METROPOLITAN
TRANSPORTATION
COMMISSION

RTIS Architecture

Volume II: RTIS Data Operations

Deliverable I.D.3

Version 0.2
February 28, 2014

Prepared by:
Leidos, Inc.
1000 Broadway, Suite 675
Oakland, CA 94607

Revision History

Document Revision Description	Author (Organization)	Progress Stage	Date	Version
Initial draft for review.	SAIC / Leidos	Draft	2011	
First round comments	Nisar Ahmed (MTC)	Draft	4/8/2011	Draft 0.1
Review and editing	Keith Kirton (Leidos)	Draft	2/28/2014	Draft 0.2

Table of Contents

1 INTRODUCTION 1

1.1 DOCUMENT PURPOSE 1

1.2 DOCUMENT USE AND INTENDED AUDIENCE 1

1.3 RTIS TECHNICAL MANUAL ORGANIZATION 1

1.4 DOCUMENT CONTENTS 2

1.4.1 Chapter 2: Data Collection 3

1.4.2 Chapter 3: Data Editing and Maintenance 3

1.4.3 Chapter 4: Data Quality and Integrity 3

1.4.4 Chapter 5: Data Transfer Processes 3

2 DATA COLLECTION 4

2.1 TYPES OF DATA COLLECTED 4

2.2 DATA COLLECTION FROM TRANSIT AGENCIES 5

2.3 DATA COLLECTION FREQUENCY 6

2.4 AD-HOC DATA COLLECTION BY THE CONTRACTOR 6

2.5 REGULAR DATA COLLECTION PROCESSES 7

2.5.1 Agency Sign-up Matrix 7

2.5.2 Monthly Reminder Email 9

2.5.3 Agency Holiday Matrix 10

2.5.4 Parking Data Master Spreadsheet 11

2.5.5 QC Sheet Template 12

3 DATA EDITING AND MAINTENANCE 13

3.1 RTD DATA MAINTENANCE ENVIRONMENT 13

3.1.1 RTD Maintenance Database: WebDMS 13

3.1.2 RTD Review Database: ReviewDB 13

3.1.3 RTD Staging Database: StageDB 14

3.2 RTD NON-SPATIAL DATA MAINTENANCE 14
3.2.1 XML Engine 14
3.2.2 Agency-Specific Updates 15
3.2.3 Updating Information Using the WebDMS Application 15
3.2.4 Processing Scripts 21
3.2.5 Real-Time Configuration Data 22
3.2.6 Post to Review Database 23
3.2.7 Quality Control 23
3.2.8 GTFS Validation 23
3.2.9 Landmark Maintenance 25
3.2.10 Holiday Maintenance 27
3.2.11 Parking Data Maintenance 28
3.3 RTD SPATIAL DATA MAINTENANCE 29
3.3.1 Agency Geometry 29
3.3.2 Route Geometry 30
3.3.3 Miscellaneous Spatial Data 30
3.4 TRIP PLANNER DATA MAINTENANCE ENVIRONMENT 32
3.4.1 Trip Planner Maintenance System: MDV-Oak3 32
3.4.2 Transit Trip Planner Staging System: MDV-STG 34
3.4.3 Multi-Modal Trip Planner Staging System: MMTP-STG-TP 35
3.5 TRIP PLANNER NON-SPATIAL DATA MAINTENANCE 35
3.5.1 Agency Maintenance 36
3.5.2 Transit XML Import 37
3.5.3 Stop Maintenance 40
3.5.4 Timetable Maintenance 41
3.5.5 Transfer Associations 42
3.5.6 Fare Maintenance 43
3.5.7 Georeferencing 44
3.5.8 Conversion 44

3.5.9 Landmark Import *45*
3.5.10 Holiday Maintenance *46*
3.5.11 Parking Import *50*
3.5.12 Project Maintenance *50*
3.6 TRIP PLANNER SPATIAL DATA MAINTENANCE 51
3.6.1 Stop Editing and Georeferencing *51*
3.6.2 Route Geometry *52*
3.6.3 Basemap Editing *53*
3.7 CMS DATA MAINTENANCE 54
3.7.1 CMS User Feedback *55*
3.7.2 Transit Service Announcements *56*
3.7.3 Popular Destinations *57*
3.7.4 Promo Boxes *58*
3.7.5 Transit Providers *59*
3.7.6 Page Messages *59*
3.7.7 Data Feed Configuration *59*
3.7.8 Reports *60*
3.8 FILE STORAGE AND SHARING 61
4 QUALITY CONTROL AND QUALITY ASSURANCE 63
4.1 MTC DATA QUALITY STANDARDS 63
4.2 DATA QC STRATEGY 63
4.3 CHECKING PRODUCTION GEOMETRY QC REPORTS 64
4.4 XENU WEBSITE BROKEN LINK CHECK 64
4.5 XML ENGINE QC MODULE 65
4.6 XML ENGINE DATA COMPARISON MODULE 67
4.7 QC SCRIPTS 67
4.8 QC OF TRIP PLANNER DATA 72
4.9 MANTIS 73
4.10 QUALITY ASSURANCE TESTING 73

5 DATA TRANSFER PROCESSES 75
5.1 RTIS TRANSIT XML 75
5.2 XML ENGINE 75
5.2.1 RTD Database Writer Considerations 76
5.2.2 Transfer from RTD to XML 77
5.2.3 Transfer from XML to RTD 77
5.2.4 Transfer from RTD to RTD 77
5.2.5 Transfer from RTD+RTD to MergedXML 77
5.3 DIVA SYNC APPLICATION 77
5.3.1 Sync from MDV-Oak3 to MDV-STG 78
5.3.2 Sync from MDV-STG to MMTP-STG-TP 78
5.3.3 Sync from MDV-STG to Production TTP 79
5.3.4 Sync from MMTP-STG-TP to Production MMTP 79
5.4 TRANSFER DYNAMIC PARTIAL DATA TO RTD 79
5.5 PRODUCTION DEPLOYMENT ISSUES 79

List of Figures

Figure 2-1 – Data Collection Process 5
Figure 2-2 – Agency sign-up matrix 7
Figure 2-3 – Monthly agency reminder email 9
Figure 2-4 – Agency holiday matrix 10
Figure 2-5 – Master Parking Spreadsheet 11
Figure 2-6 – QC Sheet 12
Figure 3-1 – RTD Data Editing Process 13
Figure 3-2 – XML Engine 14
Figure 3-3 – WebDMS Login Screen 15
Figure 3-4 – WebDMS Stop Editor 16
Figure 3-5 – WebDMS Route Editor 17
Figure 3-6 – WebDMS Pattern Composition Editor 18
Figure 3-7 – WebDMS Route Schedule Editor 19
Figure 3-8 – WebDMS Rider Categories 20

Figure 3-9 – WebDMS Fare Definition Editor 21
Figure 3-10 – Real-Time Configuration Export 22
Figure 3-11 – GTFS Validator Desktop and Console.....23
Figure 3-12 – GTFS Validation Report 24
Figure 3-13 – SyncLandmark Script Sample Run.....26
Figure 3-14 – WebDMS Special Days Editor.....27
Figure 3-15 – WebDMS Special Day Services Editor.....28
Figure 3-16 – ArcMap with Route Geometry 29
Figure 3-17 – Map with Route Geometry and Patternstops.....30
Figure 3-18 – Trip Planner Data Editing Process 32
Figure 3-19 – DIVA Data Maintenance Cycle.....36
Figure 3-20 – DIVA Operating Branch.....37
Figure 3-21 – DIVA Operator.....37
Figure 3-22 – DIVA Adjustment Tool 38
Figure 3-23 – DIVA Import Database.....38
Figure 3-24 – DIVA Import Application 39
Figure 3-25 – DIVA Import Log.....40
Figure 3-26 – DIVA Stop Management.....40
Figure 3-27 – DIVA Stop Footpaths.....41
Figure 3-28 – DIVA Stop Tariffs.....41
Figure 3-29 – DIVA Tabular Timetable 42
Figure 3-30 – DIVA Transfer Associations.....43
Figure 3-31 – DIVA oak_fares.xml File 43
Figure 3-32 – DIVA Referencing.....44
Figure 3-33 – DIVA Conversion.....45
Figure 3-34 – Landmark Access Database.....45
Figure 3-35 – GisImport Application 46
Figure 3-36 – DIVA Public Holidays.....47
Figure 3-37 – DIVA Daytypes 48
Figure 3-38 – Daytype Including a Holiday 48
Figure 3-39 – Daytype Excluding a Holiday.....49
Figure 3-40 – Parking Import Scripts 50
Figure 3-41 – DivaGeo Showing Stops Near to Freeway 51
Figure 3-42 – Route Geometry in Wrong Position 52

Figure 3-43 – Route Geometry in Corrected Position 53
Figure 3-44 – DivaGeo Basemap Alteration 54
Figure 3-45 – CMS Home Page (Administrator Account) 55
Figure 3-46 – CMS Feedback Management 56
Figure 3-47 – CMS Announcement Management 57
Figure 3-48 – CMS Popular Destination Management 57
Figure 3-49 – Promo Boxes on Transit 511 Home Page 58
Figure 3-50 – CMS Promo Box Management 58
Figure 3-51 – CMS Transit Providers (Administrator Account) 59
Figure 3-52 – CMS Data Feed Configuration 60
Figure 3-53 – CMS Reports Main Menu 60
Figure 3-54 – CMS Event Statistics 61
Figure 3-55 – REDACTED....62
Figure 4-1 – QC Process 63
Figure 4-2 – QC Sheet....64
Figure 4-3 – Mantis Tracking System 73
Figure 5-1 - Production Data Deployment Phases 75
Figure 5-2 - RTD Database Writer Sync Settings 76
Figure 5-3 - DIVA Sync Application 78

List of Tables

Table 1 – RTIS Technical Manuals....2
Table 2 – RichUI Mapping Data....31
Table 3 – MMTP Mappind Data....31
Table 4 – Transit Tracker Data 31
Table 5 – Errors Detected by XML Engine QC Module 67
Table 6 – QC Scripts 72

List of Abbreviations and Acronyms

CMS	Content Management System
DIVA	A suite of data maintenance software for the MDV trip planner system.
ESRI	Environmental Systems Research Institute
ETP	Enhanced Trip Planner (see MMTP)

GDT	A schema in the RTD to hold basemap data
GIS	Geographic Information Systems
GML	Geography Markup Language
MDV	MentzDV software company
MMTP	Multi-Modal Trip Planner (see ETP)
MTC	Metropolitan Transportation Commission
RTD	Regional Transit Database
RTDNS	A schema in the RTD to hold non-spatial transit data
RTDS	A schema in the RTD to hold spatial data
RTDWEB	A schema in the RTD to hold web interface data
RTIS XML	An XML schema specification for transporting RTIS transit data
RTIS	Regional Transit Information System
SDE	A schema in the RTD to hold the ArcSDE (spatial) database
TAC	Technical Advisory Committee
TIC	Traveler Information Center
TTP	Transit Trip Planner
WebDMS	Web Data Maintenance Suite
XML	Extensible Markup Language

1 INTRODUCTION

1.1 DOCUMENT PURPOSE

This document introduces the reader to the Regional Transit Information System (RTIS) by explaining the RTIS (aka '511 Transit') purpose, function, history, and role within the San Francisco Bay Area's traveler information system, commonly known as "511."

The document then describes the data architecture of the system. It describes the data flows and schema that make up the RTIS data, list of tables, and field and constraints for each data schema.

1.2 DOCUMENT USE AND INTENDED AUDIENCE

This document will primarily be used by MTC and the RTIS contractor as a technical reference for the RTIS data operations. It may also be used by Bay Area transportation partners and other external public agencies to learn about the RTIS data structure. Additionally, it may be used in "request for proposal" solicitation process to help potential bidders gain knowledge about the system in order to prepare their proposal.

1.3 RTIS TECHNICAL MANUAL ORGANIZATION

This document is part of a series of technical manuals, shown in Table 1 that documents MTC's 511 Regional Transit Information System.

RTIS Manual Titles	Purpose
RTIS Architecture:	
Volume 1: RTIS System Architecture	Describe the system environments, the components that make up the system, and how the components are connected together, logically and physically. Documents how the components work together, how the system collects data and handles information requests, and how system's computing logic is structured.
Volume 2: RTIS Data Architecture	Describes how data flows into and through the system, how it is managed within the system and how it is disseminated to the users. Describes the tools used to facilitate this data flow.

RTIS Manual Titles	Purpose
RTIS Operations:	
Volume 1: RTIS Systems Operations	Defines how to operate the public side of the system (i.e., configure, run, and administer the system in terms of the public delivery of all information).
Volume 2: RTIS Data Operations – This document	Defines how data moves through the RTIS - from the transit agencies to the Regional Transit Database to the trip planner. Document covers all aspects of maintaining up to date and accurate data.
RTIS Developers' Manual	This document provides technical guidelines for developers to understand the logical tier of the system. After reading this document a new development team member should feel comfortable to maintain and/or enhance a system component.
RTIS Users' Guides:	
Volume 1: RTIS Data Provider Guide	Describes the processes and tools of the RTIS that facilitate the provision of data from the transit agencies to the system. It also includes a list of requirements that a transit agency must fulfill in providing the data to the RTIS system and the roles and responsibilities both transit agencies and MTC have in sharing and maintaining data.
Volume 2: RTIS Customer Service Representative Guide including Trip Planner Call Center Interface User Guide	Instructions for transit agencies on how to use 511 Transit website including the trip planner call center interface to provide transit service information such as service announcements and transit itineraries to their customers.
Volume 3: Trip Planner User Guide	"How-to" instructions for public users using the transit trip planner
Volume 4: Traveler Information Center (TIC) Users' Guide	Instructions for TIC staff on how to use the RTIS online Content Management System (CMS) tool manage transit service announcements.

Table 1 – RTIS Technical Manuals

Readers looking for information not contained in this document should consult the Table of Contents of the other manuals.

1.4 DOCUMENT CONTENTS

This document, Volume II: RTIS Data Operations, includes the following contents:

1.4.1 Chapter 2: Data Collection

Describes the collection processes and kinds of data collected that are routinely maintained in the RTIS Transit 511 system.

1.4.2 Chapter 3: Data Editing and Maintenance

Describes the processes, tools and interaction of systems used for the maintenance of data used by the RTIS Transit 511 system.

1.4.3 Chapter 4: Data Quality and Integrity

1.4.4 Chapter 5: Data Transfer Processes

Describes the processes and tool used for transferring data throughout the various systems used in the data maintenance chain: maintenance, staging, and production.

2 DATA COLLECTION

2.1 TYPES OF DATA COLLECTED

There are two types of transit data collected and maintained in the Regional Transit Database (RTD): they are non-spatial and spatial data. Non-spatial transit data includes the following kinds of data elements:

- routes
- pattern and headsign info
- stops
- timepoints
- trips and schedules
- designated transfer points
- landmarks
- fares
- fare categories and zones
- fare transfer policies
- holiday services
- facility and parking lot
- real-time configuration
- traffic incidents

A certain amount of data maintained in the RTD is collected through the RTIS online Content Management System (CMS), a password protected, web based extension. CMS data is managed directly by CMS users who are usually employees of the transit agencies served by the RTIS. CMS data includes:

- web application events
- transit agency contact information
- route descriptions
- non-GIS transit service maps (PDF or GIF)
- service announcements
- popular destinations
- 511 Transit user feedbacks and responses
- predefined user feedback responses
- website usage reports and statistics
- CMS user information
- promobox images

Spatial data includes data such as:

- physical stop locations
- landmark and popular destination locations
- route/pattern geometry/shapes

- agency service area maps
- fare zone maps
- street basemap
- highway shields

Some spatial data such as the highway and basemap information remain static for long periods of time, and only occasionally are they updated. Other information such as route shapes are updated and edited by the Transit 511 contractor as a matter of routine maintenance.

2.2 DATA COLLECTION FROM TRANSIT AGENCIES

Transit data is collected from transit agencies in a variety of formats:

- Non-specific electronic formats (text file, Excel, PDF, website, etc.)
- Agency-specific file formats
- GTFS+
- Transit XML

The non-specific formatted data is entered into the Transit 511 system manually. Agency-specific and GTFS+ formats are first converted into Transit XML, and then Transit XML files are imported into Transit 511.

Transit agencies go through major service changes, normally scheduled between one and four times each year. These regular service changes are called “sign-ups”. The RTIS contractor has established a process to handle data updates for these scheduled service changes. The following diagram, Figure 2-1, depicts the process of data collection.

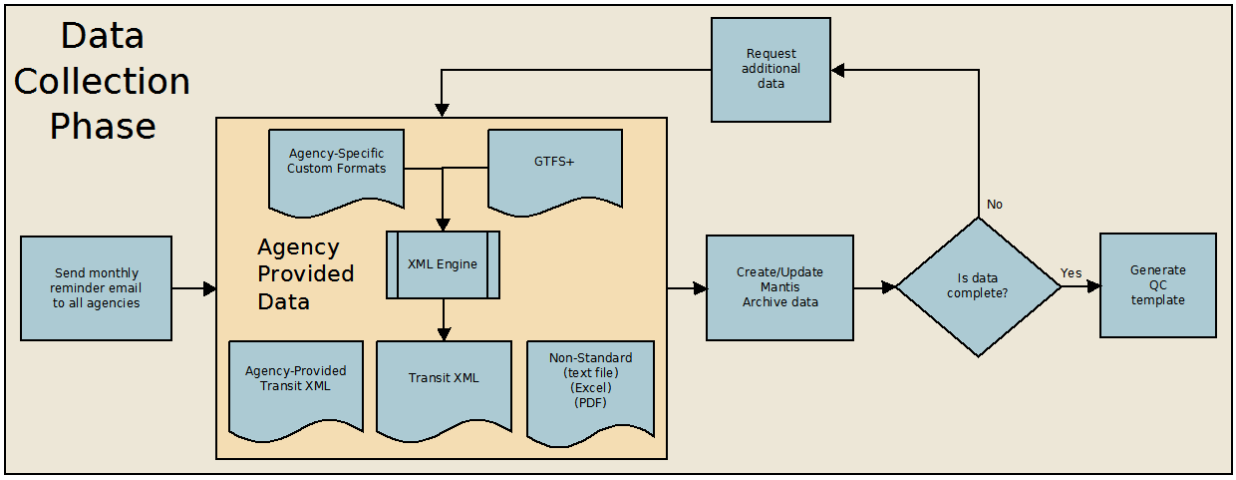


Figure 2-1 – Data Collection Process

2.3 DATA COLLECTION FREQUENCY

The frequency of scheduled sign-ups is agency dependent. Official sign-ups typically occur when an agency makes a planned change to its service. Near the beginning of each month, a reminder email is sent out to the transit agencies reminding and requesting they provide information about their sign-up dates and any other upcoming changes to their data.

In addition to scheduled agency sign-ups, various other activities can trigger data collection such as: a routine spot check of data accuracy as part of QC efforts; being notified through user or MTC feedback that a change has occurred; periodic review of transit agency web-sites; and notifications received in response to agency email subscriptions. A quarterly data QC check is performed every four months for agencies that have not had a sign-up during that time.

As part of each four month QC checkup, select transit agency websites are reviewed for notification of service changes, and a sample of service schedules posted on their websites are cross-checked against the data in the RTD. Any differences found are first confirmed with the agency, and then appropriate actions are taken to collect and update the data based on the level of changes.

User feedback and MTC audits can also trigger data correction/update. When users or MTC identify discrepancies in the data, the correct data is collected and entered into the system. Sometime the only notification of data updates comes directly from public users through the online feedback process.

Agency personnel do not always respond in a timely manner to requests for information about upcoming changes. When an agency does not respond, the agency's website is consulted to determine if any upcoming changes have been announced or missed. For agencies that do not respond after several repeated email attempts, a phone call is usually in order. This can help reestablish contact, or identify personnel changes that have occurred.

The RTIS contractor's data maintenance team members are encouraged to subscribe to individual agency news email lists. Sometimes these email notifications will announce upcoming changes that would otherwise be overlooked. News media including MTC's news clippings (a daily email containing regional transportation news headlines) is also used as information source for transit agency service changes.

2.4 AD-HOC DATA COLLECTION BY THE CONTRACTOR

Not all of the data collected is supplied directly by the transit agencies. This would include data such as facilities, landmarks, and parking lots. These data types are collected by the RTIS or other contractors, and the system is updated as and when needed.

When an agency cannot otherwise provide the information, the RTIS contractor will manually collect rail station facility location and attribute data with the help of a GPS device and data entry tools. Further, the RTIS contractor will survey all rail stations for which the facility data currently exists in the system. If new stations for which the facility data needs to be collected are identified, then those stations are included.

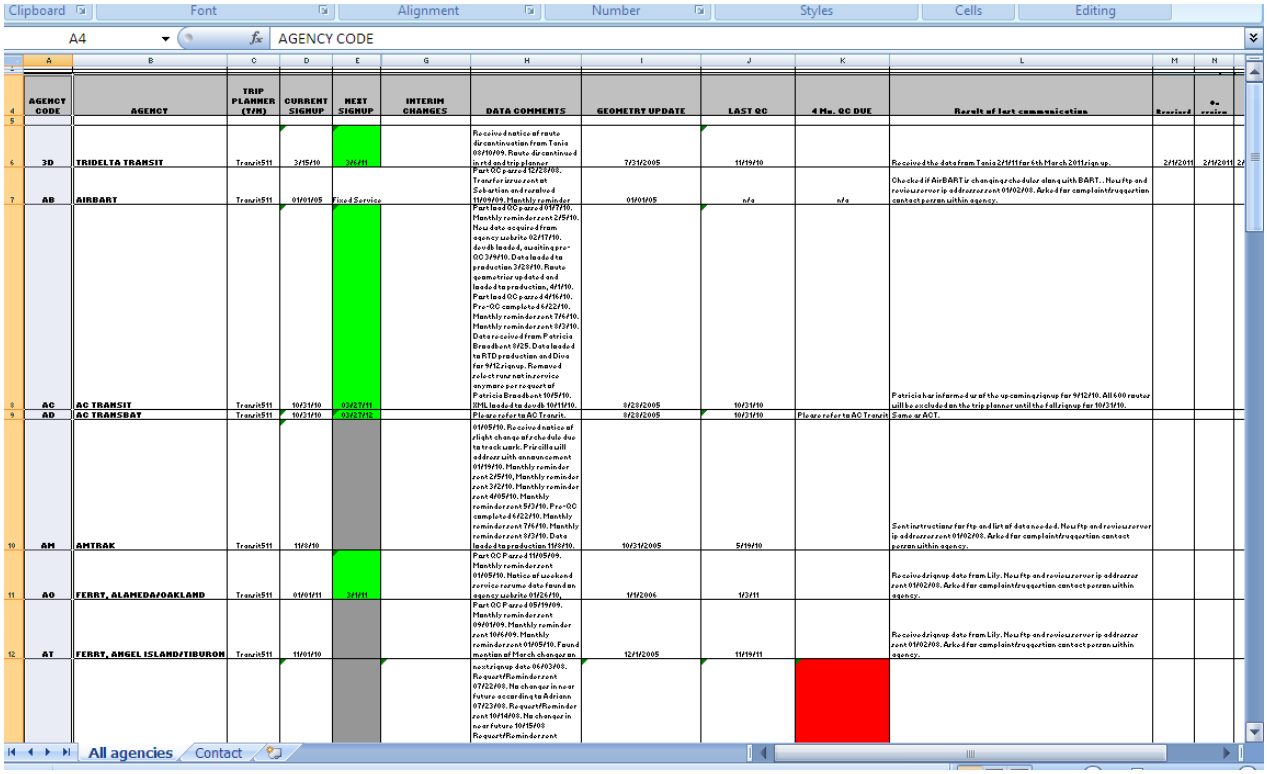
A field technician visits all the train stations on the list and collects information for those facilities. Data collected includes information about common attributes, such as: bike racks, parking lot access and number of stalls, entrances, exits, stairs, elevators, escalators, etc. The survey technician will use a report generated from the current facility data in the RTD as the base. Base data is verified and updated, as necessary, during the survey. Once the field survey is completed, the information is entered into the RTD manually. As of the time of this writing, no software tool is available for direct entry of these ad-hoc data elements into the RTD.

2.5 Regular Data Collection Processes

2.5.1 Agency Sign-up Matrix

The agency sign-up matrix is a Microsoft Excel document containing an all-inclusive list of transit agencies with contact information, current data status, sign-up dates, and reminders of upcoming action items. The sign-up matrix is continually updated whenever new information becomes known, and is distributed weekly to the RTIS contractor data maintenance employees and to MTC. A copy of the current sign-up matrix is maintained on the shared storage server "oak-storage" at the following location (see section 3.8 below for more on shared storage):

REDACTED



AGENCY CODE	AGENCY	TRIP PLANNER (Y/N)	CURRENT SIGNUP	NEXT SIGNUP	INTERIM CHANGES	DATA COMMENTS	GEOMETRY UPDATE	LAST QC	4 Mo. QC DUE	Result of last communication	Received	Re-review
3D	TRIDELTA TRANSIT	Transit511	3/15/10	3/4/11		Received notice of route discontinuation from Tonia 01/09/09. Route discontinued in rtd and trip planner	7/31/2005	11/19/10		Received the data from Tonia 2/11/11 for 4th March 2011 sign up.	2/11/2011	2/14/2011 2/
AB	AIRBART	Transit511	01/01/05	Fixed Service		Part OC parsed 12/28/08. Transfer issues sent at Sebastian and received 11/09/09. Monthly reminder	01/01/05	n/a	n/a	Checked if AirBART is changing schedular along with BART.. New ftp and revious server ip address sent 01/02/08. Asked for complaint/suggestion contact person within agency.		
AC	AC TRANSIT	Transit511	10/31/10	02/27/11		Part load OC parsed 09/17/10. Monthly reminder sent 2/5/10. New data acquired from agency website 02/17/10. dev db loaded, awaiting pre-QC 3/9/10. Data loaded to production 3/23/10. Route geometries updated and loaded to production, 4/1/10. Part load OC parsed 4/16/10. Pre-QC completed 4/22/10. Monthly reminder sent 7/6/10. Monthly reminder sent 9/3/10. Data received from Patricia Broadbent 9/25. Data loaded to RTD production and Dive far 9/12 sign up. Removed route/stone station service anymore per request of Patricia Broadbent 10/5/10. XML loaded to dev db 10/11/10.	8/28/2005	10/31/10		Patricia has informed us of the upcoming sign up far 9/12/10. All 600 routes will be excluded on the trip planner until the fall sign up far 10/31/10.		
AD	AC TRANSBAY	Transit511	10/31/10	02/27/10		Please refer to AC Transit.	8/28/2005	10/31/10	Please refer to AC Transit	Same as ACT.		
AM	AMTRAK	Transit511	11/8/10			01/05/10. Received notice of slight change of schedule due to track work. Priscilla will address with announcement 01/19/10. Monthly reminder sent 2/5/10, Monthly reminder sent 3/2/10. Monthly reminder sent 4/05/10. Monthly reminder sent 5/3/10. Pre-QC completed 6/22/10. Monthly reminder sent 7/6/10. Monthly reminder sent 8/3/10. Data loaded to production 11/5/10.	10/31/2005	5/19/10		Sent instructions for ftp and list of data needed. New ftp and revious server ip address sent 01/02/08. Asked for complaint/suggestion contact person within agency.		
AO	FERRY, ALAMEDA/OAKLAND	Transit511	01/01/11	3/4/11		Part OC Parsed 11/05/09. Monthly reminder sent 01/05/10. Notice of weekend service resume date found on agency website 01/26/10.	1/1/2006	1/3/11		Received sign up date from Lily. New ftp and revious server ip address sent 01/02/08. Asked for complaint/suggestion contact person within agency.		
AT	FERRY, ANGEL ISLAND/TIBURON	Transit511	11/01/10			Part OC Parsed 05/19/09. Monthly reminder sent 09/01/09. Monthly reminder sent 10/6/09. Monthly reminder sent 01/05/10. Found mention of March changes on	12/1/2005	11/19/11		Received sign up date from Lily. New ftp and revious server ip address sent 01/02/08. Asked for complaint/suggestion contact person within agency.		
						next sign up date 06/03/08. Request/Reminder sent 07/22/08. No change in near Future according to Adriana. 07/23/08. Request/Reminder sent 10/14/08. No change in near future 10/15/08 Request/Reminder sent						

Figure 2-2 – Agency sign-up matrix

For each transit agency in the system, the following information is maintained within the sign-up matrix, among other items:

- CURRENT SIGNUP: The effective date of most recently completed sign-up, which is updated after each agency sign-up data is processed.
- NEXT SIGNUP: The date, if known, of next sign-up for the agency based on the current date of the sign-up matrix. These cells are color coded as follows:
    - RED if the sign-up date is within one month
    - YELLOW if the sign-up date is in two months
    - GREEN if the sign-up date is beyond two months
    - GREY if the sign-up date is unknown
- MANTIS #: The number of the sign-up issue in the Mantis tracking system
- INTERIM CHANGES: Minor service changes that affect a handful of routes, or otherwise not referred to as a scheduled service change (sign-up). Because these changes often happen between sign-ups they are called interim changes.
- DATA COMMENTS: Provides a record of all communications between the RTIS contractor and the agency since the date that the last sign-up passed the post-QC process. This provides a short-term, running journal of where in the sign-up process the contractor currently stands in regards to a particular agency's upcoming sign-up. Contractor maintains notes on when monthly reminder notices are sent, promises made by the agencies to provide data, and any other relevant communications and/or updates.
- GEOMETRY UPDATE: Date of the last update for transit route/pattern shapes (geometry).
- LAST QC: The recorded date of the last QC was performed for any number of routes for the agency.
- 4 MO. QC: Date when the next four month QC is to be performed. This provides an at-a-glance opportunity to see which agencies are eligible for a four month QC. These cells are color coded as follows:
    - GREEN if the four month QC is imminent
    - YELLOW if the four month QC is within one month overdue
    - RED if the four month QC is over one month overdue
- RESULTS OF LAST COMMUNICATION; RECEIVED; ON REVIEW; QC; LOADED ON IJP (DIVA); LOADED ON WEB; ROUTE MAPS UPDATED- These columns are used to keep track of the overall status, and dates that individual steps are completed in the data update (sign-up) process.

