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Chapter 9: Schedule Calendar Date, Versioning and Day Type Issues

In This Chapter

- ▶ Understand the Schedule Calendar Date Data Concept.
- ▶ Learn how to apply the elements in the Schedule Calendar Date data concept.
- ▶ Learn the business rules related to managing Version, Day Type with the Schedule Calendar Date data concept.

Schedule Calendar Date Definition

The calendar date on which a transit agency operates based on an assigned type of service (within its schedule day).

Typical Practice in Transit Using a Schedule Calendar Date

The Schedule Calendar Date is a data concept that has been adopted by only a few agencies across the U.S., although it could become very helpful to various types of downstream applications that use schedule data. Specifically, the Schedule Calendar Date concept is a Calendar where specific service is assigned to dates of operation. The assignment is accomplished through the use of a *key* assigned to each trip and included in one or more dates in the Schedule Calendar. The *key*, called a day type (also called a service type), may be used to aggregate all the trips that are associated with a specific date (e.g., New Year's Eve), or type of day (e.g., weekday, holiday, Friday). To this end, the definition of the Day Type code is critical to this data concept.

The Schedule Calendar Date concept provides a formal structure to assign the provision of service (based on version, revision, route-depot version and day type) within a single schedule version to each valid schedule date. Thus, Schedule Calendar Date format is used as a registration table to index the appropriate service that is assigned to operate on particular days of the week and to identify service exceptions on particular dates. The concept associates multiple elements together. The business rules related to building these associations are biased by policy and institutional approaches. In order for the data concept to work consistently throughout the region, several issues and best practices are recommended.

The Schedule Calendar Date works by describing the operating service by the schedule version and appropriate day type. The schedule versioning requirements are captured by the schedule version data concept. The day type requirements are typically captured by a few standard day type definitions which are codified in an enumerated type. Complexity, ambiguity, and inconsistency emerge when applying these concepts. Specific areas where these inconsistencies show up include:

- How organizational structures generate service,
- Use of schedule notes,
- Definition of a schedule day,
- Various ways of using and assigning day type codes to the service provision.

Complexity and inconsistency may arise in the following situations:

- Various types of service (day types) may be associated with different organizational units, agency defined zones or time periods on a single calendar date. How is that managed by the Schedule Calendar Date concept?

- Some agencies identify exception services in a schedule note which may not be automated or “machine-readable” by a downstream application.
- NYCT starts its schedule day at 10 p.m. the calendar day before and ends its schedule day at 3 a.m. on the following calendar day. When does the day start?
- Most service or day type codes will point to typical service on a weekday, Saturday, Sunday or holiday. This approach will work for most days of the year, but will not work for exceptions. When an agency like Long Island Bus or New York City Transit applies a Sunday schedule to a holiday, like New Year’s Day, this approach falls apart. A Sunday schedule, when applied to a different day of the week must be associated with the specific date to which it applies.
- How should a day type code be assigned to extra trips that are added to busy travel dates like Labor Day, New Year’s Eve and days the Mets play at Shea stadium?

These issues and recommendations for implementation will be discussed in this chapter.

Requirements for Schedule Calendar Date Data Concept

The underlying requirements that drive the Schedule Calendar Date data concept are listed in Table 9-1.

Table 9-1: Schedule Calendar Date Requirements

| # | Category | Requirements |
|---|-----------------------------|---|
| 1 | Agency Designated Calendars | <ul style="list-style-type: none"> • Each agency has service (for specific routes, routes associated originating from specific depots) associated with a calendar date. • An agency need not submit a Schedule Calendar Date on a date when no service is offered (e.g., no Sunday service). • A calendar date is associated with an Agency’s schedule date even if the schedule day starts the day before or ends the day after the designated date. • Alternatively, if there are no special service days or exceptions to the standard service provisions, an agency may designate service by <i>standard day types</i>, and the regional repository will populate the calendar based on dates associated with the day types (e.g., Monday Only will cover all Mondays except for holidays that fall on Monday). • Only one set of trips for a route are operated on a calendar day. The set of trips associated with a route is distinguished by the Day Type valid during that schedule period. The route may be distinguished by the organizational unit or the depot associated with the route. |
| 2 | Unique Dates | <ul style="list-style-type: none"> • A Service Calendar Date is associated with a unique date in the calendar, route-depot version, revision number and schedule version identifier. Together each record shall be unique. • The calendar date must fall within the valid schedule version period with which it is associated. |
| 3 | Day Type | <ul style="list-style-type: none"> • The Day Type qualifies the route’s trip service provision designated to operate on a specific date. • Each Schedule Calendar Date instance will be associated with one and only one day type. The day type should be described by one of the code enumerations from the data type Day Type. |

