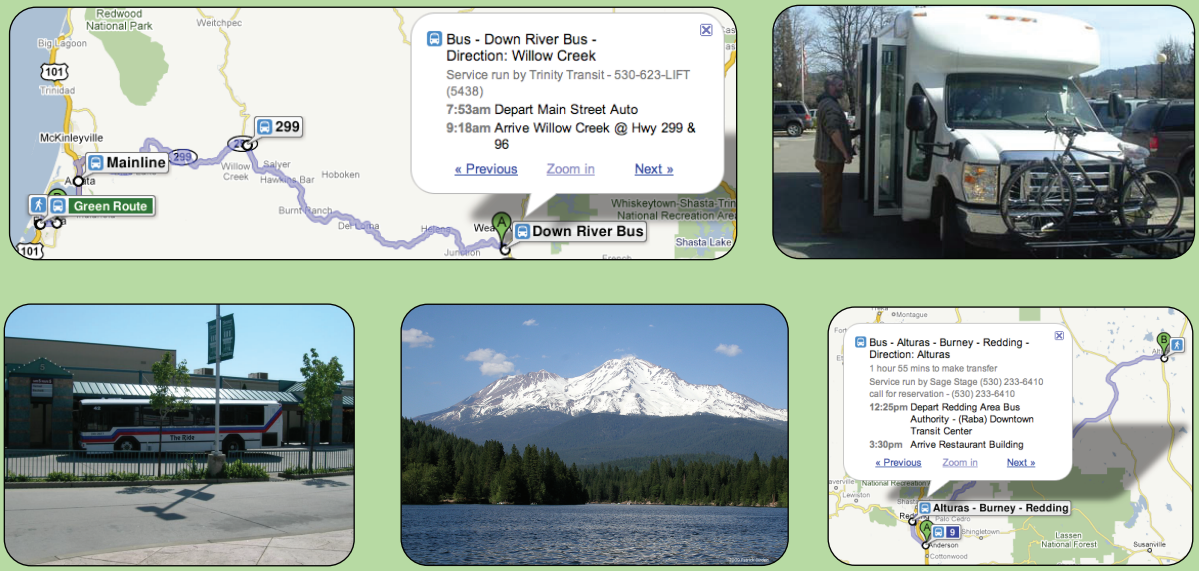
Northern California Google Transit Feasibility Study

FINAL

Pilot project and full implementation roadmap for
Inyo, Lassen, Modoc, Mono, Plumas, Shasta,
Siskiyou, Tehama, and Trinity counties



Shasta County Regional Transportation Planning Agency

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Trillium
TRANSIT INTERNET SOLUTIONS

in association with

Nelson|Nygaard
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Executive summary

This pilot planning study has been funded by a Federal Transit Administration (FTA) Section 5311 grant through the California Department of Transportation (Caltrans) Division of Mass Transportation to improve online travel information dissemination and help travelers utilize connections between transportation services. The Shasta County Regional Transportation Planning Agency (SCRTPA) is the lead agency.

This project is to test and study integrating rural and small-urban public transit service schedule and geographic information into Google Maps/Transit. The study area includes nine California counties in Northern and Eastern California.

SCRTPA selected Trillium Solutions with Nelson\Nygaard Consulting Associates, Inc. to conduct a pilot implementation of the Google Transit trip planner for selected agencies within the study area and determine the feasibility of Google Transit.

The assessment of Google Transit feasibility regards its viability as a customer information tool for rural transportation services. The assessment covers costs and tools for maintaining Google Transit data, and the availability of agency staff and technical resources to support Google Transit, and opportunities to use and leverage Google Transit and Google Transit data.

Study goals

Historically, Google Transit and other transit trip planners have been more widely implemented by metropolitan transit agencies in dense urban environments. Many current and potential transit riders in rural areas do not benefit from online tools that make transit services easier to understand and use.

Rural agencies do not have the same technology and staff resources as metropolitan transit agencies. This study compares tools to publish data for Google Transit and assesses the staff time commitment necessary to maintain Google Transit data.

The Google Transit trip planner's current design is best suited to metropolitan transit services. This study makes recommendations for how Google Transit can be improved to address the needs of rural travelers and transit providers.

Stakeholder transportation and social service agencies are implementing and planning various mobility management, technology, information & referral, and marketing projects. This study identifies opportunities to leverage the Google Transit trip planner and source Google Transit data for some of these projects.

Regional context

The project study area includes seven Northern California counties (Lassen, Modoc, Plumas, Shasta, Siskiyou, Tehama, and Trinity), and two California counties in the Eastern Sierra (Inyo and Mono). Together, these counties comprise 40,868 square miles of California populated by 371,517 residents. Overall, the area has low population densities. Shasta County has the highest density with 43 people per square mile. Inyo County has the lowest density, with 2 people per square mile. The study area includes several small cities and one small urban center (Redding). Over the next decade, the mobility needs of the elderly population (65+ years old) are projected to remain constant or grow significantly in each county.

Eight public transit agencies provide service in the study area:

- Eastern Sierra Transit Authority (ESTA)
- Lassen Rural Bus (LRB)
- Modoc Sage Stage (SS)
- Plumas Transit (PTS)
- Redding Area Bus Authority (RABA)
- Siskiyou Transit and General Express (STAGE)
- Tehama Rural Area Express (TRAX)
- Trinity Transit (TT)

Four agencies — Plumas Transit, Lassen Rural Bus, Eastern Sierra Transit Authority, and Modoc Sage Stage — operate regional (inter-county) services that are essential for customers who need out-of-county resources and medical services and resources.

Greyhound and Amtrak operate service along the Interstate 5 corridor through Tehama, Shasta, and Siskiyou Counties, and into Oregon.

Agency resources

A survey (attached as Appendix B) was conducted to determine agency interests and needs for Google Transit, available staff capacities, and relevant information resources and projects. This survey assisted in determining which of the eight agencies would be selected for the pilot study.

The results of the Resources Survey show stakeholder agencies are generally supportive of using Google Transit as a customer information tool. All agencies face budget constraints to pay for technology and consultant time to sustain Google Transit implementation on an ongoing basis. Staff time to maintain and support projects is limited. Projects that receive staff attention must demonstrate value to customers and the agency.

For agencies that do not contract services to a private operator, assisting potential travelers with trip planning takes requires considerable staff time. All agencies that contract to a private operator do not directly manage the trip planning help and customer service functions. Agency estimates for the number of trip planning help requests they receive vary between less than 20 requests/month to 2000 requests/month.

None of the transit services currently use Automated Vehicle Locator (AVL) technology, though several are looking into procurement options. Agencies are unlikely to implement AVL technology in the immediate future because of constrained funding. About half of the agencies have routes and stop locations in a Geographic Information System (GIS) library.

All agencies have high-speed Internet connections at their administrative offices. No agencies use specialized software for fixed-route scheduling. Agencies use standard office software applications for this function.

All transit operators in the survey area maintain websites. The majority of websites provide route maps and information about fares and schedules. Most websites are maintained in-house, and updated as needed.

Pilot project status and findings

Participation

Five transit agencies (PTS/Plumas, RABA/Shasta, STAGE/Siskiyou, TRAX/Tehama, TT/Trinity) are participating in a private Google Transit trip planner pilot.

Trip planner issues

The consultant, with agency input, has identified 13 generalized categories of issue that compromise the accuracy or usefulness of results returned by the Google Transit trip planner. The 5 issues identified as "critical" or "high priority" are listed in Table 1 (following page). All critical and high priority issues have been reported to Google.

All issues, including those which are "medium" and "low" priority are detailed in Table 9, Chapter 3.

Table 1. High priority issues with the Google Transit trip planner

Issue	Shasta	Trinity	Siskiyou	Plumas	Tehama	Issue manifestation / details	Proposed solution
Trip planner returns walking directions instead of available transit option for complete trip or segment	X				X	In cases of long transit travel times, the trip planner will return walking trips and walking legs, if travel by transit takes significantly longer. Example: TRAX Route 1, RABA loop routes.	Transit trip planner itineraries should maximize use of available transit service. Customers can choose "walking" directions option if they wish to compare.
Queries for travel times more than 48 hours in advance of scheduled service return no results		X		X		Intercity Plumas Transit routes and some Trinity Transit routes (Willow Creek / Down River).	Trip planner should search for and return service up to 7 days within query for desired time/date of travel.
Maximum walking distance threshold prevents display of available transit service		X	X	X		Low density, rural service areas are affected. For example, a search for Plumas Transit's Chico route that has "Chico, CA" as its origin or destination will not return because the center of Chico is outside the maximum walking distance from Plumas' Chico route.	Maximum travel to transit stop distance in Google Transit is increased to 25 miles for long-distance rural service. Drive-to-transit option is added.
Service doesn't return for certain trips				X		The trip planner does not show a trip for the Plumas Transit Reno route from Reno to Plumas county (the Plumas Co. to Reno direction works fine)	Show service
Google Maps road atlas is incorrect	X					Widespread inaccuracies	Coordinate between county, city GIS and TeleAtlas

Outcomes by agency

The viability of the Google Transit trip planner as a customer information tool varies by agency. Difference in viability is due to factors that include particulars of service features and frequency, quality of Google Maps road and address data for each region, and particularities of the trip planner implementation. Table 2 (below) shows the assessment of Google Transit viability for each pilot agency participant. The consultant conducted this assessment with agency input.

Table 2. Viability of Google Transit trip planner by pilot agency

Agency	Presently viable?	Major outstanding issue(s)
Plumas/PT	No	Google software implementation: Some trips are not returned on Reno/Chico route. Maximum walking distance threshold is constrained to 4 miles.
Shasta/RABA	Yes — Will participate in public test phase.	Google Maps road network layer missing some roads.
Siskiyou/STAGE	Yes	None.
Tehama/TRAX	Yes	Google trip planner returns walking, instead of transit directions, when travel on loop routes would involve long travel times. Address location accuracy issues have been resolved.
Trinity/TT	Yes	Trip planner does not return services more than 48 hours in advance of desired service date/time. Maximum walking distance threshold is constrained to 4 miles.

Next steps to make Google Transit customer-ready and publicly available

The authority to decide to participate in Google Transit is with individual transit agencies. At the time of this writing, pilot agencies STAGE (Siskiyou), Trinity Transit, RABA (Shasta), and TRAX (Tehama) are planning to go live on Google Transit. Staff at these agencies determined the trip planner is presently useful and valuable for customers.

STAGE and Trinity Transit have identified some issues with the trip planner. High priority issues, specifically, are low maximum walking distance to transit and the 48-hour window limitation between queried and available service to return trip planner results. RABA has also identified issues with the trip planner, specifically that the Google Maps road network layer is missing some roads.

RABA will use a customized form to collect and track customer query information. This form will present a disclaimer that the trip planner is in a public test phase and solicits customer feedback.

Plumas Transit has determined not to go live on Google Transit. This decision hinges on the resolution of one critical and high priority issue: Plumas Transit Reno-Quincy service's currently inexplicable unavailability in the trip planner.

It is recommended to address issues through coordination between Caltrans DMT and Google. The recommended approach is to focus on the highest priority issues. Google takes an incremental approach to improving Google Transit. It is unrealistic that all identified trip planner issues will be solved at the same time.

It is recommended that transit agencies launch when critical and high priority issues are sufficiently resolved to make Google Transit a viable customer information tool. After launch, the data publishing consultant and transit agencies should continue to work with Google to incrementally solve issues in a post-launch evaluation and issue-resolution phase.

Opportunities to leverage Google Transit

Geographic and schedule data for public transportation contained in the Google Transit feeds[1] can be used for applications outside of the Google Transit trip planner. The Google Transit trip planner and Google Transit feed data for geographic and schedule information provide one of the building blocks for the mobility management and 2-1-1 information and referral projects proposed in Northern California (see discussion in Chapter 6). Ensuring Google Transit provides high quality travel information is particularly important if it is used in the 2-1-1 project because 2-1-1 phone operators may not be familiar with callers' regions.

