

Challenges of GIS Based Regional Transit Information System – The Bay Area 511 Transit Experience



GIS-T Symposium

March 30, 2004

Rapid City, South Dakota

Nisar Ahmed, bd Systems, Inc.

and

Emilio Escudero, MTC



Presentation Overview

- The Premise of the system
- Challenges of data integration
- Solution approach – data model, integration tools
- Challenges of data maintenance
- Solution approach – data status tracking, maintenance app, CMS
- Website Demonstration
- What's Next



The Premise

- Develop a Regional Transit Information System (RTIS) for the San Francisco Bay Area that integrates all public transit services in the region
- Provide access to transit information for the general public through a website
- Provide access to the same information for the transit service providers' customer information centers to support phone based customers
- Make the system part of the larger 511 traveler information system



Challenges of Data Integration

- Different organizational sizes and structures
- Non-integrated islands of information
 - Stop inventory in operation
 - Schedule info in scheduling
- Different information systems with different constraints
- Minimal spatial information



The Approach for Data Integration – Data Model

- Spatially integrated database
 - Designed to integrate service information of multiple agencies
 - Spatial and non-spatial data are fully integrated
 - Allows users to update information based on their agency affiliation
 - Production, maintenance, and review databases are separated to enhance performance
 - Web usage statistics and user comments are integrated in the database to allow transit operators to view them



The Approach for Data Integration - Tools

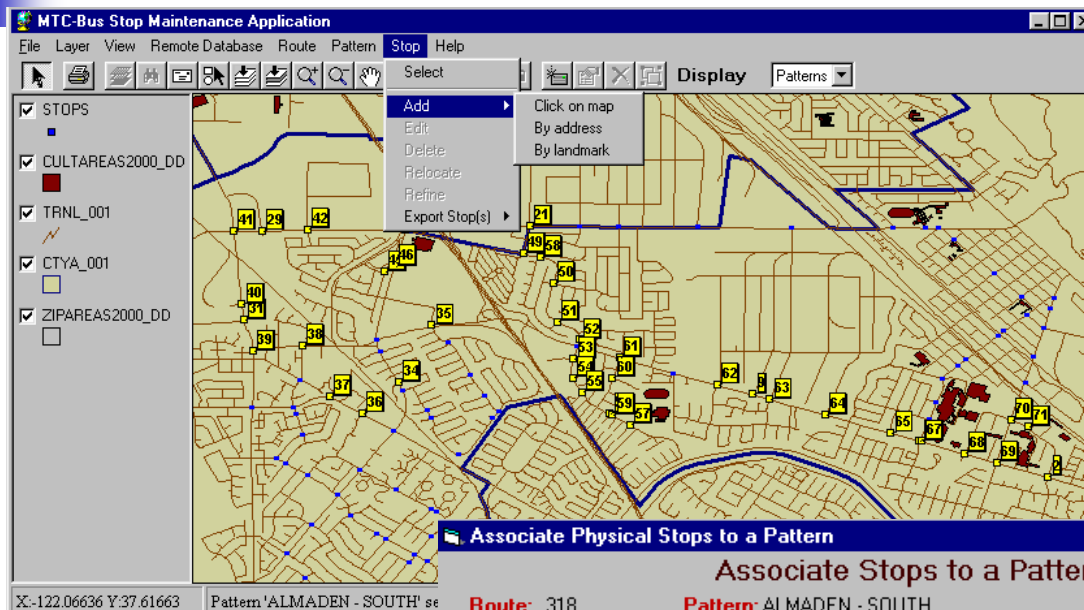
- Transit operators divided into three groups
 - Agencies with no scheduling or other major information system
 - Agencies with existing scheduling system, but stops not maintained in it
 - Agencies with scheduling system where stops are maintained
- The solution approach for each of these categories were different



The Approach for Data Integration – No Scheduling System

- Provide lightweight tool for smaller service providers to maintain required data
 - Map based, database driver
 - Links to schedule info
 - Same basemap
 - Accurate location
 - Route, pattern, stop, timepoint relationship
 - Based on the central database structure
 - Easy to load into the central database
 - Helps agencies to utilize data for other needs

Transit Stop Maintenance Application (TSMA)