Primary contact information for this agency kept in a second worksheet. An agency contact usually consists of only one person, but can be several if there are backup personnel identified. Email address and phone numbers are included when available. This information is verified and updated at least annually.

The sign-up matrix is saved with the date of the last file update at the end of the filename.

2.5.2 MONTHLY REMINDER EMAIL

As briefly mentioned in section 2.3 above, at the beginning of each month, a reminder email is sent to the agency recipient contact list. A copy of the current reminder email text can be found on the shared storage server "oak-storage" at the following location:

REDACTED

The reminder email is sent back to the sender, with relevant RTIS contractor and MTC personnel copied. By sending the email to the sender, this provides a name in the TO field of the email. The agency distribution list is then added to the blind carbon copy (BCC) field. This provides privacy to the contact list, and also prevents all of the agency contacts from receiving replies from other recipients should one of the recipients use the "Reply All" feature.

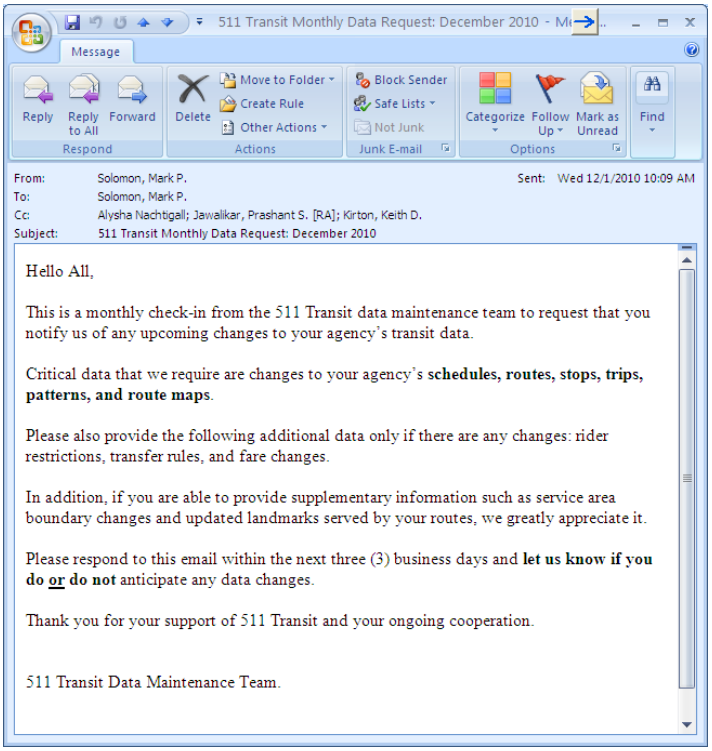


Figure 2-3 – Monthly agency reminder email

A transit agency distribution list, All_Agencies_MailingList, is maintained in the same folder above. The sender removes from the distribution list each month those agencies that meet the following criteria:

- Agencies for whom an upcoming sign-up date is already known
- Agencies that have completed a sign-up within the previous 45 days
- Agencies for whom it is known that no sign-up will be occurring until further notice (which in some cases can be several years).

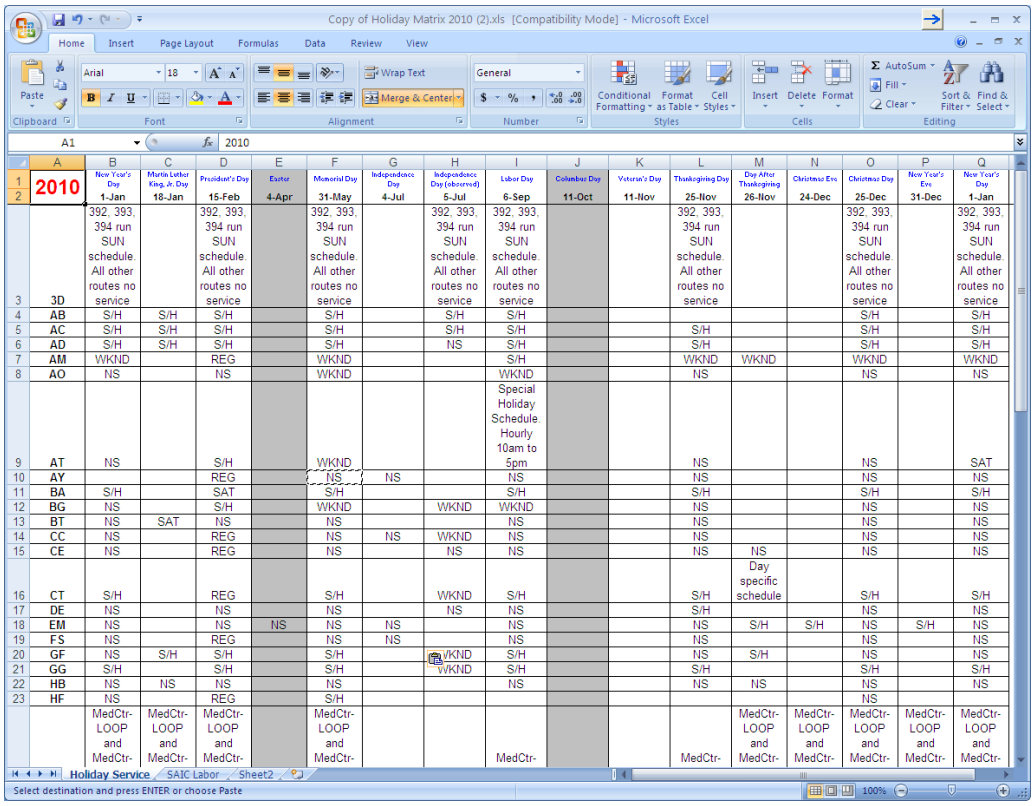
Once this email is sent out, the Data Comments column in the sign-up matrix is updated to log the distribution of the monthly reminder email.

Around the middle of the month, for any agency that has not replied to the monthly reminder email, that agency's website is visually inspected for announcements of changes in order to further ensure that RTIS data remains current. After several failures by an agency to reply, an attempt will be made to call the contact person by telephone in order to make contact, and to make sure that the contact person(s) are current.

2.5.3 Agency Holiday Matrix

The agency holiday matrix is a Microsoft Excel document containing notes about holiday service schedules for all the holidays each transit agency observes throughout an entire calendar year. In January of each year, a new copy of the holiday matrix is created for that year. The previous year's service may be copied over to the new year's document, but all agency websites are checked for any changes. Agency contacts are queried whenever information is not present on the agency website, or is too vague for complete understanding. A copy of the current holiday matrix is maintained on the shared storage server "oak-storage" at the following location:

REDACTED

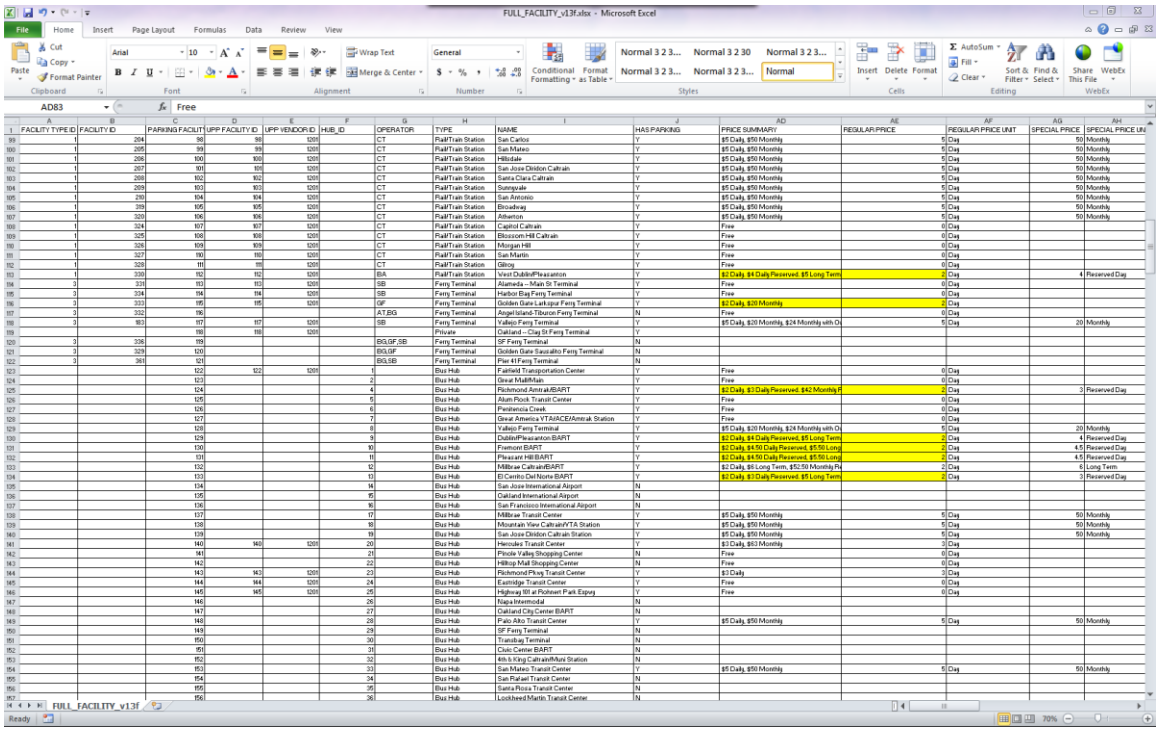


	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
1	2010	New Year's Day	Martin Luther King, Jr. Day	President's Day	Easter	Memorial Day	Independence Day	Independence Day (observed)	Labor Day	Columbus Day	Veteran's Day	Thanksgiving Day	Day After Thanksgiving	Christmas Eve	Christmas Day	New Year's Eve	New Year's Day
2		1-Jan	18-Jan	15-Feb	4-Apr	31-May	4-Jul	5-Jul	6-Sep	11-Oct	11-Nov	25-Nov	26-Nov	24-Dec	25-Dec	31-Dec	1-Jan
3	3D	392, 393, 394 run SUN schedule. All other routes no service		392, 393, 394 run SUN schedule. All other routes no service		392, 393, 394 run SUN schedule. All other routes no service		392, 393, 394 run SUN schedule. All other routes no service	392, 393, 394 run SUN schedule. All other routes no service			392, 393, 394 run SUN schedule. All other routes no service			392, 393, 394 run SUN schedule. All other routes no service		392, 393, 394 run SUN schedule. All other routes no service
4	AB	S/H	S/H	S/H		S/H		S/H	S/H						S/H		S/H
5	AC	S/H	S/H	S/H		S/H		S/H	S/H			S/H			S/H		S/H
6	AD	S/H	S/H	S/H		S/H		NS	S/H			S/H			S/H		S/H
7	AM	WKND		REG		WKND			S/H			WKND	WKND		WKND		WKND
8	AO	NS		NS		WKND			WKND			NS			NS		NS
9	AT	NS		S/H		WKND			Special Holiday Schedule. Hourly 10am to 5pm			NS			NS		SAT
10	AY			REG		NS	NS		NS			NS			NS		NS
11	BA	S/H		SAT		S/H			S/H			S/H			S/H		S/H
12	BG	NS		S/H		WKND		WKND	WKND			NS			NS		NS
13	BT	NS	SAT	NS		NS			NS			NS			NS		NS
14	CC	NS		REG		NS	NS	WKND	NS			NS			NS		NS
15	CE	NS		REG		NS		NS	NS			NS	NS		NS		NS
16	CT	S/H		REG		S/H		WKND	S/H			S/H	Day specific schedule		S/H		S/H
17	DE	NS		NS		NS		NS	NS			S/H			NS		NS
18	EM	NS		NS	NS	NS	NS		NS			NS	S/H	S/H	NS	S/H	NS
19	FS	NS		REG		NS	NS		NS			NS			NS		NS
20	GF	NS	S/H	S/H		S/H		WKND	S/H			NS	S/H		NS		NS
21	GG	S/H		S/H		S/H		WKND	S/H			S/H			S/H		S/H
22	HB	NS	NS	NS		NS			NS			NS	NS		NS		NS
23	HF	NS		REG		S/H									NS		
		MedCtr-LOOP and MedCtr-	MedCtr-LOOP and MedCtr-	MedCtr-LOOP and MedCtr-		MedCtr-LOOP and MedCtr-			MedCtr-			MedCtr-	MedCtr-LOOP and MedCtr-	MedCtr-LOOP and MedCtr-	MedCtr-LOOP and MedCtr-	MedCtr-LOOP and MedCtr-	MedCtr-LOOP and MedCtr-

Figure 2-4 – Agency holiday matrix

2.5.4 Parking Data Master Spreadsheet

The multi-modal trip planner is a version of the transit trip planner capable of producing driving directions in addition to standard transit itineraries. This expands the range of transit options beyond the maximum 1-mile walking distance. In order to drive-to-transit itineraries to be viable, information on the region's parking facilities has been collected into a spreadsheet, which in turn has been loaded into the RTD.



FACILITY TYPE ID	FACILITY ID	PARKING FACILIT	UPP FACILITY ID	UPP VENDOR ID	HUB_ID	OPERATOR	TYPE	NAME	HAS PARKING	PRICE SUMMARY	REGULAR PRICE	REGULAR PRICE UNIT	SPECIAL PRICE	SPECIAL PRICE UNI
1	204	98	98	1201		CT	Rail/Train Station	San Carlos	Y	$5 Daily, $50 Monthly	5	Day	50	Monthly
1	205	99	99	1201		CT	Rail/Train Station	San Mateo	Y	$5 Daily, $50 Monthly	5	Day	50	Monthly
1	206	100	100	1201		CT	Rail/Train Station	Hillsdale	Y	$5 Daily, $50 Monthly	5	Day	50	Monthly
1	207	101	101	1201		CT	Rail/Train Station	San Jose Diridon Caltrain	Y	$5 Daily, $50 Monthly	5	Day	50	Monthly
1	208	102	102	1201		CT	Rail/Train Station	Santa Clara Caltrain	Y	$5 Daily, $50 Monthly	5	Day	50	Monthly
1	209	103	103	1201		CT	Rail/Train Station	Sunnyvale	Y	$5 Daily, $50 Monthly	5	Day	50	Monthly
1	210	104	104	1201		CT	Rail/Train Station	San Antonio	Y	$5 Daily, $50 Monthly	5	Day	50	Monthly
1	211	105	105	1201		CT	Rail/Train Station	Broadway	Y	$5 Daily, $50 Monthly	5	Day	50	Monthly
1	320	106	106	1201		CT	Rail/Train Station	Atherton	Y	$5 Daily, $50 Monthly	5	Day	50	Monthly
1	324	107	107	1201		CT	Rail/Train Station	Capitol Caltrain	Y	Free	0	Day		
1	325	108	108	1201		CT	Rail/Train Station	Blossom Hill Caltrain	Y	Free	0	Day		
1	326	109	109	1201		CT	Rail/Train Station	Morgan Hill	Y	Free	0	Day		
1	327	110	110	1201		CT	Rail/Train Station	San Martin	Y	Free	0	Day		
1	328	111	111	1201		CT	Rail/Train Station	Gilroy	Y	Free	0	Day		
1	330	112	112	1201		BA	Rail/Train Station	West Dublin/Pleasanton	Y	$2 Daily, $4 Daily Reserved, $5 Long Term	2	Day	4	Reserved Day
3	331	113	113	1201		SB	Ferry Terminal	Alameda – Main St Terminal	Y	Free	0	Day		
3	224	114	114	1201		SB	Ferry Terminal	Harbor Bay Ferry Terminal	Y	Free	0	Day		
3	333	115	115	1201		GF	Ferry Terminal	Golden Gate Larkspur Ferry Terminal	Y	$2 Daily, $20 Monthly	2	Day		
3	332	116				AT,BG	Ferry Terminal	Angel Island-Tiburon Ferry Terminal	N	Free	0	Day		
3	183	117	117	1201		SB	Ferry Terminal	Vallejo Ferry Terminal	Y	$5 Daily, $20 Monthly, $24 Monthly with O	5	Day	20	Monthly
		118	118	1201			Private	Oakland – Clay St Ferry Terminal	Y					
3	336	119				BG,GF,SB	Ferry Terminal	SF Ferry Terminal	N					
3	329	120				BG,GF	Ferry Terminal	Golden Gate Sausalito Ferry Terminal	N					
3	361	121				BG,SB	Ferry Terminal	Pier 41 Ferry Terminal	N					
		122	122	1201	1		Bus Hub	Fairfield Transportation Center	Y	Free	0	Day		
		123			2		Bus Hub	Great Mall/Main	Y	Free	0	Day		
		124			4		Bus Hub	Richmond Amtrak/BART	Y	$2 Daily, $3 Daily Reserved, $42 Monthly P	2	Day	3	Reserved Day
		125			5		Bus Hub	Alum Rock Transit Center	Y	Free	0	Day		
		126			6		Bus Hub	Penitencia Creek	Y	Free	0	Day		
		127			7		Bus Hub	Great America VTA/ACE/Amtrak Station	Y	Free	0	Day		
		128			8		Bus Hub	Vallejo Ferry Terminal	Y	$5 Daily, $20 Monthly, $24 Monthly with O	5	Day	20	Monthly
		129			9		Bus Hub	Dublin/Pleasanton BART	Y	$2 Daily, $4 Daily Reserved, $5 Long Term	2	Day	4	Reserved Day
		130			10		Bus Hub	Fremont BART	Y	$2 Daily, $4.50 Daily Reserved, $5.50 Long	2	Day	4.5	Reserved Day
		131			11		Bus Hub	Pleasant Hill BART	Y	$2 Daily, $4.50 Daily Reserved, $5.50 Long	2	Day	4.5	Reserved Day
		132			12		Bus Hub	Milbrae Caltrain/BART	Y	$2 Daily, $6 Long Term, $52.50 Monthly Pa	2	Day	6	Long Term
		133			13		Bus Hub	El Cerrito Del Norte BART	Y	$2 Daily, $3 Daily Reserved, $5 Long Term	2	Day	3	Reserved Day
		134			14		Bus Hub	San Jose International Airport	N					
		135			15		Bus Hub	Oakland International Airport	N					
		136			16		Bus Hub	San Francisco International Airport	N					
		137			17		Bus Hub	Milbrae Transit Center	Y	$5 Daily, $50 Monthly	5	Day	50	Monthly
		138			18		Bus Hub	Mountain View Caltrain/VTA Station	Y	$5 Daily, $50 Monthly	5	Day	50	Monthly
		139			19		Bus Hub	San Jose Diridon Caltrain Station	Y	$5 Daily, $50 Monthly	5	Day	50	Monthly
		140	140	1201	20		Bus Hub	Hercules Transit Center	Y	$3 Daily, $63 Monthly	3	Day		
		141			21		Bus Hub	Pinole Valley Shopping Center	N	Free	0	Day		
		142			22		Bus Hub	Hilltop Mall Shopping Center	N	Free	0	Day		
		143	143	1201	23		Bus Hub	Richmond Pkwy Transit Center	Y	$3 Daily	3	Day		
		144	144	1201	24		Bus Hub	Eastridge Transit Center	Y	Free	0	Day		
		145	145	1201	25		Bus Hub	Highway 101 at Ploheer Park Espuq	Y	Free	0	Day		
		146			26		Bus Hub	Napa Intermodal	N					
		147			27		Bus Hub	Oakland City Center BART	N					
		148			28		Bus Hub	Palo Alto Transit Center	Y	$5 Daily, $50 Monthly	5	Day	50	Monthly
		149			29		Bus Hub	SF Ferry Terminal	N					
		150			30		Bus Hub	Transbay Terminal	N					
		151			31		Bus Hub	Civic Center BART	N					
		152			32		Bus Hub	4th & King Caltrain/Muni Station	N					
		153			33		Bus Hub	San Mateo Transit Center	Y	$5 Daily, $50 Monthly	5	Day	50	Monthly
		154			34		Bus Hub	San Rafael Transit Center	N					
		155			35		Bus Hub	Santa Rosa Transit Center	N					
		156			36		Bus Hub	Lockheed Martin Transit Center	N					

Figure 2-5 – Master Parking Spreadsheet

The file name is versioned with a numeric portion and an alphabetic portion, for example "FULL_FACILITY_v13f". The number indicates the version of the spreadsheet structure. For instance, if a column is added or changed, the number part of the version will increment. The alphabetic portion will increment every time the data contents are updated.

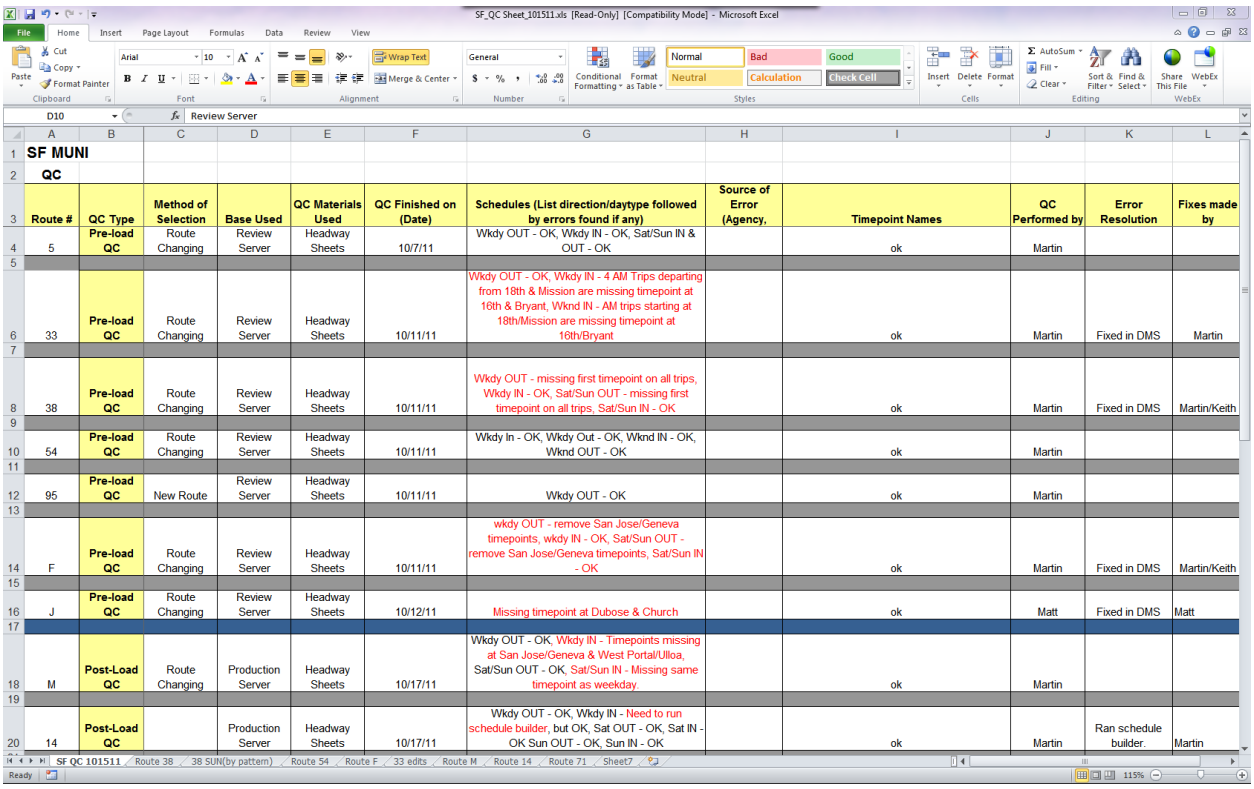
With each new version, the highlighting of cells is cleared, and only cells updated in the new version of the file are highlighted. This makes it easy to determine what changed with each version of the file. A copy of the current parking spreadsheet is maintained on the shared storage server "oak-storage" at the following location:

REDACTED

2.5.5 QC Sheet Template

An important part of each sign-up with the quality control (QC) of data. Along with each sign-up, a QC spreadsheet is completed. A sample of routes is quality checked prior to production deployment, and a smaller sample is checked after deployment. A copy of the blank QC sheet template is maintained on the shared storage server "oak-storage" at the following location:

REDACTED



SF MUNI

QC

Route #	QC Type	Method of Selection	Base Used	QC Materials Used	QC Finished on (Date)	Schedules (List direction/daytype followed by errors found if any)	Source of Error (Agency,	Timepoint Names	QC Performed by	Error Resolution	Fixes made by
5	Pre-load QC	Route Changing	Review Server	Headway Sheets	10/7/11	Wkdy OUT - OK, Wkdy IN - OK, Sat/Sun IN & OUT - OK		ok	Martin		
33	Pre-load QC	Route Changing	Review Server	Headway Sheets	10/11/11	Wkdy OUT - OK, Wkdy IN - 4 AM Trips departing from 18th & Mission are missing timepoint at 16th & Bryant, Wknd IN - AM trips starting at 18th/Mission are missing timepoint at 16th/Bryant		ok	Martin	Fixed in DMS	Martin
38	Pre-load QC	Route Changing	Review Server	Headway Sheets	10/11/11	Wkdy OUT - missing first timepoint on all trips, Wkdy IN - OK, Sat/Sun OUT - missing first timepoint on all trips, Sat/Sun IN - OK		ok	Martin	Fixed in DMS	Martin/Keith
54	Pre-load QC	Route Changing	Review Server	Headway Sheets	10/11/11	Wkdy In - OK, Wkdy Out - OK, Wknd IN - OK, Wknd OUT - OK		ok	Martin		
95	Pre-load QC	New Route	Review Server	Headway Sheets	10/11/11	Wkdy OUT - OK		ok	Martin		
F	Pre-load QC	Route Changing	Review Server	Headway Sheets	10/11/11	wkdy OUT - remove San Jose/Geneva timepoints, wkdy IN - OK, Sat/Sun OUT - remove San Jose/Geneva timepoints, Sat/Sun IN - OK		ok	Martin	Fixed in DMS	Martin/Keith
J	Pre-load QC	Route Changing	Review Server	Headway Sheets	10/12/11	Missing timepoint at Dubose & Church		ok	Matt	Fixed in DMS	Matt
M	Post-Load QC	Route Changing	Production Server	Headway Sheets	10/17/11	Wkdy OUT - OK, Wkdy IN - Timepoints missing at San Jose/Geneva & West Portal/Ulloa, Sat/Sun OUT - OK, Sat/Sun IN - Missing same timepoint as weekday.		ok	Martin		
14	Post-Load QC		Production Server	Headway Sheets	10/17/11	Wkdy OUT - OK, Wkdy IN - Need to run schedule builder, but OK, Sat OUT - OK, Sat IN - OK Sun OUT - OK, Sun IN - OK		ok	Martin	Ran schedule builder.	Martin

Figure 2-6 – QC Sheet

3 Data Editing and Maintenance

3.1 RTD Data Maintenance Environment

Before any data is ready for release to the public by publishing it on production system, data must first make its way through the maintenance and review systems. What follows is a brief description of the RTD database servers and systems used for getting data into a production ready state.

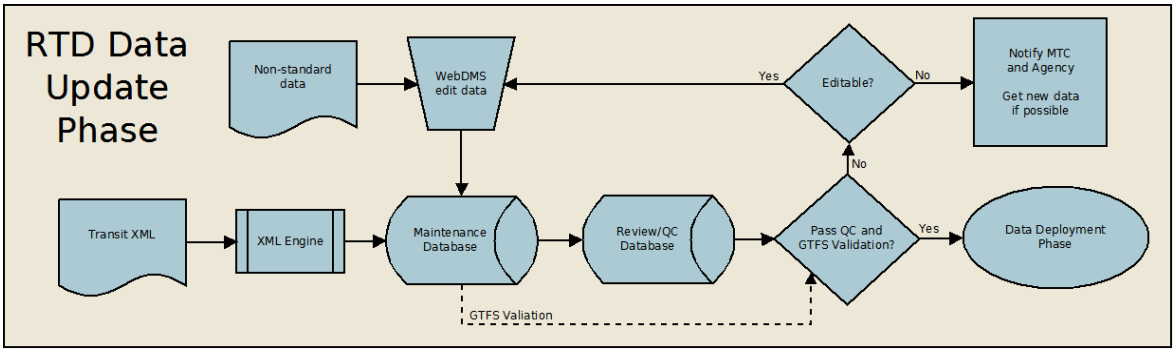


Figure 3-1 – RTD Data Editing Process

A description of the Trip Planner editing and maintenance enviornment follows in sections 3.4 and 3.5 below.

3.1.1 RTD Maintenance Database: WebDMS

The principle RTD database used for the maintenace of data is called WebDMS. All new data intended for future release is imported directly into the WebDMS database and/or edited manually using a web-based application of the same name, WebDMS.

All manual updates to data are entered using a software tool called WebDMS, and all changes take place against the WebDMS database. Agency provided data files are first converted to Transit XML, or are already in Transit XML format. The Transit XML file is imported into the WebDMS database using a software tool called XML Engine. Both software tools are described below in section 3.3.

3.1.2 RTD Review Database: ReviewDB

After data editing is complete and data is ready for review, it is copied from the WebDMS database to another database called ReviewDB. The ReviewDB database is the source for a Transit 511 web application specifically used to review in an offline location, but view the data as it will be seen once it is in production. At the time of this writing, the current URL for the review website is:

REDACTED

3.1.3 RTD Staging Database: StageDB

A copy of each agency's production-ready data is kept on a staging database called StageDB. Agency data is not deployed to production until the night before its effective date. Until then, the data sits ready on StageDB. The data on StageDB can be combined with the data on WebDMS to create a current + future dataset for use in the trip planner (see section ???? below).