A low-level integration of Google Transit into these programs would involve training phone operators to use Google Transit to assist callers who are planning fixed-route public transportation trips, and incorporating trip planning quick links into web-based information systems.

A potential longer-term and higher-level integration of Google Transit data and centralized mobility management and information and referral services may also be possible. The Northern California 2-1-1 Virtual Call Center is in the planning stage. Identifying opportunities and developing a roadmap for integration will involve further scoping. One integration option could involve importing Google Transit feed data into another system for multi-modal trip planning, service discovery, and travel reservations.

In addition to these opportunities, Google Transit data (in the Google Transit Feed Specification, or GTFS) can also be leveraged for other functions and applications, including:

- Timetable publishing
- Telephone-based interactive voice response (IVR) systems for travel planning
- Mobile schedule access
- Data and service visualization
- Improved accessibility for users who are disabled

These functions are detailed in Chapter 5. New opportunities to leverage Google Transit feed data will continue to emerge as the Google Transit Feed Specification continues to gain adoption as a data standard.

[1] Google Transit feeds contain the geographic, schedule, and fare data necessary to describe transit services and include them in the Google Transit trip planner. For more discussion, see Chapter 3.

Implementation plan

GTFS publishing tool recommendation

The recommendation for a GTFS publishing tool is based several criteria. These criteria are the availability of service and support for the selected tool, its ease of use for transit agency staff, inclusion of built-in data visualization and validation tools, ability to export optional data such as route alignments and preferred transfers, upgradability, and data ownership agreements and overall cost. The most important criteria are ease-of-use, overall cost, and that agencies must have full ownership over their published GTFS data.

Based on these criteria, hosted web-based tools offered by Trillium Solutions and Trillium Insight, Inc. are recommended.

Costs for maintenance and full implementation

The cost to launch the remaining project area services, Lassen Rural Bus and Eastern Sierra Transit Authority, is $7,000. Ongoing costs for hosted GTFS publishing and maintenance tools for 7 agencies is $8,000 per year.

Lead agency recommendation

Shasta County RTPA has served as the lead agency over the course of this project. A lead agency will be necessary for functions such as pursuing funding, evaluation, and coordination with related projects. If implementation of additional agencies and ongoing maintenance is funded through Caltrans, or if funding is regionally pooled, a lead agency will be necessary for grant administration.

It is recommended that Shasta County RTPA should continue to perform as the lead agency. Other potential lead agency candidates include Modoc CTC, Caltrans District 2 with the Division of Mass Transportation, or Redding Area Bus Authority.

Implementation phases and proposed next steps

A proposed schedule for implementation, evaluation, and marketing appears as Table 17 in Chapter 6.

Identified implementation phases and tasks are:

1. **Resolve pilot trip planner issues.** Goal is achieved through coordination between agencies, Caltrans DMT, Google, and data publishing consultant. Begin July 1, 2009 and continue on an ongoing basis. The cost is approximately $1,500 for consultant time. Continue ongoing attention to Google Transit trip planner issues and their resolution.

2. **Launch willing pilot agencies** beginning September 1, 2009 through October 31, 2009. The cost for consultation between consultant, agency, and Google is estimated at $2,500. This cost is covered under existing project budget.

3. **Launch remaining stakeholder agencies** ESTA and LRB. Begin this phase August 31, 2009. The estimated cost is $7,000.

4. **Promotion and marketing** to accompany Google Transit launch. Incorporate Google Transit into existing websites and marketing programs. Take advantage of earned media opportunity with press releases. This step requires agency and/or consultant time. Cost will depend on strategy.

5. **Ongoing data maintenance** must continue once agencies are launched. The cost for GTFS publishing and maintenance software for seven agencies with the proposed approach is $8,000 per year. One day of agency staff time per quarter is estimated to be necessary for entering schedule updates.

6. **Leverage data**. Make GTFS data public (no cost). Consider implementing applications such as automated timetable publishing for which the cost is unknown.

7. **Agencies gather customer feedback** continuously from launch to use for evaluation.

8. **2-1-1 virtual call center integration.** Integrate links to Google Transit into 2-1-1 call center software. Prepare plan for deeper integration of GTFS data into mobility management and 2-1-1 operations.

9. **Evaluation.** Review and summarize customer and stakeholder feedback, compare ridership trends and volume of trip planning customer service calls pre- and post-implementation. Wait at least 9 months after implementation to give time for trip planner adoption before surveying customers.

Chapter 1. Project Overview

Introduction

Google Transit is an online transit trip planner for planning trips on participating public transportation services around the world. Currently, the majority of participating transit agencies are metropolitan-scale transit agencies. Many smaller transportation providers face technical barriers to participation in Google Transit.

The purpose of this study is to consider methods to facilitate broader rural and small-urban transit service participation in Google Transit. The concept for this study evolved during stakeholder interactions and discussions over many months. Each stakeholder has different perspectives and interests.

The Caltrans DMT focus is high-level and statewide. The division's goals are to improve connectivity (trips using two or more operators) and to enhance the traveler experience when planning trips to, from, and through rural California regions. Caltrans DMT seeks recommendations for statewide Google Transit deployment and to identify issues with Google Transit that may prevent passengers from receiving accurate, complete, and easy-to-use itinerary information for rural service areas.

Individual stakeholder transit service providers' interests include (1) increasing fixed-route ridership and farebox revenue (2) reducing unnecessary paratransit costs (3) reducing telephone call volume for trip planning help, (4) efficiently connecting transportation-disadvantaged people with transportation services, (5) reducing costs and staff overhead for maintaining Google Transit implementation, and (6) helping customers understand what Google Transit can and cannot do.

The California 2-1-1 organization is interested in the utility of Google Transit for incorporating transportation information into integrated information & referral and mobility management programs.

Federal law mandates coordination of human transportation services. The Shasta County Regional Transportation Planning Agency (SCRTPA), as the designated Metropolitan Planning Organization for Shasta County, is the lead agency for this pilot planning study that integrates rural and small-urban public transit service schedule and geographic information into Google Maps/Transit. Trillium Solutions, supported by Nelson\Nygaard Consulting Associates, Inc., was selected to conduct this project and study.

The California Department of Transportation (Caltrans) Division of Mass Transportation (DMT) provided full funding for this project.

Purpose

The purpose of this document is to:

- Describe geographic and planning context of the project.
- Provide selected background information necessary to understand relevant technical issues.
- Evaluate the usefulness and viability of the trip planner based on pilot agency experiences.
- Document methodology for implementing Google Transit and maintaining Google Transit data both within, and beyond, the project study area in Northern California.
- Inventory available tools for maintaining and publishing Google Transit data.
- Inventory options for re-using Google Transit data for other applications.
- Recommend implementation tools and next steps.

Challenges and barriers to navigating fixed-route public transportation

Conventional transit timetables and maps are difficult to use for many prospective transit customers. The National Center for Transit Research at the University of South Florida, studied the usability of conventional maps and timetables in a November 2004 study, "Elements of Effective Transit Information Materials". [2]

Most study participants were successful at identifying origin and destination points on a map and at identifying nearby bus stops. However, almost half of participants were unable to correctly identify bus times using the tabular schedules. Study participation was not constrained to existing transit riders.

Opportunities presented in online customer information

The third most common internet activity for Americans is to "search for a map or driving directions," (86%) behind only email and using search engines. 92% of Internet users say the Internet is a good place to go for getting everyday information. [3]

A majority of current and prospective transit riders in the United States are internet users. The Google Transit trip planner provides travel information in a format that not only borrows from, but is also directly integrated with, familiar online driving directions and maps.

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[2] Cain, Alasdair. Design Elements of Effective Transit Information Materials. Rep. Nov. 2004. National Center for Transit Research Center for Urban Transportation Research, University of South Florida. 22 Apr. 2009. <http://www.nctr.usf.edu/pdf/527-12.pdf>

[3] "Trend Data | Pew Internet & American Life Project." Pew Internet & American Life Project. Pew Research Center. 29 Apr. 2009 <http://www.pewinternet.org/Data-Tools/Download-Data/Trend-Data.aspx>.

Needs identified by California Coordinated Plans

Selected projects that receive Federal Transit Administration (FTA) Section 5310 and the small urban and rural portions of FTA Sections 5316 and 5317 program funding requires that all federal grant funds must be derived from locally developed, coordinated public transit-human services transportation plans. These 42 Coordinated Public Transit-Human Services Transportation Plans, completed in 2007 and 2008, are available online at the California Coordinated Plan Resources Center website.[4]

Many of the Coordinated Plans recommended implementing an online trip planner as an element of a mobility management program. Eight of the plans mention Google Transit specifically as a current, planned, or recommended element of coordinated transportation programs.

Needs identified by California Statewide Rural Intercity Bus Study

Intercity services funded under S.5311(f) must provide a "meaningful connection" to the national and statewide intercity bus network. Broadly defined, California's intercity bus network includes intercity services operated by private carriers such as Greyhound Lines, Inc., public transit operators, and Amtrak Thruway bus services.

"Meaningful connections" between intercity transit services are created by: (1) schedule coordination between connecting services for efficient layover times (2) the use of shared/intermodal facilities (3) proximity of terminals and transit stop locations for easier and faster connection between services, and (4) the implementation of integrated information dissemination programs that provide passengers with a single source of information for multiple operators' services.

The 2008 California Statewide Rural Intercity Bus Study recommended "Caltrans fund a statewide effort to improve the information available about the intercity bus services and the rural feeders funded under S.5311(f)" in order to provide meaningful connections between intercity transit services.[5]

One of the recommended channels for intercity bus service information dissemination is through internet trip-planning sites. In order to function as a statewide intercity trip transit planner, Google Transit must include all intercity and local services, both publicly and privately operated. The trip planner must generate trip itineraries that show connections between these services.

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[4] "California Coordinated Plan Resources Center." California Department of Transportation.. 21 June 2009 <http://www.dot.ca.gov/hq/MassTrans/Coord-Plan-Res.html>.

[5] State of California Department of Transportation Division of Mass Transportation. March 2008. "California Statewide Rural Intercity Bus Study" prepared by KFH Group, Inc. <http://www.dot.ca.gov/hq/MassTrans/5311-Intercity-Bus-Study.html>. Page 7-11.

The California Statewide Rural Intercity Bus Study also recommends disseminating intercity bus service information through a single booklet of printed timetable and route information. Google Transit/GTFS data can be used to create print-ready timetables (see Chapter 5).

Related projects

CALnections pilot project

The Modoc Transportation Agency initiated and continues to manage the CALnections pilot project[6], a web-based mobility management tool that includes trip planning and reservation systems. Partner agencies in the project include the FTA, Caltrans, and planning agencies from four other counties along the Highway 395 corridor (Lassen, Plumas, Inyo, and Mono Counties). CALnections currently provides trip planning assistance for the Sage Stage and some connecting routes in the five-county area.[7]

2-1-1 California

"Information and referral" (I&R) services bridge the information gap between human service programs and people who need them. The Federal Communications Commission (FCC) has designated the three-digit telephone dialing code 2-1-1 for providing public access to information about and referral to health and human services across the country.

"2-1-1 California" provides statewide planning, coordination, training, capacity building, quality assurance, and funding partnership building for I&R projects in California. "2-1-1 California" is an unincorporated organization formed through agreements among California Alliance of Information & Referral Services (CAIRS), United Ways of California (UWCA), and Volunteer Centers of California working with the Governor's Office on Services and Volunteerism and the Governor's Office of Emergency Services.[8]

In February 2009, "California 2-1-1" released the *2-1-1 California Rural Mobility Management Planning Study* to "Develop mobility management concepts that include information technologies and interface with 2-1-1 call centers for improved coordination of service calls and transportation."[9]

[6] www.calnections.com

[7] Modoc County Transportation Commission. Modoc County 2005 Regional Transportation Plan. By LSC Transportation Consultants, Inc. 2006.