Table 9-1: Schedule Calendar Date Requirements

| # | Category | Requirements |
|---|--|--|
| | | <ul style="list-style-type: none"> • The standard set of day types are only those described in the day type code set. • Day types should not overlap, as such, a set of business rules related to assigning service to day types should be adopted. (See business rules in <i>Use and Examples</i> section.) • <i>Agencies that need to describe “special days” may need to define those day types in the Day Type XML element (in the AgencyRegistration branch). A special day type shall be described as a record by the submitting Agency in the Day Type entity.</i> |
| 4 | Specialization of Schedule Calendar Date | <ul style="list-style-type: none"> • The Schedule Calendar Date may be described for any type of schedule version, revision or update. |

Conceptual Data Reference Model (CDRM) Description for the Schedule Calendar Date

The Schedule Calendar Date requirements may be described in the CDRM depicted in Figure 9-1. The Schedule Calendar Date data concept in Figure 9-1 is described as:

Transit service is scheduled for each day of operation. Service components may be scheduled to operate on different dates depending on a number of factors. These factors may be schedule based; for example, special trips are designated when there is an event at Shea Stadium or service to evacuate workers from the city during a snow storm. The Schedule Calendar Date associates the relevant schedule components (designated by the Route Depot Version, Revision, and Schedule Version) and an index related to the appropriate trips (designated by the day type) into a table which is used as a reference.

A Schedule Calendar Date is created for each set of schedule version components and the trips that operate on the specific dayType. In some cases, the schedule version components are scheduled for only part of a day, for example, the schedule components vary when the Mets play games that begin at 5 p.m. versus at 7 p.m.”

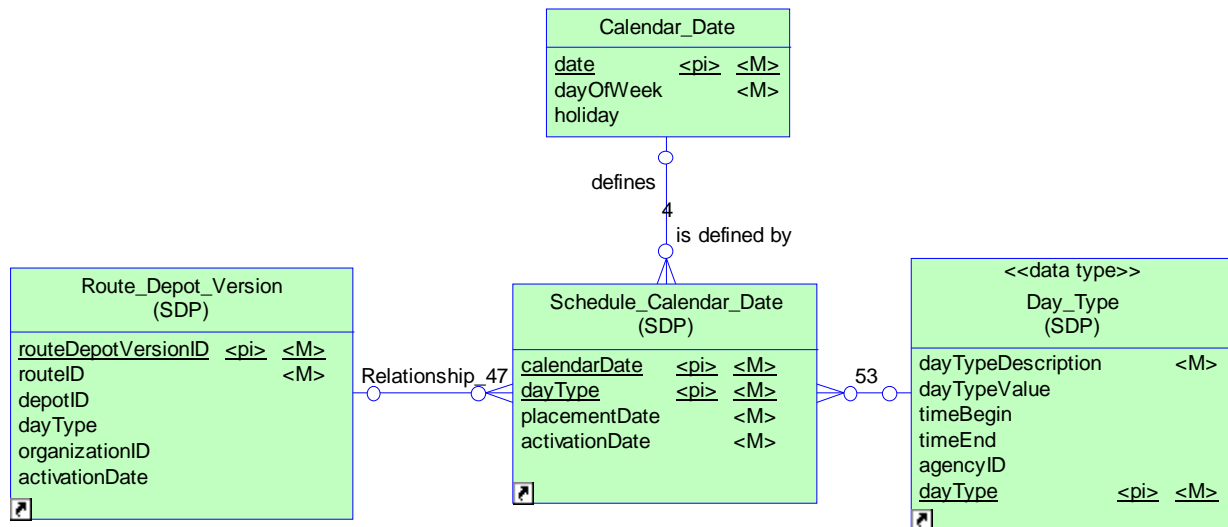


Figure 9-1: Schedule Calendar Date Concept Model

Note: The logical model will include primary and foreign keys—scheduleVersionID, revisionNo and routeDepotVersion—in the Schedule_Calendar_Date entity.

