are not included.

## A-2: Quick Search Guidance for Rail SDP

The quick search guide is a table that lists the SDP Data Concept, its Definition and guidance to rail operators on how to apply the concept to rail characteristics. Table A-1 SDP Data Concept Rail Guidance contains three columns:

- SDP Data Concept and the SDP XML Schema branch in which it is positioned,
- Formal data concept definition, and
- Guidance on how to apply the concept to rail

The table includes all the data concepts that are found in the SDP XML Schema. Most data concepts are applied in a similar way to bus and rail. When this is the case, the Guidance field states: “Same for all modes”.

**Table A-1: SDP Data Concept Rail Guidance**

Data Concept (Branch)	Definition	Application to Rail
AdditionalContact (Agency Registration)	Agency contact information that is in addition to the information supplied in the Agency element.	Same for all modes
Agency (Agency Registration)	“A transit agency is an organization that provides transportation services by bus, rail, or other conveyance to the general public or special services on a regular, continuous basis.”	Same for all modes
Amenity (Transit Facility)	Elements of a physical feature, a fixed location, or a transit facility. Example: the amenities of a public transportation stop may include the shelter, platform announcement panel, and benches. Note: an amenity may be described by one or more characteristics, or attributes, such as the year of construction or its	Same for all modes. The amenity may be used as a template or generic feature (such as a trash can). An instance of a Transit Facility may then include it as one of many Plant Components.



**Table A-1: SDP Data Concept Rail Guidance**

Data Concept (Branch)	Definition	Application to Rail
	current condition. [GOS, part 7d, p., 2]	
Block (Service)	The daily, sequence of revenue and non-revenue trips assigned to a transit vehicle in revenue service from pull-out to pull-in.”	<b>Not applicable</b> to Rail Services. A Block relates to scheduling buses.
BlockTime (Service)	The path on which the vehicle travels is described by the Block Times, a series of coordinates, also linear references (distanceFromStart) from the beginLocation. The Block Event Times (blockTimes) are an ordered set. Each blockTime is associated with a specific event along the block. Each Block Event Time is associated with one trip. The Block Event Time may be any type of transit feature type: timepoint, transit stop or other event (e.g., fare set change, headsign change) that is referenced by a Location.	<b>Not applicable</b> to Rail Services. A Block relates to scheduling buses.
ConnectionSegment (Transfer Cluster)	The directions between two stops within a Transfer Cluster. The directions may describe accessible and mobility-challenged instructions.	For coordinated rail to rail, rail to bus, and generally mode to mode transfers, this construct provides directions from one trip (or train) to another.
DayType (Agency Registration)	A classification for the service provided on a type of day or day of the week. Among the examples of day type include: Monday, weekday, Saturday, holiday, Thanksgiving, Wed before Thanksgiving, New Years Eve, New Years Day.	Same for all modes
Depot (Agency Registration)	A storage facility operated by a transit agency or its agent where transit vehicles park overnight and are maintained. alias: base, garage, division, yard	Same for all modes. Detailed descriptions of facilities within the depot are not within the scope of the SDP.
EventConnection (Service)	An entity that describes an agency specified connection or transfer between two trips on different routes.	This element may provide a connection between two trains on the same branch or a coordinated transfer between train and bus services.