[8] 2-1-1 California. 2-1-1 Across California by 2010. 2008.

[9] California Department of Transportation. Division of Mass Transportation. 211 California Rural Mobility Management Planning Study. By "211 California" Partnership under the leadership of 211 LA County. 2009. Page 9.

Northern California 2-1-1 pilot project

Shasta County has been selected as a potential pilot site for a rural 2-1-1 "virtual call center." A preliminary implementation schedule expects the project will be implemented by the first quarter of 2010. The implementation plan and timeline in this document (Chapter 6) offers further details for integrating Google Transit, Google Transit data and regional 2-1-1 operations.

If 2-1-1 operators use Google Transit to provide callers with transit information, transit and geographic information will need to be of high quality. 2-1-1 operators may not be familiar with callers' home areas.

Report overview

Chapter 1 gives an overview of the project, including its sponsorship by Caltrans, and describes the purpose of this document. The chapter introduces the online travel information opportunity and need. The statewide planning background, including the California Coordinated Plans and the California Statewide Rural Intercity Bus Study, is overviewed. The chapter also describes related projects, the CALnections pilot project and the Northern California 2-1-1 pilot project.

Chapter 2 discusses overall characteristics of the nine county project study area and the unique market, demographic, and resources characteristics of individual counties and agencies. The chapter includes a summary of nearby Google Transit projects. This chapter describes the project methodology for stakeholder participation and Resources Survey.

Chapter 3 describes the Google Transit trip planner. The chapter describes the data gathering and publishing methodology for the Google Transit trip planner pilot. It inventories the costs of data publishing, the status of agencies in the trip planner, and the status of trip planner issues.

Chapter 4 overviews available Google Transit Feed publishing tools. The chapter includes a comparison of features, costs, and approach.

Chapter 5 inventories ways in which Google Transit data can be used for applications outside of Google Transit, including other trip planners, mobile information and devices, mapping and visualization, accessibility for disabled passengers, and telephone-based interactive voice response systems.

Chapter 6 presents a phased implementation plan with costs.

Chapter 2. Stakeholder agencies and the project study area

Regional and demographic characteristics

The project study area includes Inyo, Lassen, Modoc, Mono, Plumas, Shasta, Siskiyou, Tehama, and Trinity Counties.

The nine county study area comprises 40,868 square miles populated by 371,517 residents. Overall, the area has low population densities. Shasta County has the highest density with 43 people per square mile; Inyo County has the lowest density, with 2 people per square mile. The study area includes several small cities and one small urban center (Redding). Over the next decade, the mobility needs of the elderly population (65+ years old) are projected to remain constant or grow significantly in each county.

Demographic and geographic characteristics for each county are presented in Table 3.

Stakeholder agencies

Stakeholder agencies include:

- Eastern Sierra Transportation Authority (ESTA)
- Inyo County Local Transportation Commission
- Lassen County Transportation Commission
- Modoc County Transportation Commission
- Mono County Local Transportation Commission
- Plumas County Transportation Commission
- Redding Area Bus Authority (RABA)
- Sage Stage
- Shasta County Regional Transportation Planning Agency
- Siskiyou Local Transportation Commission
- Siskiyou Transit and General Express (STAGE)
- Tehama County Transportation Commission
- Tehama Rural Area Express (TRAX)
- Trinity County Transportation Commission
- Trinity Transit

Agency resources and characteristics

Agency interest

Agencies are generally supportive of this project, but all face budget challenges that limit ability to pay for technology and consultant time. There is limited staff time to sustain the Google Transit project on an ongoing basis.

Assessment of existing trip planning customer service burden

Assisting potential travelers with trip planning takes up a considerable amount of time for some agencies, while other agencies rely on their contract operator to serve this function. Most agencies do not formally track the number or type of information requests received. Agency estimates vary between less than 20 requests/month (Lassen Rural Bus) to 2000 requests/month (Siskiyou Transit and General Express). Requests typically are made via telephone but some agencies also stated that "walk-ins" occur periodically. Most agencies do not have an automated telephone system for responding to transit information requests, requiring person-to-person communication. Some agencies have an answering machine (providing "24/7" information) to inform customers about basic transit information. Current approximate trip planning assistance call volumes for stakeholder agencies are listed in Table 5.

Technology implementation for customer information, administration, and operations management

None of the transit services currently use Automated Vehicle Locator (AVL) technology, though several are looking into procurement options. This effort will not likely move forward in the immediate future because of constrained funding. About half of the agencies have routes and stop locations in a Geographic Information System (GIS) library.

All agencies have high-speed Internet connections at their administrative offices. Most do not use specialized software for dispatch or scheduling. Instead, agencies use standard office software applications.

All transit operators in the survey area maintain websites, with the vast majority providing route maps and information about fares and schedules. Most websites are maintained in-house, and updated as needed.

Selected stakeholder project highlights

- **Eastern Sierra Transit Authority** has recently extended the southern terminus of the C.R.E.S.T. route to Lancaster, California, where customers can connect with the LA Basin Metrolink service, which is live on Google Transit. 2007/08 ESTA ridership was nearly double 2007/06 ridership, largely due to tourist ridership on new summer routes. Tourists are an important customer audience.

- **Lassen County Transportation Commission** recently launched a new website that includes information on available transportation services at www.lassentransportation.org.

- **Modoc County Transportation Commission** leads the development and maintenance of the CALnections trip planner. The concept for CALnections[10] evolved during a 5- year period supported through a research project funded by the California Department of Transportation (then Division of New Technology / now Division of Research and Innovation) to examine the potential for rural trip planning over multiple days using public bus and rural intercity transit services originating in California. The initial research project began five years ahead of Google Transit's launch.

  Critical intercity public transit connections to and from Oregon and Reno, Nevada have existed since 1999. Beginning in December 2007 travelers have made trip plans on Modoc Sage Stage with Google Transit. Modoc Sage Stage's Google Transit Feed data was prepared and is maintained using Excel spreadsheets and the routes display on the roads. Costs for on- going maintenance of the Sage Stage Schedules are under $175 per year including hosting of the data on a server with domain registration costs.

  Modoc Sage Stage serves as the extension of Greyhound from Reno, Redding and Klamath Falls. Travelers can purchase Greyhound tickets for a through- trip to anywhere on the Greyhound network in Alturas at the Stage Stage offices.

- **Redding Area Bus Authority** recently adopted and is implemented a 2009-2010 Marketing Plan to improve ridership and farebox revenue. This marketing program includes a new website (www.rabaride.com), hiring a locally-based marketing coordinator, implementing an information mailing program, and developing community marketing partnerships.

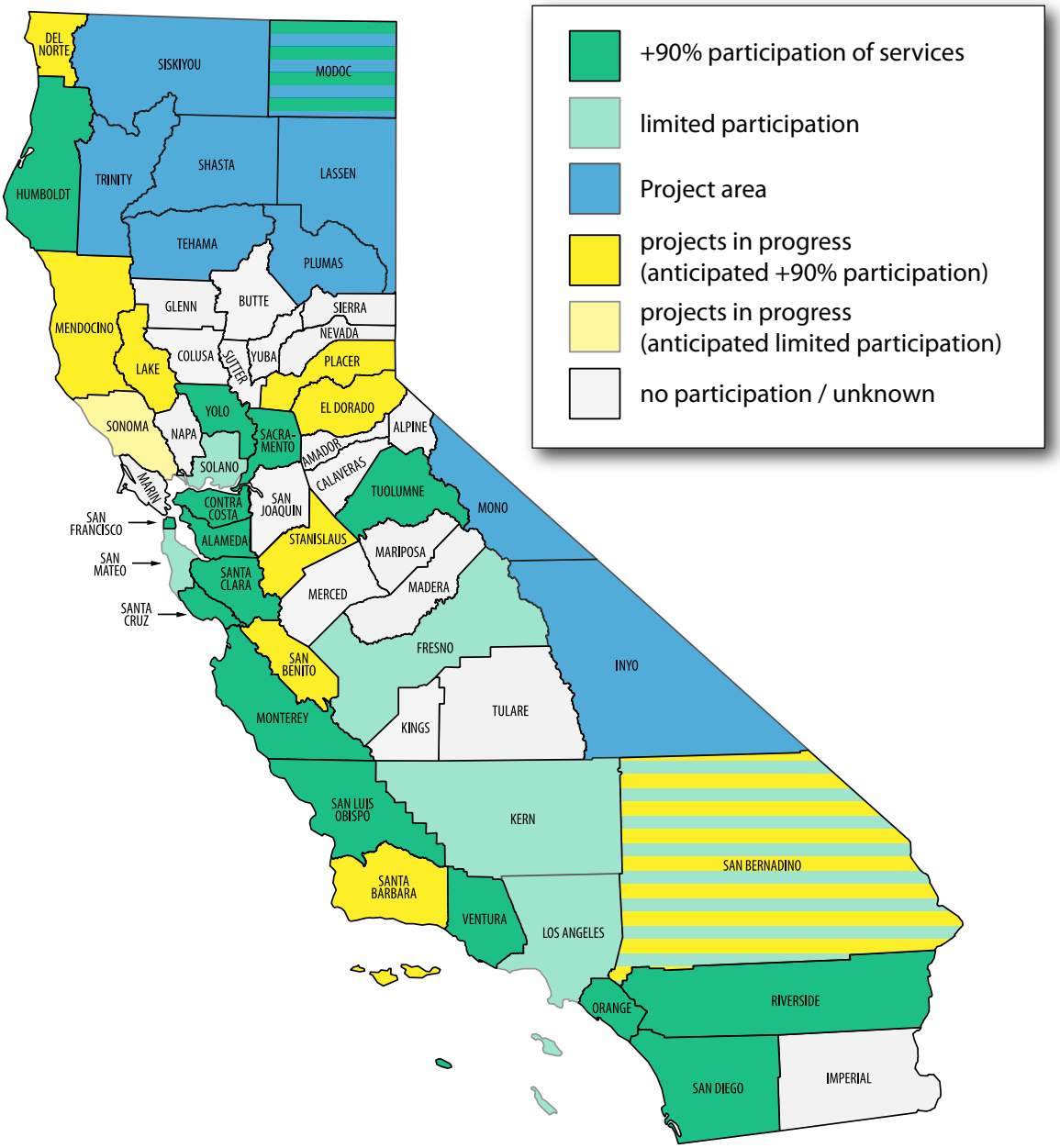
- **Tehama Area Rural Express** is in the process of rolling out a restructured route and schedule (completed July 1).

- **Trinity County Transportation Commission** recently launched a new website at www.trinitytransportation.org. The Trinity County Transit Development Plan adopted in March 2009 notes that less than two-thirds (63%) of respondents have access to the internet on a regular basis. Trinity Transit plans to apply for FTA 5311(f) funding in the next cycle to operate service between Willow Creek and Redding.

[10] CALnections test website is found: http://www.CALnections.com and viewed via Internet Explorer 5.0+. For more information on CALnections contact Ms. Pam Couch, Executive Director, Modoc County Transportation Commission, by telephone to (530) 233- 6410 or via email to pamcouch@frontiernet.net.

Summary figures and tables

Figure 1. Study area and statewide context



This figure is not based on an exhaustive survey of Google Transit projects in California, but on informal communications and the consultant's awareness of Google Transit projects underway.

Table 3. Population and land area characteristics of counties in study area

	Size of County (sq. mi.)[11]	Population (2000)[12]	Persons per square mile	Persons 65 years old and older (2000)[13]	Persons with a disability, age 5+ (2000)[14]
Trinity County	3,223	13,022	4.0	17.4%	22.7%
Modoc County	4,100	9,449	2.3	17.6%	25.5%
Lassen County	4,690	33,828	7.2	9.0%	13.7%
Plumas County	2,554	20,824	8.2	18.0%	20.6%
Siskiyou County	6,318	44,301	7.0	18.2%	20.7%
Tehama County	2,951	56,039	19.0	18.7%	21.3%
Shasta County	3,785	163,256	43.1	15.2%	21.2%
Inyo County	10,203	17,945	1.8	19.0%	17.9%
Mono County	3,044	12,853	4.2	14.6%	12.8%

[11] State and County QuickFacts. U.S. Census Bureau. 1 May 2009 <http://quickfacts.census.gov/qfd/index.html>.