Associate Physical Stops to a Pattern

Route: 318 **Pattern:** ALMADEN - SOUTH **New Sequence No.**

Source Physical Stops (161)	Stops in the Selected Pattern
Stop# 23303, At: , 0	STOP# 23303, Seq. No: 1
Stop# 23304, At: UNION SQUARE & ALVARADO NILES BLVD, 94587	STOP# 23304, Seq. No: 2
Stop# 23305, At: ALVARADO-NILES BLVD & DECOTO RD, 94587	STOP# 23305, Seq. No: 3
Stop# 23306, At: ALVARADO-NILES RD & MEYERS DR, 94587	STOP# 23306, Seq. No: 4
Stop# 23307, At: ALVARADO-NILES BLVD & H ST, 94587	STOP# 23307, Seq. No: 5
Stop# 23308, At: ALVARADO-NILES BLVD & HARTNELL ST, 94587	STOP# 23308, Seq. No: 6
Stop# 23309, At: ALVARADO-NILES BLVD & WESTERN AVE, 94587	STOP# 23309, Seq. No: 7
Stop# 23310, At: ALVARADO-NILES BLVD & CENTRAL AVE, 94587	STOP# 23310, Seq. No: 8
Stop# 23311, At: , 94587	STOP# 23311, Seq. No: 9
Stop# 23312, At: ALVARADO-NILES BLVD & DOWE AVE, 94587	STOP# 23312, Seq. No: 10
Stop# 23313, At: ALVARADO-NILES BLVD & HOP RANCH RD, 94587	STOP# 23494, Seq. No: 11
Stop# 23314, At: ALVARADO-NILES RD & MEDALLION DR, 94587	STOP# 23495, Seq. No: 12
Stop# 23315, At: ALVARADO-NILES RD & ALMADEN BLVD, 94587	STOP# 23496, Seq. No: 13
Stop# 23316, At: , 0	STOP# 23497, Seq. No: 14



The Approach for Data Integration – Scheduling System w/o Stops

- Provide TSMA for stop data maintenance
 - Map based, database driver
 - Route, pattern, and stop information from TSMA
 - TSMA helps agencies to maintain stop inventory
- Build data loading tools to load schedule data exported out of the scheduling system
 - Schedule info from scheduling system
- Build process to merge TSMA data with scheduling data
 - Links between TSMA and scheduling data through patterns and timepoints



The Approach for Data Integration – Scheduling System with Stops

- Build a XML based data exchange process to load the complete dataset from the scheduling system
 - Created a XML schema and data definition based on the central database design
 - Transit service providers developed a routine to export data out of their system into the XML file
 - A separate XML tools was developed to get data into the central database from the XML file
 - Provides flexibility to load partial data – service changes between signups



Challenges of Data Maintenance

- Keeping track of signups; acquiring and loading data
 - Schedule update
 - Route map update
- Review and approval of new data by transit operator
- Temporary service changes and other information



The Approach for Data Maintenance – Signups

- Signup tracking
 - A process was established to maintain continuous communication with transit operators to track upcoming signup dates
 - Operators are contacted one month ahead of the signup date for new data
 - Signup tracking matrix is reviewed weekly