SDP XML Schema Description for Schedule Calendar Date

In implementing the CDRM into the XML Schema, a number of rules were applied.

- The Schedule Calendar Date (SCD) was generated as an independent XML Schema (called the SCD Schema), separate from the SDP. This was done in order to use the Schedule Calendar Date concept as a mechanism to integrate SDP documents, partial updates and revisions.

Figure 9-2 shows the organization of the SCD (Schedule Calendar Date) XML schema.

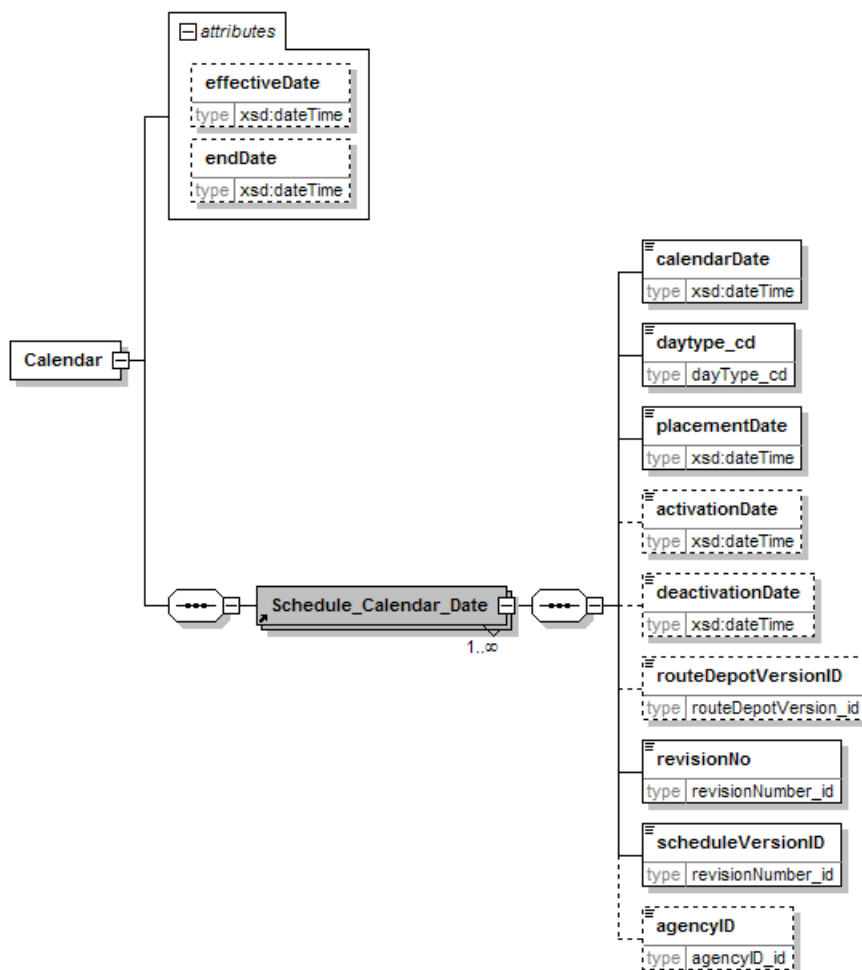


Figure 9-2: Schedule Calendar Date XML Schema Model

Detailed Data Descriptions and Guidance for the Schedule Calendar Date

This section describes best practices and guidance associated with each element in the Schedule Calendar Date data concept described above. The guidance for each element is consolidated into a table with the following column headings: Requirement Status (M for mandatory and O for optional), the element name, the data type and guidance related to the element. The guidance attempts to bring additional clarity to the data definition. The first column of each table identifies the baseline requirements as driven by the SDP XML Schema version 1.0.