3.2 RTD Non-Spatial Data Maintenance

Non-spatial data in the RTD is comprised of transit elements such as: agency, routes, patterns, stops, trips, and fares. In addition to these are some extra-transit elements such as: landmarks, holidays, facilities, hubs, parking, and real-time configuration data.

The data maintenance process begins with the data collection phase. As discussed in Chapter 2 above, some agencies have their own proprietary electronic export formats which must first be converted into a Transit XML document. The Transit XML format is documented in the RTIS Data Architecture manual. Some agencies are able to provide the Transit XML directly from their systems. Once the Transit XML file has been obtained, it is imported into the maintenance database for editing and review. If an agency cannot provide a Transit XML, then all updates are performed manually.

3.2.1 XML Engine

A software tool called XML Engine is able to read and write transit agency data to and from an RTD compatible database. It can move data directly between databases, and it can also read and write Transit XML data files. Special versions of XML Engine are also maintained with select transit agencies in order to convert their special data formats into Transit XML files.

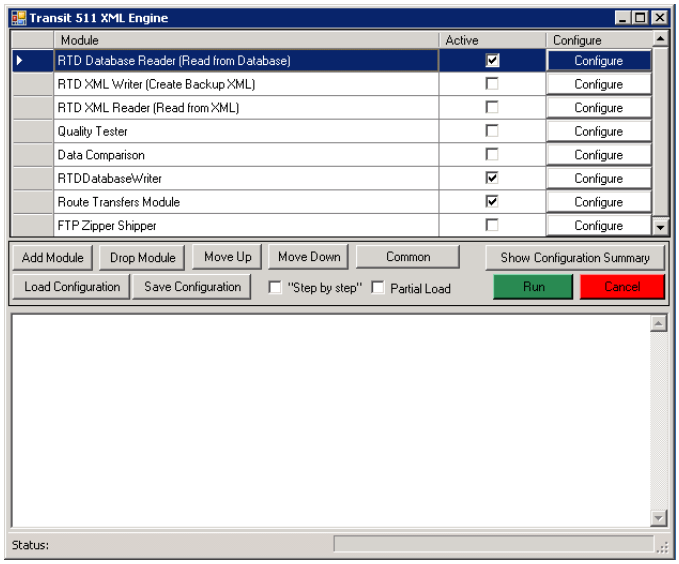


Figure 3-2 – XML Engine

3.2.2 AGENCY-SPECIFIC UPDATES

Some agencies have specific data maintenance processes that need to be performed repeadetly with every sign-up. These agency-specific instructions are noted in a text file called 'AGENCY NOTES (READ EVERY SIGN-UP).txt' which is maintained on the shared storage server "oak-storage" at the following location:

REDACTED

In this document special data update instructions, if any, can be looked up by the agency name.

3.2.3 UPDATING INFORMATION USING THE WEBDMS APPLICATION

The RTIS contractor developed and maintains a password protected, web-enabled tool called Data Maintenance Suite, or WebDMS. This tool is used to make edits to the transit data on the maintenance RTD database. At the time of this writing, the current URL for accessing the WebDMS application is:

REDACTED

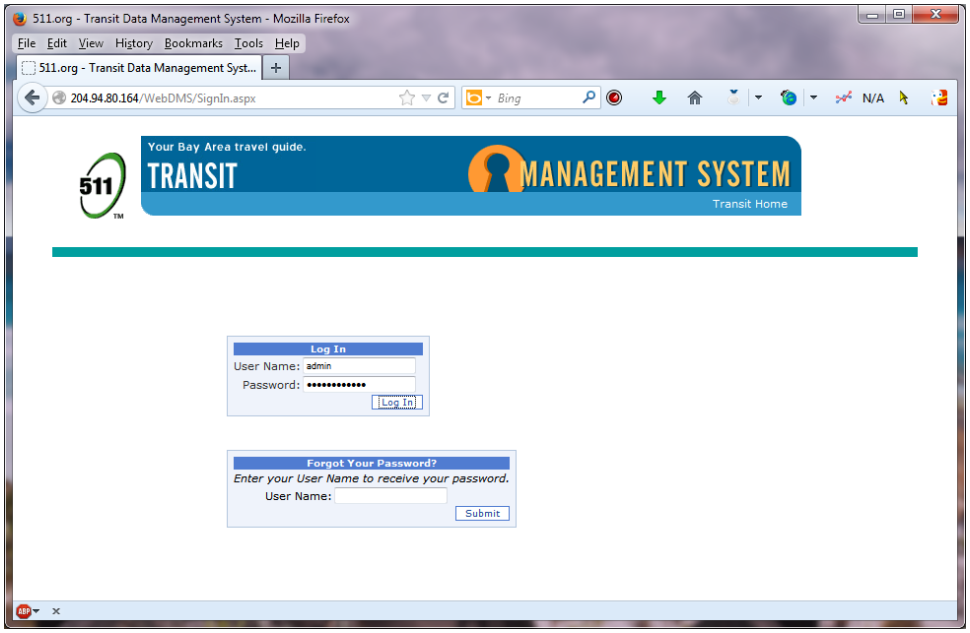


Figure 3-3 – WebDMS Login Screen

3.2.3.1 AGENCY

The WebDMS tool operates on one agency's set of data at a time. At this time, and because this is such an infrequent activity, creating an agency is done directly in the maintenance

database and cannot be done using WebDMS. An agency record must be added to both the RTDNS.CARRIER table and to the RTDWEB.TRANSIT_PROVIDER table. A description of these tables can be found in the RTIS Data Architecture document.

3.2.3.2 Stops

In order to build a transit agency, if it is to have schedules to display and be included in the trip planner, it must have stops. Agency stops are maintained by selecting "Stops" in the WebDMS panel menu. At a minimum, a stop should have an identifying name (which can take the form of an intersection, a street address, or a named location), a mode (such as Bus, Train, or Ferry), and a position expressed in WGS-84 latitude and longitude coordinates. Stops can be added, edited, and deleted.

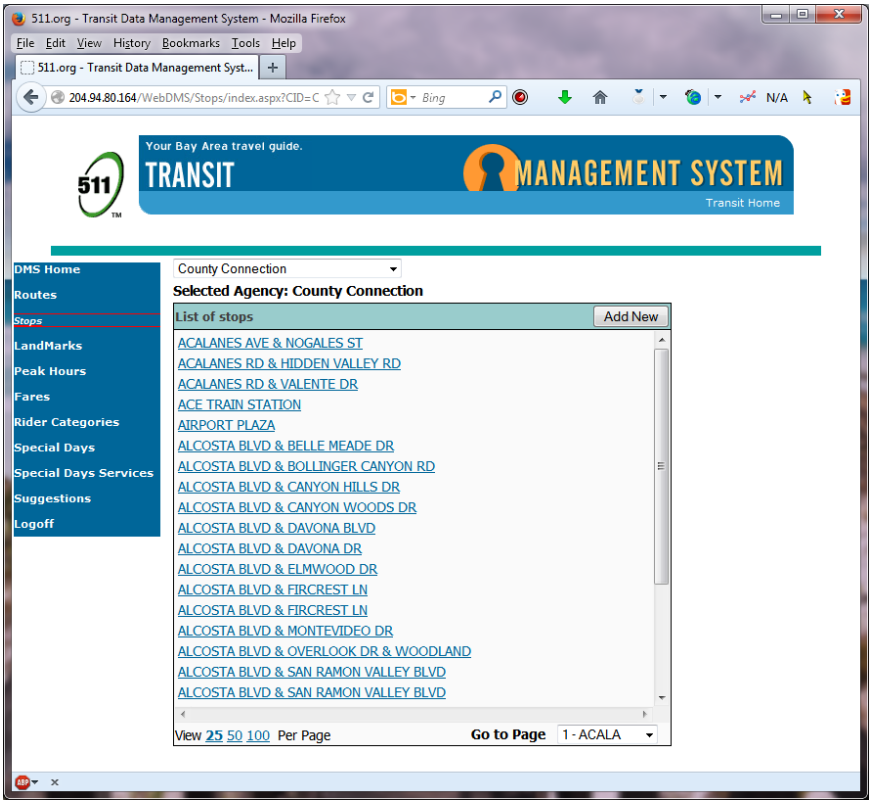


Figure 3-4 – WebDMS Stop Editor

3.2.3.3 Routes

After the maintenance of stops is complete, it is time to work with routes. Agency routes are maintained by selecting "Routes" in the WebDMS panel menu. Routes can be added, edited, and deleted.

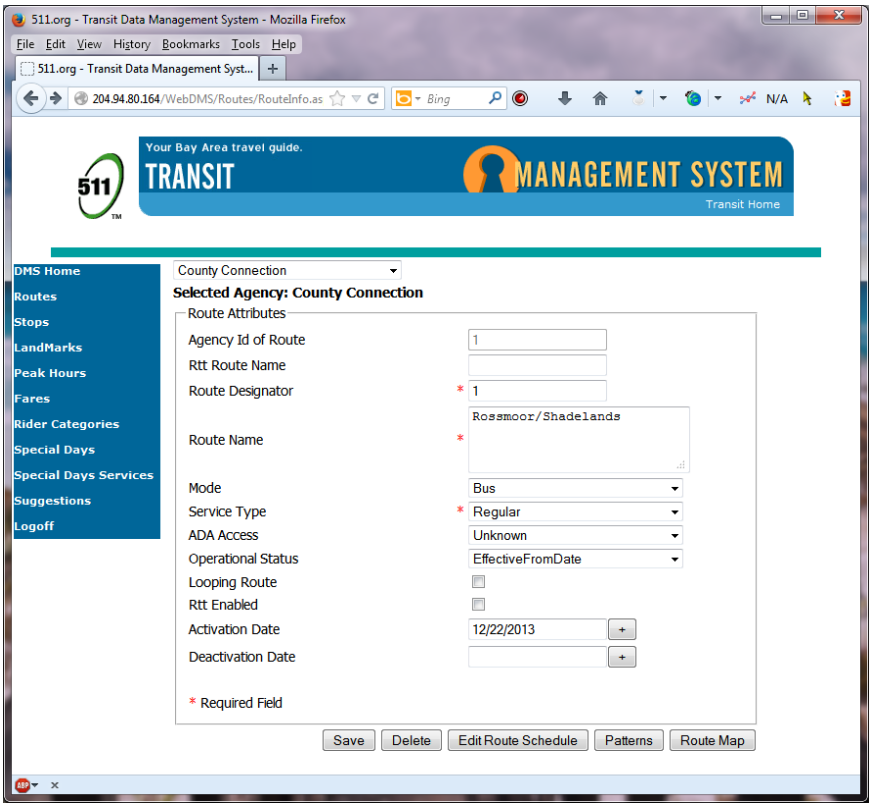


Figure 3-5 – WebDMS Route Editor

3.2.3.4 PATTERNS AND PATTERNSTOPS

A route must have at least one pattern to be useful. Patterns have a property called "direction". Typically, a route will have either one or two directions. Each pattern contains an ordered sequence of stop references called patternstops. Each patternstop references one of the stops that belong to the agency. If the stop is edited, the change affects all patternstops that reference it.

3.2.3.5 TIMEPOINTS AND TURNPOINTS

Some patternstops are classified as timepoints, which are special stops to which times in a trip can be attached and will appear in the schedule editor. The first and last patternstop in each pattern must be a timepoint. The decision of which stops are timepoints is determined by the agency's route schedule. Patterns are maintained in WebDMS by first selecting a route, and then click the Patterns button.

An additional patternstop option is the turn only option which is typically a bus schedule feature. Some agencies express popular, well known locations in their published timetables; however, it is not always possible or safe for a bus to stop and exchange passengers at the timepoint. By also designating the timepoint as a turnpoint, it establishes the distinction that the bus will pass through or turn and not stop for passengers. This allows the location to still appear on the

timetable, but signals to the trip planner that it should not permit passengers to board or disembark at the location.

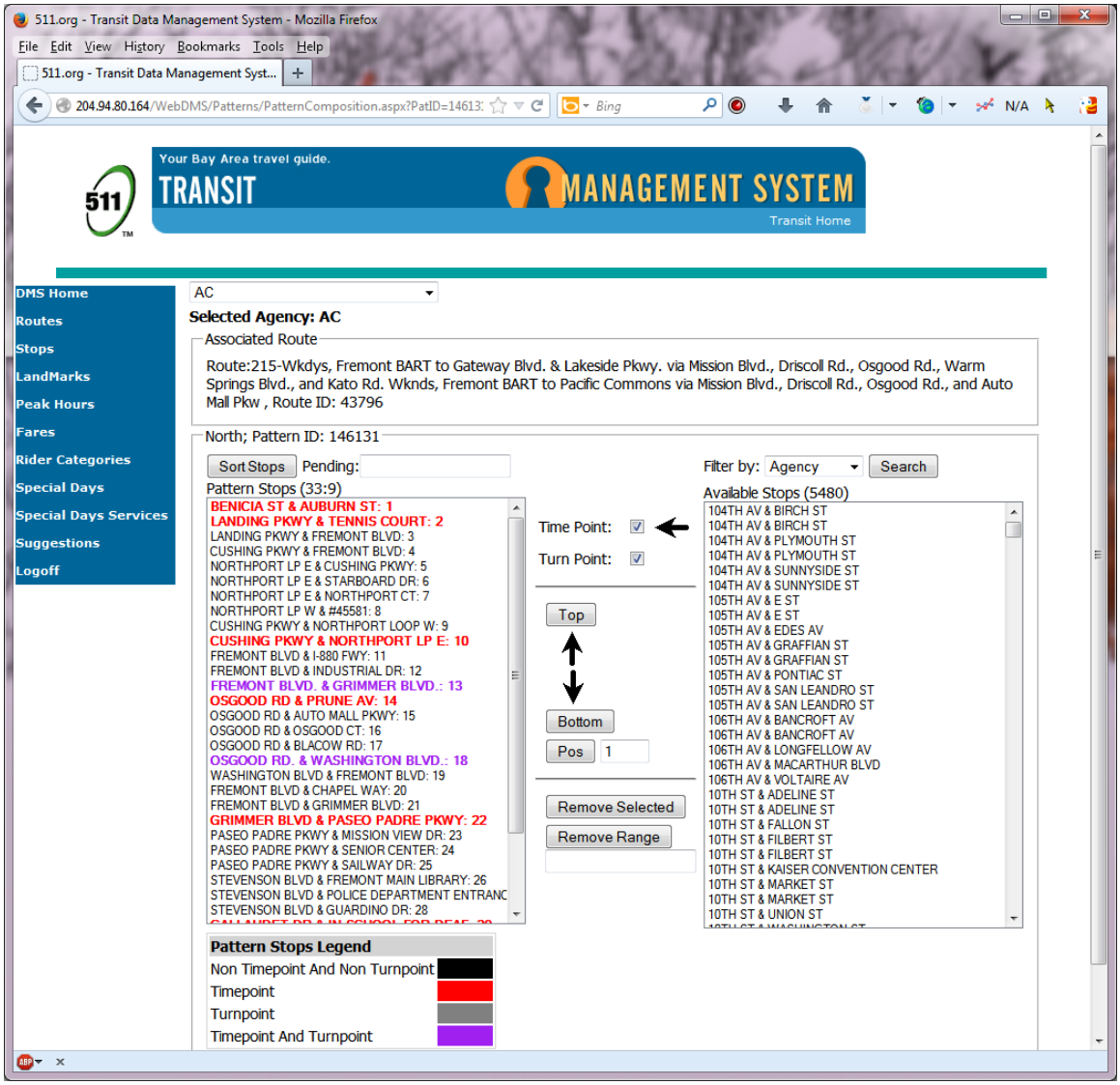


Figure 3-6 – WebDMS Pattern Composition Editor

3.2.3.6 Route Schedules

Route schedules, also called timetables, are edited by clicking the Edit Route Schedule button from the selected route's page. A daytype and direction can be selected, then trips created for any pattern.

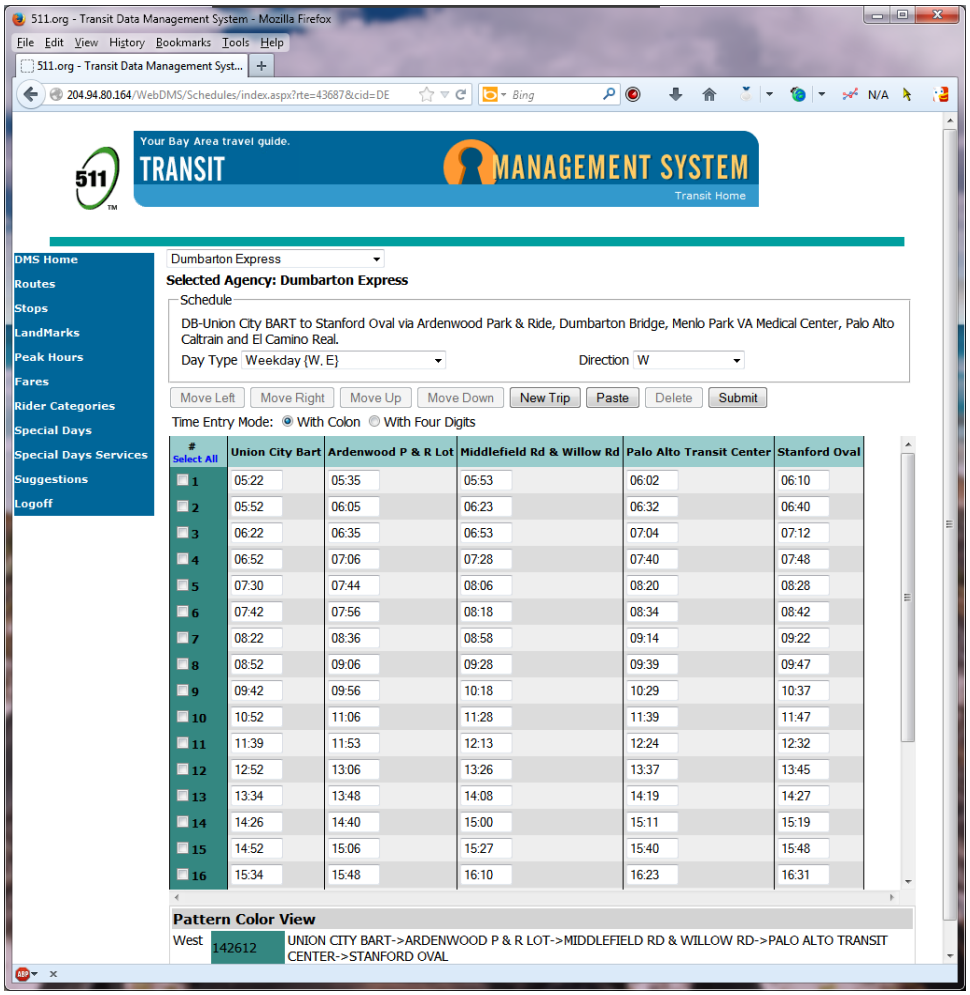


Figure 3-7 – WebDMS Route Schedule Editor

3.2.3.7 TRIPS AND DAYTYPES

Trips must be assigned to an element called a daytype. A daytype represents one week (Sunday through Saturday) and has an effective date range. Trips assigned to a daytype are assumed to run the same schedule on the daytype's operating days repeatedly every week within the effective dates. At this time, the WebDMS application does not permit the maintenance of daytypes. Therefore, daytypes will need to be created directly within the RTDNS.DAYTYPE table of the maintenance database using a tool such as SQL*Plus or SQL Developer. A description of this table can be found in the RTIS Data Architecture document.

3.2.3.8 RIDER CATEGORIES

Rider categories represent classes of transit riders such as: Adult, Youth, Child, Senior Citizen, Disabled, etc. Each of the rider categories are useful in determining the cost to ride a particular agency's transit system. Many rider categories are offered discounts and sometimes special

transfer rules apply. Rider categories are maintained by selecting “Rider Categories” in the WebDMS panel menu.

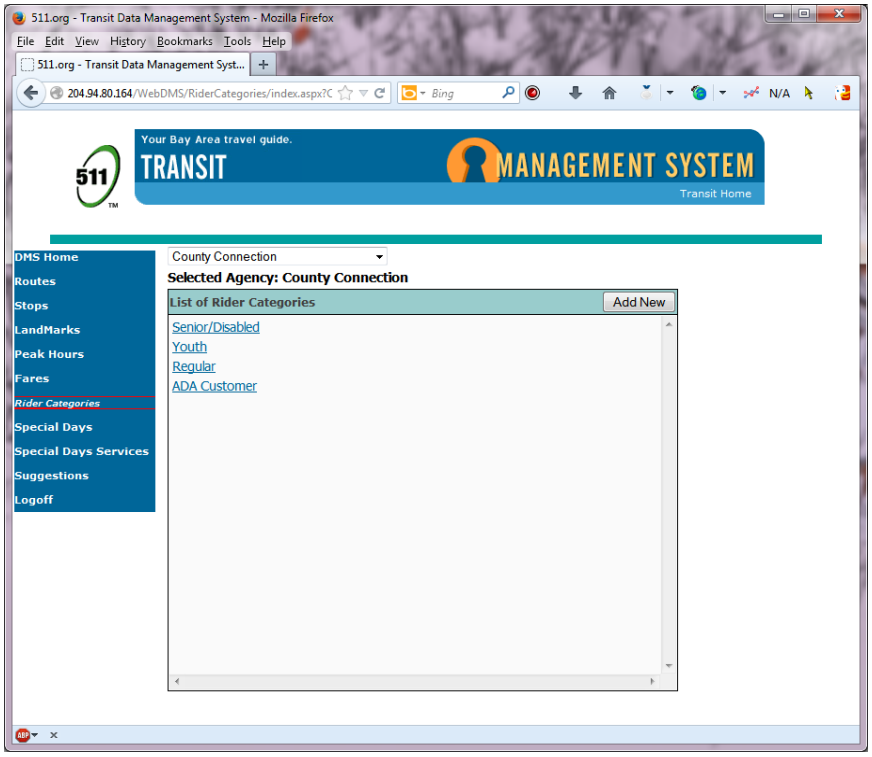


Figure 3-8 – WebDMS Rider Categories

3.2.3.9 Fare Zones

Some transit agencies have a zoned fare system where zones are divided up into geographical regions. The cost of riding the transit agency system depends upon the zone in which the rider boards and the zone in which they disembark. Once established, fare zones will typically never change. Therefore, fare zones are created directly within the RTDNS.FAREZONE table of the maintenance database using a tool such as SQL*Plus or SQL Developer. A description of this table can be found in the RTIS Data Architecture document.

3.2.3.10 Fare Definitions

A fare definition can be applied to an entire agency, to a particular route, or to a mode of travel. All transit agencies should have one fare definition that describes the cost to ride for all defined rider categories. Additional fare definitions should be created for special route or mode based fares that do not fit the default agency fare model. Fare definitions are maintained by selecting “Fares” from the WebDMS panel menu.

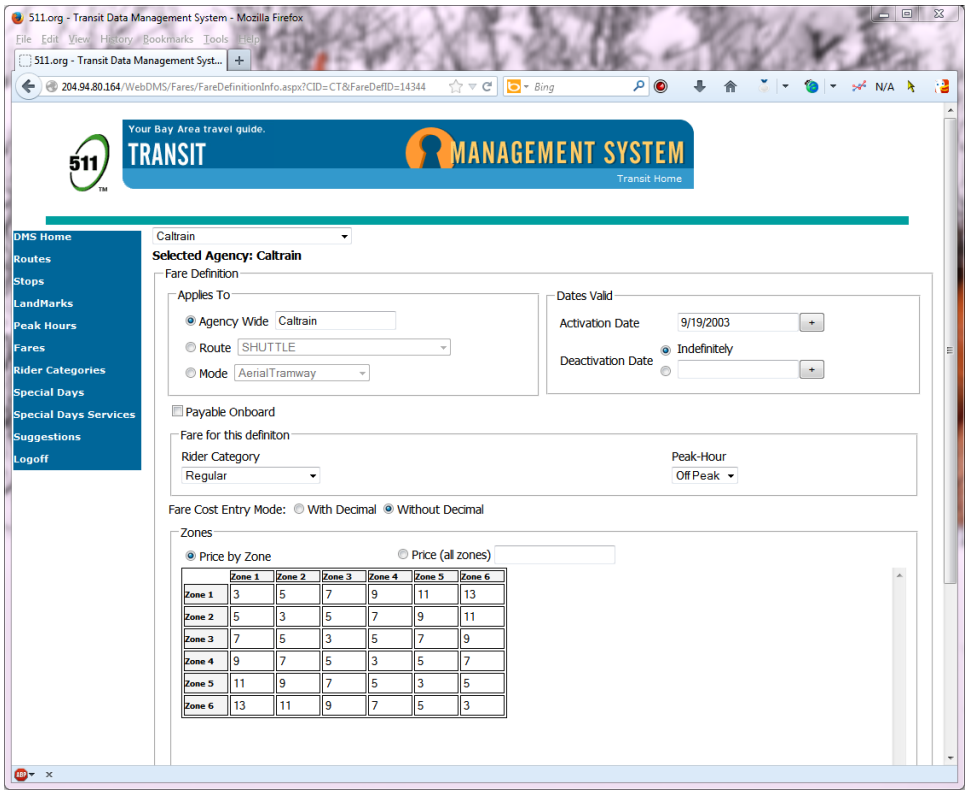


Figure 3-9 – WebDMS Fare Definition Editor

3.2.3.11 Peak Hours

A seldom used feature called Peak Hours is available for agencies whose fare cost will differ depending upon the time of day. For example, during peak operating hours a fare might be a fixed amount, but during the off-peak time the same fare might be discounted. Peak hour definitions are maintained by selecting “Peak Hours” in the WebDMS panel menu.

3.2.4 Processing Scripts

Several agency-specific scripts are used to perform final processing on the sign-up data before it can be used. A folder for each agency can be found on the RTIS contrator’s shared storage server “oak-storage” at the following location:

REDACTED

Below is a list of the typical actions performed by these scripts (not every action is necessary for every agency):

- Set effective date of sign-up on maintenance database
- Set expiration date of sign-up on staging database
- Copy new route and stop records from maintenance to staging database
- Set the correct mode for stops

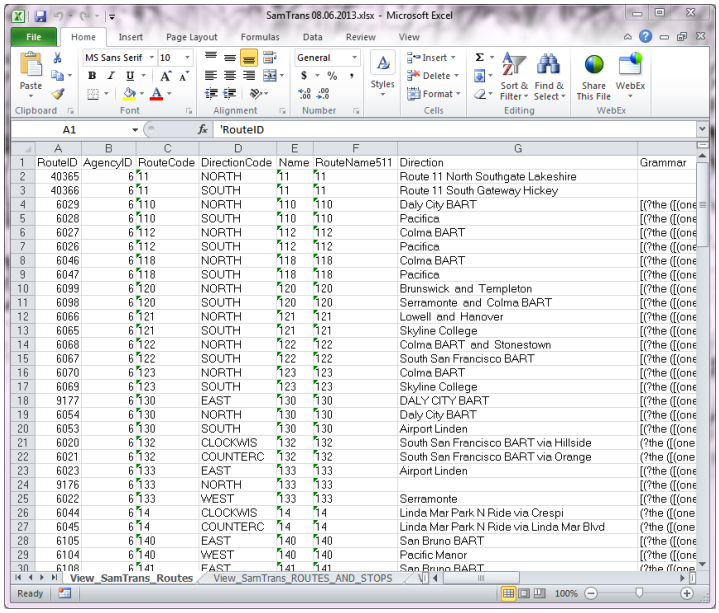
- Duplicate stops for shared mode (e.g. a single stop used by both bus and train service is separated into two stops, one for bus and one for train)
- Standardize stop and/or city names
- Assign fare zones to individual stops
- Ensure compatible daytypes between maintenance and staging databases
- Fill out the public ID values in the database (necessary for GTFS exports of data)
- Apply real-time configuration data (see section 3.2.5 immediately below)

3.2.5 Real-Time Configuration Data

For real-time enable agencies, in order to support real-time, the RTD transit data needs to have the same set of IDs that the real-time data is using. When the IDs from the transit data match those in the real-time system, the web applications are able to communicate with and obtain real-time predictions for stops.

The real-time stop ID and trip ID are generally known and provided with a transit agency's Transit XML data file. However, at this time the route and direction IDs need to be obtained from an external source. The RTIS Transit contractor will request a data export from the RTIS Traffic contractor, who will then provide a Microsoft Excel file containing the real-time configuration data from the real-time system.

The Excel file will have several worksheets, the only one of significance is the once that contains the route name, route code, direction name, and direction code. This route worksheet needs to be saved as a comma separated value (CSV) file, and saved directly to a folder on the same server where the maintenance database is present.