[12] "USA Counties." CenStats Databases. U.S. Census Bureau. 1 May 2009 <http://censtats.census.gov/usa/usa.shtml>.

[13] ibid

[14] Ibid

Table 4. Neighboring Google Transit projects

Region	Transit Services	Connecting services	Google Transit status
Del Norte County	Redwood Coast Transit (RCT)	Redwood Transit System	Live
Humboldt County	Redwood Transit System (RTS)	Trinity Transit	Live
Lake Tahoe basin	North Lake Tahoe Express	Plumas Transit, Sage Stage (Modoc), Eastern Sierra Transit Authority (Inyo/Mono)	Live
Los Angeles County	Metrolink	Eastern Sierra Transit Authority (Inyo/Mono)	Live
Reno area	RTC Ride[15]	Plumas Transit, Sage Stage (Modoc), Eastern Sierra Transit Authority (Inyo/Mono)	Live

[15] In addition to the Google Transit trip planner for fixed-route public transit information, RTC Washoe also offers an online ridematching service, Smart Trips, at *www.rtcwashoe.greenride.com/en-US/*. Smart Trips is helps connects users within the Reno area to carpool/rideshare partners, and bus and bike "buddies." User registration is required for the service. This system is not integrated with the Google Transit trip planner.

Table 5. Transit service characteristics summary

	Governing Body	Public Transit Agency and Service Name	Agency Type	Operator	Service Area	Services Provided	Fixed -route Service Provided Out of the County	Access to long-distance air & ground transport?	Days of Operation	Provides Complementary ADA Paratransit	Operating Fund	Ridership	Customer Service for Trip Planning	Approximate cost/month for trip planning [16]
Trinity County	Trinity County Transportation Commission (TCTC)	Trinity Transit (TT)	County	In-house	Weaverville and Intercity in County	1 Local Route (Weaverville) and 4 Intercity routes serving Hayfork, Willow Creek, Lewiston and Trinity Center	Willow Creek service (Humboldt County)	No	Mon-Fri	No – provided by flexible routing within Weaverville	TDA, FTA 5311, Local Transportation Funds, & Farebox	06/07: 9,456 07/08: 9,314	Est. 70 requests/month	$210
Modoc County	Modoc County Transportation Commission (MCTC)	Modoc Transportation Agency (MTA) – Sage Stage	JPA (City/County)	MV Transportation	Alturas (10 mi radius) and Regional	Intercity (3 routes), DAR Deviated Fixed-Route, and Inter-regional service (reservation)	Yes – Reno, Klamath Falls, and Redding	Yes	Mon – Fri	Yes – all trips are provided as ADA / complimentary paratransit	TDA, FTA 5311 Rural and Intercity, & Farebox	06/07: 12,695	N/A	N/A
Lassen County	Lassen County Transportation Commission (LCTC)	Lassen Transit Service Agency (LTSA) – Lassen Rural Bus (LRB)	JPA (City/County)	MV Transportation	Susanville and Intercity in County	2 Commuter, 1 Fixed, 1 Deviated Fixed-route, and Paratransit (DAR)	Yes – Modoc Sage Stage, serving Alturas and Reno	Yes	Mon – Fri, Sat	Yes	TDA, FTA 5311 Rural, Local Sales Tax, Farebox	06/07: 73,735 07/08: 74,198	Est. 10-15/month	$39
Plumas County	Plumas County Transportation Commission (PCTC)	Plumas Transit System (PTS)	County	Alliance for Workforce Development –Non-Profit	Quincy, Intercity in County and Regional	5 Fixed-routes (Deviated for seniors and disabled)	Yes – Reno and Chico	Yes	Mon – Fri	No – Plumas County Senior Services	TDA, FTA 5311, Farebox, & Contracts/Charter	07/08: 50,755	4-8/day (42-84/month)	$189
Siskiyou County	Siskiyou County Local Transportation Commission	Department of Public Works – Siskiyou Transit and General Express (STAGE)	County	In-house	Intercity within County and Yreka (pilot)	6 Fixed-routes (not including Yreka circulator pilot)	No	Yes (Ground)	Mon-Fri (Sat in pilot)	No	TDA, FTA 5310/5311, Farebox, Contracts/Charter, & Non-Transportation	06/07: 95,204 07/08: 95,124	Est. 2000 requests/month	$600
Tehama County	Tehama County Transportation Commission (TCTC)	Tehama Rural Area Express (TRAX)	County	Paratransit Services	Red Bluff, Corning, Tehama and communities along 99E and 99W corridors	3 commuter, 3 fixed intercity, 2 fixed local (Red Bluff, Corning)	No	Yes	Mon-Fri	Yes – w/in ¾ miles of TRAX routes, demand-response in Red Bluff provided by ParaTRAX	LTF, STA, 5311, farebox	Fixed-route: 06/07: 69,281 07/08: 67,200 General Public dial-a-ride: 06/07 14,346 07/08: 16,153	Est. 20-50 requests/day (420-1050/month)	$2,205
Shasta County	Shasta County Regional Transportation Planning Agency (SCRTPA)	Redding Area Bus Authority (RABA)	JPA (City/County)	Veolia Transportation	Anderson, Redding, Shasta Lake, and the County of Shasta	10 fixed and 1 Commuter route	No	Yes (Ground)	Mon-Sat	Yes – w/in ¾ miles of RABA routes	TDA, STA, FTA, farebox	06: 755,184 trips 07: 751,572 trips (calendar year)	30 hours/month	$900
Inyo/Mono County	Eastern Sierra Transit Authority Board of Directors	Eastern Sierra Transit Authority (ESTA)	JPA (City/County)	Eastern Sierra Transit Authority (ESTA)	Highway 395 corridor, Benton, Tecopa	5 intercity, 2 inter-regional, 2 local fixed-routes (Bishop and Mammoth Lakes)	Yes – Reno, NV and Ridgecrest, CA	Yes	Mon-Sun	Yes - deviations	LTF, STA, FTA, farebox	06/07: 177,683 07/08: 342,801	Est. 20-25 requests/day (420-525/month)	$1,416

[16] Assuming staffing cost of $30/hour, 10 minutes per trip planning call

Table 6. Summary of transit connections between stakeholder and neighboring agencies

Connection Area	City / facility	Agency	Service Days	Details
Butte County	Chico	Plumas Transit	W	Stops in Chico on Wednesdays
		Butte Regional Transit	7 days/ week	Transfer opportunities to Plumas Chico route
Humboldt County	Willow Creek	Trinity Transit	Tu	Weaverville to Willow Creek
		Redwood Transit System	M thru F	Arcata to Willow Creek
		Klamath Trinity Non Emergency Transportation Services	N/A	Hoopa to Willow Creek
Kern County	Mojave	Eastern Sierra Transit Authority (ESTA)	M, W, F	C.R.E.S.T. route
		Kern Regional Transit	M thru Sa	3 routes originate in Mojave
Lassen County	Susanville	Lassen Rural Bus	M thru F	Susanville city fixed-route connects to Sage Stage
		Modoc/ Sage Stage	M, W, F	Stops in Susanville on Reno Route
	Hallelujah Junction	Plumas Transit	M, F	Both services stop at HJ on Reno routes. Not a timed connection.
		Modoc/ Sage Stage	M, W, F	
Klamath County, Oregon	Klamath Falls	Modoc/ Sage Stage	Wed	Sage Stage's Alturas-Klamath Falls route provides connection opportunities to *The Klamath Shuttle* (Klamath Falls to Medford), and *Basin Transit* (Klamath County local transit) services
		Basin Transit	M thru Sa	
		The Klamath Shuttle	7 days/ week	
Los Angeles County	Lancaster	ESTA	M, W, F	Service between Mammoth and Lancaster
		Santa Clarita Transit	M thru F	Service from Lancaster to Santa Clarita via commuter Route 795
		Metrolink	7 days/ week	Antelope Valley line runs from Los Angeles to Lancaster
Mono County	June Lake	ESTA	M, Tu, Th, F	Route runs between Lone Pine, CA and Reno, NV
		Yosemite Area Regional Transit System	Depends on season	Service goes to Yosemite Park
Plumas County	Hamilton Branch	Plumas Transit	M thru F	This is a schedule-coordinated transfer, guaranteed transfer
		Lassen Rural Bus	M thru F	
Shasta County	Redding Intermodal Passenger Facility	Modoc/ Sage Stage	M, F	Service between Alturas and Redding
		Redding Area Bus Authority (RABA)	M thru S	Shasta county service
		Amtrak	7 days/ week	National rail service
		Greyhound	7 days/ week	National bus service
Washoe County, Nevada	Reno	Plumas Transit	M, F	Transfer opportunities to Amtrak, Greyhound, and Lake Tahoe airport shuttles
		Modoc/ Sage Stage	M, W, F	
		ESTA	M, Tu, Th, F	
		Regional Transportation Commission Washoe	7 days/ week	

Outreach methodology

Literature review

The consulting team conducted a literature review of relevant planning efforts. The documents included in the literature review are listed in Appendix H.

Stakeholder participation

The following stakeholders have been consulted during the course of this project:

- Public transportation providers (these organizations are identified in Chapter 2)
- Regional planning agencies (these organizations are identified in Chapter 2)
- Caltrans District 2
- Caltrans Division of Mass Transportation
- Caltrans Division of Rail
- Google, Inc.
- Private transportation providers (Greyhound)
- Social Service Transportation Advisory Committees (SSTACs)
- California 2-1-1 project

In the initial phase, many identified stakeholders participated in a kick-off meeting with consultants at Caltrans District 2 Headquarters in Redding, California to explain what Google Transit is, the purposes of this project, and to discuss stakeholder expectations and goals. Appendix A includes notes from this meeting.

Resources Survey

Shortly after project kick-off, a Resources Survey was conducted to:

- Assess information sources available for creating Google Transit feeds
- Inform the recommendation of participant agencies for the trip planner pilot project
- Establish baseline data on ridership and trip planning assistance demands for later comparison if pilot project participant agencies choose to go live on Google Transit.

The consultant team interviewed transit agency and other relevant staff and gathered data from available existing documents and sources of information, including:

- Agency websites, where available
- Printed maps & timetables
- Planning documents & ridership reports

Transit agency contacts were asked:

- How frequently do schedule or route changes occur?

- What information technology infrastructure, expertise or staff exists within the agency?
- What systems or software are currently employed to produce customer information and plan schedules and service?
- How many staff resources are currently dedicated to customer service (i.e.: answering transit trip planning requests)?

The survey script and completed Resources Survey summary document are attached as Appendix B.

Chapter 3. The Google Transit trip planner and pilot

Google Transit description and history

Google Transit is a global online transit trip planner for planning trips on participating agencies' services. The service launched in December of 2005. As of June 2009, it was possible to plan transit trips in approximately 405 cities on more than 115 transit systems on 6 continents with Google Transit.[17] The Google Transit trip planner is available through 40 Google Maps supported languages.[18]

In June 2008, Google added transit directions to some device-specific versions of Google Maps for Mobile.[19] Transit directions are currently available in Google Maps for mobile on Apple's iPhone, BlackBerry, S60 (Nokia), Windows Mobile, or Java-enabled phones.[20]

In addition to transit directions, Google Maps also provides travel itineraries for walking and driving. This horizontal integration of travel information services allows Google Maps to suggest transit as an alternative to driving on desktop and handheld/mobile platforms.