**Table A-1: SDP Data Concept Rail Guidance**

Data Concept (Branch)	Definition	Application to Rail
Location (Gazetteer)	This entity represents a place in the Transit Gazetteer. It contains the location description for points used to describe or relate a transit network over which transit service is provided.	The location of a place related to train service. The location may describe the path of the tracks (if used in TransitPath), or the location of a station. In most cases this feature describes the location of the rail station or one of its portals (entrances).
Note (Service)	A note for the public that describes a characteristic of the service. The note may be associated with a Trip or a Trip Time.	Same for all modes. May be attached to a Trip or tripTimeList (TripTime) element.
Organization (Agency Registration)	A part of an Agency that issues or uses a transit schedule.	Same for all modes.
PassengerAccessComponent (Transit Facility)	The components used to aid travelers to traverse from one level to another or from one end of a facility to another. Examples include stairs, elevator, escalator, moving walkway. The component may be described by direction (up, down, or both), accessibility for people with disabilities or carts, and other characteristics.	This element is used to represent accessible paths in a rail station or between the rail station and another transit facility or stop.
Pattern (Transit Network)	A unique, non-branching, ordered sequence of transit paths, time points, or transit stops to be followed by a transit vehicle in scheduled service for a route in a given direction.	A pattern is not a typical modeling object in rail service. However, many downstream applications require the one way path from origin to destination of all <i>transit</i> service. Rail service may provide a one-way, non-branching, sequential list of each set of stations along its branch lines in lieu of representing all unique patterns. There are some rules with respect to matching the seqNo of each Pattern eventList element with the seqNo of each Trip tripTimeList element.
PlantComponent (Transit Facility)	A Plant Component is a physical part of a larger facility such as a boarding area, turnstile, fare vending machine, information booth, escalator, stairs, etc. The five specific types of plant components included in this model are Track, Transit Stop or	Same for all modes although rail stations are typically more complex than bus stops because it may include platforms, tracks, ticket vending equipment, gates, stairs, portals, parking (park & ride lots), etc.

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Data Concept (Branch)	Definition	Application to Rail
	boarding area, Amenity, Access Component and Portal.	
Portal (Transit Facility)	A place where transit customers may enter or exit a transit facility, station or stop. Examples include doors and gates to transit facilities.	Same for all modes.
RelativeLocation (Location)	A linear reference or attribute related to a Location. Fields include position relative to intersection, off or on transportation network, etc.	RelativeLocation describes the relationship of the bus stop to the road network. This element does not tend to apply to Rail.
Route (Agency Registration)	A collection of patterns and associated trips in revenue service with a common identifier or name.  Rail alias: Line or Branch	The Route is a collection of services that are grouped together. A Route has a one-to-many relationship with trips. A trip is associated with only one route. Use RouteGrouping for timetable generation.
RouteDepotVersion (Agency Registration)	Characteristics of the schedule version that applies to a route that operates from a specific depot or that is generated by a specific organizational unit. In the case where there is no distinction on specific organizational unit, the depotID or organizationUnitID is a non-identifying foreign key.	Same for all modes. This may be used for updates to select services or Route (Branch or Line) changes.
RouteDirection (Route)	The direction of travel of a transit conveyance along the physical path. The element allows for public facing information.	Same for all modes, there is a first and second direction for most routes. The publicRouteDirection may use a destination location as the route direction, e.g., "Babylon".
RouteGrouping (Agency Registration)	The Route Grouping entity describes a collection of Patterns or Trips that are grouped together for a particular purpose (i.e., route grouping type: A set of patterns or trips may be grouped together operationally in order to closely coordinate their scheduled headways along a common alignment or carriageway. Public timetables group routes together to communicate the frequency of service of routes that share a common corridor before they branch).	This concept may be used to group trips into more than one branch for the purpose of publishing the information in a timetable.

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Data Concept (Branch)	Definition	Application to Rail
ScheduleRevision (Agency Registration)	Records the state and manages the changes to the designated schedule version.	Same for all modes.
ScheduleVersion (SDP XML Document header attribute group)	The time period, described by the start date and time and optionally end date and time, when an agency service provision is valid. Due to the nature of transit schedules, different routes, depots and organizational units may implement various versions that operate during the same time period.  Example: Long Island Bus typically issues a new Schedule Version in March, June, September and January.	Same for all modes.
Status (Plant Component)	The state or condition of the Plant Component with respect to the dates of placement, activation, deactivation, etc.	Same for all modes.
Timepoint (Gazetteer)	A location at which time is measured for a trip.	Rail only needs timepoints at rail stations.
TimetableHeader (Route)	The header row used for a route timetable.	Same for all modes. The timetable is for use by the public. A “crew” timetable was not part of the downstream applications that generated the functional requirements.
Track (Transit Facility)	"A pair of parallel rails, and required ties and fastenings, over which trains move." [LIRR] Also known as Lane and Berth	The track referenced at a station. Track may also be monorail.