RouteID	AgencyID	RouteCode	DirectionCode	Name	RouteName511	Direction	Grammar
40365	6	11	NORTH	11	11	Route 11 North Southgate Lakeshire	
40366	6	11	SOUTH	11	11	Route 11 South Gateway Hickey	
6029	6	110	NORTH	110	110	Daly City BART	[(?the ([(one
6028	6	110	SOUTH	110	110	Pacifica	[(?the ([(one
6027	6	112	NORTH	112	112	Colma BART	[(?the ([(one
6026	6	112	SOUTH	112	112	Pacifica	[(?the ([(one
6046	6	118	NORTH	118	118	Colma BART	[(?the ([(one
6047	6	118	SOUTH	118	118	Pacifica	[(?the ([(one
6099	6	120	NORTH	120	120	Brunswick and Templeton	[(?the ([(one
6098	6	120	SOUTH	120	120	Serramonte and Colma BART	[(?the ([(one
6066	6	121	NORTH	121	121	Lowell and Hanover	[(?the ([(one
6065	6	121	SOUTH	121	121	Skyline College	[(?the ([(one
6068	6	122	NORTH	122	122	Colma BART and Stonestown	[(?the ([(one
6067	6	122	SOUTH	122	122	South San Francisco BART	[(?the ([(one
6070	6	123	NORTH	123	123	Colma BART	[(?the ([(one
6069	6	123	SOUTH	123	123	Skyline College	[(?the ([(one
9177	6	130	EAST	130	130	DALY CITY BART	[(?the ([(one
6054	6	130	NORTH	130	130	Daly City BART	[(?the ([(one
6053	6	130	SOUTH	130	130	Airport Linden	[(?the ([(one
6020	6	132	CLOCKWIS	132	132	South San Francisco BART via Hillside	(?the ([(one
6021	6	132	COUNTERC	132	132	South San Francisco BART via Orange	(?the ([(one
6023	6	133	EAST	133	133	Airport Linden	[(?the ([(one
9176	6	133	NORTH	133	133		[(?the ([(one
6022	6	133	WEST	133	133	Serramonte	[(?the ([(one
6044	6	14	CLOCKWIS	14	14	Linda Mar Park N Ride via Crespi	(?the ([(one
6045	6	14	COUNTERC	14	14	Linda Mar Park N Ride via Linda Mar Blvd	(?the ([(one
6105	6	140	EAST	140	140	San Bruno BART	[(?the ([(one
6104	6	140	WEST	140	140	Pacific Manor	[(?the ([(one
6108	6	141	EAST	141	141	San Bruno BART	(?the ([(one

Figure 3-10 – Real-Time Configuration Export

The maintenance RTD is configured with several external tables that can map each agency's CSV file into a database table. A custom script is then run by the RTIS contrator on the maintenance RTD that will read the external table data and apply the route and direction IDs to the transit data in the database.

3.2.6 POST TO REVIEW DATABASE

Once the data on the maintenance database has been fully edited and processed, it is ready for review. Using XML Engine the agency data is copied from the maintenance database to the review database. A web application similar to production is used to view the data from the review database, the current URL is:

204.94.80.164/transit511richui/schedules/index.aspx

3.2.7 QUALITY CONTROL

With every sign-up, a quality control spreadsheet is created and used to validate the timetables of a select number of routes. The timetables on the review database are compared against agency provided timetables to ensure correctness. Results of this QC process are kept in the QC spreadsheet (see section 2.5.5 above, also Figure 2-6). See chapter 5 for more information on the processes involved in quality control.

3.2.8 GTFS VALIDATION

Before an agency's data leaves the maintenance database for use in any system other than review (*i.e.* trip planner, staging database, production database), it must first be run through the GTFS validator. Prior to the validation step, it is imporant that the script that establishes public ID values (see section 3.2.4) first be run. The RTIS contractor maintains a data exporter and validation console application used for this purpose.

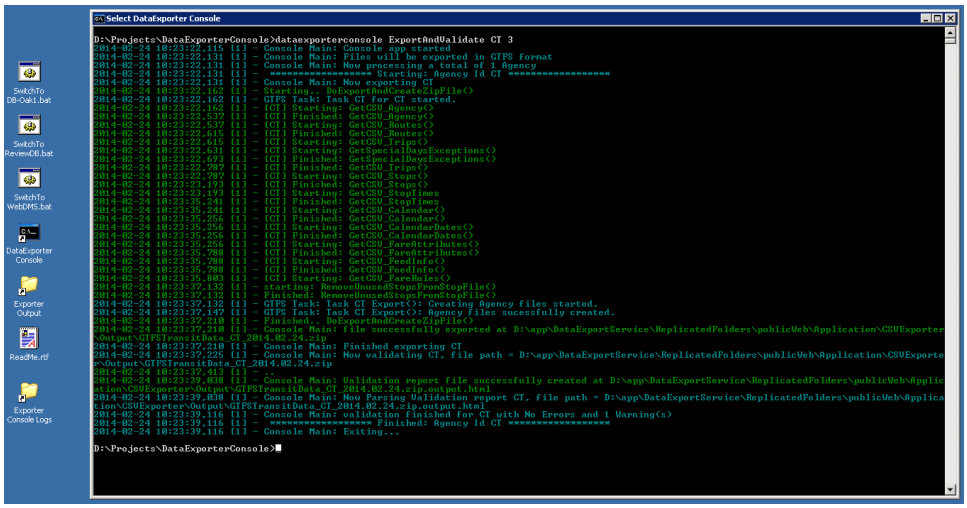


Figure 3-11 – GTFS Validator Desktop and Console

The image in Figure 3-11 above shows a portion of the computer's desktop and an open console window with the output of a successful validation run. There are three "SwitchTo" batch file icons on the desktop. Running one of these batch files prior to beginning will set the configuration of the validator to extract data from the specified database. In order to validate against the maintenance database, one would double-click the "SwitchTo WebDMS.bat" icon.

Next, the DataExporter Console is opened to a command prompt window. The name of the command to enter is "DataExporterConsole" followed by parameters that indicate which actions the console program is to take. Just entering the command name with no parameters at all will generate the usage information in the command prompt window (an online documentation of the command).

The parameters to use for validating the maintenance database data are:

1. "ExportAndValidate" – this is case sensitive and tells the console to first export a new set of GTFS data and then run it through the GTFS validator.
2. The two character agency ID, which is the same as the two-character primary key from the RTDNS.CARRIER table.
3. "3" – the number 3 indicates the export data format is to be GTFS.

Within the Exporter Output folder (to which the shortcut on the desktop links) is the exported GTFS data archive plus an HTML log file which summarizes the results. The HTML log file is used to identify an errors and warnings, and how they might be fixed in the data using the WebDMS application.

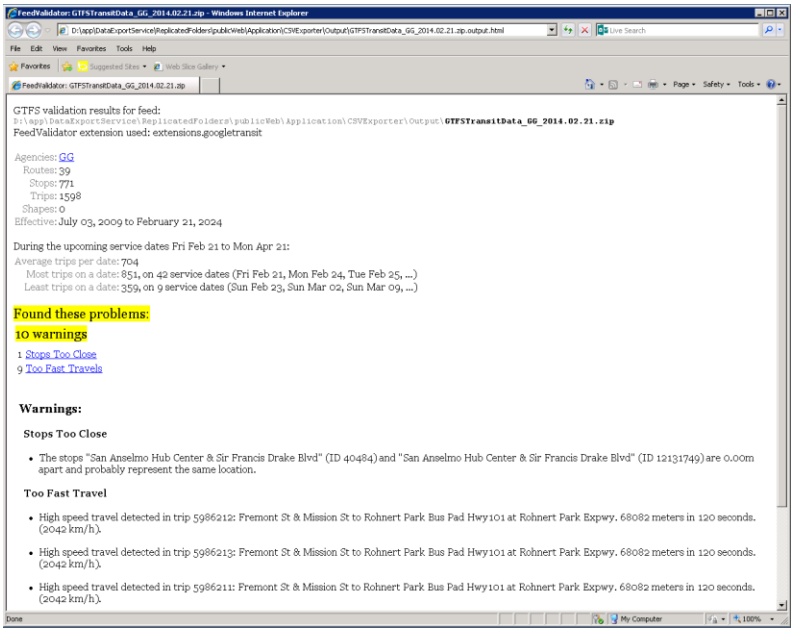


Figure 3-12 – GTFS Validation Report

3.2.9 LANDMARK MAINTENANCE

Since the WebDMS application was developed, the structure of the landmark system in the RTD has changed. Therefore, the WebDMS application cannot be used to maintain landmarks. Instead, the data must be maintained directly in the three RTDNS tables that govern landmarks: LANDMARK, LANDMARKCATEGORY, and LANDMARKALIAS. The descriptions for these tables can be found in the RTIS Data Architecture document.

3.2.9.1 LANDMARK CATEGORIES

Landmark categories are fairly well established and should not need to be changed. However, approval should be obtained from MTC for any changes made to the set of categories. Also, any category changes should be duplicated in the trip planner Point of Interest system (see section 3.5.1).

3.2.9.2 LANDMARKS

A landmark is an entity with a commonly known name and a geographic position, much like an agency stop. However, landmarks are generally used as start or end points for the trip planner, and are therefore treated as walking points rather than stop points. Each landmark also has a category, allowing landmarks to be grouped by city and category. A select number of landmarks are designated as popular destinations, and there is a section of the production web application dedicated to popular destinations.

3.2.9.3 LANDMARK ALIASES

A landmark alias is simply a named entity that references an existing landmark. This allows a single landmark to be known by more than one name.

3.2.9.4 SYNCLANDMARKS SCRIPT

In order to update landmarks from one RTD database to another (e.g. from maintenance to production), a PL/SQL script named SyncLandmarks.pls and a corresponding Microsoft Windows Batch Command file are used. The script is invoked from the command line and has the ability to either report what changes need to be made without making them, or to make the changes directly in the target database.

```
Sync Landmarks

C:\Program Files\Sync landmarks>synclandmarks
SyncLandmarks script -- Sun 02/23/2014 13:34:07.27

USAGE: SyncLandmarks [-D][-I][-U][-R] user@SID/password destdblink

options:
-D = delete rows found in destination, but not source
-I = insert rows found in source, but not destination
-U = update destination rows that differ from source
-R = report only, take no actions on destination

user@SID/password = connect login of the source database
destdblink = source's public database link to destination database

C:\Program Files\Sync landmarks>synclandmarks -D -I -U -R [redacted]
SyncLandmarks script -- Sun 02/23/2014 13:35:01.92
running...

Counting landmark records...
Total categories in source      = 120
Total categories in destination = 120
Total landmarks in source       = 5719
Total landmarks in destination  = 5715
Total aliases in source         = 405
Total aliases in destination    = 402

Checking for missing categories in rtdns.rtd_rac ...
None found.

Checking for missing landmarks in rtdns.rtd_rac ...
4 found.
..skipping landmark #108204, "Kaiser Medical Center"
..skipping landmark #108205, "Crocker Amazon Playground"
..skipping landmark #108206, "Hall of Justice Superior Court"
..skipping landmark #108207, "San Mateo Police Department"

Checking for missing aliases in rtdns.rtd_rac ...
3 found.
..skipping alias #6773, "Hall of Justice"
..skipping alias #6774, "San Mateo Police Station"
..skipping alias #6775, "Crocker Amazon Soccer Field"

Checking for updated categories in rtdns.rtd_rac ...
None found.

Checking for updated landmarks in rtdns.rtd_rac ...
3 found.
..skipping landmark #34746, "Santa Rosa Marketplace"
..skipping landmark #106550, "Carlmont High"
..skipping landmark #72243, "Santa Rosa Market Place Costco"

Checking for updated aliases in rtdns.rtd_rac ...
None found.

Checking for extra aliases in rtdns.rtd_rac ...
None found.

Checking for extra landmarks in rtdns.rtd_rac ...
None found.

Checking for extra categories in rtdns.rtd_rac ...
None found.

Completed at 13:35:05.14.

C:\Program Files\Sync landmarks>_
```

Figure 3-13 – SyncLandmark Script Sample Run

Figure 3-13 above shows a couple of sample runs from the SyncLandmark script. The first run is without any parameters so that the command usage is displayed. A second run with the reporting option enabled (some of the command line parameters are obfuscated for security reasons) showing what is yet to be updated between the maintenance database and the production database.

3.2.9.5 LANDMARK EXPORT VIEWS FOR TRIP PLANNER

Since the structure of the landmark tables changed somewhat after their original design, and since the trip planner still expects data in the original format, three database views were created in the maintenance database that produce the original data format:

- RTDNS.MDV_LANDMARK_EXPORT
- RTDNS.MDV_LANDMARKALIAS_EXPORT
- RTDNS.MDV_LANDMARKCATEGORY_EXPORT

Exporting from these views into comma separated value (CSV) files is necessary in order to import the landmark data into the trip planner. More on the trip planner import of landmarks in section 3.5.9 below.

3.2.10 HOLIDAY MAINTENANCE

To establish holiday service, the date(s) must first be established as a special day. Special Day definitions are maintained by selecting “Special Days” in the WebDMS panel menu.

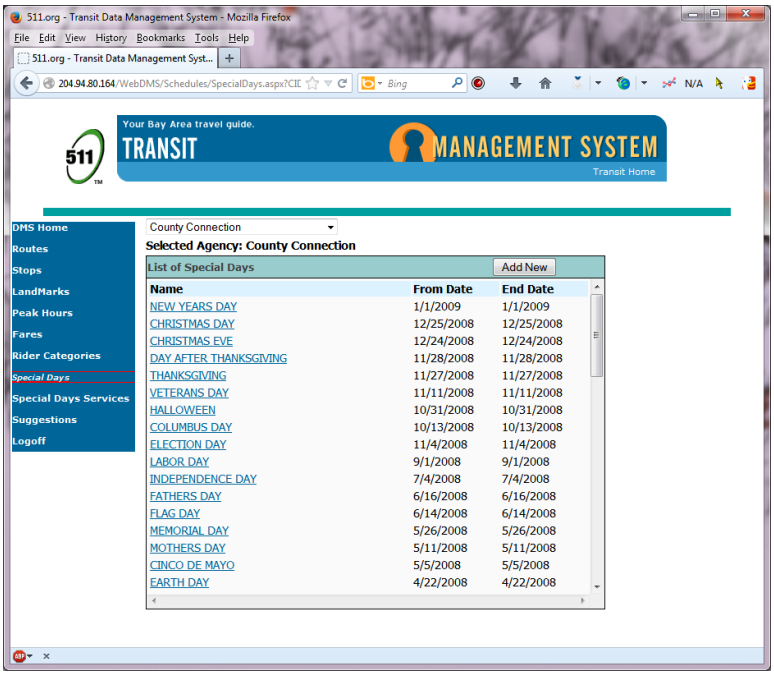


Figure 3-14 – WebDMS Special Days Editor

Once the special day has been defined, each agency needs to be selected and an entry created by selecting “Special Day Services” in the WebDMS panel menu. For example, if a holiday falls on a weekday but an agency is running its Sunday service instead, the special day service entry should set the from-daytype as Weekday, and the to-daytype as Sunday. Thus, a substitution of daytypes occurs, substituting one daytype (Sunday) in place of another (Weekday).

It is important that the substituting daytype have actual schedules. There are external services such the SF Ferry Building Flap Sign and Hub Signs that pull data directly from the RTD database. If no trips can be found for the substituted daytype, then no trips will be available for display on the Flap Sign and Hub Sign services. So if a daytype named “Special Holiday” is used to replace a normal daytype for a holiday, the Special Holiday daytype needs to have the proper holiday trips defined for it using the agency holiday matrix as a guide (see section 2.5.3 above, also Figure 2-4).

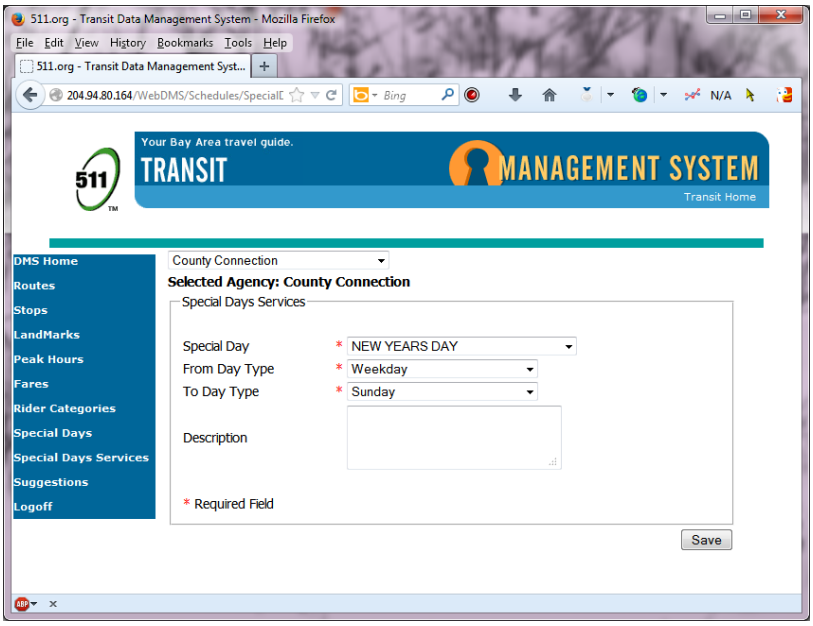


Figure 3-15 – WebDMS Special Day Services Editor

Once the holiday service has been defined, it needs to be copied to the review database. One of the RTIS contractor developer staff can reconfigure the review website to use the newly created holiday information. It is customary to notify MTC that the holiday definitions are on the review website and ready for inspection. The current URL for reviewing holidays is:

204.94.80.164/transit511richui/schedules/holiday.aspx

After the review holiday definitions have been approved they can be moved to production.

The trip planner must also be updated with holiday schedules. The process for updating holidays in the trip planner is discussed below in section 3.5.10.

3.2.11 Parking Data Maintenance

When the master parking data spreadsheet updates (see section 2.5.4) are ready to be taken live, the spreadsheet is saved as a comma separated value (CSV) file and saved directly to a folder on one of the production database servers. The production RTD is configured with an external table that will map the CSV file and treat it as if it were an internal table. A custom script is run on the production database which will update the data in the parking related tables.

After the parking data has been updated in the RTD, it needs to be loaded into the multi-modal trip planner (MMTP). Two database views were created in the production database that produce the correctly formated data files for the MMTP:

- RTDNS.MDV_DRIVE_TO_TRANSIT_EXPORT
- RTDNS.MDV_DROPOFF_EXPORT

A third view is used to export the parking data in a format that can be used by the RTIS Traffic contractor team:

- RTDNS.UPP_PARKING_EXPORT

One of the developers on the RTIS Transit contractor staff will first add geographic neighborhood information to the export file, and then hand it off to the RTIS Traffic contractor.

3.3 RTD SPATIAL DATA MAINTENANCE

The RTD maintains a set of spatial data which is used to overlay data on a map that conveys geographic information in a visual way to users of Transit 511. All transit service related spatial data (route shapes, stops locations, service area and fare zone boundaries, etc.) are maintained as layers of business data overlaid against prerendered map image tiles. 511 Transit currently uses the TeleAtlas basemap. RTIS basemap is updated when a new basemap is provided by the vendor. Simple spatial data can be generated directly from data tables, and more complex spatial data is stored in special spatial schemas in the database. The complex data is preprocessed by the RTIS contractor using a software tool by Environmental Systems Research Institute (ESRI) called ArcMap. More information about the database can be found in the RTIS Data Architecture manual.

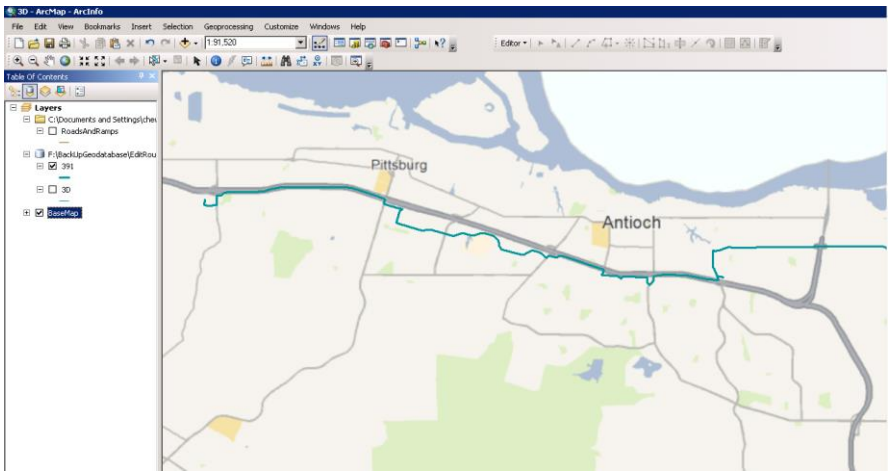


Figure 3-16 – ArcMap with Route Geometry

3.3.1 AGENCY GEOMETRY

Agency geometry consists of centerpoints, service areas, and fare zone boundaries. These seldom changing features are created and maintained using ArcMap and stored in the RTD.

3.3.2 Route Geometry

Route geometry is the spatial representation of the path traversed by a transit route, and is one of the most routine spatial data maintenance duties. The RTIS contractor is reponsible for building all route geometry using ArcMap. Route alignment changes, as observed in new stop configurations for new and existing routes signal the need to update route geometry.

As part of regular spatial data maintenance, segments of the route geometry are added and removed as and when necessary to match the route alignments shown in transit agency's printed and online route maps. Also compared are any changes in geometry that are affected by changes in the patternstops. In addition, an occasional visual inspection is performed on route geometry for routes selected for QC.

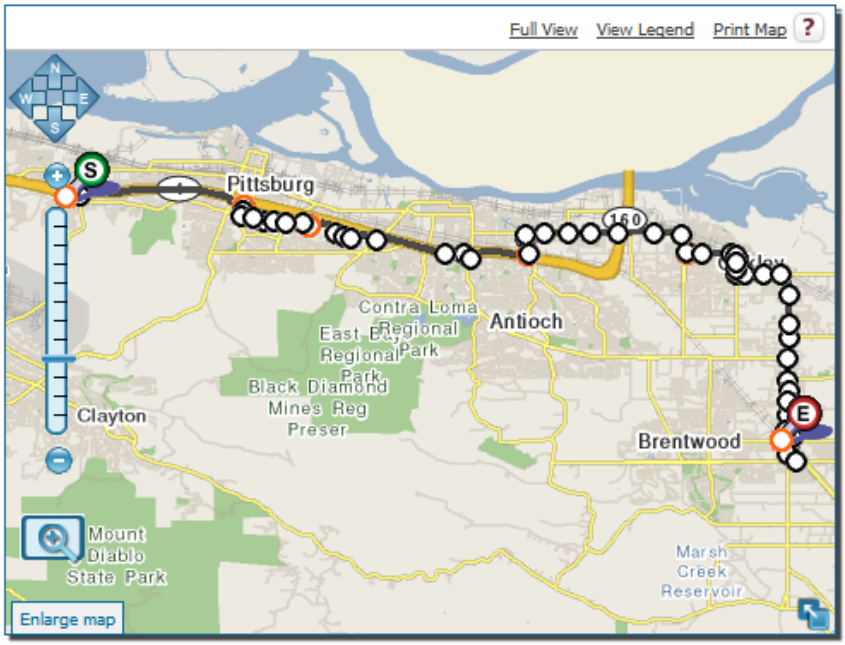


Figure 3-17 – Map with Route Geometry and Patternstops

Most of the spatial data maintenance work is performed as part of a scheduled major service change (sign-up) for each transit agency. Ad-hoc spatial data maintenance work may also be performed when data errors are reported.

3.3.3 Miscellaneous Spatial Data

In addition to the elements already discussed, the following tables provide a more comprehensive view of the kinds of spatial data, whether they are generated automatically by the mapping service or by hand using ArcMap, and the schemas where the data is kept.

3.3.3.1 RichUI Mapping Data

Mapping	Storage Schema	ArcMap or Automated
Agency Center Point	RTDS	ArcMap
Agency Service Area	RTDS	ArcMap
Agency Boundary	RTDS	ArcMap
Route	RTDS	ArcMap
Route Station	RTDS	ArcMap
Landmark	RTDNS	Automated
Basemap	GDT	TeleAtlas extracted data

Table 2 – RichUI Mapping Data

3.3.3.2 MMTP Mapping Data

Mapping	Storage Schema	ArcMap or Automated
Rail Line	GDT	ArcMap
Ferry Line	GDT	ArcMap
Highway Shield	GDT	ArcMap
Incident	TRAFFIC	Automated
Construction	TRAFFIC	Automated
Regional Transit Hubs	RTDNS	Automated
Parking (all types)	RTDNS	Automated
Live Traffic	GDT	TeleAtlas extracted data
Basemap	GDT	TeleAtlas extracted data

Table 3 – MMTP Mappind Data

3.3.3.3 Transit Tracker Data

Mapping	Storage Schema	ArcMap or Automated
DIY RTT Stop	RTDNS	ArcCatalog for registration

Table 4 – Transit Tracker Data

3.4 TRIP PLANNER DATA MAINTENANCE ENVIRONMENT

Once data has been fully edited and updated on the RTD maintenance system, it can be imported into the trip planner. What follows is a brief description of the Trip Planner servers and systems used for getting data inot a production ready state.

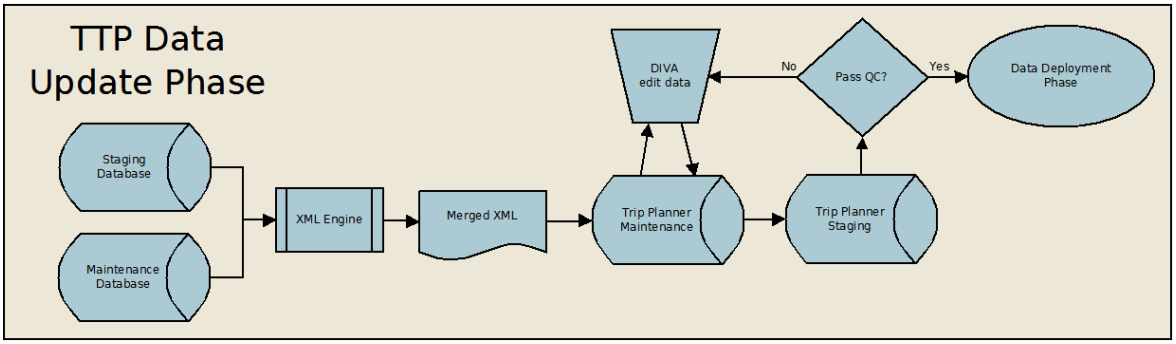


Figure 3-18 – Trip Planner Data Editing Process

3.4.1 TRIP PLANNER MAINTENANCE SYSTEM: MDV-OAK3

The principle system used for the maintenance of trip planner data is called MDV-Oak3, sometimes this system is simply referred to as DIVA. Data is exported from the RTD maintenance and/or staging systems, and then imported into the trip planner maintenance system and maintained using a software suite known as DIVA, which in German stands for *Dialoggesteuertes Verkehrsmanagement- und Auskunftssystem* (in English: Dialog-Driven Traffic Management and Information System). The following is a list of DIVA applications that the RTIS contractor employs for data maintenance and a description of their function:

- Common Data Server – This application is usually left running in the server's console mode session. It allows multiple users to connect and access DIVA data simultaneously.
- Common Data Tabular Timetable – Provides a number of different maintenance functions such as:
  - Establishing modes of transport (e.g. Bus, Ferry, Train, Cable Car, etc.)
  - Establishing operators and operating branches (i.e. transit agencies)
  - Editing route properties, including long names for routes
  - Establishing a route/stop correspondence list
  - Establishing permissible tariff (fare) zone values
  - A timetable manager for copying, deleting, changing timetables
  - Establishing transfer associations (e.g. interlining, timed transfers, etc.)
  - Establishing vehicle types
- Days of Operation – Works with calendar daytypes, establishes service restrictions and holidays

- DivaGeo – Permits the editing of geographic entities like the street level basemap, points of interest (landmarks), stops, and route links (route geometry).
- DivaImport – Takes a Transit XML file exported from the RTD and imports it into the DIVA system.
- DivaPOIs – Used to establish the Point of Interest categories. If any changes are made to the RTD landmark categories (see section 3.2.9), the same changes should be mirrored with the DivaPOIs application.
- GisImport – Used by the RTIS contractor to import a new set of landmarks.
- Stop Management – Manages the properties of stops such as:
    - Alternate stop names
    - Stop areas and stop points
    - Footpaths (which permit walking transfers between stops)
    - Tariff (fare) zones
- Tabular Timetable – Provides editing capabilities for route patterns and schedules, including timetables and rider restrictions such as pick-up/drop-off only stops.

There are a few additional DIVA applications which provide conversion and deployment functions:

- Conversion – Compiles the DIVA data into a system dataset for use by the trip planner software. This is the final processing step on MDV-Oak3.
- EFALeastCostGraphBuilder – Takes the fare data and builds a graph network for the trip planner to be able to generate lowest fare itineraries.
- EFALocationConverter – Rebuilds the basemap dictionaries so that intersections and street addresses are recognizable to the trip planner and mapped to their correct geographic locations.
- ITRouterStaticNetworkConverter – Rebuilds the graph network of the street level basemap so that the Referencing application can correctly follow the streets on the map and generate stop-to-stop links for bus, train, and ferry travel.
- Referencing – Performs several functions: (1) georeferences new stops to the basemap, (2) calculates the times for all intermediate, non-timepoint stops, and (3) computes the links (route geometry) between new stops along each route.
- SyncApplication – This application is usually left running in the server's console mode session. It is used to deploy code, layouts, and data between trip planner servers. An email is distributed to a group upon the completion of each data deployment.

The trip planner maintenance system hosts a few scripts and tools that provide a few additional and useful functions:

- DataPreProcessor – A python script that accepts a Transit XML as input, applies a set of transformation rules to correct stop name inconsistencies, and then outputs an updated Transit XML.

- InterchangeDistances – Generates a report of the stops where footpaths exist between stops where too much distance may exist for an effective walking transfer.
- FareZones – Generates a report of stops missing tariffs (zones).
- Raw2Diva – This is not actually a script, but rather a Microsoft Access database with a few processing queries used when importing a new set of landmarks.

Fares are not maintained with an application, instead a file entitled *oak_fares.xml* must be edited manually with a standard text editor or XML editor.