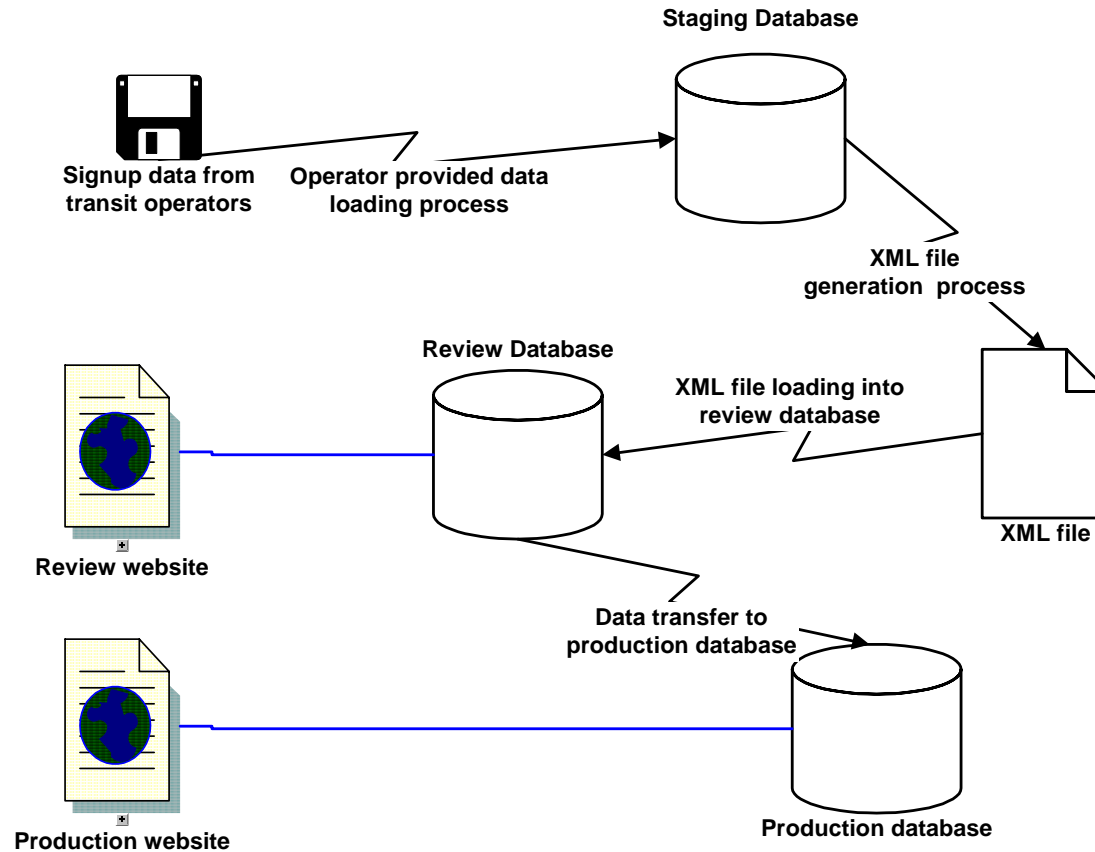


The Approach for Data Maintenance – Signups

■ Signup data loading

- Depending on the type of operator, appropriate process is applied to load data into a staging area of the maintenance system
- Shapes for transit route alignments are generated using an automated GIS tool that extracts unchanged segments from the previous signup and builds new segments where necessary
- A XML file is produced from the staging area and the same file is loaded into the review database
- Transit operators are notified to review and approve the new data
- Operators review schedules, route maps, and trip itineraries
- Any errors identified are fixed
- Approved data is then transferred to the production system for release at an appropriate time

Data Processing for Signups





The Approach for Data Maintenance – Minor Changes Between Signups

- Transit Data Maintenance Application
 - A comprehensive GIS based transit data maintenance tool was developed to perform minor modifications to transit service information
 - Application allows users to create, read/view, update, and delete (CRUD) route/pattern, stop, landmark, schedule, and fare information
 - Modifications are made to the maintenance database and transferred to the production system
 - Application allows for modifying/rebuilding of route shapes

Transit Data Maintenance Application

R. T. I. S. - Bay Area

File Help

118:WE : TO AM
118:EA : TO CO

Pattern Stops
Trips
Schedule

Routes

- 101
- 102
- 104
- 105
- 106
- 107
- 108
- 109

Patterns

- 109:NO : TO
Pattern Stops
BART PLE
COGGINS
OAK PK B
PLEASAN
OAK PK B
OAK PK B
PATTERS
PATTERS
PATTERS
BOYD RD:
BOYD RD:
CLEAVEL
CLEAVEL
GREGORY
GREGORY
PLEASAN
CONTRA I
CONTRA I
CONTRA I
SEARS (P

Map Schedule

Choose Day Type Weekdays

	PACHECO BLVD:BUSH ST	ARNOLD DR:MORELLO AV	COUNTY BUILDING (MARTINEZ)	PACHECO BLVD:CENTER AV
1	6:35 am	6:42 am	6:45 am	6:51 am
2	7:20 am	7:27 am	7:30 am	7:36 am
3	9:35 am	9:42 am	9:45 am	9:51 am
4	10:20 am	10:27 am	10:30 am	10:36 am
5	11:05 am	11:12 am	11:15 am	11:21 am
6	11:50 am	11:57 am	12:00 pm	12:06 pm
7	12:35 pm	12:42 pm	12:45 pm	12:51 pm
8	2:05 pm	2:12 pm	2:15 pm	2:21 pm
9	2:50 pm	2:57 pm	3:00 pm	3:06 pm
10	3:35 pm	3:42 pm	3:45 pm	3:51 pm
11	3:50 pm	3:57 pm	4:00 pm	4:06 pm
12	4:20 pm	4:27 pm	4:30 pm	4:36 pm
13	5:05 pm	5:12 pm	5:15 pm	5:21 pm
14	5:50 pm	5:57 pm	6:00 pm	6:06 pm
15	6:35 pm	6:42 pm	6:45 pm	6:51 pm
16	7:20 pm	7:27 pm	7:30 pm	7:36 pm
17	8:05 pm	8:12 pm	8:15 pm	8:21 pm
18	8:50 pm	8:57 pm	9:00 pm	9:06 pm
19	9:35 pm	9:42 pm	9:45 pm	9:51 pm