Transit agency Google Transit participation requirements

Google does not require a fee for agencies to participate in Google Transit. Google requires transit schedule and geographic data to be submitted and regularly updated in the Google Transit Feed Specification (GTFS)[21], and for participating data providers to execute the "Google Transit Agreement."

[17] "Google Transit." Google Maps. Google. 21 June 2009 <http://maps.google.com/transit>.

[18] "Google Transit Partner Program." Google Transit Paterner Program FAQ. Google. 29 Apr. 2009 <http://maps.google.com/help/maps/transit/partners/faq.html#genq2>.

[19] Hughes, Joe. "Get bus and train directions on the go with Google Maps for mobile." Weblog post. Official Google Mobile Blog. 5 June 2008. 29 Apr. 2009 <http://googlemobile.blogspot.com/2008/06/get-bus-and-train-directions-on-go-with.html>.

[20] "Mobile - Maps with Transit Directions." Google Mobile. Google. 29 Apr. 2009 <http://www.google.com/mobile/default/maps-transit.html>.

[21] "Google Transit Feed Specification." Google Code. 29 Apr. 2009 <http://code.google.com/transit/spec/transit_feed_specification.html>.

Google Transit Feed Specification (GTFS)

GTFS defines a common format for public transportation schedules and geographic information. The specification is licensed under the Creative Commons Attribution 2.5 License.[22] This license allows the specification to be freely redistributed, used, and adapted with the condition that Google, Inc. is attributed for the standard.

Many data consumers besides Google Maps use GTFS data (see Chapter 5). As such, the ongoing development and discussion of GTFS involves a number of stakeholders besides Google. Changes to the GTFS can be proposed and discussed on an electronic forum called the *Google Transit Feed Spec Changes* group (gtfs-changes).[23]

Pilot purpose

The purpose of the pilot / trip planner preview is to:

- Assess the ability of Google Transit to provide a platform for rural transit service information, where service density and frequency is significantly less than in urban areas.
- Provide recommendations to the Google Transit engineering team for how to improve the trip planner to better serve rural agency needs.
- Provide the opportunity for transit agencies to see and use the Google Transit trip planner with their own data to solicit their feedback on the trip planner.
- Find any errors and refine the transit schedule and geographic data provided to Google to ensure customers receive accurate transit trip planning information.
- Provide the opportunity for other stakeholders such as California 2-1-1 to see, use, and understand the Google Transit trip planner in order to incorporate it into their information programs.
- Prepare for live implementation of Google Transit, if deemed feasible.

Outcomes

Five transit agencies within the project study area are participating in the Google Transit trip planner pilot. Google and the consultant implemented a password-protected private trip planner preview for each participating agency.

[22] http://creativecommons.org/licenses/by/2.5/

[23] "Google Transit Feed Specification." Google Code. 29 Apr. 2009 <http://code.google.com/transit/spec/transit_feed_specification.html>.

Pilot agencies

Five agencies were selected for the Google Transit trip planner pilot implementation:

1. Plumas/Plumas Transit
2. Shasta/RABA
3. Siskiyou/STAGE
4. Tehama/TRAX
5. Trinity/Trinity Transit

Costs

Table 7. Costs of gathering and publishing GTFS for pilot agencies

County	Data engineer (associate) hours at $65/hour	Developer (principal) hours at $120/hour	Cost
Plumas	60	8	$4,860
Shasta	54	14	$5,190
Siskiyou	76	7	$5,780
Tehama	56	6	$4,360
Trinity	36	8	$3,300
Total	**282**	**43**	**$23,490**

The costs listed above show consultant time for gathering data for bus stop locations and route alignments (for Plumas and Siskiyou), publishing GTFS, validating, error checking and correcting issues.

Status overview

Table 8. Status of agencies in pilot

Agency	Status			
	In preview	Outstanding issues	Awaiting additional agency feedback	Planning to "go live"
Plumas Transit	X	X		
RABA/Shasta	X	X		X
STAGE/Siskiyou	X			X
TRAX/Tehama	X	X		X
Trinity Transit	X	X		X

Trip planner issues

1. Limited capability to display detailed stop information

Some stops should be displayed with pertinent information such as a notice that a stop is not visited in snowy weather. GTFS includes a "stop_description" field, but its contents are not shown to end users of the trip planner. Instead, feed publishers must adapt to this limitation by including stop information in the "stop_name" field.

2. Google Transit instructs passenger end-users to transfer at the top of loop routes

For some trips in which the vehicle passes the endpoint of a loop route, the trip planner indicates an in-seat transfer or instructs riders to exit the bus at the endpoint and then board the same bus (see Figure 2). This occurs even when two successive trips are assigned the same vehicle block in the Google Transit feed. Over the course of this project, this issue has been corrected in some, but not all, cases.

Figure 2. Google Transit indicates a transfer at the top of a loop route trip

Transit directions to St Elizabeth Community Hospital

A Monroe Ave & Walton Ave
Red Bluff, CA 96080

$0.50 (vs. $2.24 driving!)
Showing **Trip 1** Travel time: about 28 mins

Walk to Sacred Heart School
About 1 min

Show details

Bus - **1** - S. Main/ Walnut - Direction: Bus & Ride / Rio & Walnut
Service run by Tehama Rural Area Express - 530-385-BUSS (2877)

10:46am Depart Sacred Heart School
9 mins
10:55am Arrive Bus & Ride / Rio & Walnut

Bus - **1** - S. Main/ Walnut - Direction: Bus & Ride / Rio & Walnut
5 mins to make transfer

11:00am Depart Bus & Ride / Rio & Walnut
10 mins
11:10am Arrive St. Elizabeth Hospital

Walk to 2550 Sister Mary Columba Dr
About 3 mins

Show details

B St Elizabeth Community Hospital
2550 Sister Mary Columba Dr
Red Bluff, CA 96080

3. Trip planner returns walking directions instead of available transit option for complete trip or segment

The two causes of this problem are sparse time points and long on-vehicle times due to the indirect path of a loop route. These two causes are discussed separately, below.

3a. Sparse time points cause trip planner to overestimate transit travel times

To determine arrival or departure times for stops between time points the trip planner looks forward to the arrival time of next time point or searches backward to the departure time of the previous time point. When a route's timing points are widely spaced (occurring more than 12 minutes apart), the trip planner returns significantly longer transit travel times than would actually occur. In some cases this overestimation causes the trip planner to display walking trips, which are calculated as shorter than the longer transit trips, instead of transit trips.

RABA schedules have sparse time points, which previously caused the trip planner to display walking instead of transit for complete trips or portions of trips within the RABA service area.

A potential solution to this problem would be for the trip planner to automatically interpolate times for non-time point stops. However, this approach is inadvisable and is unlikely to be implemented. Most transit agencies prefer that arrival and departure times should be calculated conservatively. An agency-specific solution would be for affected agencies or their consultant to manually interpolate selected stop times between time points. RABA has directed the consultant to test this approach on a trial basis in the preview trip planner.

3b. Long on-vehicle time for loop routes causes trip planner to suggest unnecessary walking leg of trip

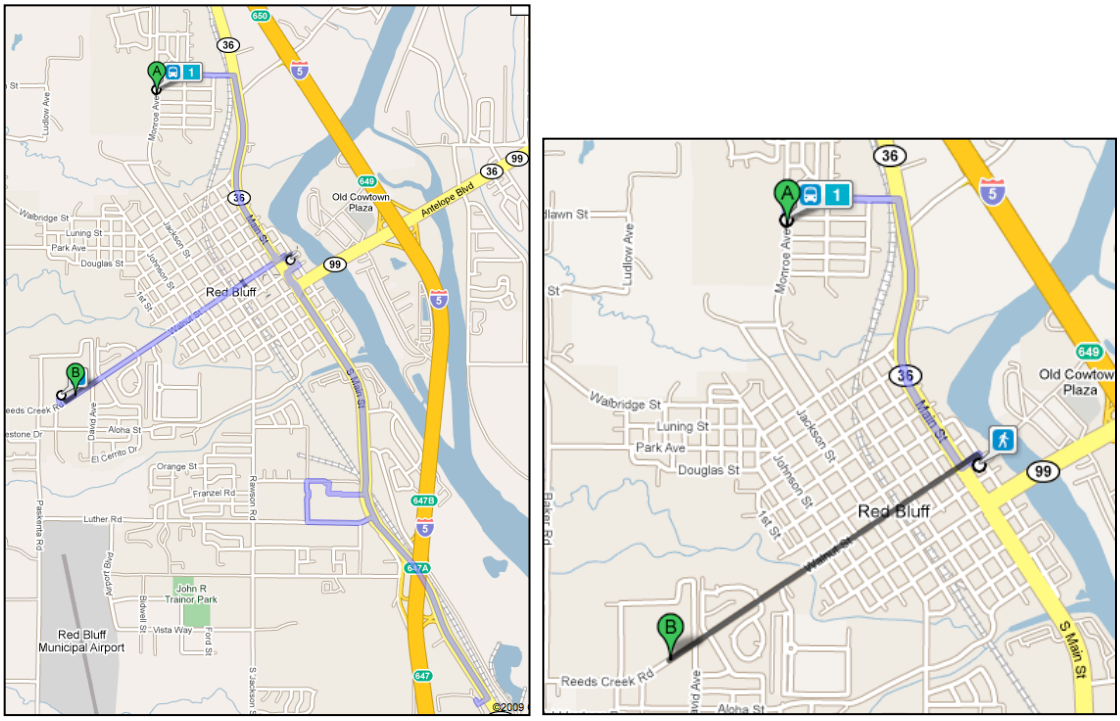
Some travel itineraries on loop routes may involve indirect travel paths and correspondingly long on-vehicle passenger travel times. In cases where the trip planner calculates walking is a faster alternative to transit over all or part of a transit route, the trip planner does display options that maximize travel onboard transit vehicle.

For an example, see Figure 3 (next page).

This software decision produces optimal travel itineraries for individuals that do not mind and are able to walk distances of, for example, 0.5 or more miles. However, the result does not serve the needs of mobility-limited customers or customers with heavy bags.

The consultant team recommends that the transit trip planner should always show and preference transit options over walking when available. This will enable customers to see the full availability of transit service. Customers may choose a walking alternative by clicking the "Walking directions" option in Google Maps.

Figure 3. A more ideal display of a trip on TRAX Route 1 (Photoshop mockup, left) and TRAX Route 1 trip as it currently displays (right)



4. Queries for travel times more than 48 hours in advance of scheduled service return no results

Some routes within the project study area operate once or twice each week. Currently, for these services to be returned in the trip planner, the end-user must query for a departure time and date near to the scheduled time of service. If the query is for a desired travel time 48 hours or more in advance of the scheduled service, no results will be returned.

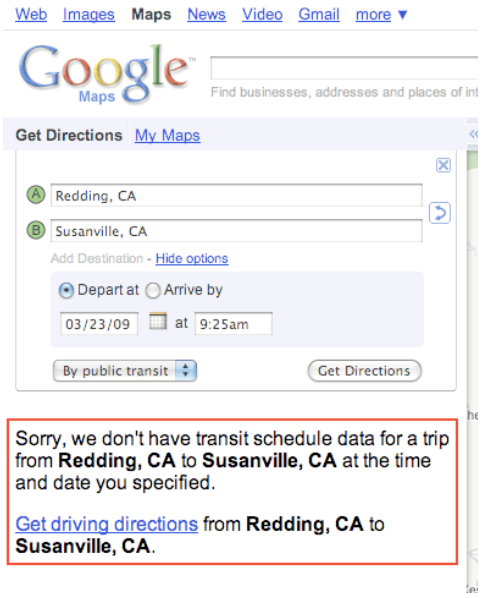
It is recommended that the Google Transit trip planner should search for and return services that are up to 7 days in the future of the desired travel time.

Google has responded by saying they are aware of the issue. While there is no short-term fix, the engineering team plans to resolve this issue at some point in the future.