A downstream application may further restrict these requirements in order for the data set to meet the application's data needs. The XML Schema element name corresponds to the related CDRM entities and attributes descriptions (although the capitalization and spacing may differ slightly). The type may refer to a native XML type, or a declared type in the XML schema. The Guidance column is called "Questions to Ask." These questions direct the analyst to a similar or equivalent concept in their own schedule data set. In addition, some comments describe the impact of the data structures on the SDP XML Document deployment.

Table 9-2 incorporates Schedule Calendar Date Guidance.

Table 9-2: Schedule Calendar Date Guidance

| Required | Element Name | Type | Questions to Ask |
|----------|-------------------|----------------------|--|
| M | calendarDate | date | More than one calendar may be associated with different route-depot versions of the schedule. For that reason, more than one calendar date may be included in the set of ScheduleCalendarDates. |
| M | dayType | dayType_cd | There are a standard set of codes defined for dayType. If an agency has a need to include additional codes, a DayType element which includes a code designation and description may be developed and used as a look up table. |
| M | placementDate | date | The date on which this record was placed. |
| O | activationDate | date | The date on which this calendar date is valid. This may seem redundant with the date, however, the calendar date may be placed several months earlier, to be active during the schedule version. Later, the version may be overwritten, and the record is obsolete. This activation date should match the schedule, revision or route depot activation date to ensure consistency. |
| O | deactivationDate | date | See activationDate comment. |
| O | routeDepotVersion | routeDepotVersion_id | This element is part of the identifying key of the schedule calendar date element. The Route Depot Version designates a set of routes generated or operated by an organizational unit or depot. A unique set of trips may be designated by more than one organizational unit or depot. The service type is designated by the schedule origin, and as such a route may include trip sets that are assigned different day types for the same date. When a single dayType distinguishes the service provision for all the routes, then the routeDepotVersion is optional. |
| M | revisionNo | revisionNumber_id | This element is part of the identifying key of the schedule calendar date element. If multiple service revision documents are available, a rev-temporary or rev-permanent (i.e., scheduleVersionType) may supplant a scheduleVersionType equal to “original” or “suspended.” |
| M | scheduleVersionID | scheduleVersionID_id | This element is part of the identifying key of the schedule calendar date element. When a single dayType distinguishes the service provision for all the routes in a schedule version, then the identifying scheduleVersionID shall be used. |
| O | agencyID | agencyID_id | When more than one agency submits and stores a schedule calendar date data in the same SCD document, then the agencyID is needed. Otherwise it may be populated by the regional repository. |

Usage and Examples of Schedule Calendar Date

This section describes several examples and issues that impact usage of the Schedule Calendar Date. The topics include:

- Service Precedence and Management of Schedule Version Components
- Schedule Note Versus Day Type Description
- Schedule Day
- Business Rules and Precedence Related to Assigning Day Types to Trips
- “Special” Day Type Descriptions and Extra Trips
- Physical Database Implementation

Service Precedence and Management of Schedule Version Components

The schedule version components consist of the Schedule Version, Revision and Route Depot Version. The schedule version fields are stored as an attribute group in the SDP XML Document header. The Schedule Revision is contained in the Agency Registration Branch of the Document. It describes the history of the schedule version. Most medium to small agencies will submit one document that covers their entire service for their quarterly schedule. Other agencies, supporting different modes, separately governed operating units or depots, or generating a significant number of routes, will generate multiple documents to register their schedules. When the Schedule Calendar Date is being populated or revised based on schedule component updates, the rules in Table 9-3 should be followed. (Low and High refer to precedence level.)