3.4.2 Transit Trip Planner Staging System: MDV-STG

Once data maintenance is complete on MDV-Oak3, the data is then deployed to the staging system, MDV-STG. The staging system is actually running the same version of the trip planner engine and layout (interface) that is used for production. This system is used to generate test itineraries to look for potential problems in transit data and fare updates. The staging system is also used for testing application updates, but that is beyond the scope of this document.

The staging system provides the DIVA suite of software maintenance tools as well, but it is perferable that all maintenance work take place on MDV-Oak3. However, in emergencies it is possible to perform data maintenance directly on the staging system.

There are a few applications that the RTIS contractor will use on the MDV-STG system:

- Deployment (No Mail) – A batch file that will redeploy the data contained in the update folders (transferred by the SyncApplication from MDV-Oak3). It will not generate an automated email notice of the deployment.
- Deployment (No Mail - Quick) – Same as above, except the step to rebuild the real-time stop reference XML will be skipped as it is a time consuming process.
- EFALocationConverter – Several versions of this application exist (some versions take minutes, where others can take over 12 hours to complete):
    - Complete – rebuilds the entire geographic set of dictionaries.
    - Crossings – rebuilds just the intersection dictionary from the basemap.
    - Localities Stops Landmarks – rebuilds just the city name, stop name, and landmark name dictionaries.
    - Street Addresses – rebuilds just the street address dictionary.
- Start Trip Planner – A batch file accessible on the desktop that will start the trip planner engine.
- Stop Trip Planner – A batch file accessible on the desktop that will stop the trip planner engine.
- Sync Application – This application is usually left running in the server's console mode session. It is used to deploy data to the production transit trip planner servers. An email is distributed to a group upon the completion of each data deployment.

3.4.3 Multi-Modal Trip Planner Staging System: MMTP-STG-TP

The multi-modal trip planner also has a staging system known as MMTP-STG-TP. Being a different version of the trip planner, it has a few different data requirements. Data is transferred from the MDV-STG system and then run through a few additional processing stops on the multi-modal staging system. The applications used for this are as follows:

- DIVA Common Data Server – Allows the use of DIVA applications, only used when also using the DIVA GIS Import application.
- DIVA GIS Import – Used to import the parking data exported from the RTD (see section 3.2.11, also section 3.5.11).
- DIVA Sync – This application is usually left running in the server's console mode session. It is used to deploy data to the production multi-modal trip planner servers. An email is distributed to a group upon the completion of each data deployment.
- EFAExtendedGISModelBuilder_OAK – Rebuilds the graph network of the street level basemap so that the multi-modal trip planner can correctly follow the streets on the map when generating driving directions.
- EFALocationConverter_OAK – Several versions of this application exist (some versions take minutes, where others can take over 12 hours to complete):
    - Complete – rebuilds the entire geographic set of dictionaries.
    - Place, Stop, POI – rebuilds just the city name, stop name, and landmark name dictionaries.

The trip planner vendor has produced for the RTIS contrator a separate PDF document entitled MMTP_DataUpdateAndDeployment_v0.1 containing the steps necessary to perform the manual update of data.

3.5 Trip Planner Non-Spatial Data Maintenance

Non-spatial data in the trip planner is comprised on transit elements such as: agency, routes, stops, timetables, transfer associations, and fares. In additional to these are some extra-transit elements such as: points of interest, and days of operation. A detailed description of the import process can be found on the RTIS contractor's Wiki site, currently at the following URL:

204.94.80.141/wiki/index.php/OAK:Project:ImportProcessDetail

The typical sequence of steps for data maintenance means importing a Transit XML data file generated by XML Engine from some RTD database. However, sometimes needed edits are so minor that they can simply be handled manually using DIVA. The following sections highlight the data maintenance processes that the RTIS contractor will perform on the trip planner maintenance and staging systems.

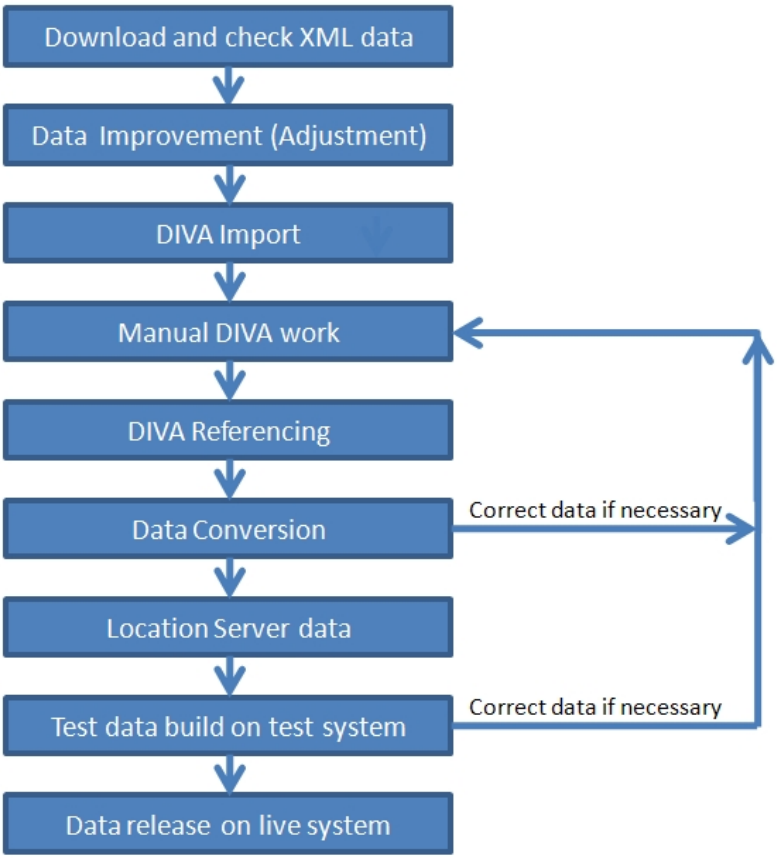


Figure 3-19 – DIVA Data Maintenance Cycle

Unless otherwise specified, the data maintenance descriptions in the following section 3.5 subsections are all performed on the maintenance trip planner (MDV-Oak3).

3.5.1 AGENCY MAINTENANCE

To create an agency in the trip planner, an Operating Branch and an Operator must be created using the Common Data Tabular Timetable. Deleting an agency means that every reference to the agency data must first be removed (timetables, routes, fares, tariff (fare) zones, transfer associations), and then the operator and operating branch can be removed.

Operating branches [oak]

Code	Name	Short name	County (main area)	Hourly operating rate	Bold print of this trip	Stop spelling
11	Angel Island - Tiburon Ferry	AT		0.00	no	Standard
12	Golden Gate Ferry	GF		0.00	no	Standard
14	Hornblower Alcatraz Ferry	HF		0.00	no	Standard
16	San Francisco Bay Ferry	SB		0.00	no	Standard
51	BART	BA		0.00	no	Standard
52	Muni	SF		0.00	no	Standard
53	AC Transit	AC		0.00	no	Standard
54	Golden Gate Transit	GG		0.00	no	Standard
55	Sonoma County Transit	SO		0.00	no	Standard
57	Santa Rosa CityBus	SR		0.00	no	Standard
58	Amtrak Capitol Cor. & Reg. S...	AM		0.00	no	Standard
59	Blue & Gold Fleet	BG		0.00	no	Standard
61	ACE	CE		0.00	no	Standard
62	American Canyon Transit	AY		0.00	no	Standard
63	Emery Go-Round	EM		0.00	no	Standard
64	Fairfield-Suisun Transit	FS		0.00	no	Standard
65	Stanford Marguerite Shuttle	MS		0.00	no	Standard
67	Petaluma Transit	PE		0.00	no	Standard
68	Santa Clara VTA	SC		0.00	no	Standard
69	SamTrans	SM		0.00	no	Standard
70	Union City Transit	UC		0.00	no	Standard
71	Vacaville City Coach	VC		0.00	no	Standard
72	VINE (Napa County)	VN		0.00	no	Standard
74	WestCAT	WC		0.00	no	Standard
75	WHEELS	WH		0.00	no	Standard
76	Yountville Shuttle	YV		0.00	no	Standard
77	The County Connection	CC		0.00	no	Standard
78	AirBART	AB		0.00	no	Standard
79	Caltrain	CT		0.00	no	Standard
80	Dumbarton Express	DE		0.00	no	Standard
81	Tri Delta Transit	3D		0.00	no	Standard
82	Rio Vista Delta Breeze	RV		0.00	no	Standard
84	Healdsburg Transit	HL		0.00	no	Standard
85	Marin Transit	MA		0.00	no	Standard
86	Soltrans	ST		0.00	no	Standard
99	School Bus	8		0.00	no	Standard

Figure 3-20 – DIVA Operating Branch

Operator [oak]

Type	Short name	Name
3D	3D	TriDelta Transit
AB	AB	AirBART
AC	AC	AC Transit
AM	AM	Amtrak Capitol Cor. & Reg. Svc
AT	AT	Angel Island - Tiburon Ferry
AY	AY	American Canyon Transit
BA	BA	BART
BG	BG	Blue and Gold
CC	CC	The County Connection
CE	CE	ACE
CT	CT	Caltrain
DE	DE	Dumbarton Express
EM	EM	Emery Go-Round
FS	FS	Fairfield-Suisun Transit
GF	GF	Golden Gate Ferry
GG	GG	Golden Gate Transit
HF	HF	Hornblower Alcatraz
HL	HL	Healdsburg Transit
MA	MA	Marin Transit
MS	MS	Stanford Marguerite Shuttle
PE	PE	Petaluma Transit
RV	RV	Rio Vista Delta Bree
SB	SB	SF Bay Ferry
SC	SC	Santa Clara VTA
SF	SF	Muni
SM	SM	SamTrans
SO	SO	Sonoma County Transit
SR	SR	Santa Rosa CityBus
ST	ST	Soltrans
UC	UC	Union City Transit
VC	VC	Vacaville City Transit
VN	VN	Napa VINE
WC	WC	WestCAT
WH	WH	WHEELS
YV	YV	Yountville Shuttle

Figure 3-21 – DIVA Operator

3.5.2 TRANSIT XML IMPORT

The majority of transit data maintenance occurs when a fresh Transit XML data file is imported into the trip planner system. The XML file must first be physically transferred onto the server. Next the XML file is run through an adjustment tool to standardize stop and city names. The output of the adjustment tool is another XML file that is then run through the DIVA Import application. After the import is complete, supplemental data maintenance using DIVA can begin.

3.5.2.1 DIVA ADJUSTMENT TOOL

The first step of the import process is to run the Transit XML data file through the DIVA adjustment tool. The tool is a Python script with customizable transformation rules that apply specific transformations to route and city names (for example, converting every instance of “Av.” to “Ave.”).

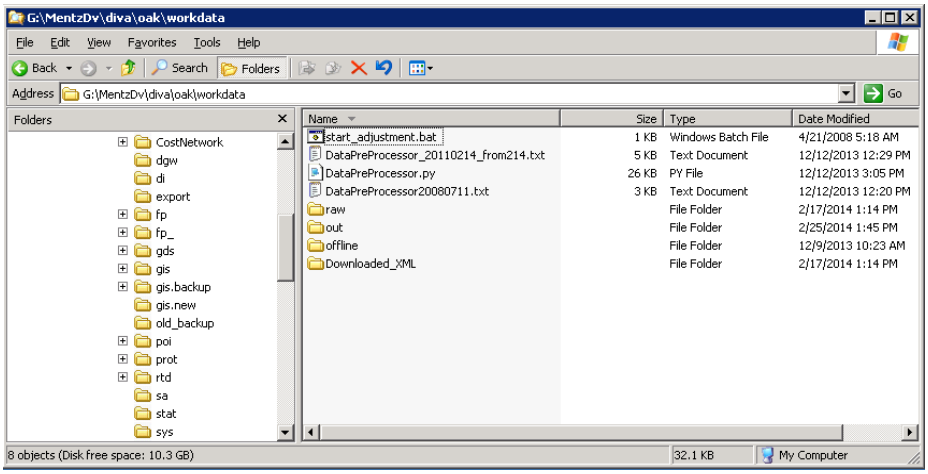
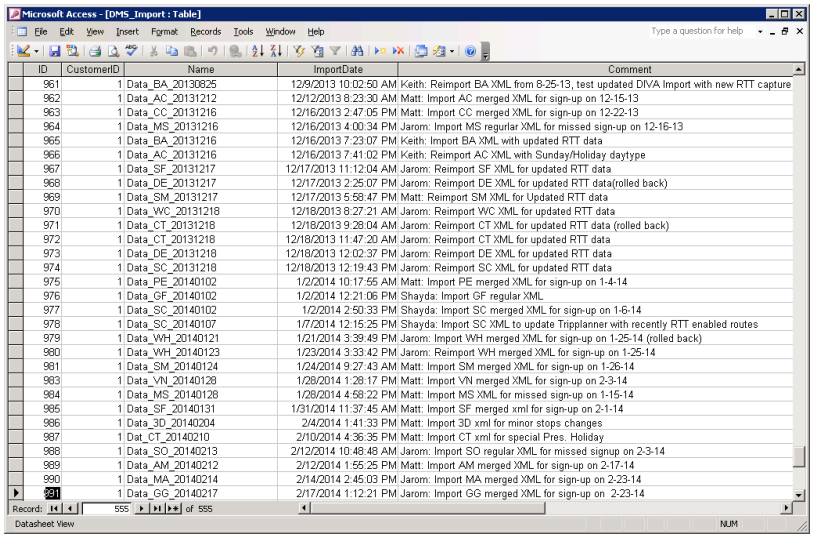


Figure 3-22 – DIVA Adjustment Tool

3.5.2.2 UPDATE DIVA IMPORT LOG

Next, create a new entry in the DIVA Import database in the table called DMS_Import.



ID	CustomerID	Name	ImportDate	Comment
961	1	Data_BA_20130825	12/9/2013 10:02:50 AM	Keith: Reimport BA XML from 8-25-13, test updated DIVA Import with new RTT capture
962	1	Data_AC_20131212	12/12/2013 8:23:30 AM	Matt: Import AC merged XML for sign-up on 12-15-13
963	1	Data_CC_20131216	12/16/2013 2:47:05 PM	Matt: Import CC merged XML for sign-up on 12-22-13
964	1	Data_MS_20131216	12/16/2013 4:00:34 PM	Jarom: Import MS regurlar XML for missed sign-up on 12-16-13
965	1	Data_BA_20131216	12/16/2013 7:23:07 PM	Keith: Import BA XML with updated RTT data
966	1	Data_AC_20131216	12/16/2013 7:41:02 PM	Keith: Reimport AC XML with Sunday/Holiday daytype
967	1	Data_SF_20131217	12/17/2013 11:12:04 AM	Jarom: Reimport SF XML for updated RTT data
968	1	Data_DE_20131217	12/17/2013 2:25:07 PM	Jarom: Reimport DE XML for updated RTT data(rolled back)
969	1	Data_SM_20131217	12/17/2013 5:58:47 PM	Matt: Reimport SM XML for Updated RTT data
970	1	Data_WC_20131218	12/18/2013 8:27:21 AM	Jarom: Reimport WC XML for updated RTT data
971	1	Data_CT_20131218	12/18/2013 9:28:04 AM	Jarom: Reimport CT XML for updated RTT data (rolled back)
972	1	Data_CT_20131218	12/18/2013 11:47:20 AM	Jarom: Reimport CT XML for updated RTT data
973	1	Data_DE_20131218	12/18/2013 12:02:37 PM	Jarom: Reimport DE XML for updated RTT data
974	1	Data_SC_20131218	12/18/2013 12:19:43 PM	Jarom: Reimport SC XML for updated RTT data
975	1	Data_PE_20140102	1/2/2014 10:17:55 AM	Matt: Import PE merged XML for sign-up on 1-4-14
976	1	Data_GF_20140102	1/2/2014 12:21:06 PM	Shayda: Import GF regular XML
977	1	Data_SC_20140102	1/2/2014 2:50:33 PM	Shayda: Import SC merged XML for sign-up on 1-6-14
978	1	Data_SC_20140107	1/7/2014 12:15:25 PM	Shayda: Import SC XML to update Tripplanner with recently RTT enabled routes
979	1	Data_WH_20140121	1/21/2014 3:39:49 PM	Jarom: Import WH merged XML for sign-up on 1-25-14 (rolled back)
980	1	Data_WH_20140123	1/23/2014 3:33:42 PM	Jarom: Reimport WH merged XML for sign-up on 1-25-14
981	1	Data_SM_20140124	1/24/2014 9:27:43 AM	Matt: Import SM merged XML for sign-up on 1-26-14
983	1	Data_VN_20140128	1/28/2014 1:28:17 PM	Matt: Import VN merged XML for sign-up on 2-3-14
984	1	Data_MS_20140128	1/28/2014 4:58:22 PM	Matt: Import MS XML for missed sign-up on 1-15-14
985	1	Data_SF_20140131	1/31/2014 11:37:45 AM	Matt: Import SF merged xml for sign-up on 2-1-14
986	1	Data_3D_20140204	2/4/2014 1:41:33 PM	Matt: Import 3D xml for minor stops changes
987	1	Dat_CT_20140210	2/10/2014 4:36:35 PM	Matt: Import CT xml for special Pres. Holiday
988	1	Data_SO_20140213	2/12/2014 10:48:48 AM	Jarom: Import SO regular XML for missed signup on 2-3-14
989	1	Data_AM_20140212	2/12/2014 1:55:25 PM	Matt: Import AM merged XML for sign-up on 2-17-14
990	1	Data_MA_20140214	2/14/2014 2:45:03 PM	Jarom: Import MA merged XML for sign-up on 2-23-14
991	1	Data_GG_20140217	2/17/2014 1:12:21 PM	Jarom: Import GG merged XML for sign-up on 2-23-14

Figure 3-23 – DIVA Import Database

3.5.2.3 IMPORT TRANSIT XML FILE

Use the DIVA Import application to load the Transit XML file into the DIVA file system.

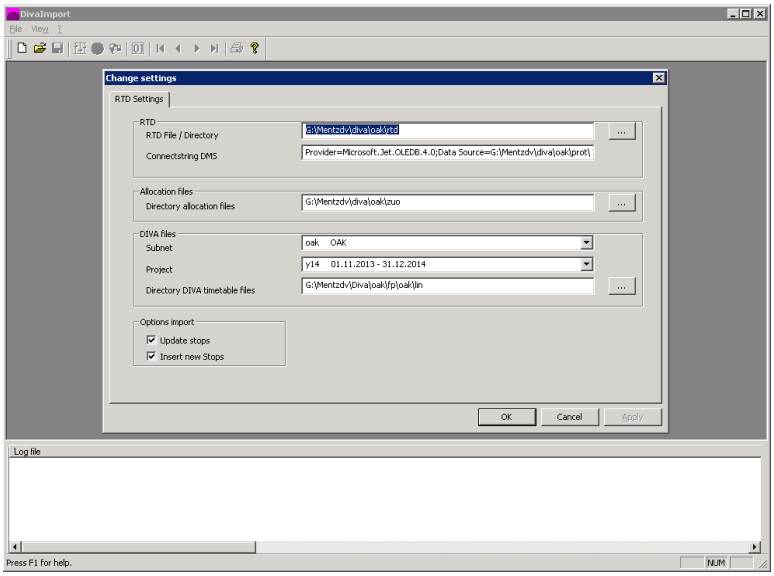
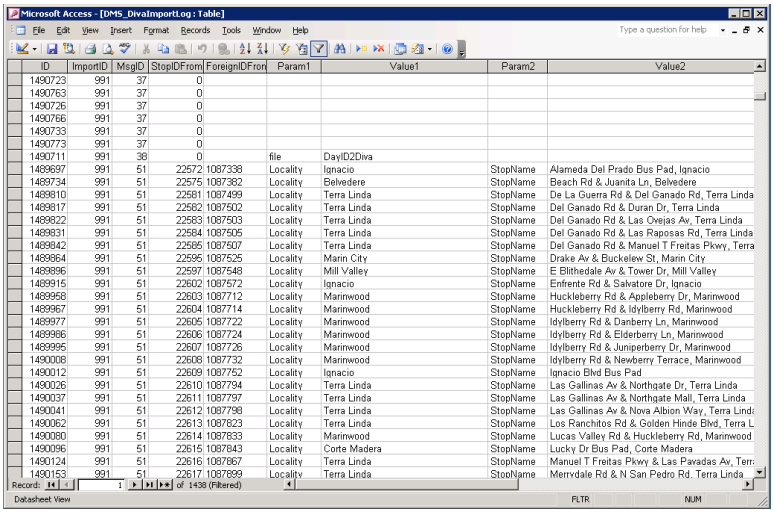


Figure 3-24 – DIVA Import Application

During the import process, several mapping files are generated that provide ID linkage between the objects in the trip planner and objects from the RTD. First, a stop mapping file is maintained that maps DIVA stop areas and stop points to RTD stops. Second, line mapping files are maintained, one for each agency, that map trip planner routes to RTD routes. Lastly, a trip mapping file is maintained that captures real-time agency, route, and direction configuration data.

3.5.2.4 VIEW THE IMPORT LOG

The DIVA Import application will write a terse summary of events to the Microsoft Access import database in a table called DMS_DivaImportLog.



Microsoft Access - [DMS_DivaImportLog : Table]

ID	ImportID	MsgID	StopIDFrom	ForeignIDFron	Param1	Value1	Param2	Value2
1490723	991	37	0					
1490763	991	37	0					
1490726	991	37	0					
1490766	991	37	0					
1490733	991	37	0					
1490773	991	37	0					
1490711	991	38	0		file	DayID2Diva		
1489697	991	51	22572	1087338	Locality	Ignacio	StopName	Alameda Del Prado Bus Pad, Ignacio
1489734	991	51	22575	1087382	Locality	Belvedere	StopName	Beach Rd & Juanita Ln, Belvedere
1489810	991	51	22581	1087499	Locality	Terra Linda	StopName	De La Guerra Rd & Del Ganado Rd, Terra Linda
1489817	991	51	22582	1087502	Locality	Terra Linda	StopName	Del Ganado Rd & Duran Dr, Terra Linda
1489822	991	51	22583	1087503	Locality	Terra Linda	StopName	Del Ganado Rd & Las Ovejas Av, Terra Linda
1489831	991	51	22584	1087505	Locality	Terra Linda	StopName	Del Ganado Rd & Las Raposas Rd, Terra Linda
1489842	991	51	22585	1087507	Locality	Terra Linda	StopName	Del Ganado Rd & Manuel T Freitas Pkwy, Terra
1489864	991	51	22595	1087525	Locality	Marin City	StopName	Drake Av & Buckelew St, Marin City
1489896	991	51	22597	1087548	Locality	Mill Valley	StopName	E Blithedale Av & Tower Dr, Mill Valley
1489915	991	51	22602	1087572	Locality	Ignacio	StopName	Enfrente Rd & Salvatore Dr, Ignacio
1489958	991	51	22603	1087712	Locality	Marinwood	StopName	Huckleberry Rd & Appleberry Dr, Marinwood
1489967	991	51	22604	1087714	Locality	Marinwood	StopName	Huckleberry Rd & Idylberry Rd, Marinwood
1489977	991	51	22605	1087722	Locality	Marinwood	StopName	Idylberry Rd & Danberry Ln, Marinwood
1489986	991	51	22606	1087724	Locality	Marinwood	StopName	Idylberry Rd & Elderberry Ln, Marinwood
1489995	991	51	22607	1087726	Locality	Marinwood	StopName	Idylberry Rd & Juniperberry Dr, Marinwood
1490008	991	51	22608	1087732	Locality	Marinwood	StopName	Idylberry Rd & Newberry Terrace, Marinwood
1490012	991	51	22609	1087752	Locality	Ignacio	StopName	Ignacio Blvd Bus Pad
1490026	991	51	22610	1087794	Locality	Terra Linda	StopName	Las Gallinas Av & Northgate Dr, Terra Linda
1490037	991	51	22611	1087797	Locality	Terra Linda	StopName	Las Gallinas Av & Northgate Mall, Terra Linda
1490041	991	51	22612	1087798	Locality	Terra Linda	StopName	Las Gallinas Av & Nova Albion Way, Terra Linda
1490062	991	51	22613	1087823	Locality	Terra Linda	StopName	Los Ranchitos Rd & Golden Hinde Blvd, Terra L
1490080	991	51	22614	1087833	Locality	Marinwood	StopName	Lucas Valley Rd & Huckleberry Rd, Marinwood
1490096	991	51	22615	1087843	Locality	Corte Madera	StopName	Lucky Dr Bus Pad, Corte Madera
1490124	991	51	22616	1087867	Locality	Terra Linda	StopName	Manuel T Freitas Pkwy & Las Pavadas Av, Terr
1490153	991	51	22617	1087899	Locality	Terra Linda	StopName	Merrydale Rd & N San Pedro Rd, Terra Linda

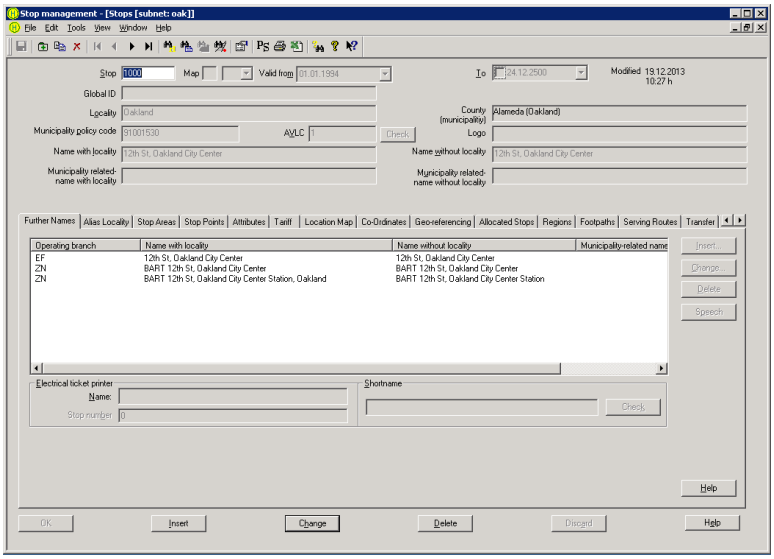
Record: 1 of 1438 (Filtered)

Datasheet View

Figure 3-25 – DIVA Import Log

3.5.3 STOP MAINTENANCE

The Stop Management application is used to add additional properties to stops that cannot be added as part of the XML data feed.



Stop management - [Stops [subnet: oak]]

Stop 1000 | Map | Valid from 01.01.1994 | To 24.12.2500 | Modified 19.12.2013 10:27 h

Global ID

Locality Oakland | County (municipality) Alameda (Oakland)

Municipality policy code 91001530 | AVLC 1 | Check | Logo

Name with locality 12th St, Oakland City Center | Name without locality 12th St, Oakland City Center

Municipality related-name with locality | Municipality related-name without locality

Further Names | Alias Locality | Stop Areas | Stop Points | Attributes | Tariff | Location Map | Co-Ordinates | Geo-referencing | Allocated Stops | Regions | Footpaths | Serving Routes | Transfer

Operating branch	Name with locality	Name without locality	Municipality-related name
EF	12th St, Oakland City Center	12th St, Oakland City Center	
ZN	BART 12th St, Oakland City Center	BART 12th St, Oakland City Center	
ZN	BART 12th St, Oakland City Center Station, Oakland	BART 12th St, Oakland City Center Station	

Insert... | Change... | Delete | Speech

Electrical ticket printer | Name: | Stop number 0

Shortname | Check

Help

OK | Insert | Change | Delete | Discard | Help

Figure 3-26 – DIVA Stop Management

The most commonly added features to stops as part of regular data maintenance with each imported Transit XML file are:

- Footpaths – A footpath expresses in minutes a walking transfer between stops. It also establishes the walking time in minutes between stop areas (a component of a stop useful to representing parts of a station such as entrance, concourse, and platform). This is best done in conjunction with the DIVAGeo application.

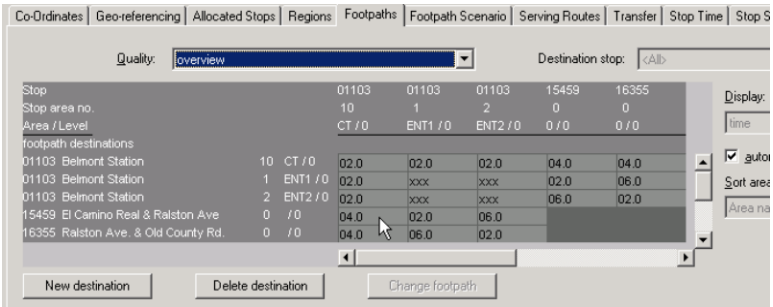


Figure 3-27 – DIVA Stop Footpaths

- Tariff – A fare zone number which indicates the agency fare zone in which a particular stop dwells. Tariff zone numbers are defined using the Common Data Tabular Timetable application.

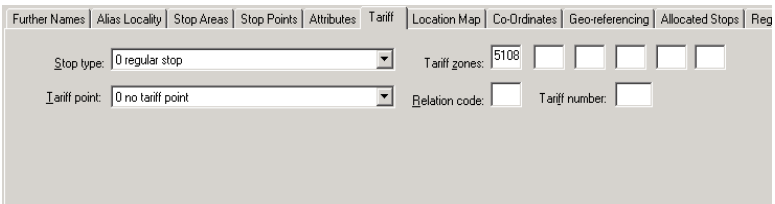


Figure 3-28 – DIVA Stop Tariffs

More information about the Stop Management application can be found on the RTIS contractor's Wiki site, currently at the following URL:

204.94.80.141/wiki/index.php/MDV:Diva:StopApp

3.5.4 TIMETABLE MAINTENANCE

The DIVA Tabular Timetable application allows direct editing of route schedules for the trip planner. Time-saving, minor edits to schedules can be made here without the need to reimport an entire agency XML file.