Transit Data Maintenance Application

R. T. I. S. - Bay Area

File Edit Tools Help

Collection

Find Address

Intersection Street Number

Find Address by Intersection:

On Street:

At Street:

City:

Find

Zoom to Candidate

Apply Cancel

Find an intersection address

- 108:EA : CONCBAR
- 108:EA : TO NCON
- 108:EA : TO NCON
- 110:EA : TO CONC I
- 110:EA : TO CONC I
- 110:EA : MARSHCR
- 110:EA : MARSH CF
- 110:EA : CONCORD
- 110:EA : CONCBAR
- 110:EA : CBART&M/
- 108:EA : TO NCONC
- 108:EA : TO NCON
- 115:EA : TO CONCB
- 111:EA : TO CONCC
- 111:EA : TO CONCC
- 111:EA : SAN MIGU
- 110:EA : WASHING
- 110:EA : TO WASHI
- 110:EA : TO WASHI
- 110:EA : TO MARSH

X:-122.05 Y:38.03 Scale 1:92337

Active Layer: Landmarks

Start

Inbox - Microsoft Out...

RTIS - Microsoft Visua...

Document1 - Microsof...

R. T. I. S. - Bay Area

5:52 PM

Transit Data Maintenance Application

The screenshot displays the 'Pattern Composition Editor' window within the 'R. T. I. S. - Bay Area' application. The window is divided into several sections:

- Selected Patterns:** A list on the left side of the window showing various route identifiers such as 108:EA, 116:NO, 118:EA, and 308:WE.
- Table:** A central table with columns: Pattern, Split link, From Stop, New To Stop, Timepoint, To Stop, and View. The table lists several transit patterns, with the entry for 'LINK# 3' and 'JOE DIMAGGIO DR/BOCCE BALL LOT' highlighted in blue.
- Map:** A map view at the bottom showing a street grid with red lines indicating transit routes. A green shaded area is visible on the map.
- Buttons:** 'Edit', 'Remove', 'Apply', and 'Cancel' buttons are located at the bottom of the table area.

Pattern	Split link	From Stop	New To Stop	Timepoint	To Stop	View
108:EA : TO NCON B*HOWDOUGBAT	LINK# 11	#950 HOWE RD	COURT ST:GREEN ST	No	HOWE RD:PARKWAY DR	Preview
108:EA : TO NCON B*PALDOUGBAT	LINK# 12	10 DOUGLAS DR	COURT ST:GREEN ST	No	PINE ST:DOUGLAS DR	Preview
108:EA : TO NCON B*PALMVABATE	LINK# 10	ARNOLD DR:BUENA VIDA CT	COURT ST:GREEN ST	-Select-	PINE ST:DOUGLAS DR	Preview
108:EA : TO NCON B*PALMVADVC	LINK# 3	ESCOBAR ST:CASTRO ST	JOE DIMAGGIO DR/BOCCE BALL LOT	Yes	COURT ST:WARD ST	Preview
108:EA : TO NCON BART(SAT)	LINK# 3	ESCOBAR ST:CASTRO ST	-Select-	-Select-	COURT ST:WARD ST	Preview

Source stops filtered by: Current Map Extent

Active Layer: Patterns



The Approach for Data Maintenance – Temporary Changes and Other Info

- Web based Content Management System (CMS)
 - Temporary and short-term service changes due to road construction and public events are handled through service announcements posted on the web through trip itinerary and schedule pages.
 - The CMS allows transit operators to write, review, approve, and post service announcements
 - CMS also allows them to update content of their agency profile page and upload static system and route maps
 - CMS provides tools for operator assigned administrator to manage CMS users from that transit agency
 - CMS also allows transit operators to view usage of their service information and review and respond to users comments



Content Management System (CMS)

Bay Area RTIS CMS on the Web



Bat Area Transit 511 Website

Demonstration



What's Next

- Expansion to add personalized transit information page
- Adding of PDA/wireless features for on-demand schedules, itineraries on-the-go
- Integration of the trip planner
- Wider XML based data integration
- Voice Activation for 511 phone system
- Inter-System Communication for Wider travel support