Table 9-3: Service Precedence and Management of Schedule Version Components

| Sched. Ver. Type\Element | Schedule Version | Schedule Revision | Route Depot Version |
|-----------------------------|--|---|------------------------|
| original | Low | Low | Low |
| rev-temporary | Must be associated with an existing Schedule Version to be applicable | High Overrides service with scheduleVersionTypes: <ul style="list-style-type: none"> • original • rev-permanent Activation/deactivation dates describe dates of precedence; reverts back to last permanent schedule (original or rev-permanent). | High |
| rev-permanent | Must be associated with an existing Schedule Version to be applicable | High Replaces service with scheduleVersionType: <ul style="list-style-type: none"> • original Activation/deactivation dates describe dates of precedence; deactivation date should correspond to deactivationDate of original schedule version. | High |
| suspended | (Must be associated with an existing Schedule Version to be applicable.) | Suspends original; must be followed by a new schedule. | Not applicable |

Schedule Note Versus Day Type Description

As recommend in Chapter 5.2, a note provides additional information to the customer, however, it does not aid the processing of information. As such, a note is acceptable as long as it is not a substitute for using or describing a day type. If notes are used, care should be taken to maintain the consistency between the note and day type code. Additional consistency checks may be needed to ensure that message and meaning matches the note and day type enumeration.

Schedule Day

The time used to designate service is defined as a 36 hour clock. The data type is a signed integer representing seconds past midnight. Negative values are associated with the day prior to midnight of the calendar date; values past 86400 seconds (24 hours) are associated with the day following the calendar date. As such, a trip assigned a day type code even if it logically falls on a day prior to or following the calendar date belongs to the assigned calendar date. For example, a day type designating special service for New Year's Day may include extra trips from 6 p.m. on December 31 to 3 a.m. on January 2.

Business Rules and Precedence Related to Assigning Day Types to Trips

A set of business rules are included to describe how day types will be automatically allocated to a calendar. The importance of these precedence rules is to help generate a timetable that groups and presents the information to the user in a format that is consistent and mitigates ambiguity. The basic requirement that drives these business rules is that the reserved set of day types should not overlap by days of the week. As such, for each route, any combination of non-overlapping day types is valid:

- Scenario 1: Weekday, Sat, Sun, Hol
- Scenario 2: Weekday, Mon-Sat, Sun, Hol
- Scenario 3: Weekday, Wk-closed, Sat, Sun, Hol
- Scenario 4: Sat, Sun, Mon, Fri, Tue-Thu, Hol
- Scenario 4: Sat, Sun, Mon, Tue, Wed, Thu, Fri, Hol

In all cases, special day types assume the highest level of precedence. A special day type must be assigned to a specific calendar date to be legitimate.

Scenario #1

- The service assigned to Weekday, Sat, Sun will be assigned to their representative days of the week.
- The service assigned to a Holiday day type will override the default day type based on the date when it is celebrated by the submitting agency during that calendar year (within the applicable schedule version).

Scenario #2

- A route or group of routes may be assigned to only one set of exclusive days of the week:
 - Mon-Sat and Sun will be assigned to their representative days of the week.
 - Weekday, Sat and Sun will be assigned to their representative days of the week.
 - All trips associated with a single route and route direction should conform to either [Mon-Sat and Sun] or [Weekday, Sat and Sun].

- The service assigned to a Holiday day type will override the default day type based on the date when it is celebrated by the submitting agency during that calendar year (within the applicable schedule version).

Scenario #3

- The service assigned to Weekday, Sat, Sun will be assigned to their representative days of the week.
- The service assigned to a Wk-closed day type will override a Weekday day type only. The Wk-closed will be assigned a date that corresponds with a school schedule submitted by an operating agency. The school schedule will only constrain the submitting agency schedules.
- The service assigned to a Holiday day type will override the default day type based on the date when it is observed by the submitting agency during that calendar year (within the applicable schedule version).

Scenario #4

- A route or group of routes may be assigned to only one set of exclusive days of the week:
 - Sat, Sun, Mon, Fri, Tue-Thu,
 - Sat, Sun, Weekday
 - Sat, Sun, Mon, Tue, Wed, Thu, Fri
- The service assigned to a Holiday day type will override the default day type based on the date when it is observed by the submitting agency during that calendar year (within the applicable schedule version).