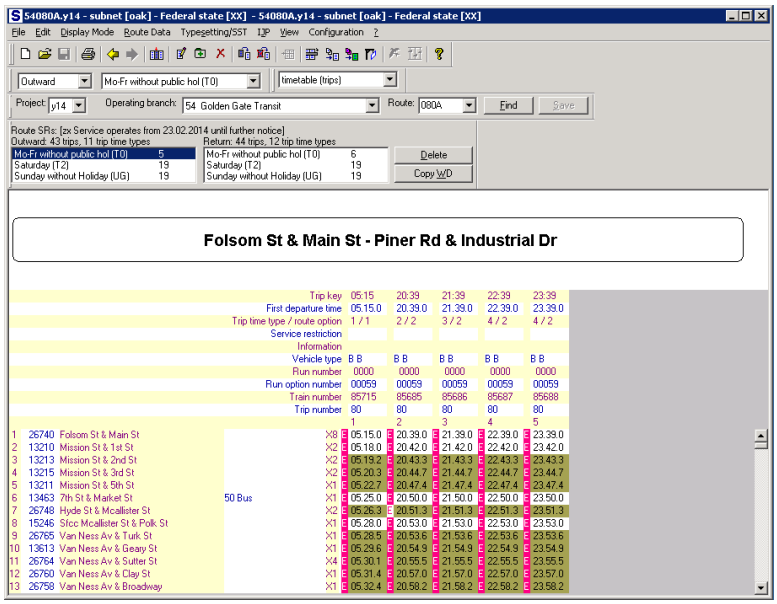


Figure 3-29 – DIVA Tabular Timetable

The most common data maintenance tasks performed with Tabular Timetable are:

- Adjust post-midnight trips – The trip planner clock is greater than 24-hours, thus trips that begin at or after midnight can be pushed as overflowing into the following day. For example, a trip beginning at 01:25 would be altered to start at 25:25, which is 01:25 on the following day.
- Add rider restrictions – Some routes are not permitted to both pick-up and drop-off passengers in the same trip within certain geographic boundaries. The Tabular Timetable is used to set stop interdictions to enforce select stops to function as either pick-up only or drop-off only. A third option implements the turnpoint feature (refer to Section 3.2.3.5 above).
- Holiday schedules – See section 3.5.10 below for information about holidays.

More information about the Tabular Timetable application can be found on the RTIS contractor's Wiki site, currently at the following URL:

204.94.80.141/wiki/index.php/MDV:Diva:TTApp

3.5.5 TRANSFER ASSOCIATIONS

For multiple trips that have a guarantee wait for each others' arrival at a shared stop, transfer associations can be created to enforce these timed transfers. Also, the end of one route can be interlined to the beginning of another route, which allows the trip planner to keep passengers on the vehicle at the end of the line and ride through to another possible destination, which avoids confusing transfers. Transfer associations are established using the Common Data Tabular Timetable application.

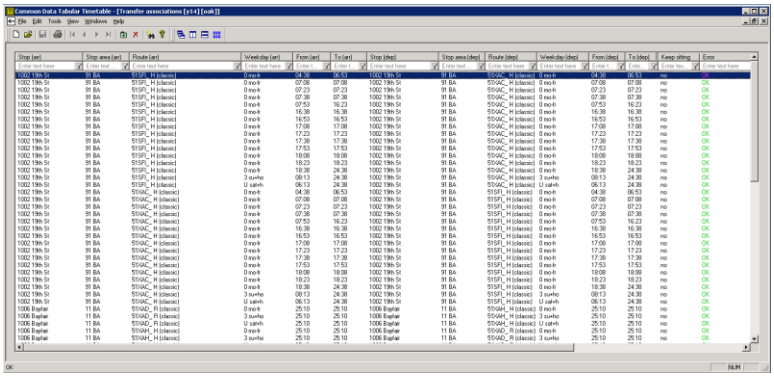


Figure 3-30 – DIVA Transfer Associations

3.5.6 FARE MAINTENANCE

The fares in the trip planner are more complex to implement than the data which is conveyed by the Transit XML. Therefore, fares are maintained in a single XML file on the trip planner simply entitled *oak_fares.xml*. Within this file are expressed all of the agency fare costs, whether direct or zoned, for multiple categories of riders. Also expressed are both intra-agency and inter-agency transfers, so that known transfer discounts can be applied and the trip planner can reflect an accurate cost of each itinerary plan.

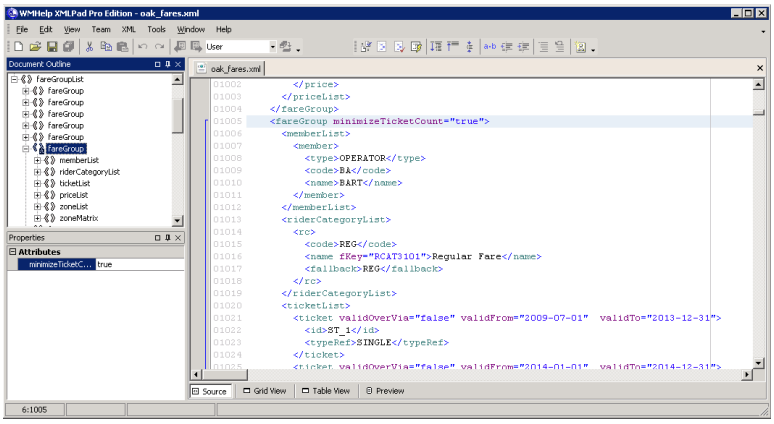


Figure 3-31 – DIVA oak_fares.xml File

Whenever the fares are updated, the application EFALeastCostGraphBuilder must be run in order to recompute the structures necessary for the trip planner to calculate itineraries based on least cost.

3.5.7 GEOREFERENCING

Georeferencing is the process of referencing objects such as stops and points of interest to links, or edges, on the basemap. The Referencing application will take any new stops and georeference them to the basemap, afterwhich links (route geometry) will be automatically created between new pairs of stops. Existing links between pairs of stops will be preserved.

Objects such as stops can also be manually georeferenced using the DivaGeo application (see section 3.6 for more information about DivaGeo and manual georeferencing).

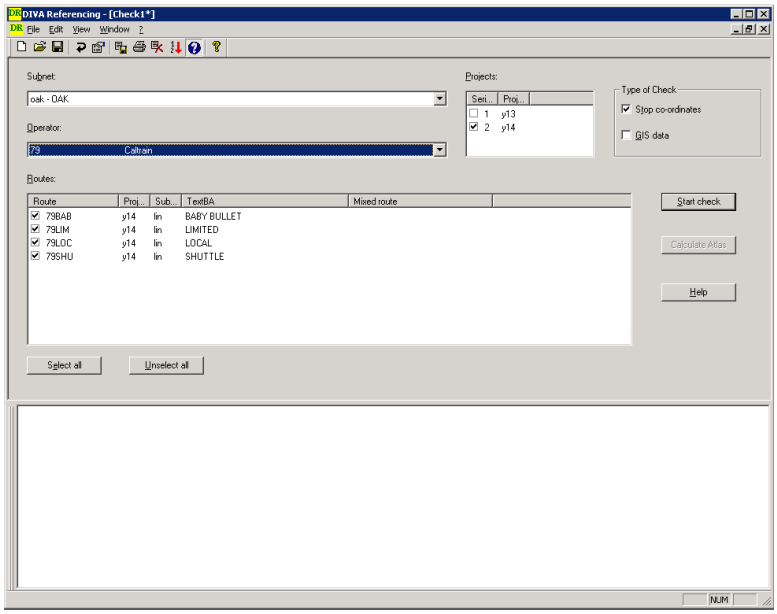


Figure 3-32 – DIVA Referencing

More information about the Referencing application can be found on the RTIS contractor's Wiki site, currently at the following URL:

204.94.80.141/wiki/index.php/MDV:Diva:RefApp

3.5.8 CONVERSION

After all of the data maintenance activities are completed, the DIVA data needs to be compiled and optimized into a format for use by the trip planner engine. This is accomplished by running the Conversion application as a final step before deploying data to the staging trip planner (MDV-STG).

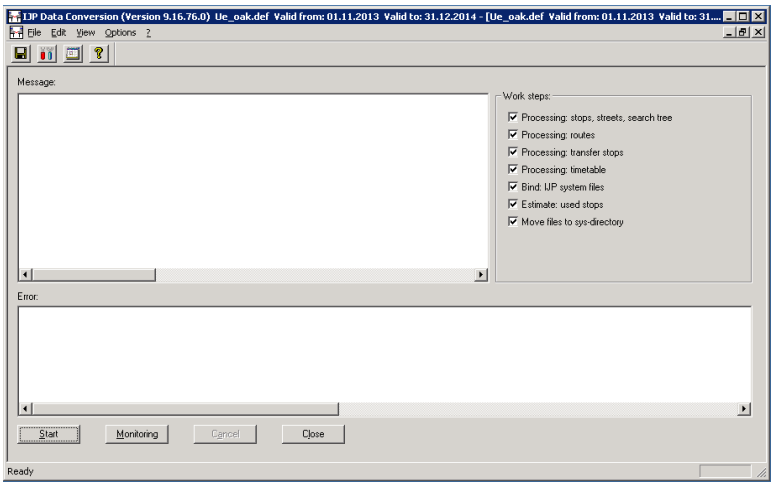


Figure 3-33 – DIVA Conversion

More information about the Conversion application can be found on the RTIS contractor's Wiki site, currently at the following URL:

204.94.80.141/wiki/index.php/MDV:Diva:ConversionApp

3.5.9 LANDMARK IMPORT

Landmark data is exported from the RTD (see section 3.2.9) in CSV format, and then imported into the GIS layer of DIVA data. A Microsoft Access database is used to run conversions of the data and create the GIS import files based on the RTD landmark data.

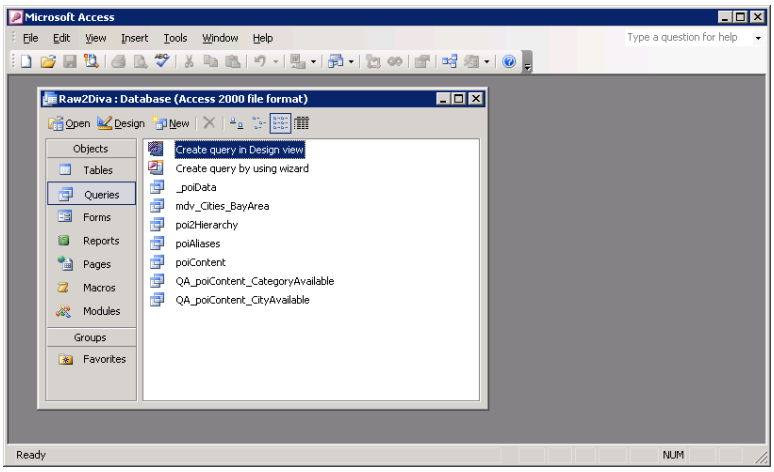


Figure 3-34 – Landmark Access Database

Once the GIS files are generated, the GisImport application is used to import the data into the GIS system.

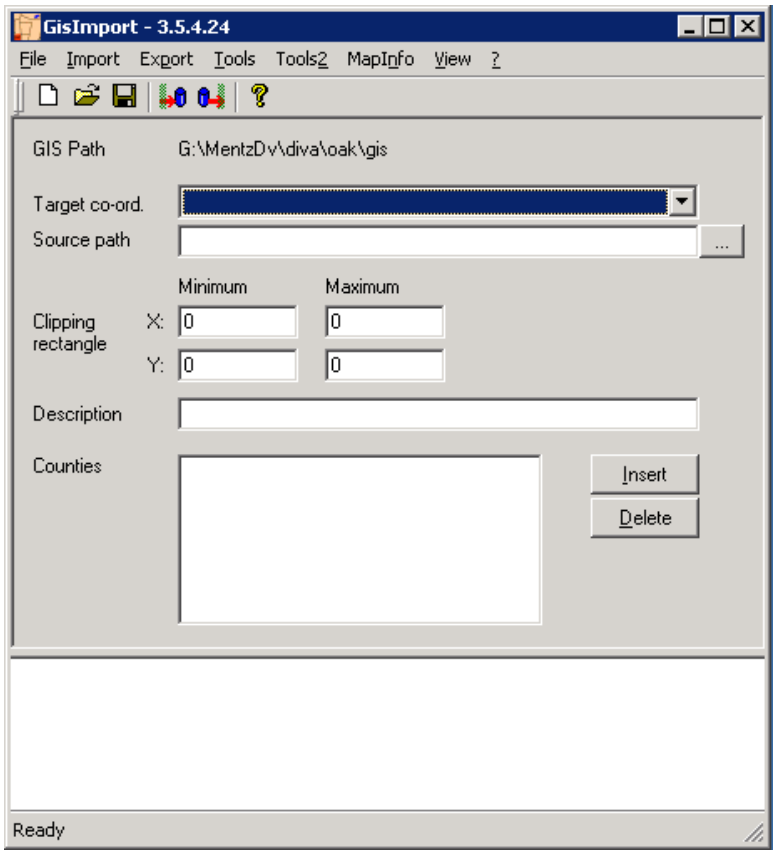


Figure 3-35 – GisImport Application

After the landmark data has been successfully imported, it must be transferred to the staging trip planner (MDV-STG) where the EFALocationConverter is run in order to merge the landmark names with the dictionary of recognizable names. This allows users to type a landmark name into the Start or End locations of the trip planner panel and have those landmark names be recognized. After the converter is run on the staging system, the local redeployment script will complete the landmark import.

A complete description of the landmark import process can be found on the RTIS contractor's Wiki site, currently at the following URL:

204.94.80.141/wiki/index.php/MDV:Diva:LandmarkLoading

3.5.10 HOLIDAY MAINTENANCE

The process of setting up holiday schedules begins with the holiday matrix (see section 2.5.3), followed by setting up the daytype substitutions for the holiday in the RTD (see section 3.2.10). The trip planner vendor currently takes care of the holiday configuration, establishing the name and date of each holiday in the trip planner.

Public holidays: subnet [oak] - start year [2014] - federal state [free public holidays r...

NO	Date	Holiday	Used in internal (F*) and predef. (w*,x...
11	15.02.10	President's Day	FB, wi, wj
7	31.05.10	Memorial Day	F7
4	04.07.10	July 4th Sunday	F4
6	06.09.10	Labor Day	F6, we, wf
1	25.11.10	Thanksgiving Day	F1, wa, wb, xc, xd, xe, xf, xg, xh
15	25.12.10	Christmas Day	FF, ws, wt, xa, xb, xc, xd, xe, xf, xg, xh
1	01.01.11	New Years Day	F1, wa, wb, xc, xd, xe, xf, xg, xh
11	17.01.11	Martin Luther King Day	FB, wi, wj
11	21.02.11	President's Day	FB, wi, wj
7	30.05.11	Memorial Day	F7
4	04.07.11	Independence Day	F4
6	05.09.11	Labor Day	F6, we, wf
1	24.11.11	Thanksgiving Day	F1, wa, wb, xc, xd, xe, xf, xg, xh
10	16.01.12	Martin Luther King Day	FA
12	28.05.12	Memorial Day	FC, wg, wh
12	04.07.12	Independence Day	FC, wg, wh
13	03.09.12	Labor Day	FD, wm, wn
13	22.11.12	Thanksgiving Day	FD, wm, wn
13	25.12.12	Christmas Day	FD, wm, wn
9	01.01.13	New Years Day	F9
9	21.01.13	Martin Luther King Day	F9
9	27.05.13	Memorial Day	F9
9	04.07.13	Independence Day	F9
9	02.09.13	Labor Day	F9
9	28.11.13	Thanksgiving Day	F9
13	25.12.13	Christmas Day	FD, wm, wn
9	01.01.14	New Years Day	F9
10	20.01.14	Martin Luther King Day	FA
9	17.02.14	Presidents Day	F9
12	26.05.14	Memorial Day	FC, wg, wh
12	04.07.14	Independence Day	FC, wg, wh
13	01.09.14	Labor Day	FD, wm, wn
13	27.11.14	Thanksgiving Day	FD, wm, wn
13	25.12.14	Christmas Day	FD, wm, wn

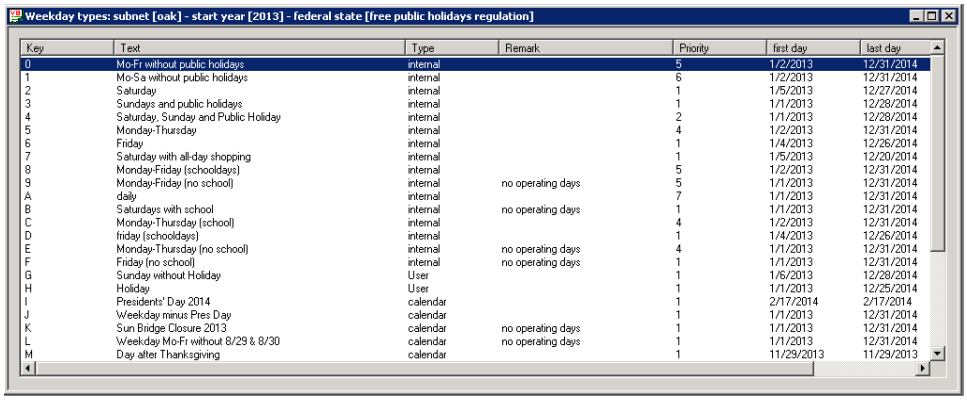
Figure 3-36 – DIVA Public Holidays

Some built-in daytypes will work for specified days of the week plus public holidays (for example, a Sunday recurring daytype plus the date of every public holiday), and others will work for specified days of the week minus public holidays (for example, a Weekday recurring daytype with gaps for all of the public holidays falling on a Weekday). Establishing a date as a public holiday in the trip planner will affect all of the built-in daytypes that either include or exclude the public holiday. Therefore, for holidays where only minor service changes occur, it is better to just work with daytypes and not establish the date as a public holiday in the trip planner.

The first step for the RTIS contractor is to set up any additional daytypes that might be necessary to support holiday service. Once daytypes are set up, then agency timetables are edited to ensure they have the correct daytypes to implement the desired holiday services. The most important thing to keep in mind is that a timetable must not have trips in two different daytypes that are attempting to run on the same day. For example, using both Weekday plus holiday and Sunday plus holiday daytypes will cause both daytypes to compete on public holidays. What typically happens is the trip planner cannot resolve the conflict and will then not run any service for the trips on that date.

It is hoped that in most cases, the existing daytypes already in use will suffice for most holiday services. In most instances, the Weekday daytype will exclude public holidays and the Sunday daytype will include public holidays. If the timetables are already in this configuration, then nothing further needs to be done by the RTIS contractor.

Some of the daytypes are available for editing, where the type is “calendar”, and they can be reused over and over for each holiday when needed.



Weekday types: subnet [oak] - start year [2013] - federal state [free public holidays regulation]

Key	Text	Type	Remark	Priority	first day	last day
0	Mo-Fr without public holidays	internal		5	1/2/2013	12/31/2014
1	Mo-Sa without public holidays	internal		6	1/2/2013	12/31/2014
2	Saturday	internal		1	1/5/2013	12/27/2014
3	Sundays and public holidays	internal		1	1/1/2013	12/28/2014
4	Saturday, Sunday and Public Holiday	internal		2	1/1/2013	12/28/2014
5	Monday-Thursday	internal		4	1/2/2013	12/31/2014
6	Friday	internal		1	1/4/2013	12/26/2014
7	Saturday with all-day shopping	internal		1	1/5/2013	12/20/2014
8	Monday-Friday (schooldays)	internal		5	1/2/2013	12/31/2014
9	Monday-Friday (no school)	internal	no operating days	5	1/1/2013	12/31/2014
A	daily	internal		7	1/1/2013	12/31/2014
B	Saturdays with school	internal	no operating days	1	1/1/2013	12/31/2014
C	Monday-Thursday (school)	internal		4	1/2/2013	12/31/2014
D	friday (schooldays)	internal		1	1/4/2013	12/26/2014
E	Monday-Thursday (no school)	internal	no operating days	4	1/1/2013	12/31/2014
F	Friday (no school)	internal	no operating days	1	1/1/2013	12/31/2014
G	Sunday without Holiday	User		1	1/6/2013	12/28/2014
H	Holiday	User		1	1/1/2013	12/25/2014
I	Presidents' Day 2014	calendar		1	2/17/2014	2/17/2014
J	Weekday minus Pres Day	calendar		1	1/1/2013	12/31/2014
K	Sun Bridge Closure 2013	calendar	no operating days	1	1/1/2013	12/31/2014
L	Weekday Mo-Fr without 8/29 & 8/30	calendar	no operating days	1	1/1/2013	12/31/2014
M	Day after Thanksgiving	calendar		1	11/29/2013	11/29/2013

Figure 3-37 – DIVA Daytypes

In Figure 3-37, daytypes I and J have been configured for the President’s Day 2014 holiday.

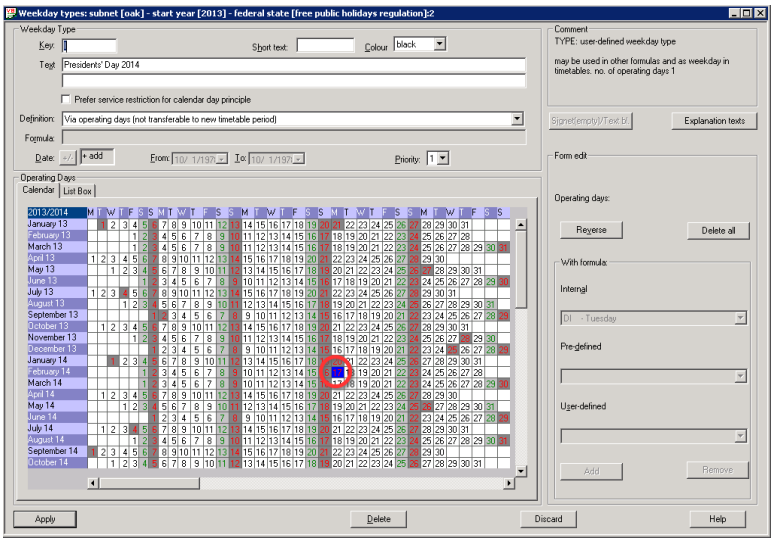


Figure 3-38 – Daytype Including a Holiday

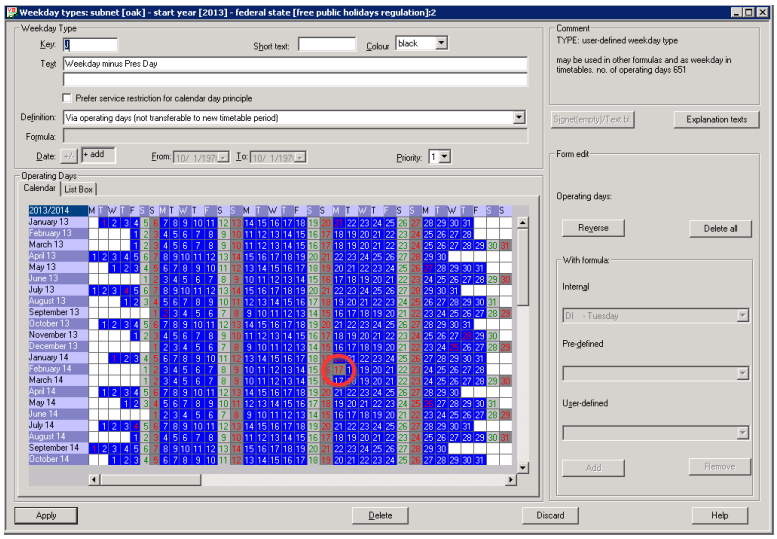


Figure 3-39 – Daytype Excluding a Holiday

There are three common holiday service operations that are performed on timetables using the Timetable Manager:

- No Service – In this case, if the public holiday is configured, running Weekday minus holiday causes operating day gaps on the dates of public holidays effectively rendering no service. Any existing daytypes that include public holidays should be replaced with daytypes that exclude public holidays. Should the date not be configured as a public holiday, the regular Weekday service is replaced with a custom Weekday service daytype that is missing the date (see Figure 3-39 for example).
- Substituted Service – In this case, an already existing service such as Saturday or Sunday runs in place of the Weekday service on the holiday. If the public holiday is configured, running Weekday minus holiday causes operating day gaps on the dates of public holidays, and running Saturday plus holiday or Sunday plus holiday will run on its normal day and fill in the holiday gap. If necessary, existing daytypes are replaced with appropriate ones. Should the date not be configured as a public holiday, the regular Weekday service is replaced with a custom Weekday service daytype that is missing the date (see Figure 3-39 for example). Then the alternate existing service is copied into a daytype that just runs on the needed holiday date (daytype H for example, see Figure 3-37).
- Custom Service – In this case, a new timetable that does not already exist must run in place of the Weekday service on the holiday. If the public holiday is configured, running Weekday minus holiday causes operating day gaps on the dates of public holidays, and the custom schedule is created using a daytype that does run on public holidays. Any existing daytypes that include public holidays should be replaced with daytypes that exclude public holidays. Should the date not be configured as a public holiday, the regular Weekday service is replaced with a custom Weekday service daytype that is

missing the date (see Figure 3-39 for example). Then the custom service is copied into a daytype that just runs on the needed holiday date (see Figure 3-38 for example).

3.5.11 PARKING IMPORT

Parking data is exported from the RTD (see section 3.2.11) in CSV format, and then imported into the GIS layer of the MMTP staging system. The DIVA GIS Import application is used to load the parking data.

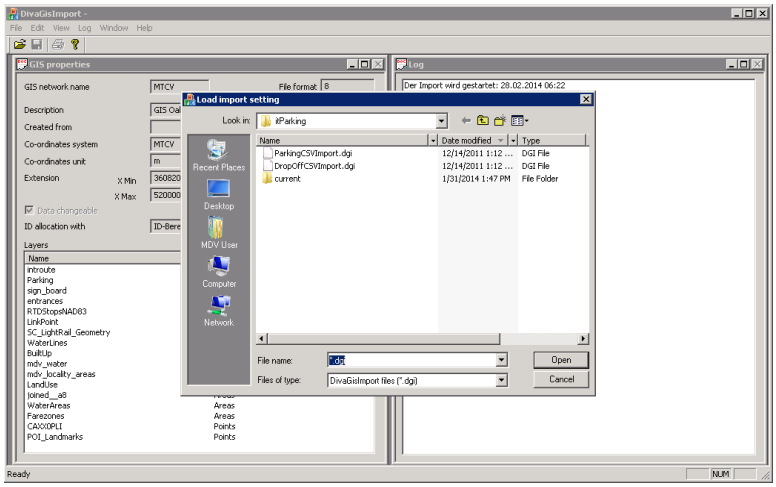


Figure 3-40 – Parking Import Scripts

The trip planner vendor has produced for the RTIS contrator a separate PDF document entitled MMTP_DataUpdateAndDeployment_v0.1 containing the steps necessary to perform the manual update of data.

3.5.12 PROJECT MAINTENANCE

The operation of the trip planner works with a project year. Since calendar daytypes can only keep a two year timespan, the project year is used to extend the service period for another year. For example, daytypes in the project “y10” (year 2010) will have service covering Jan 2010 thru Dec 2011. Daytypes in the project “y11” (year 2011) will have service covering Jan 2011 thru Dec 2012. If the project year is not extended on time, there is a risk that the trip planner will cease to provide itineraries past the end of the project calendar year.

Every October, the RTIS contractor will request the trip planner vendor to update the project year. At the same time, the RTIS contractor will update the fares file *oak_fares.xml* to extend of the fare element to the end of the next calendar year which ensures continued service. It is best to begin this process in October so that the process will not interfere with the Thanksgiving holiday preparations in November.

3.6 TRIP PLANNER SPATIAL DATA MAINTENANCE

After updating information in DIVA through a data import or as part of scheduled data maintenance the spatial data in DIVA should be verified using the DivaGeo application. Spatial data includes the street network basemap, stops (with their components: stop areas and stop points), points of interest, and route links (route geometry). The following sections provide a brief overview of the spatial editing processes. More specific information on spatial data maintenance can be found on the RTIS contractor's Wiki site, currently at the following URL:

204.94.80.141/wiki/index.php/MDV:Diva:GeoApp

3.6.1 STOP EDITING AND GEOREFERENCING

The provided latitude and longitude coordinates generally are sufficient for stop positioning. The DIVA Referencing application will georeference all new stops to their nearest links (edges) on the street network basemap. Occasionally the results are not what was intended or desired. For instance, a stop might exist on a street that runs orthogonal and beneath and overhead freeway. Yet the position of the stop is closer to the freeway link than it is to the street link, and the stop becomes georeferenced to the freeway.

Figure 3-41 – DivaGeo Showing Stops Near to Freeway

The most common affect seen by an incorrectly georeferenced stop is abberations in the route geometry which is supposed to illustrate the street route that a bus is traveling. From the example just given, the route geometry would show unusual routing in order to place the bus on the freeway where the misplaced stop was georeferenced.

Using DivaGeo, the stop position can be quickly corrected and new route geometry generated. The action of dragging the stop with the mouse just a little closer to the street and away from the

freeway will cause the stop to be regeoreferenced to the street. The dark lines running down the middle of the street links in Figure 3-41 are a visual cue revealing to which street links the nearby stop points are georeferenced. Had one of the stop points in the figure been georeferenced to the freeway, a dark blue line would have been seen running through the middle of the orange freeway link.

3.6.2 Route Geometry

The computation of route geometry of the DIVA Referencing application uses a shortest path approach. Occasionally the results are not what was intended or desired. The shortest path shown in shows the bus cutting across 6th Street. However, buses actually use the signal light a little farther down on 8th Street.