**Table A-1: SDP Data Concept Rail Guidance**

Data Concept (Branch)	Definition	Application to Rail
TrackAssociation (Transit Facility)	<p>An association between a specific platform and track.</p> <p>A Platform may be associated with multiple Tracks, for example, platform "A" at Jamaica Station is flanked on both sides by track 1 and 2. Alternatively, a track may support multiple platforms, such as platforms A and B are served by Track 2. This entity distinguishes the combined relationship between one platform and an adjacent track.</p>	See note in Definition column.
TransferCluster (Gazetteer)	A place where transit customers may transfer from one service provision to another such as from one bus to another, or from one mode of travel to another. The Transfer Cluster may include related information on the connecting trips (see EventConnection) and directions between the connecting stops (ConnectionSeg).	Same for all modes.
TransitFacility (TransitFacility)	<p>A building or center used by a transit vehicle or transit operator for the purpose of parking, storing, maintaining or providing services to transit customers.</p> <p>The SDP uses this entity to represent multiple transit stops wherein transfers may occur between routes, modes and/or operators. Although a transit facility in a general sense may also encompass a vehicle garage, maintenance yard, administration building or other facility type, within the context of the SDP, only facilities that serve the public need be included.</p>	Same for all modes. There are several detailed examples on rail and multimodal facilities in Section 9.
TransitPath (Transit Network)	A path over which transit service is provided. Alias: route segment, timepoint interval	The Transit Path element may be used to describe the physical path of the rail track.
TransitPathEvent (Pattern)	A path that composes the	The Transit Path Event is used by

**Table A-1: SDP Data Concept Rail Guidance**

Data Concept (Branch)	Definition	Application to Rail
	alignment of a pattern where service is delivered. The path should include stops, timepoints and other events.	the Pattern in place of the TransitPointEvent.
TransitPointEvent (Pattern)	A place where transit service is delivered along the transit network.	The TransitPointEvent element includes some specific elements that may be used by rail service. In particular, the ptEventType (eventType_cd) may be used to designate the location of the event relative to the platform for the purpose or providing information on boarding or alighting the train.
TransitStop (Transit Facility)	An established location where public transportation customers may board or alight a transit vehicle in revenue service.  Alias: bus stop, boarding area, ramp, platform.	A transit stop is typically used to describe the platform at the station, for example, the Nostrand Ave. Station Platform A may be described as NAV-A.
Trip (Service)	A one way scheduled movement of a transit vehicle between starting and ending locations. Each trip is an instance of a pattern where service is provided for a route in a given direction.  Rail alias: Train	The Train is the equivalent service concept as the Trip.  Both rail and commuter bus trip times are associated with stops or stations. The tripName is specifically inserted to capture the primary train number.

**Table A-1: SDP Data Concept Rail Guidance**

Data Concept (Branch)	Definition	Application to Rail
TripTime (Service)	The time along a trip when a vehicle is scheduled to pass (arrives at/departs from). The trip time may be published or unpublished, coordinated or uncoordinated with trip times of other trips.	<p>Both rail and commuter bus trip times are associated with stops or stations along a Pattern, which for rail is defined as a unique origin-destination pair and the stations along the path.</p> <p>The TripTime elements should comply with designated business rules. Key among them is that the seqNo should match the same location designated by the associated Pattern eventList seqNo.</p> <p>Additional customer tripTimeType codes or special notes may be included with trip times to describe customer directions such boarding and alighting permitted, reservations required, luggage storage available.</p>