5. Service unavailability message provides minimal useful information or resource referral

When riders search for a trip and trip time that cannot be served by a nearby agency, the Google Transit trip planner displays the following message: "Sorry, we don't have transit schedule data for a trip from *Location A* to *Location B* at the time and date you specified." This occurs even when there is transit service available from Google Transit within the query bounds, but is not within a reasonable walking distance (roughly four miles).

Figure 4. Current transit service unavailability message in Google Maps



The consultant team has proposed to the Google Transit support community that this message should be expanded to provide more information. A suggestion for expanding this message follows:

> Sorry, we don't have transit schedule data for a trip from Redding, CA to Susanville, CA at the time and date you specified.
>
> The Google Maps trip planner currently includes service schedules for these agencies in this area:
>
> - Redding Area Bus Authority (website link), (530) 241-2877
> - Sage Stage (website link), 530-233-6410
> - Plumas Transit (website link), 530-283-2538
>
> You can also try:
>
> - Search businesses and organizations for "Transportation" in this area (http://maps.google.com/maps?f=q&source=s_q&hl=en&geocode=&q=transport)
> - Get driving directions from Redding, CA to Susanville, CA.

6. Google Transit does not return trips to stops where services are flagged as "must phone agency"

The GTFS includes the capability to specify pick-up and drop off type as follows in stop_times.txt. Potential pickup types and drop off types are as follows:

- Regularly scheduled
- Not available
- Must phone agency to arrange
- Must coordinate with driver to arrange

The only scheduled services that are returned to trip planner end users are at stops at which pickup or drop-off is specified as "regularly scheduled" or "must coordinate with driver."

For stops times that are flagged with as "must phone agency" for pickup or drop-off type, the trip planner does not return available service.

7. Google Transit does not indicate "must coordinate with driver" or "must phone agency"

Most agencies would like to include all potential serviced stops in Google Transit. It may not always make sense or be advisable to do this, however, if the bus may not take an exit or travel a side-segment without advanced request from a passenger for pick up or drop at that location. A passenger could misunderstand that the bus will normally stop at or travel by a particular location if Google Transit returns the stop in an itinerary.

The consultant has changed the names of certain stops to provide more information ("[STOP NAME]... must phone agency in advance"). A limitation of this approach is that it is not possible to represent reservation-only and regularly- scheduled service at that same stop without publishing non-regularized data (two stop records for the same location).

It would be helpful for several agencies if it were possible to return trips that are flagged with non-regularly scheduled stop times with an appropriate message that instructs passengers to coordinate with the driver or call the agency.

A suggestion for improvement has been posted in the Google Transit Partner Support forums (See Appendix I: Communication with Google: "Specifying call-ahead and 'must coordinate with driver' pick up and drop off types.")

8. Maximum walking distance threshold prevents display of available transit service

When the origin or destination entered into the trip planner is farther than four miles from the nearest transit stop, no trip options are returned. The consultant team has contacted Google Transit Partner Support about the possibility of modifying walking distance thresholds in rural areas.

The recommendation developed with stakeholder input is for the travel to transit stop distance to be increased to 25 miles. This travel distance to transit can be expected in areas where transit passengers travel over 100 miles to a regional airport in service areas with density of less than 5 persons per square mile, for example. In order to avoid trip planner results where travel-to-transit distance is greater than transit-by-transit distance, the travel-to-transit threshold should be increased for long-distance transit routes.

This issue presents a particular problem in instances where end users query for transit destinations and origins by the name of a city. In Google Maps, the discrete points that indicate the location of rural cities may be a significant distance from actual town centers and transit stop locations (see example in Figure 5, below). This issue cannot be corrected with the TeleAtlas Map Insight tool (see Appendix E).

Figure 5. "Weaverville" location point in Google Maps

In rural areas, friends, family, and neighbors sometimes drive transit passengers to bus stops if walking distances are significant. For some commuter rail services, Google has incorporated drive-to-transit directions.[24] This feature may also be useful in rural areas.

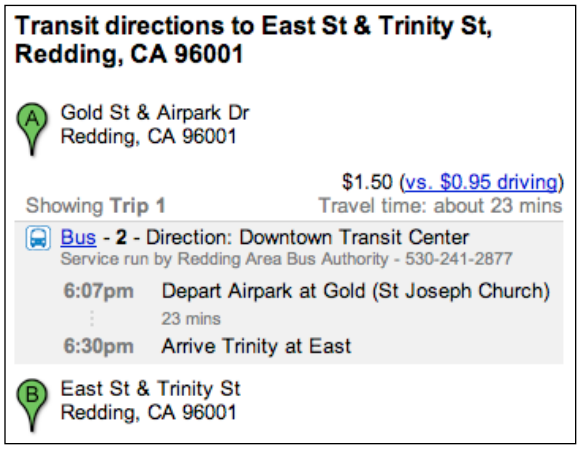
9. Google Transit shows destination headsign for non-directional (loop) routes

The trip planner always shows a direction or headsign after the route name. For trips where a trip_headsign was not defined, the trip planner uses the last stop name in the trip as the headsign. This is confusing in the case of looping routes.

[24] Antrim, Aaron. "Google Transit feature: Park and ride / drive to commuter rail." Weblog post. Trillium Solutions Blog. 3 Apr. 2009. <http://www.trilliumtransit.com/blog/2009/04/03/google-transit-feature-park-and-ride-drive-to-commuter-rail/comment-page-1/>.

The consultant team has recommended to Google that, for direction-less trips, no "Direction" should be shown. As an interim solution, Google Transit feeds have been re-published with a headsign of "(loop)" for loop trips.

Figure 6. Google Transit shows destination / direction for loop route



10. Available services are not returned

The trip planner doesn't return a trip option for multiple trips of the Plumas Transit Reno/Quincy Route. The data supplied to Google shows no sign of error; this issue is unexplained.

11. Google Maps baselayer (road maps) are inaccurate and/or out-of-date

Some newer roads are not shown in Google Maps. Other roads are not correctly labeled. This issue has been identified and emphasized in Shasta County. In particular, a significant number of roads in the greater Redding area are mislabeled or missing in Google Maps. Over the course of this project, map data improved for Tehama County.

The steps for solving this issue are to report individual issues to TeleAtlas, the Google Maps data provider, using the web-based tool Map Insight[25] through the steps documented in Appendix E. User feedback in the Google Maps Help Group[26] indicates that Tele Atlas does respond to reported issues, but it can take up to 9 months to be reflected in Google Maps.

TeleAtlas gathers data directly from municipal governments. It may be possible for county governments to update TeleAtlas information most efficiently by providing a complete update of local road network data. Google also receives information directly through a Base Map Partner Program[27] introduced in October 2009.

[25] http://mapinsight.teleatlas.com

[26] http://groups.google.com/group/Google-Maps/topics

[27] maps.google.com/help/maps/basemap

Current TeleAtlas data is updated quarterly.[28] Google updates their maps whenever they receive updated information from data providers.[29] TeleAtlas reports that it takes between 2-5 months for reported issues to be taken into account in the current TeleAtlas geographic database.

12. Address locations in Google Maps are inaccurate

Some street addresses are not correctly located in Google Maps. This issue has been identified and emphasized in Shasta and Tehama counties. The steps for solving this issue are to report individual issues to TeleAtlas, the Google Maps data provider using the web-based tool Map Insight[30] through the steps documented in Appendix E. See topic above "Google Maps baselayer (road maps) are inaccurate and/or out-of-date" for more information on TeleAtlas data issues and options for issue resolution.

The consultant team has issued reports on inaccurate addresses to TeleAtlas for addresses in Red Bluff. The status of these reports can be tracked at the following locations:

- Antelope Blvd, Red Bluff, CA: http://tinyurl.com/mjul95
- S Main St, Red Bluff, CA: http://tinyurl.com/mdf978

13. Trip planner does not direct passenger to alight at the most appropriate stop for some destinations

The Google Transit trip planner directs passengers to alight at the transit stop nearest to their destination. Most of the time, this decision-making rule effectively returns the best possible result. However, the nearest transit stop to a particular destination may not always be the best one.

Cases for which the trip planner fails to direct the passenger to the most appropriate stop may include:

- obstructions such as highways make walking a short distance from the selected transit stop to the destination dangerous or impossible
- a destination is mis-located in Google Maps
- a large campus, mall, or store destination is indicated as a discrete point, creating geographic ambiguity

One reported instance of this issue in the pilot project was for the main Shasta College campus, which is served by Redding Area Bus Authority. Figure 7 (next page). The trip planner does not direct passengers to alight at the stop in the parking lot in front of Shasta College Drive but at College View Drive at Old Oregon Trail, which is across Highway 299.

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[28] "Frequently Asked Questions." 2009. Tele Atlas. 18 June 2009 <http://www.teleatlas.com/WhyTeleAtlas/FAQs/index.htm#faq11>.

[29] Google Maps Help Group. 13 July 2007. Google. 18 June 2009 <http://tinyurl.com/mfrq88>.

[30] http://mapinsight.teleatlas.com

This is because the later stop is located nearer to the Google Maps location for Shasta College.

Figure 7. Google Transit directions for Shasta College campus

The most immediate solution for this problem is to move the location for Shasta College (indicated above by the green marker labeled "B") to a central location of the campus, nearer to the RABA bus stop for the college. The location can only be edited by college staff because Shasta College has "claimed" it in the Google Local Business Center[31]. Unclaimed locations can be edited by any internet user (see "Appendix E: Guide for transit agencies: How to correct street network data, addresses and places of interest in Google Maps").

A different longer-term approach to resolving this issue is to work with the Google Transit engineering team and Google Transit Feed Specification community of developers to justify and refine a GTFS change proposal to specify points of interest and tie specific services and transit stop locations to these points of interest. One of the primary challenges with this approach is that Google Maps incorporates location information from many sources. This proposal will probably not be implemented immediately.

The most recent discussion on the GTFS-changes list regarding this issue occurred in January 2009[32]. The issue was also been discussed in 2007 and 2008.[33]

[31] http://www.google.com/local/add/

[32] http://groups.google.com/group/gtfs-changes/browse_thread/thread/c6e6af54c86557c5

[33] http://tinyurl.com/ov7drv

Table 9. Google Transit pilot issues, problem instances, and statuses

Issue	Shasta	Trinity	Siskiyou	Plumas	Tehama	Issue manifestation / details	Proposed solution	Action taken	Priority	Status	Next steps
1. Limited capability to display detailed stop information				X		Need to display information that Graeagle and Blairsden stops not available in snow season.	Include details in stop name field (interim, implemented). Long term solution would be to show a notes or description field or link to stop URL field.	Added "Availability depends on weather, call agency" to stop name field.	Low	Resolved by adding information to stops table in transit feed data. Displaying correctly.	N/A
2. Google Transit instructs passenger end-users to transfer at the top of loop routes	X				X	TRAX Route 1, RABA loop routes.	Trip planner should not show any transfer between trips on loop route.	Reported issue to Google.	Low	No change.	Follow up / wait for resolution from Google
3. Trip planner returns walking directions instead of available transit option for complete trip or segment	X				X	See 3a and 3b.	Transit trip planner itineraries should maximize use of available transit service. Customers can choose "walking" directions option if they wish to compare.	See 3a and 3b.	High	No change.	
3a. Sparse time points cause trip planner to overestimate transit travel times	X					All RABA routes, specifically route 2, often have long transit travel times, and preference walking trips, because long (sometimes 20+ min) gaps between timing points.	Interpolate some stop times between time points. Re-publish Google Transit feed.	Proposed solution incorporated.	High	Proposed solution has solved problem.	None.
3b. Long on-vehicle time for loop routes causes trip planner to suggest unnecessary walking leg of trip	X				X	TRAX Route 1, RABA loop routes.	See 3.	Reported issue to Google.	Medium	No change.	Follow up / wait for resolution from Google
4. Queries for travel times more than 48 hours in advance of scheduled service return no results						Intercity Plumas Transit routes and some Trinity Transit routes (Willow Creek / Down River).	Trip planner should search for and return service up to 7 days within queried desired time/date of travel.	Reported issue to Google.	High	No change.	Follow up / wait for resolution from Google
5. Service unavailability message provides minimal useful information or resource referral	X	X	X	X	X	Example: A search from Redding to Susanville returns the message "Sorry, we don't have transit schedule data for a trip from Redding, CA to Susanville, CA at the time and date you specified."	Google Transit returns area transit agency website links and other information to end-user.	Proposed solution to Google and Google Transit partners.	Medium	In correspondence with Google and stakeholders	Follow up with Google, stakeholders, and existing Google Transit partner agencies
6. Google Transit does not return trips to stops where services are flagged as "must phone agency"				X		Many trips on Reno and Chico routes are only used when agency is notified by phone.		Added "Pre-arranged pick-ups and drop offs only" to stop name but removed "must phone agency" flag in stop_times.txt. Researched agency needs; submitted issue & details to Google.	Medium	Response from Google pending.	Continue current strategy until trip planner implementation changes.
7. Trip planner does not indicate "must coordinate with driver" or "must phone agency"		X	X	X			Google Transit returns message that indicates type of scheduled service at a stop.	Proposed solution to Google and Google Transit partners.	Low	Response from Google pending.	Publish new data if/when trip planner implementation changes.