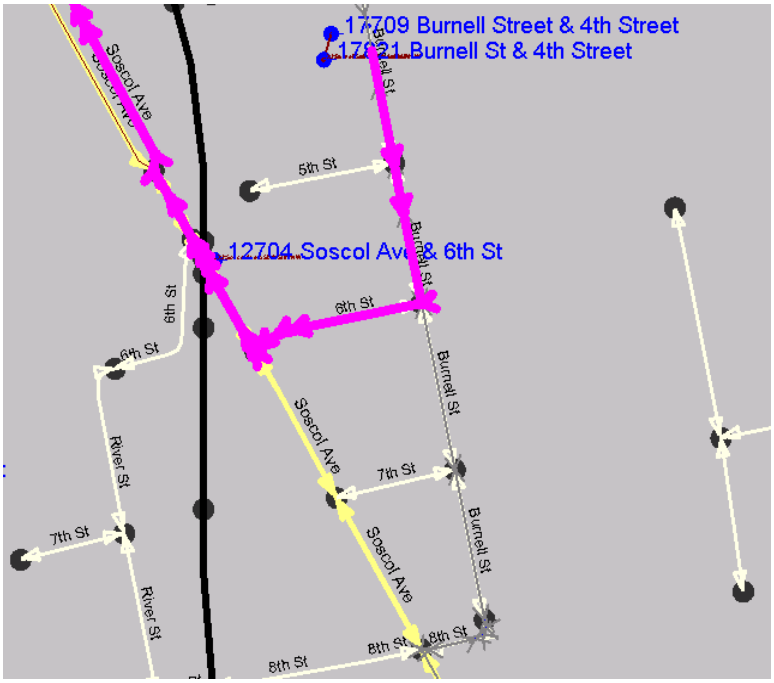


Figure 3-42 – Route Geometry in Wrong Position

With DivaGeo, the incorrect link can be selected and all intermediate points deleted. This deletes all of the automatically generated routing and reduces the link to a straight line between the two stops. Then with manual editing enabled, the link can be grabbed with the mouse and dropped on the 8th Street. The link will be automatically routed from the starting stop to the point where the link was dropped on 8th Street. Finally the remaining portion of the link can use the automatic georeferencing feature to complete the rest of the link as it was.

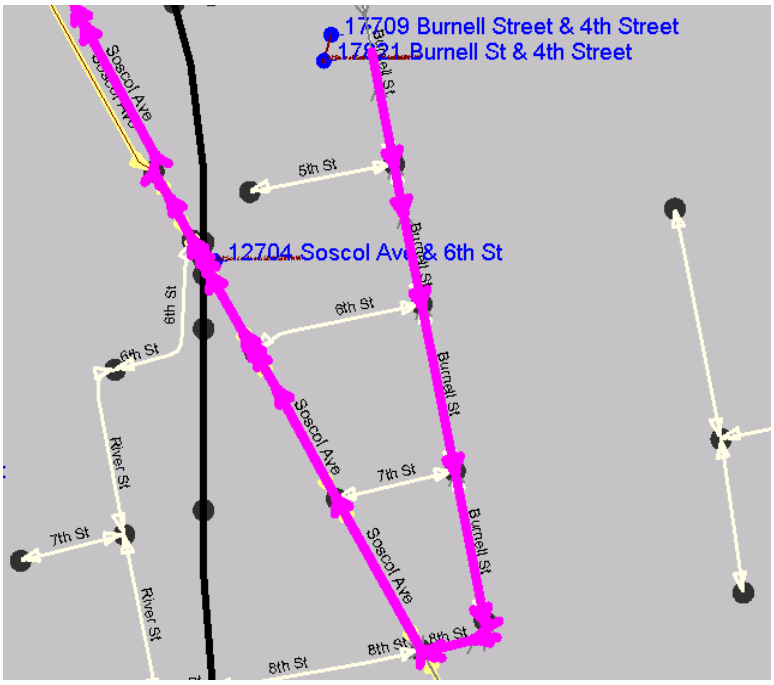


Figure 3-43 – Route Geometry in Corrected Position

The result will affect every route which uses the same sequence of both stops. The link generated between the two stops will be preserved even when new data is imported. So long as the stops remain unchanged, the updated link will also remain.

3.6.3 BASEMAP EDITING

The DIVA street network basemap is a two-dimensional representation of a map in digital form using an abstract data type called a graph. The end-points of a street segment are the nodes of the graph, and the street segment between them are the edges or links. The street segments have properties that can permit travel in either one or two directions, indicate a type (suburban street, highway, freeway, etc.), represent an address range, express a speed limit, and more. The nodes very often are used to connect the end-points of several street links at an intersection. Nodes have properties that express turn bans. Turn bans prevent illegal turns from one street link to another so that automatic routing will faithfully represent traffic rules.

Because the basemap is a costly and time consuming set of data to replace, DivaGeo provides the ability to make manual changes to the basemap. A primary example is in cases where digital maps have not yet caught up to recent road changes.

One such structure built by the RTIS contractor is the San Francisco Temporary Transbay Terminal. At the time of this writing, a large, looping section of road that connected nearby streets and freeway with the Transbay Terminal is being replaced. An entire city block has been converted into a temporary terminal while the new Transbay Terminal is under construction.

In below, the new temporary structure can be seen which was drawn entirely using DivaGeo. Also, just enough of the old terminal service roads were removed to make way for the temporary terminal, with some remnants of the old roads still visible.

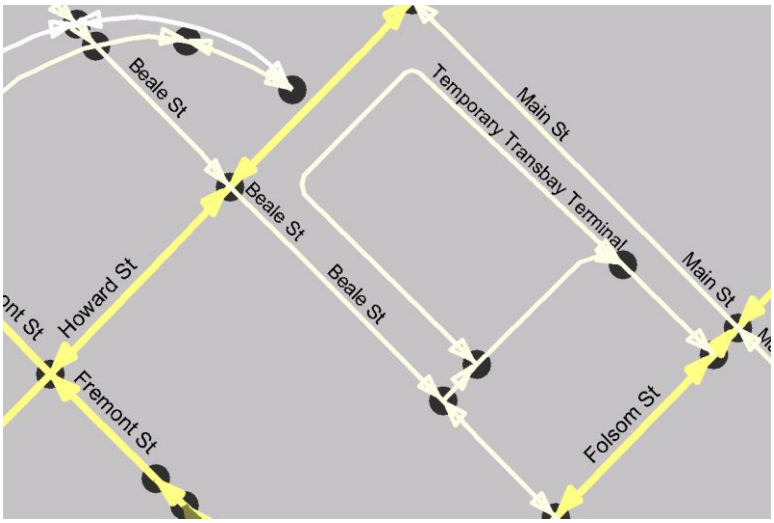


Figure 3-44 – DivaGeo Basemap Alteration

After the basemap is edited, the underlying data structures need to be rebuilt. On the trip planner maintenance system (MDV-Oak3, where the basemap editing was performed), there is an application called ITRouterStaticNetworkConverter used to rebuild the basemap network structures. After the data is transferred to the trip planner staging system (MDV-STG), one of the EFALocationConverter applications must be run to update the dictionaries (see section 3.4.2). After the data is transferred to the MMTP staging system (MMTP-STG-TP), an additional basemap processing application called EFAExtendedGISModelBuilder further updates the internal data structures to support driving directions. The MMTP staging also has its own version of the EFALocationCoverter which must be run.

3.7 CMS DATA MAINTENANCE

The 511 Transit Content Management System (CMS) is a powerful, online platform that allows the RTIS contractor, transit agencies, 511 TIC (Traveler Information Center) and MTC staff to maintain certain transit service data, as well as review website usage statistics through secured access, password-protected user accounts with varying degrees of privilege. Privileges permit users to post and edit service announcements, edit transit agency profile information, route names, add transit system map files in PDF or GIF, review and respond to customer feedbacks, edit predefined responses, edit promo boxes, review usage reports and statistics, configure data feeds, and maintain user accounts.

REDACTED *Figure 3-45 – CMS Home Page (Administrator Account)*

3.7.1 CMS USER FEEDBACK

Customer feedback reported through the 511 Transit website suggestions and feedback forms are managed through the CMS system. A new user feedback requires a response within one business day of being reported in the system, even if the response is simply an acknowledgement along with a promise to dig deeper and follow up with the user later.

New feedbacks are shown by default on the CMS Feedback page. Clicking on a CMS feedback link opens the feedback content. Based on the content of the feedback a 'Type' is assigned and a response be prepared by clicking the 'Response' button. Checking the 'Close' box and clicking on "Save and Send" marks the feedback as closed and sends the response to the user, saving the response in the RTD database. It is also possible to assign the feedback to another user of the CMS for response. Each CMS user can view the feedbacks assigned to them under the Assigned Feedback section. Closed feedbacks can also be viewed by selecting "Closed" from the Show dropdown menu.

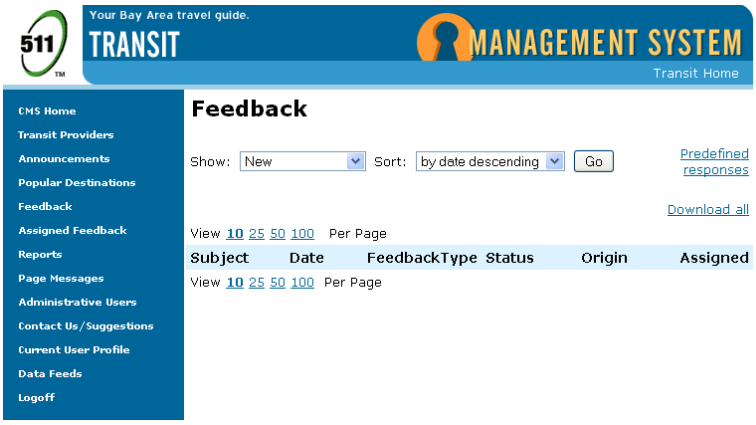


Figure 3-46 – CMS Feedback Management

3.7.2 TRANSIT SERVICE ANNOUNCEMENTS

Announcements for the Transit 511 website are managed through the CMS Announcements section. The announcement page lists announcements by various categories such as pending, queued, active, deactivated, and more. The list can be ordered by agency, and by activation, deactivation, and publishing dates. Each announcement can reviewed in detail by clicking on its link from the list. In the detail page the announcement content can be edited and its status updated.

To create a new announcement user would click on the “Add New” button from the announcement home page. In the new announcement page user, a transit agency provider can be optionally selected. The “Approved” checkbox must be checked and the announcement saved in order for the announcement content to be published on Transit 511 website. Clicking the “Emergency” box elevates the status of the announcement so that it shows at the top of all announcements on the 511 Transit website home page.

The Announcement category determines where on the website the announcement is shown. Itinerary, Route specific, and Schedule messages show on the Trip Planner itineraries, Route, and Schedule pages, respectively. For these announcements user also selects routes that are impacted. Multiple announcement categories and multiple routes can be selected. Regional announcements show on the home page of the Transit 511 website in addition to the Announcements section of the website. Provider specific announcements are displayed only under the Agency Announcements tab of the announcement section.

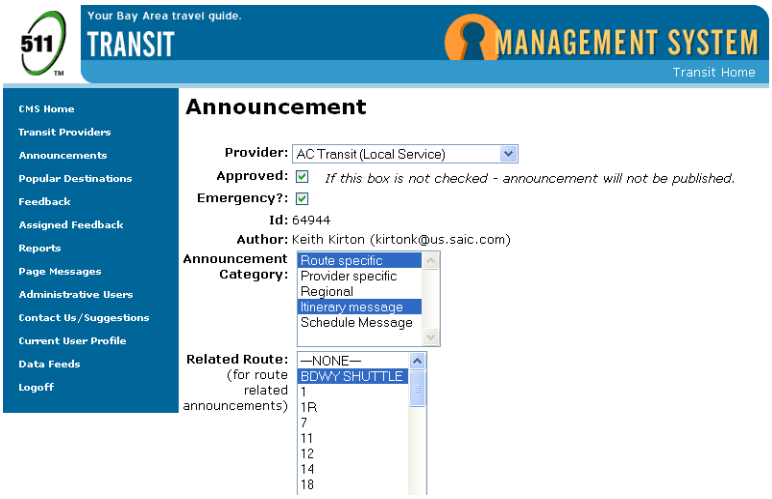


Figure 3-47 – CMS Announcement Management

3.7.3 POPULAR DESTINATIONS

Popular Destinations are a select subset the landmarks maintained in RTD. Certain aspects of popular destination information such as URL for the landmark website, thumbnail and larger images, an alternate title, description, location address, and transit agencies providing service to the landmark are all maintained through the CMS interface. New popular destinations can be created and existing ones can be deleted. Creation of new popular destination requires that the landmark already exist in RTD (see also section 3.2.9).

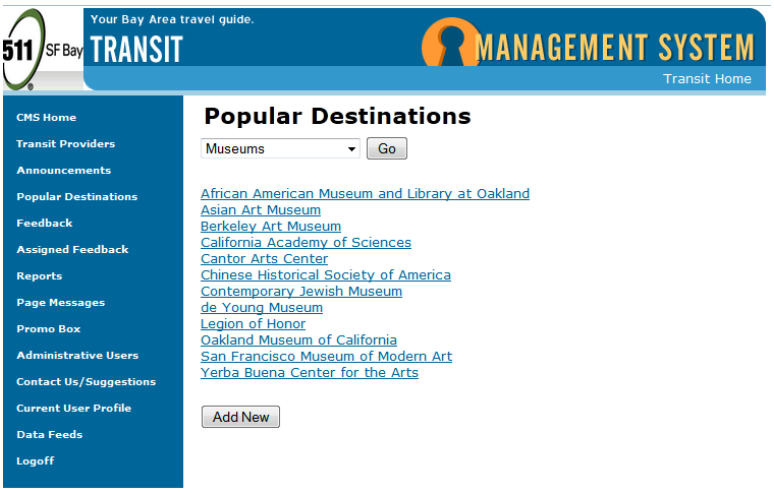


Figure 3-48 – CMS Popular Destination Management

3.7.4 Promo Boxes

On the trip planner and accessible home pages of the Transit 511 website, there exist image links to promote services or information that MTC desires to convey to the public. These image links are maintained through CMS.

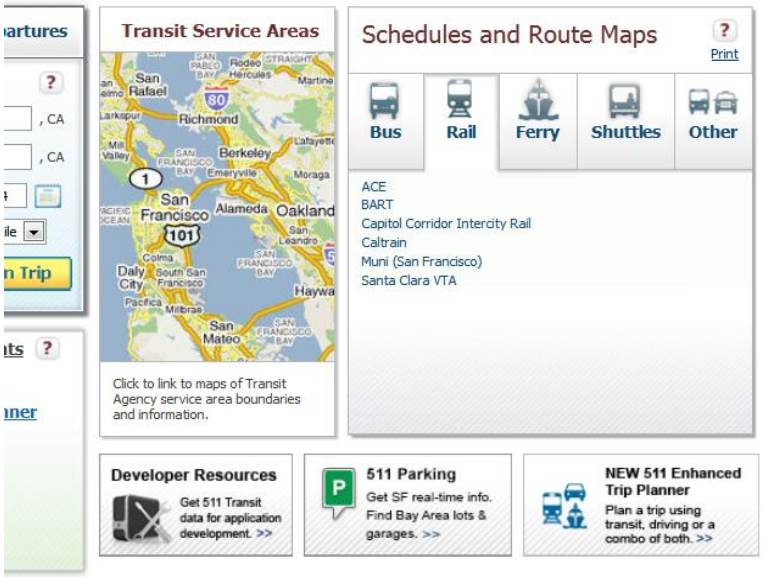


Figure 3-49 – Promo Boxes on Transit 511 Home Page

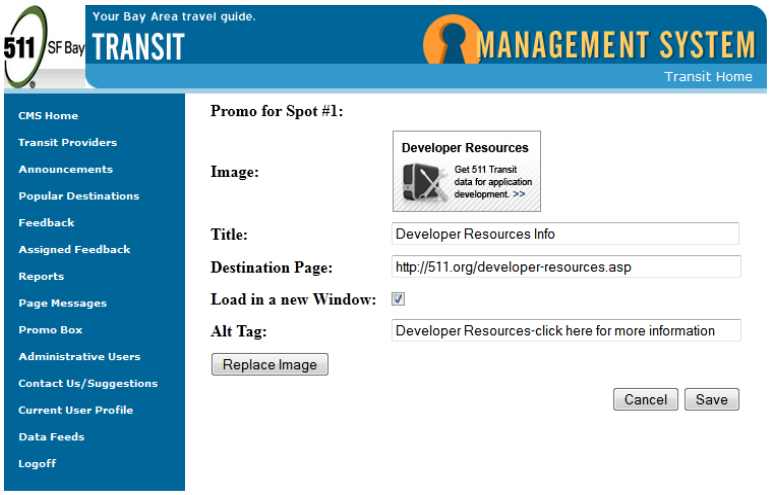


Figure 3-50 – CMS Promo Box Management

3.7.5 Transit Providers

Basic information about the transit agencies that appears on Transit 511 website is maintained through the Transit Providers section of the CMS. Agency logos, addresses, website links, profile descriptions, extended route name descriptions, route map images, and system map images can all be updated through the CMS system.

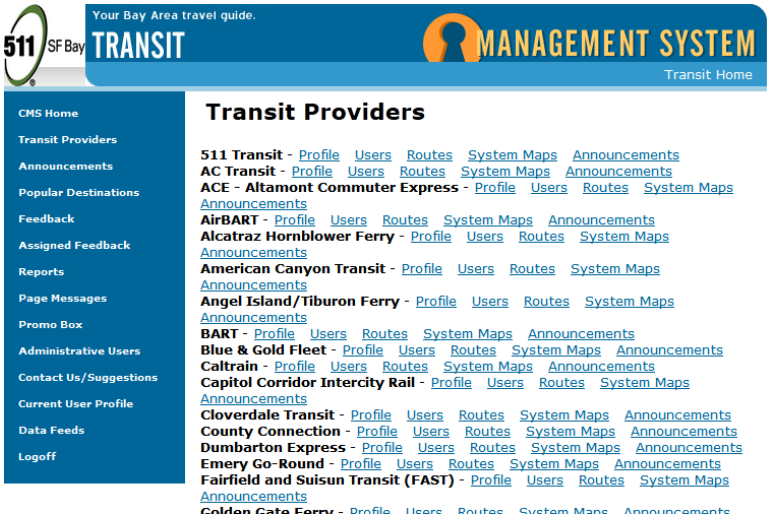


Figure 3-51 – CMS Transit Providers (Administrator Account)

3.7.6 Page Messages

The Page Messages feature was added to perform a feature similar to Promo Box, except with text. However, the feature was never fully tested nor fully implemented.

3.7.7 Data Feed Configuration

Users with access can create and edit the configured data feed tasks. These are tasks that run at regular intervals, create an export of agency data in a predetermined format (CSV or GTFS), and will archive the exported data set for later download by data feed enabled users. The configuration also allows a peak hour setting during which downloads by the data feed users will not be permitted.

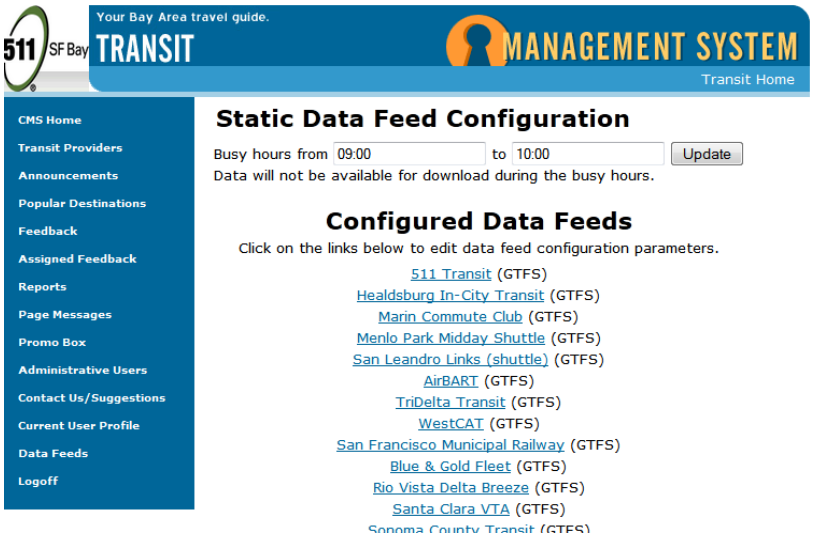


Figure 3-52 – CMS Data Feed Configuration

3.7.8 REPORTS

While not a data maintenance function, selecting Reports from the CMS panel menu will present options for viewing event history statistics. Every time the user interacts with the Transit 511 web application, and event is created and stored in the database. These events have a category associated with them so it is possible to tell how many of each kind of event occurs on a given day, week, or month.

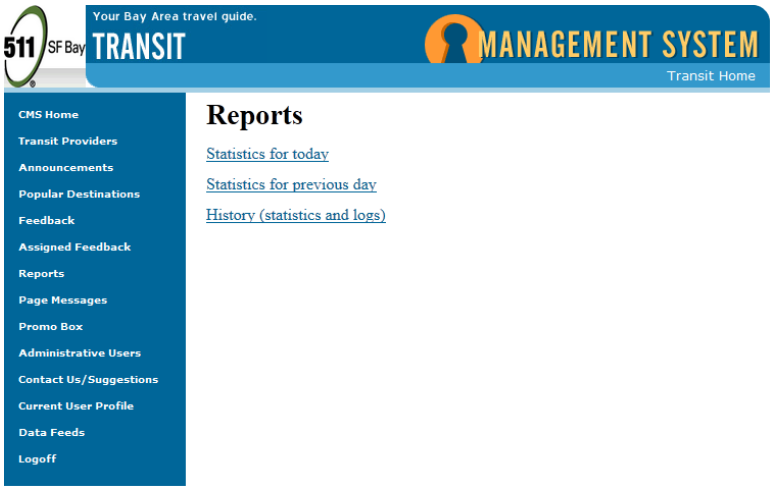
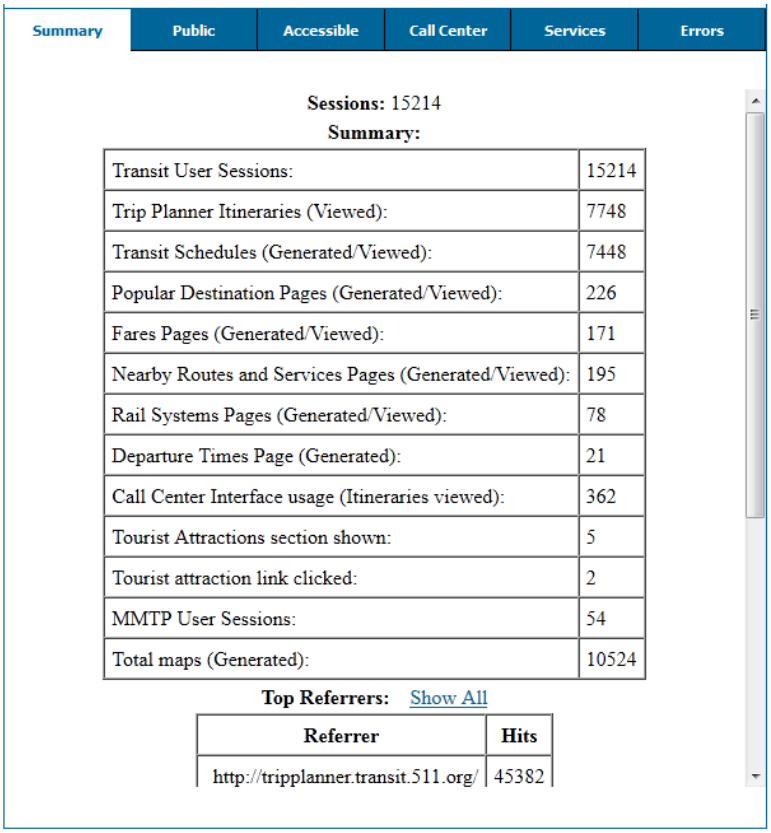


Figure 3-53 – CMS Reports Main Menu

Selecting "Statistics for today" will cause the system to summarize events up to the minute (which may cause a brief delay), and then present the event summary report. Besides the

summary tab, there are additional tabs that group events by their system of origin: Public, Accessible, Call Center, Services, and Errors.



Summary | Public | Accessible | Call Center | Services | Errors

Sessions: 15214

Summary:

Transit User Sessions:	15214
Trip Planner Itineraries (Viewed):	7748
Transit Schedules (Generated/Viewed):	7448
Popular Destination Pages (Generated/Viewed):	226
Fares Pages (Generated/Viewed):	171
Nearby Routes and Services Pages (Generated/Viewed):	195
Rail Systems Pages (Generated/Viewed):	78
Departure Times Page (Generated):	21
Call Center Interface usage (Itineraries viewed):	362
Tourist Attractions section shown:	5
Tourist attraction link clicked:	2
MMTP User Sessions:	54
Total maps (Generated):	10524

Top Referrers: Show All

Referrer	Hits
http://tripplanner.transit.511.org/	45382

Figure 3-54 – CMS Event Statistics

Selecting “Statistics for previous day” will present the event summary report with already summarized events for the previous full day.

Selecting “History (statistics and logs)” will present the option of viewing the event summary report for one day, or summarized for an entire week, or summarized for an entire month.

3.8 File Storage and Sharing

Proper data file storage is a critical part of the data maintenance process. It helps ensure that data can be found by all team members and that an audit trail exists for the data work done.

The RTIS contractor maintains a server with very large storage capacity usable as a Network Attached Storage device (NAS). REDACTED The NAS provides storage folders for the RTIS

contractor users, projects, documentation, and software. Many folders are also user restricted which provides a measure of security, and the entire NAS system is backed up regularly in the event of system failure.

Throughout this document, specific folder locations on this NAS system are documented. Let the reader understand that the NAS system referred to is not accessible to anyone other than the RTIS contractor.

Figure 3-55 – REDACTED

4 Quality Control and Quality Assurance

4.1 MTC Data Quality Standards

MTC imposes data quality standards on the transit data, transit trip planner data, and GIS applications and data. Transit data are kept current and accurate at all times. Quality Assurance/Quality Control (QA/QC) methods, such as scripts or manual checks on data for use in RTIS, ensure both data quality and accuracy. The methods and strategies will be discussed in some detail below. These methods aim at completing data review to an error rate of no greater than 2%.

The itinerary data provided in transit trip planner cannot exceed the error rate of 5% on a recurring basis. Data and itinerary accuracy and consistency are measured through quality assurance processes.

GIS Applications and Data are kept current and accurate data at all times. Errors in the identified elements, including incorrectly drawn lines, missing or misplaced stops, road centerlines, landmarks, labels, coding errors and address ranges, are corrected within 5 working days of being notified of the errors or inconsistencies.

The following diagram depicts the current QC process:

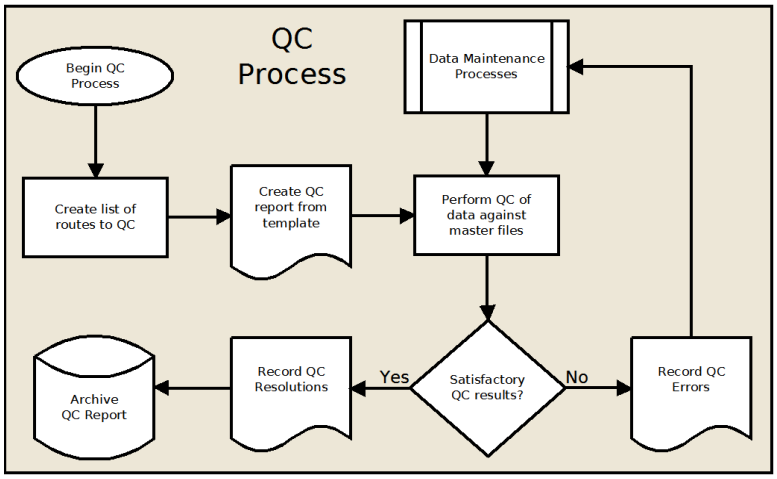
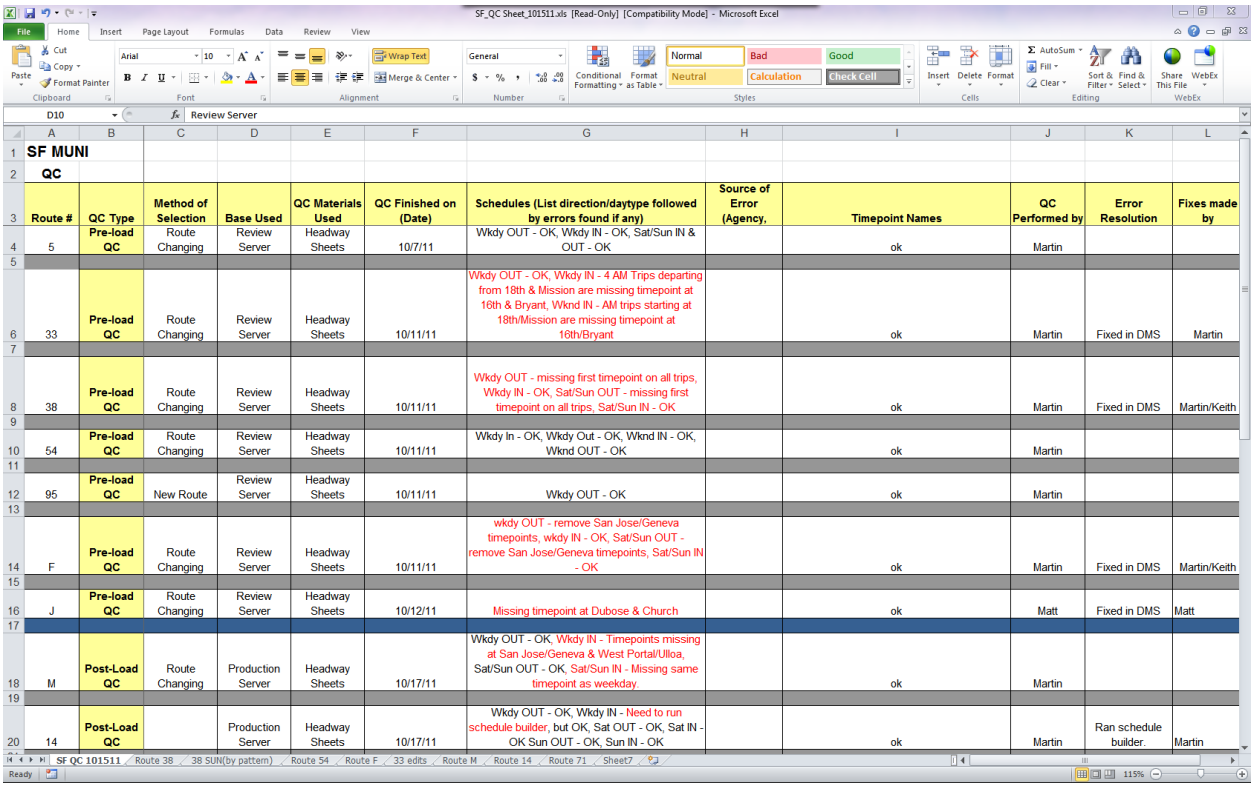


Figure 4-1 – QC Process

4.2 Data QC Strategy

Routes selected for the data QC check are typically those with a large number of trips or large number of patterns given the greater probability of finding errors in these routes. Routes can also be selected for data QC based on recommendation from the agency. Due to the check only being a sample, it is possible that errors may go undetected in the non-sampled data. The

RTIS contractor will prepare a detailed report of all errors and will manually update the data on the maintenance systems and request updated data from the agency when necessary to resolve all detected errors.