“Special” Day Type Descriptions and Extra Trips

There are holidays and events when an Agency will run its “normal” schedule but add extra trips or trains to support a special event. For example, the Long Island Rail Road runs different service to Shea Stadium when the Mets are playing a home game at 5 p.m., a different service when the Mets are playing at 7 p.m., and yet another when the game is on the weekend, in the spring, summer and fall. In total, there are more than 70 different unique trip sets that operate on those “special” days. In reality, the schedule for those days remains the same for most service. Only a few train times are changed or trains added. There may be a limit to the number of special day types a downstream application can handle. To this end, the SDP enables alternate approaches for managing periods of service changes, extra trips or special events.

Within the context of choosing among these alternatives, one should recall these SDP requirements and precedent logic:

- The SDP limits the smallest unit of schedule component to a route, although the Route Depot Version will allow a route’s trip set constrained by the day type as the smallest schedule component.
- The Route Depot Version and Schedule Revision may be constrained by activationDate and deactivationDate.
- A user-defined Day Type element (included the AgencyRegistration branch) may be constrained by beginTime and endTime.
- There are rules for logical precedence for day type enumerated types.

- There are rules for logical precedence for schedule version types (as assigned in Schedule Revision); the rules will apply to the most detailed Schedule Version component (e.g., schedule revision or route depot version).

Several scenarios handle various situations. These are described below:

Scenario #1—Typical Approach: Assign Day Type Codes to All Affected Routes and Related Service Components (Trip)

The typical and most often used by downstream applications is to generate the affected routes with trips regenerated under a different day type code. For example, if a local transit agency (agencyID=440) ran three trips (for a route) into New York City on a daily basis (dayType=weekday), although, on Thanksgiving Day they ran an additional trip on that route into New York City. The agency may use an existing SDP enumerated type (dayType=thanksgiving) to uniquely reference all the trips that operate service on that dayType, and they could specify all the day types associated with that trip in the Trip element. Specifically, the SDP document when detailing the trips for that Route would include four (4) trips, three (3) with dayType=weekday and dayType=thanksgiving, and one (1) trip¹ with just dayType=thanksgiving. The Schedule Calendar Date will have a total of 260 dates assigned service: 259 weekdays assigned a dayType code of “weekday,” and the fourth Thursday of November will be assigned a dayType code of “special” of “thanksgiving,”

Scenario #2—Designate Time Range of Day Type Validity

This is a more complex approach than the previous scenario, and for that reason, special consideration must be used prior to using it. In this approach a special day type may be described that is constrained by beginTime and endTime. The logic for day type precedence must be implemented in the downstream application in order for this approach to work.

The Day Type element which is contained in the Agency Registration Branch of the SDP XML Schema includes timeBegin and timeEnd. If the precedence logic for day type is included in the downstream application data processing module, two Schedule Calendar Date elements with the same date, but different dayTypes may be included in the SDP XML Document for a given set of schedule version components. The first element would include normal operations, the second element will include a user defined dayType (e.g., Mets play night game on October 10) with the timeBegin and timeEnd specified (e.g., beginTime=5:30 a.m.; endTime=12 p.m.). Care must be applied when using this approach because all the trips that run on that schedule day, initiated after the beginTime and before the endTime for the specific scheduleVersionID, revisionNo and if appropriate routeDepotVersion, will be overridden by the designated dayType.

Scenario #3—RouteDepotVersion for Specific Time Periods

The RouteDepotVersion embedded in the Schedule Revision may be used to designate temporary service or alternate day types with different activation/deactivation dates within a Schedule Version. Where extra service is provided for a limited number of routes during the period between Thanksgiving and New Years, New Jersey Transit may designate changes to

¹ Three of the four trips would be the same three trips in the weekday list.

their route schedules based on activation and deactivation dates. Similar to Scenario #1, the entire set of trips operating on the active dates should be included in the SDP XML Document.

Physical Database Implementation

The White Paper on Schedule Calendar Date [DataExample_Schedule_Calendar_Date_v1.0.doc] includes the SCD XML Schema as well as a description of a physical database. The White Paper may be found on the SDP web site (see Appendix C for Resources).