Issue	Shasta	Trinity	Siskiyou	Plumas	Tehama	Issue manifestation / details	Proposed solution	Action taken	Priority	Status	Next steps
8. Maximum walking distance threshold prevents display of available transit service		X	X	X		Low density, rural service areas are affected. For example, a search for Plumas Transit's Chico route that has "Chico, CA" as its origin or destination will not return because the center of Chico is outside the maximum walking distance from Plumas' Chico route.	Maximum travel to transit stop distance in Google Transit is increased to 25 miles for long-distance rural transit service. Add drive-to-transit option.	Reported issue to Google	High	Response from Google pending.	Follow up / wait for resolution from Google
9. Google Transit shows destination headsign for non-directional (loop) routes	X			X	X	All loop routes.	Google Transit should not show "Direction:" for loop routes.	Reported issue to Google; consultant will republish feed with text "(loop route)" as headsign	Low	Response from Google pending.	Follow up / wait for resolution from Google
10. Service doesn't return for certain trips				X		The trip planner does not show a trip for the Plumas Transit Reno route from Reno to Plumas county (the Plumas Co. to Reno direction works fine)	Show service	Reported issue to Google	Critical – agency cannot launch	Response from Google pending.	Follow up / wait for resolution from Google
11. Google Maps baselayer (road maps) are inaccurate and/or out-of-date	X					Section of Akard Ave in Redding should be Civic Center Dr. Many other issues in the Redding area.	Provide updated county road network data to TeleAtlas. Consider participating in the Google Base Map Partner Program (maps.google.com/help/maps/basemap/).	Submitted reports to Tele Atlas; created instructions for on submitting other issues to Tele Atlas	Medium	Corrections pending next data cycle	Coordinate with TeleAtlas and county and city GIS / Public Works
12. Address locations in Google Maps are inaccurate (Resolved)					X	Locations S Main and Antelope Blvd in Red Bluff incorrect; Incorrect address locations in many other areas	Provide updated county street address data to TeleAtlas.	Submitted reports to Tele Atlas; created instructions for on submitting other issues to Tele Atlas	High	This issue has been resolved.	Coordinate with TeleAtlas and county GIS / Public Works
13. Trip planner does not direct passenger to alight at most appropriate stop for some destinations	X					Passenger is instructed to alight at incorrect stop, when there is a dedicated and particular stop for their destination.	Move destination location nearer to dedicated bus stop. Coordinate with authorized destination staff/owner if location has been claimed in "Google Local Business Center."	None.	Medium	No change.	Coordinate with RABA, Shasta College.

Summary of issues and outcomes

Most of the critical and high priority issues uncovered in the Google Transit trip planner pilot relate to the software implementation of the Google Transit trip planner and the accuracy of street atlas data in Google Maps.

The most critical issue is agency-specific for Plumas Transit. Some Plumas Transit services are not being returned in the trip planner. There is no explanation for this problem.

The next highest priority and most widespread issues are:

- Trip planner returns walking directions instead of available transit option.
- Queries for travel times more than 48 hours in advance of scheduled service do not return results.
- Maximum walking distance threshold prevents the display of available transit service.
- Google Maps street atlas data is inaccurate.

Issue resolution

Resolving the issues identified over the course of the pilot project will require engagement from Google. Correspondence with Google on these issues is included in Appendix J. In order to support Google's resolution process for identified issues, it is recommended for involved organizations to take the following roles and functions:

- **Caltrans DMT** communicates priorities for trip planner issue resolution to Google.
- **Stakeholder transit agencies** continue to identify and prioritize issues, reporting this information to a technical consultant or directly to Google. Transit agencies may submit specific issues with Google Maps road atlas layer to TeleAtlas.
- **Local GIS departments and planning agencies** provide updated road map and address data to TeleAtlas for inclusion in the Google Maps road atlas layer.
- **Data publishing consultant** remains available to coordinate with Google in order to explain particular features of rural transit service and collaborate to create alternative strategies for describing service and infrastructure in GTFS.

Depending on the success of the issue resolution effort, transit agencies will choose if or how to launch publicly on Google Transit. Steps and options for accomplishing this are detailed in "Chapter 6: Implementation Plan."

Stakeholder-requested features

Capability for representing non general public, fixed-route transportation services

At the initial meeting in Redding, stakeholders suggested that Google Maps should also present all available human service transportation options for a given itinerary, date, time, and passenger eligibility criteria.

Google Transit agency participation is presently constrained to general service fixed-route transportation services. It appears unlikely that the company will incorporate non fixed-route services or services which are not open to the public in the near future. Incorporating eligibility criteria into data feeds and travel search tools would represent a significant technical and policy challenge on the world-wide scale.

The consultant team has proposed an approach for extending GTFS capabilities to describe human service transportation types (see correspondence with Google in Appendix I on route_type field).

The consultant team also proposed an approach to represent deviated route and dial-a-ride service availability. The Google engineering team indicated interest, but also expressed that prototype implementation and GTFS use testing should be accomplished in another trip planning tool. This is likely due to the difficulty of implementing and testing new features in a live transit trip planner that millions of users depend on around the globe. The next step is to explore interest and opportunity in the developer community to address this need.

Trip planner query analytics to assist agencies in understanding their investment and assessing Unmet Needs

While Google does not require a fee from transit agency partners, the Policy Boards of these agencies and Caltrans should quantify the benefits of the time or money invested in deploying Google Transit trip planning. Some agencies track visits to their website with Google Analytics and can monitor number of visits to specific pages, from which countries, etc. Once the public user leaves the agency's website to begin trip planning via Google Maps those statistics are known only to Google. As a return on FTA's, Caltrans' and the Agency's investment (ROI), Google should offer summary reports back to partner agencies and Caltrans that display trip planning activity including:

- Number of trips planned within that agency's service area
- Percent of total "Directions" hits where the rider then clicks on "public transit"
- Samples of trips planned (top five)
- Samples of trips planned among agencies (trips that require more than one transit system) (top five)
- Summary samples of trips attempted but returned "we have no data for that day and time" (top 50)

It would be ideal to capture any pattern by day of week using 4 hours blocks:

6 a.m. – 10 a.m.
10 a.m. – 2 p.m.
2 p.m. – 6 p.m.
6 p.m. – 10 p.m.

The trips that cannot be served would assist Caltrans, FTA and the agency with assessing mandated Unmet Transit Needs determinations or perhaps debug data that is being reported as a failed trip, in error.

Pilot methodology

Pilot agency selection

Agencies were chosen by the following criteria using Resources Survey results:

- Availability and accuracy of bus stop location data (in GIS libraries or other sources)
- If bus stop location data is not available, willingness/availability of agency staff to help gather location data using Trillium-provided handheld GPS
- Availability of staff support to answer questions and test pilot
- Representation of a variety of sizes and types transportation service providers
- Service adjacency and connection-availability (i.e.: connecting services in contiguous areas or corridors to test Google Transit's connection-making features).
- Stated agency interest level in the project and in participating in the pilot

Data gathering

Information for route alignments, stop locations, schedules, fare tables, transfer preferences, agency phone numbers, route information URLs, route colors, and service calendars and holidays is necessary to publish complete Google Transit feeds. This data was gathered by the following means:

- **Agency websites.**

- **On-board bus stop location gathering with handheld GPS receiver.** Consultant team gathered bus stop location and route alignment data by riding buses with a handheld GPS receiver for Plumas and Siskiyou/STAGE systems. Agency staff participated in data gathering process for Siskiyou/STAGE. Trinity Transit agency staff gathered all their own data with consultant-supplied GPS unit.

- **Existing GIS layers.** Shasta/RABA and Tehama/TRAX maintain transit stop location and route alignment data in GIS libraries. This data was used to create Google Transit feeds and launch the Google Transit preview.

- **Map-based data input.** In cases where transit stops are on long-distance routes that would necessitate many hours to gather one or two data points, Google Earth and Google Maps were used to plot bus stop locations using road network and satellite views. These locations were verified and/or corrected by transit agency staff.

- **Paper schedules and customer information materials** were used as data sources for Trinity/Trinity Transit and Siskiyou/STAGE.

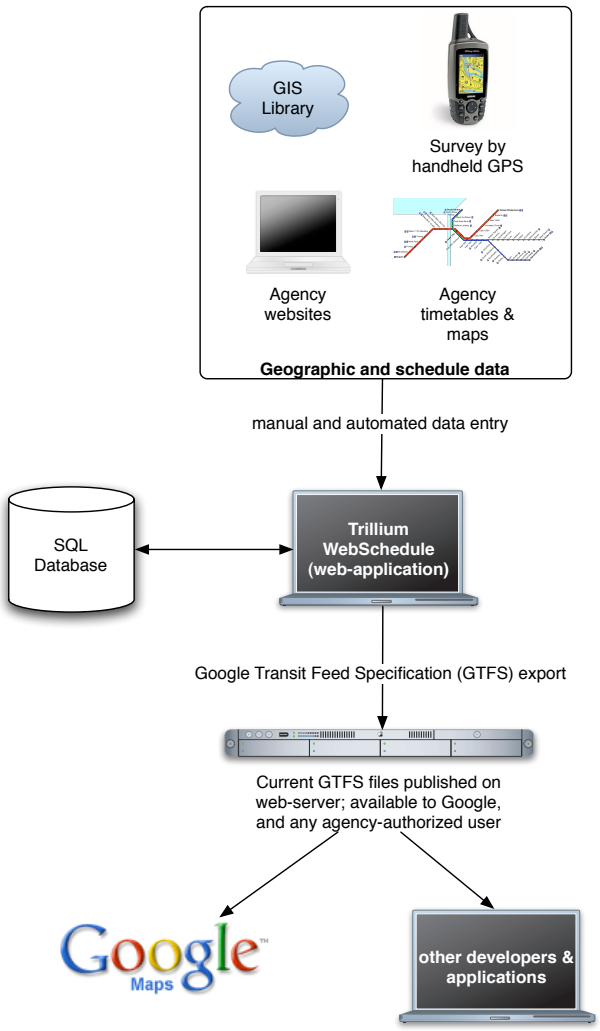
- **Electronic forms** were used to gather information on preferred transfers to be included in the Google Transit trip planner.

GTFS publishing

Trillium WebSchedule was used to create GTFS Data. This tool is described in Chapter 4. The following figure shows the sources, components, and consumers of GTFS data in the GTFS publishing process.

All optional Google Transit Feed data elements were incorporated, including "shapes.txt" to describe route alignments, "transfers.txt" to describe transfer preferences (where they exist), and fares and fare rules.

Figure 8. Trillium WebSchedule within data gathering and GTFS export process



Data validation

The supplied data and trip planner results passed at least two review processes — one conducted by the consultant team and the other by agency staff.