SF MUNI

QC

Route #	QC Type	Method of Selection	Base Used	QC Materials Used	QC Finished on (Date)	Schedules (List direction/daytype followed by errors found if any)	Source of Error (Agency,	Timepoint Names	QC Performed by	Error Resolution	Fixes made by
5	Pre-load QC	Route Changing	Review Server	Headway Sheets	10/7/11	Wkdy OUT - OK, Wkdy IN - OK, Sat/Sun IN & OUT - OK		ok	Martin		
33	Pre-load QC	Route Changing	Review Server	Headway Sheets	10/11/11	Wkdy OUT - OK, Wkdy IN - 4 AM Trips departing from 18th & Mission are missing timepoint at 16th & Bryant, Wknd IN - AM trips starting at 18th/Mission are missing timepoint at 16th/Bryant		ok	Martin	Fixed in DMS	Martin
38	Pre-load QC	Route Changing	Review Server	Headway Sheets	10/11/11	Wkdy OUT - missing first timepoint on all trips, Wkdy IN - OK, Sat/Sun OUT - missing first timepoint on all trips, Sat/Sun IN - OK		ok	Martin	Fixed in DMS	Martin/Keith
54	Pre-load QC	Route Changing	Review Server	Headway Sheets	10/11/11	Wkdy In - OK, Wkdy Out - OK, Wknd IN - OK, Wknd OUT - OK		ok	Martin		
95	Pre-load QC	New Route	Review Server	Headway Sheets	10/11/11	Wkdy OUT - OK		ok	Martin		
F	Pre-load QC	Route Changing	Review Server	Headway Sheets	10/11/11	wkdy OUT - remove San Jose/Geneva timepoints, wkdy IN - OK, Sat/Sun OUT - remove San Jose/Geneva timepoints, Sat/Sun IN - OK		ok	Martin	Fixed in DMS	Martin/Keith
J	Pre-load QC	Route Changing	Review Server	Headway Sheets	10/12/11	Missing timepoint at Dubose & Church		ok	Matt	Fixed in DMS	Matt
M	Post-Load QC	Route Changing	Production Server	Headway Sheets	10/17/11	Wkdy OUT - OK, Wkdy IN - Timepoints missing at San Jose/Geneva & West Portal/Ulloa, Sat/Sun OUT - OK, Sat/Sun IN - Missing same timepoint as weekday.		ok	Martin		
14	Post-Load QC		Production Server	Headway Sheets	10/17/11	Wkdy OUT - OK, Wkdy IN - Need to run schedule builder, but OK, Sat OUT - OK, Sat IN - OK Sun OUT - OK, Sun IN - OK		ok	Martin	Ran schedule builder.	Martin

Figure 4-2 – QC Sheet

Please refer to the RTIS Data QA/QC Strategy document for more information.

4.3 Checking Production Geometry QC Reports

Each night a script runs that performs a simple analysis to ensure that every route in the RTD also has a route geometry shape associated with it. The RTIS contractor will fetch the report maintained on the shared storage server "oak-storage" at the following location:

REDACTED

Any deficiencies identified in the report will be addressed within five working days.

4.4 Xenu Website Broken Link Check

The RTIS contractor uses a free software tool called Xenu Link Sleuth to crawl the Transit 511 website in search of broken links. Xenu will produce a list of broken links and their related information such as the type of error, the URL location of the broken link, and the website on which the broken link is used. The following sections of the Transit 511 website must be checked individually:

- Trip Planning: http://tripplanner.transit.511.org
- Schedules: http://transit.511.org/schedules/index.aspx
- Destinations: http://transit.511.org/destinations/index.aspx
- Announcements: http://transit.511.org/announcements/index.aspx
- Accessibility & Seniors: http://transit.511.org/disabled/index.aspx
- Shuttles serving BART: http://transit.511.org/providers/bartshuttles.aspx
- Accessible Version [link at bottom left of site]: http://transit.511.org/accessible/

The Xenu website analysis tool is run monthly. Because the use of Xenu can generate a large number of website events, the database administrator is notified after each run to ensure that the Xenu generated events are not reflected in the event statistics.

4.5 XML ENGINE QC MODULE

At transit agencies where the XML Engine application is deployed, the agency will run the XML Engine QC module to check the data quality. Agencies will resolve reported errors and then send the XML data to the RTIS contractor.

For transit agencies not using the XML Engine application, the RTIS contractor will run the XML Engine QC module on the agency data before posting it on the review website and will report any critical data quality errors to the agency. The RTIS contractor will resolve errors that can be resolved without obtaining a new dataset from the agency (e.g., a missing route description). If necessary, the RTIS contractor will obtain a new dataset and begin the update process over again. Once all identified data quality errors are resolved, the RTIS contractor will post the data on the review website for the agency to review.

The following table shows the violations of the QC rules detected by XML Engine QC Module and the appropriate resolutions:

RTIS Data Type	Data Quality Indicator (DQI)	Possible Impacts from violation of DQI	Data Error Resolutions
Pattern	All patterns in Hastus/Trapeze are included in RTD	Users will get incomplete schedules	Any unmatched pattern in Hastus/Trapeze will be reported to the users.

RTIS Data Type	Data Quality Indicator (DQI)	Possible Impacts from violation of DQI	Data Error Resolutions
Pattern Stops	Has timepoint codes (when data is provided through TSMA)	Patterns will not be matched against the patterns from Hastus	Agencies will update the data in TSMA and run the XML Engine QC Module once more to make sure all timepoints have timepoint code.
Trip	Has no duplicates	Duplicate trips will be shown in the time tables. Will cause problems during data loads on Trip planner	Transit agencies using the XML Engine will correct the data. The RTIS contractor will work with rest of the agencies to get corrected data. When possible, errors will be resolved by the RTIS contractor by removing duplicate trips, adding sequence number, etc.
	Has a trip sequence number	Trips will not be sorted properly.	Transit agencies using the XML Engine will correct the data. The RTIS contractor will work with rest of the agencies to get corrected data.
	Has a standard day type	Trips will not be categorized by any daytype.	Transit agencies using the XML Engine will correct the data. The RTIS contractor will work with rest of the agencies to get corrected data.
Schedules	Has all time values in ascending order	The trip schedules have wrong values.	Transit agencies using the XML Engine will correct the data. The RTIS contractor will work with rest of the agencies to get corrected data.

RTIS Data Type	Data Quality Indicator (DQI)	Possible Impacts from violation of DQI	Data Error Resolutions
	Timepoint sequences are present	Timepoint sequence in the time table will be wrong or incomeplete	Transit agencies using the XML Engine will correct the data. The RTIS contractor will work with rest of the agencies to get corrected data.
Timepoint	Has a description	Timepoint name will not be displayed.	Update Timepoint Names. By default the timepoint names will be names of the corresponding stops.
	Has a stop associated with it	Orphan data will exist in database.	Transit agencies using the XML Engine will correct the data. The RTIS contractor will work with the rest to get corrected data.

Table 5 – Errors Detected by XML Engine QC Module

4.6 XML ENGINE DATA COMPARISON MODULE

The automated data comparison module for the XML engine is used by the RTIS contractor prior to importing an agency provided Transit XML data file into the maintenance RTD. The data comparison module will identify the differences between any two XML files, two RTD databases, or and XML file and an RTD database. An HTML formatted report detailing all of the differences between the two datasets will be produced by the data comparison module.

4.7 QC SCRIPTS

The RTIS contractor will develop scripts to check the data quality indicators (DQIs) for each agency. The DQIs will identify data inaccuracies or inconsistencies. For example the scripts will check how many routes are missing route descriptions, how many patterns have no trips, etc. The RTIS contractor will run these scripts to query the data and produce a report where the quality of all data types will be listed based on the rules shown in below. The numeric results from the query will indicate the data quality. These scripts can be run against the review data or production data to get a quick snapshot of the quality of the data.

RTIS Data Type	Data Quality Indicator (DQI)	Possible Impacts from violation of DQI	Error Detection Method	Data Error Resolutions
Stop	Has correctly formatted stop names	Unformatted stop names	Scripts	Format stop addresses before loading them on production server.
	Has corner information	Incomplete/Unusable itineraries	Scripts	Update corner information wherever available.
	Has Latitude/Longitude within agency service area	Incorrect itineraries	Scripts	Update the agency boundaries and/or stop co-ordinates.
	Has mode information	Mode based display of stops will not work	Scripts	Assign appropriate modes.
	Has amenities (for agencies providing amenities)	Itineraries will not display any amenities associated with involved stops.	Scripts	Collect and load amenities.
	Has zone information (for agencies using fare zones)	Trip planner fares will not be calculated properly.	Scripts	Provide the Zone information to Trip Planner along with merged XML. (After fare zone editing functionality is added to DMS)

RTIS Data Type	Data Quality Indicator (DQI)	Possible Impacts from violation of DQI	Error Detection Method	Data Error Resolutions
	Spatial Accuracy	Incorrect stop location might lead to wrong itineraries.	Visual QC, scripts	Update stop location.. Transit agencies will then be requested to correct the location in Hastus, Trapeze, TSMA or other systems they use to maintain stop coordinates.
	Has portal information	Incorrect or incomplete walking directions to access transit stop.	Scripts	Collect and load portal information.
Route	Has route name	Route description will not be displayed on the web site. Less useful information.	Scripts	Update route descriptions through CMS. This can be done by the RTIS contractor or the transit agencies.
	Has at least one pattern	Incomplete or unnecessary information provided to end users.	Scripts	Get pattern information from agency. If not delete route.
	Has route geometry	Route geometry will not be available to end users.	DMS, Script	Build route geometry, compare it with actual route shape and load it on production servers.
	Has mode	End users will not be able to distinguish mode of route s.	Script	Get mode information from the transit agency.

RTIS Data Type	Data Quality Indicator (DQI)	Possible Impacts from violation of DQI	Error Detection Method	Data Error Resolutions
Pattern	Has at least two timepoints	Incomplete schedule information will be made available to RTIS users.	Script	Get updated information from transit agency, preferable from the transit agency website. Update.
	Has at least one trip	Unnecessary data stored in RTD	Script	Ask agency to provide the required data. Delete the pattern manually if no trips are associated with this pattern.
	Has headsign	Incomplete trip itineraries will be generated.	Script	Ask agencies to provide the headsigns.
	Has pattern direction	Patterns cannot be grouped by direction to show schedules.	Script	Ask agencies to provide the required data.
	Has pattern geometry	Accurate and representative route geometry cannot be built.	DMS/Script	Create pattern geometries based on the snapped patternstops.
Pattern Stops	Has sequence information	Incorrect itineraries will be generated.	Scripts	Ask agencies to provide the required data.
	Are clearly marked as a timepoint or not timepoint	Incomplete time tables will be displayed. Incorrect itineraries will be generated.	Scripts	Ask agencies to provide the required data.
	Has snapped co-ordinates so that correct route geometry can be built.	Inaccurate route geometries will be generated.	Scripts	After snapping is done rebuild the pattern geometry using DMS.

RTIS Data Type	Data Quality Indicator (DQI)	Possible Impacts from violation of DQI	Error Detection Method	Data Error Resolutions
Timepoint	Has a description	Timepoint name will not be displayed.	Scripts/QC Module of XML Engine	Update Timepoint Names. By default the timepoint names will be names of the corresponding stops.
Fares, Fare Zones and Rider Categories	Has values for supported rider category and fare zones;	Incomplete fare information is provided to the user.	Manual	Information will be updated based on the data provided by transit agencies.
	Fare Zone has user friendly description;	Descriptions like Zone1, Zone2, etc. reduce the ability to provide meaningful information to users.	Manual	Update fare zone descriptions manually when necessary
Landmarks	Has latitude and longitude	Itineraries cannot be created from the landmark location.	Script	Update the location information manually
	Has city or county information	Selection of landmarks will be difficult when multiple landmarks with the same name are part of the search results.	Script	Update the attribute information manually
Popular Destinations	Has description and picture;	Users will not get more information about a popular destination.	Scripts	Update manually using CMS.
Agency Information	All attributes of agency information have been populated.	Incomplete agency information will be provided to the users.	Manual /Script	Update using CMS

RTIS Data Type	Data Quality Indicator (DQI)	Possible Impacts from violation of DQI	Error Detection Method	Data Error Resolutions
Route Maps (Route Geometry)	Has one for every route	Users will not be able to see the route maps associated with each route;	DMS/Script	Create route geometry for the route using DMS and ArcMap.
	Represents ID of correct route	Users will see route maps associated with the same route.	Script	Synchronize the route ID
Service Area	Has one for every agency;	Users will not be able to see the service area maps.	Script	Create the service map and upload on production server. Update map as necessary.
	Covers all stops, fare zones and route maps for the agency;	Service area does not include all the areas served by the transit agency	Script/DMS	?

Table 6 – QC Scripts

An automated report generation script is used to create a report showing the following information by agency: sign-up date (includes current and upcoming sign-up dates); status of transit data types, CMS data, spatial data, landmarks, popular destinations, route geometry, fare zone maps, agency service area maps, and associated data elements in the database.

The data synchronization scripts is used to check if all route geometries are linked with the correct route IDs, if all route announcements are linked to the correct route IDs, and if all static files (route maps, GIFs loaded by transit agency using CMS) are linked to the correct route IDs. Links to these files are available whenever the user selects schedules for that particular route. They are also used to check if agency information such as Provider Website, Provider Description and Provider Contact are included, and if all popular destinations are linked with a valid landmark IDs.

4.8 QC OF TRIP PLANNER DATA

The trip planner has the ability to hold data for two sign-ups simultaneously. In order to accommodate this functionality, XML Engine generates a merged XML which holds the current data set from the staging RTD plus the new data set from the maintenance RTD. The activation

and deactivation dates of each sign-ups are updated before generating a merged XML. Routes, stops, and daytypes are synchronized between maintenance and staging RTDs using scripts.

The trip planner import process has various data validation rules built-in that are logged in a Microsoft Access database (see section 3.5.2). Errors reported during the import process are analyzed by the RTIS contractor and necessary actions are taken to ensure data quality. A sample of route geometries are also visually inspected and repaired as needed.

Data is then transferred to the staging trip planner. A number of sample itineraries are tested on the staging trip planner in order to check the function of schedules, transfers, walking distance and fares just as they would work in production. If any issues are found, they are resolved before transferring data to the production trip planner systems.

4.9 MANTIS

Mantis is a web-enabled task, bug, and issue tracking system. With every sign-up a new task is opened in the Mantis system and relevant details and documents concerning the sign-up are recorded. When the data is finally deployed to production and a final QC is passed, the Mantis issue is closed. The Mantis system is also used to track other data related tasks, even feedback issues from the general public.

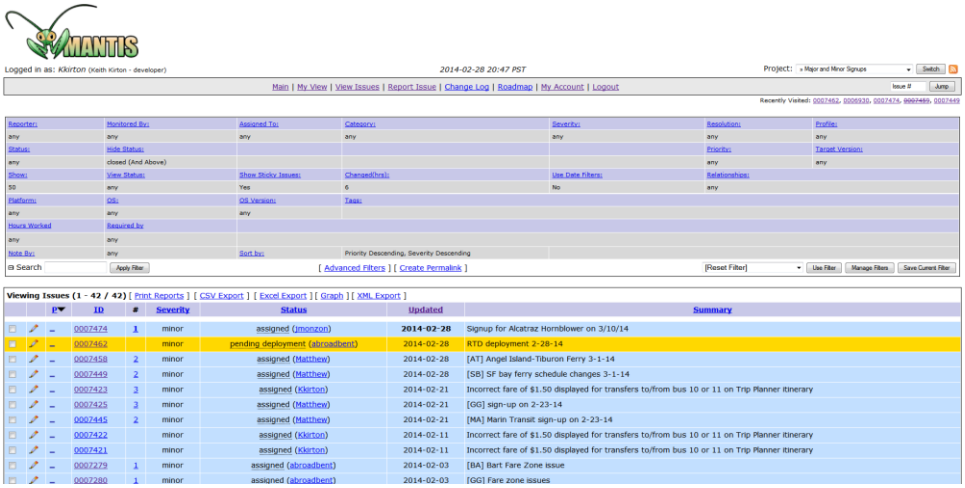


Figure 4-3 – Mantis Tracking System

4.10 QUALITY ASSURANCE TESTING

While actually a software function, the RTIS contractor's data team is routinely called upon to perform quality assurance testing against the software that supports all Transit 511 functionality. In order to support routine testing processes, a number of testing templates have been created

in order to facilitate a standard testing aparatus. An outline of what each template covers is as follows:

- Section 1 Regression Test Template
    - Trip Planner Main Page
    - Trip Planner Itineraries
    - Nearby Stop and Routes
    - Rail Systems
    - Call Center
    - Custom Schedules
- Section 2 Regression Test Template
    - Schedules, Maps and Fares
    - Regional Info
    - Real-Time Departures
    - Accessible
- CMS Regression Test Template
    - Data Feeds
    - Transit Providers
    - Announcements
    - Popular Destinations
    - Feedback
    - Reports
    - Promo Box
- MMTP Regression Test Template
    - Drive Only Itineraries
    - Drive to Transit Itineraries
    - Transit
    - Map Layer
- Mobil Application Regression Test Template
    - Popular Destination
    - Trip Planner Itineraries
    - Schedules
    - Map
    - Real-Time Departures

5 DATA TRANSFER PROCESSES

This chapter deals with the processes behind transferring RTIS Transit data amongst systems and with production data deployments. The DIVA import process and some of the minor data transfer processes such as landmarks and parking have already been sufficiently covered in chapter 3 Data Editing and Maintenance and will not be repeated here.

Figure 5-1 illustrates the production deployment phase for both the RTD and the trip planner system.

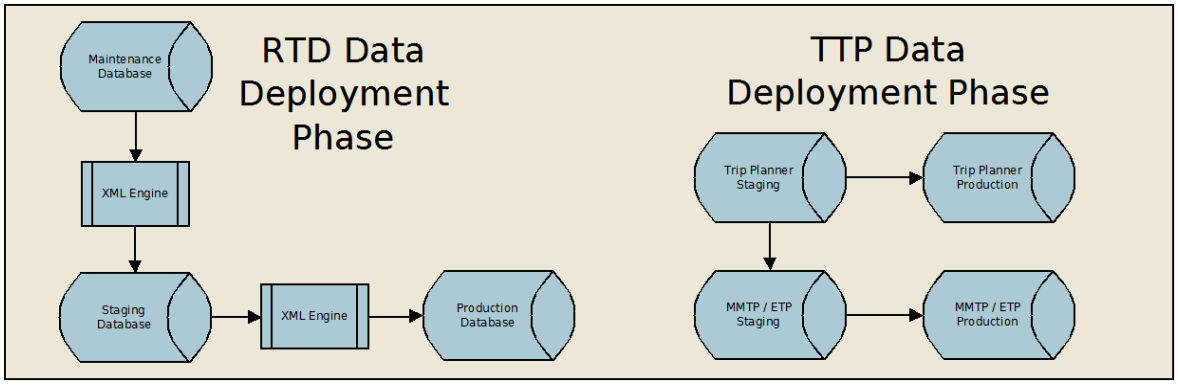


Figure 5-1 - Production Data Deployment Phases

5.1 RTIS TRANSIT XML

The RTIS Transit XML schema is the foundation for exchanging RTD data. The details of the XML schema can be found in the RTIS Data Architecture documents. The RTIS contractor created an software tool called XML Engine that can export and import XML files based on the Transit XML schema. The details of the XML schema have been shared with some RTIS partner transit agencies who are then able to provide sign-up data in an XML file directly to the RTIS contractor.

The Transit XML data file does not contain linefeeds, so care must be taken if the file is to be edited manually. Some editors will break up lines that are too long and insert linefeeds automatically, but this will cause the XML file to be unusable by XML Engine. Provided the XML file is not too large, Windows Notepad is a good choice for performing minor edits.

5.2 XML ENGINE

The XML Engine application is the principle tool for the exchange of transit agency data to and from an RTD database. The tool is build around the concept of modules that can be combined to perform a variety of data transfer needs. A list of the modules is as follows:

- RTD XML Reader
- RTD XML Writer
- RTD Database Reader
- RTD Database Writer
- RTD Merged XML Writer
- Quality Tester
- FTP Zipper Shipper
- Route Transfers Module
- Data Comparison
- RTT-RTD Data Comparer

A group of modules can be created for a special purpose and saved into an XML Engine configuration file. This configuration file can then be loaded and reused. XML Engine configuration files are preconfigured for a variety of features.

Some transit agencies have their own custom versions of XML Engine designed to convert their scheduling system exports into a Transit XML which is then provided to the RTIS contractor.

At the time of this writing, a separate development version of XML Engine is used to read the GTFS+ files and convert them into a Transit XML data file. It is anticipated that this feature will eventually be rolled into the common XML Engine as an additional module.

5.2.1 RTD Database Writer Considerations

It is necessary that some of the object IDs in the RTD, in particular Route and Stop IDs, must remain in sync across all RTD databases. There are settings in the RTD Database Writer module that are able to keep these IDs in sync. When these sync settings are disabled, any new route and stop objects written to the target RTD will get a newly generated ID (primary key value). Alternatively, when the sync settings are enabled, new route and stop objects will be written to the target RTD with the same ID as found within the source XML.

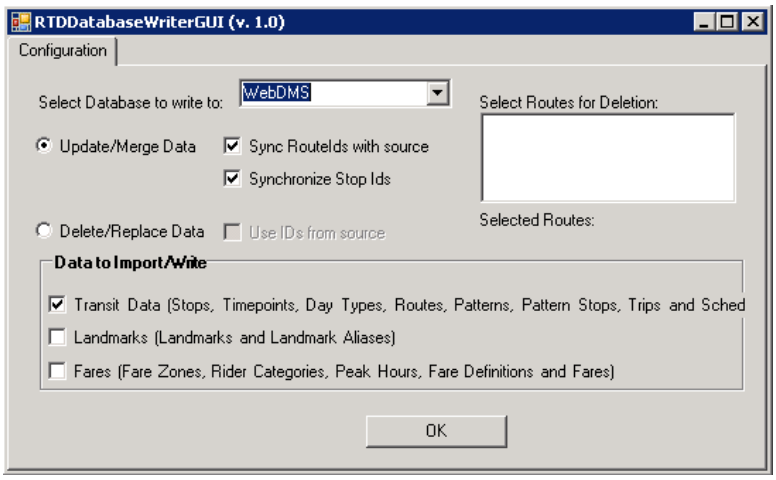


Figure 5-2 - RTD Database Writer Sync Settings

The only time when the sync setting should be disabled is when importing an agency provided XML file directly into the maintenance database. Each transit agency will have their own IDs for these objects, and it is important to preserve the IDs already in the RTD and to generate new IDs from a numeric range (sequence) which is guaranteed not to conflict with IDs already in existance.

For importing XML files that were generated from an RTD database, and for RTD to RTD transfers, the sync feature of the RTD Database Writer should be enabled.

5.2.2 Transfer from RTD to XML

Transferring agency data from an RTD to an XML file involves the use of the RTD Database Reader module and the RTD XML Writer module. This action is used to create a backup file of an agency, and to generate an XML file for import into the trip planner.

5.2.3 Transfer from XML to RTD

Transferring agency data from an XML file to an RTD involves the use of the RTD XML Reader module and the RTD Database Writer module. The data quality module can be optionally used in between. This action is used to import an agency provided XML, and for restoring an agency from a backup XML.

5.2.4 Transfer from RTD to RTD

Transferring agency data from one RTD to another RTD involves the use of the RTD Database Reader module and the RTD Database Writer module. The data quality module can be optionally used in between. This action is used for deploying maintenance data to the staging RTD, and from the staging RTD to the production RTD.

5.2.5 Transfer from RTD+RTD to MergedXML

The trip planner is able to accept two sign-ups at once within a single XML file using the RTD Merged XML Writer module, merging together both current data from the staging RTD and future data from the maintenance RTD. This action is used to generate a merged XML file for import into the trip planner ahead of the actual sign-up effective date.

5.3 DIVA Sync Application

The DIVA Sync application is the principle tool for the exchange of trip planner data to other trip planner systems. This function is almost entirely automated leaving the user to only select the target system and launch the application. In order to function properly, the Sync application must be running on both the source and the target systems. If Sync is not running on the target system, the source system will update the files on the target system, but they will not be deployed.

To conserve time and bandwidth, only the new and updated files are transferred. The contents of specific file folders are compared between the source and target systems performing the following conditional actions:

- If source file does not exist on target system, source file is copied to target system.
- If source file has later timestamp than target file, target file is replaced with newer source file.
- If source file has same/earlier timestamp than target file, target file is left untouched.
- If file exists on target system, but not on source system, target file is deleted.

When the Sync operation is complete, the target system should have within its update area an identical set of files as found on the source system. Finally, the target system will launch a deployment process that will stop its trip planner application, move the transferred files from its update area to its operational area, and then restart its trip planner application. At the very end, the target system will generate a log of the deployment and send it to the RTIS contractor staff.

REDACTED *Figure 5-3 - DIVA Sync Application*

5.3.1 SYNC FROM MDV-OAK3 TO MDV-STG

The Sync application on the maintenance system (MDV-Oak3) is used to push data to the staging trip planner (MDV-STG). A few extra processing steps will take place on the staging machine. The ageny specific line mapping files are combined into a single, unified line mapping file. Also, an additional stop mapping file is created which includes real-time stop IDs. By recreating the real-time stop file each time, it ensures that no stale data will be left behind.

5.3.2 SYNC FROM MDV-STG TO MMTP-STG-TP

Updating the MMTP staging system (MMTP-STG-TP) is different from other Sync functions in that data is pulled rather than pushed, plus there is no automated file deployment on the staging system. The Sync application on the MMTP staging system is used to pull data from the staging trip planner (MDV-STG). Deployment of the data is performed manually by the RTIS contractor.

To support driving direction, the GIS data needs of the MMTP differ from the traditional trip planner and require different processes. Also, parking data needs to be merged with the MMTP data. These are all steps that must be done in post-processing directly on the MMTP staging system.

The trip planner vendor has produced for the RTIS contrator a separate PDF document entitled MMTP_DataUpdateAndDeployment_v0.1 containing the steps necessary to perform the manual update of data.

5.3.3 Sync from MDV-STG to Production TTP

The Sync application on the staging trip planner system (MDV-STG) is used to push data to the production transit trip planner (TTP) systems. Because the trip planner application must be shut down during the deployment phase, in order to prevent an outage on the website, a small group of of TTP systems are updated in a batch. Only after one batch is complete will another batch begin the deployment process. After the deployment is complete, the RTIS contractor will run a few sample itineraries to check the functionality of the transit trip planner.

5.3.4 Sync from MMTP-STG-TP to Production MMTP

The Sync application on the staging MMTP trip planner system (MMTP-STG-TP) is used to push data to the production MMTP trip planner systems. Because the trip planner application must be shut down during the deployment, in order to prevent an outage on the website, only one MMTP system is deployed at a time. After the deployment is complete, the RTIS contractor will run a few sample itineraries to check the functionality of the MMTP trip planner.

5.4 Transfer Dynamic Partial Data to RTD

Spatial Data is transferred to Production servers as needed with regular data deployments in order to update route geometries. The RTIS contractor uses ESRI ArcMap to install updated route geometry.

5.5 Production Deployment Issues

A final note about production deployments is that they must occur during a non-peak usage time of day. Generally, data deployments are performed no earlier than 10pm and no later than midnight. In the event of an error or if something unexpected occurs, the RTIS contractor's data manager will be called immediately for advice and possible assistance. Should the function of the Transit 511 web application be impaired or otherwise negatively affected, the data manager will immediately escalate to the RTIS contractor's project manager.