These were the methods used to check and validate data.

1. **Map-based view of complete routes and schedule data.** The software "schedule_viewer.py"[34] was used to proof schedule, route alignment, and stop

[34] http://code.google.com/p/googletransitdatafeed/wiki/TransitFeed

location data provided to Google. To make this interface constantly available, the consultant team installed the software on a web-server.

2. **Trip planner test with random and constructed queries.** Using open-source tools from Google, the consultant team generated random test queries within agency service areas. The consultant team and agency staff used these computer-generated queries and human-generated queries to test the trip planner.

Feedback

Stakeholder transit agencies submitted issues with the preview trip planner and source data through email, Basecamp (an online project management space), and through an electronic form.

Issue resolution

Unexpected results in the Google Transit trip planner can be caused by inaccuracies in the Google Transit feed data provided to Google, or by Google's implementation of transit trip planning software. Once an issue is identified, a multi-step process is used to diagnose the issue and set a resolution process in motion:

1. Issue is discovered and logged by consultant or agency stakeholder.
2. Erroneous trip planner results are examined and considered with multiple approaches:
    a. Query results are categorized, according to nature of the issue
    b. Query result are compared to results with similar error
    c. Query results are compared to correct results for similar query
3. Provided GTFS data is examined closely for consistency.
4. If Google Transit feed data has errors, these errors are corrected and feed is re-submitted to Google.
5. If Google Transit feed data is without errors, then the potential issue with the trip planner implementation is submitted to Google through one of three channels (below).

Issues and support requests are submitted to Google on an ongoing basis in order to expedite their resolution, participate collaboratively with other Google Transit Feed publishers and Google Transit efforts, and conform to Google's preferred communication channels. These channels include:

- **Google Transit Feed Spec Changes group.**[35] If it is not possible to fully represent data necessary to correct the issue in the current GTFS, suggestions are made for how to extend or modify the GTFS. As much as possible, suggestions have followed the stated goals of the GTFS (see Section 7, page 33). This group message archive is available to the public, but only GTFS publishers and consumers can post messages.

[35] http://groups.google.com/group/gtfs-changes

- **Google Transit Partner Support.**[36] If the issue concerns the trip planner implementation only, and is not an issue with the data specification (GTFS), messages are posted in this online group, in which only authorized Google Transit feed publishers and partners have access to read and post.
- **Direct contact to Google Transit team.** Some feed publishing issues have been submitted directly to the Google Transit team outside of the semi-public forums.

Copies of electronic communication with Google and in online forums are attached in Appendix J.

[36] http://groups.google.com/group/google-transit-partner-support/

Chapter 4. Google Transit feed publishing tools

Several tools and software systems exist to help transit agencies maintain and publish Google Transit feed data. Large, metropolitan agencies use scheduling software such as the products offered by GIRO and Trapeze to manage data and export GTFS. Several lower cost options exist for smaller agencies to maintain and publish GTFS.

This section compares the four currently available GTFS publishing tools for small agencies by features, cost, and delivery model.

Tools overview

Trillium Solutions WebSchedule

WebSchedule is the commercial subscription-based application that Trillium Solutions offers to help small and medium sized agencies produce and maintain Google Transit feeds.

The software is centrally hosted and web-based. It is periodically updated with fixes and new features.[37]

Excel GTFS tools

The main advantage of the Excel GTFS tools is the fact that there are no purchase or subscription costs. However, there may be ongoing training or consultant costs to assist agencies with using the tools or make updates for them. Excel GTFS tools require users to be familiar and comfortable with Excel functions, GTFS structure, Google Earth KML files, and shape information.

Next Insight Google Transit Feed Creator tool

Next Insight Transportation Software LLC offers a subscription-based tool to help small and medium sized agencies produce and maintain Google Transit feeds.

[37] While Trillium Solutions continues to serve existing clients, the company is not taking on new clients. New clients are directed to a recently formed company, Trillium Insight, Inc. Trillium Solutions and Next Insight Transportation Software LLC are presently collaborating to create an updated web-based GTFS publishing tool that combines the features and technologies of the existing Trillium Solutions and Next Insight tools. A new Oregon-based company, Trillium Insight, Inc. will offer the new service. There will be a seamless upgrade for existing customers of Trillium Solutions and Next Insight, LLC.

Iteris Bus Feeder

Bus Feeder is a web-based application that Iteris developed for the State of Idaho, which owns the codebase.

For any agency or group of agencies that wish to use this software, they would need to purchase, configure, and maintain a server to host the application. If a server were to be purchased and set up for this purpose, this cost would likely total around $6,000. Iteris estimates user training for the software would cost $3,000 per session. There would be maintenance costs for internet connectivity and to maintain the server and software.

Avego Futurefleet

Avego Futurefleet is a suite of tools that includes in-vehicle mobile data terminals, real-time passenger alerts, fleet management capabilities, electronic fare payment capabilities, and Google Transit Feed Specification data export.

Google Transit feed maintenance and export is a free service offered by Avego. The free services are supported by revenues from offering optional in-vehicle AVL hardware and other systems that are updated through the same interface.

Avego is a subsidiary of Mapflow. Futurefleet was first announced late 2008. The product's availability has not been widely publicized so complete information is not included in this document. More complete information will be included in the next version of the document.

More information is at www.avego.com/ui/futurefleet.action.

Screen captures

For screen captures of available GTFS publishing tools, see Appendix C.

Comparison

Table 10. Google Transit feed publishing options as of June 2009

GTFS Tool	WebSchedule	Excel GTFS Creation tool	Google Transit Feed Creator	Bus Feeder	Avego FutureFleet
Vendor / Author	Trillium Solutions	Bob Heitzman (San Luis Obispo Transit)	Next Insight Transportation Software, LLC	Iteris, Inc.	Avego, Ltd.
Codebase owner	Trillium Solutions	Open source	Next Insight Transportation Software, LLC	State of Idaho	Avego, Ltd.
License	Commercial subscription-based service	[Open source - awaiting additional details in response from Bob Heitzman]	Commercial subscription-based service	No information	Free subscription-based service
Customer owns produced GTFS	X	X	X	X	X
Shapes export	X	X			
Specify preferred transfer points	X	X			X
Drag-and-drop stop placement	X		X		X
Visualization tools	Yes: stop locations are plotted on map within application	Users must follow link to leave Microsoft Excel and view on Google Maps	Yes: most extensive. Application plots stop locations and route patterns on map.	No. Users see latitude and longitude points only.	Stops, routes, trips graphically represented.

GTFS Tool	WebSchedule	Excel GTFS Creation tool	Google Transit Feed Creator	Bus Feeder	Avego FutureFleet
Validation features	Some. Automatic checks for out-of-order stops.	Some	Some. Automatic checks for out-of-order stops. Runs feed_validator.py on export. Provides dashboard of data statistics.	Unknown	Unknown
Upgrade path	New features are periodically added to hosted application; not necessary to re-enter data	New features are periodically added to Excel file. Users must export and re-import data.	New features are periodically added to hosted application; not necessary to re-enter data	Next-generation product in development. Upgrade path is unclear.	New features are periodically added to hosted application; not necessary to re-enter data
Install location	Hosted - existing managed server	Desktop	Hosted - existing managed server	Hosted - requires new server	Hosted - existing managed server
Technical requirements	Firefox or Internet Explorer web-browser on client machine	Microsoft Office Excel for Windows; web-server to host data	Firefox or Internet Explorer web-browser on client machine	Client: web-browser Server hardware: requires Microsoft SQL Server	Firefox & Safari currently. Full multi-browser support is scheduled for 15th August 2009.
Setup costs	None	None	None	$2,500 for software setup (assumes web-browser with MS SQL Server is setup)	None – supports use with optional hardware

GTFS Tool	WebSchedule	Excel GTFS Creation tool	Google Transit Feed Creator	Bus Feeder	Avego FutureFleet
Ongoing costs	Annual subscription fee, includes service + support Lassen $800 Redding $2,400 Plumas $800 Tehama $1000 Siskiyou $800 Trinity $700 ESTA $1,500 Total cost (all 7 agencies): $8,000	None	Annual subscription fee, includes service + support Lassen $1,000 Redding $2,500 Plumas $1,200 Tehama $1,300 Siskiyou $1,400 Trinity $1,000 Eastern $1,700 Total cost for bulk license arrangement (all 7 agencies): $8,585	Server and software maintenance costs	None

Key terms, differences, and functions

Shapes export

"Shapes" are descriptions of transit route alignments. They are an optional element of a Google Transit feed. If they are not provided in a feed, Google Transit draws a lines point-to-point between bus stop locations. Below are screenshots of trip itinerary maps produced by the Google Transit trip planner before (Figure 9) and after (Figure 10) the introduction of shapes to the Humboldt County Google Transit feed.

Figure 9. Screenshot of trip itinerary maps (no shapes)

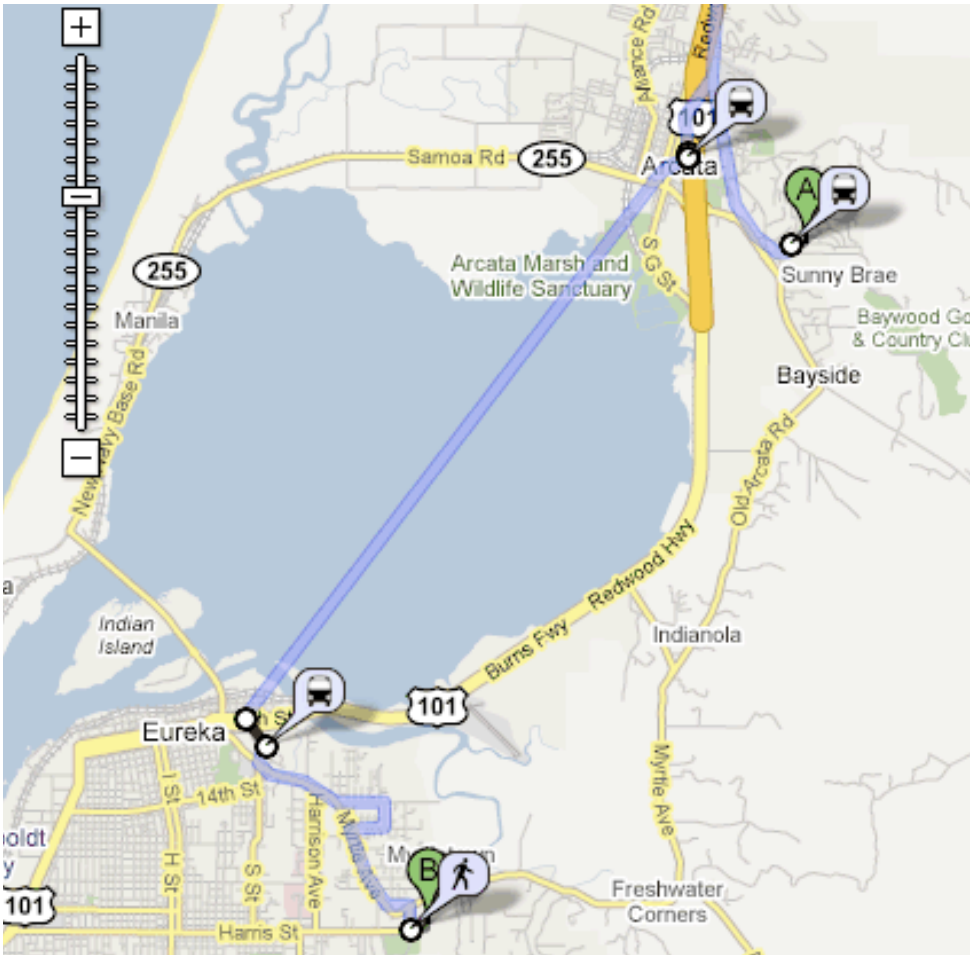
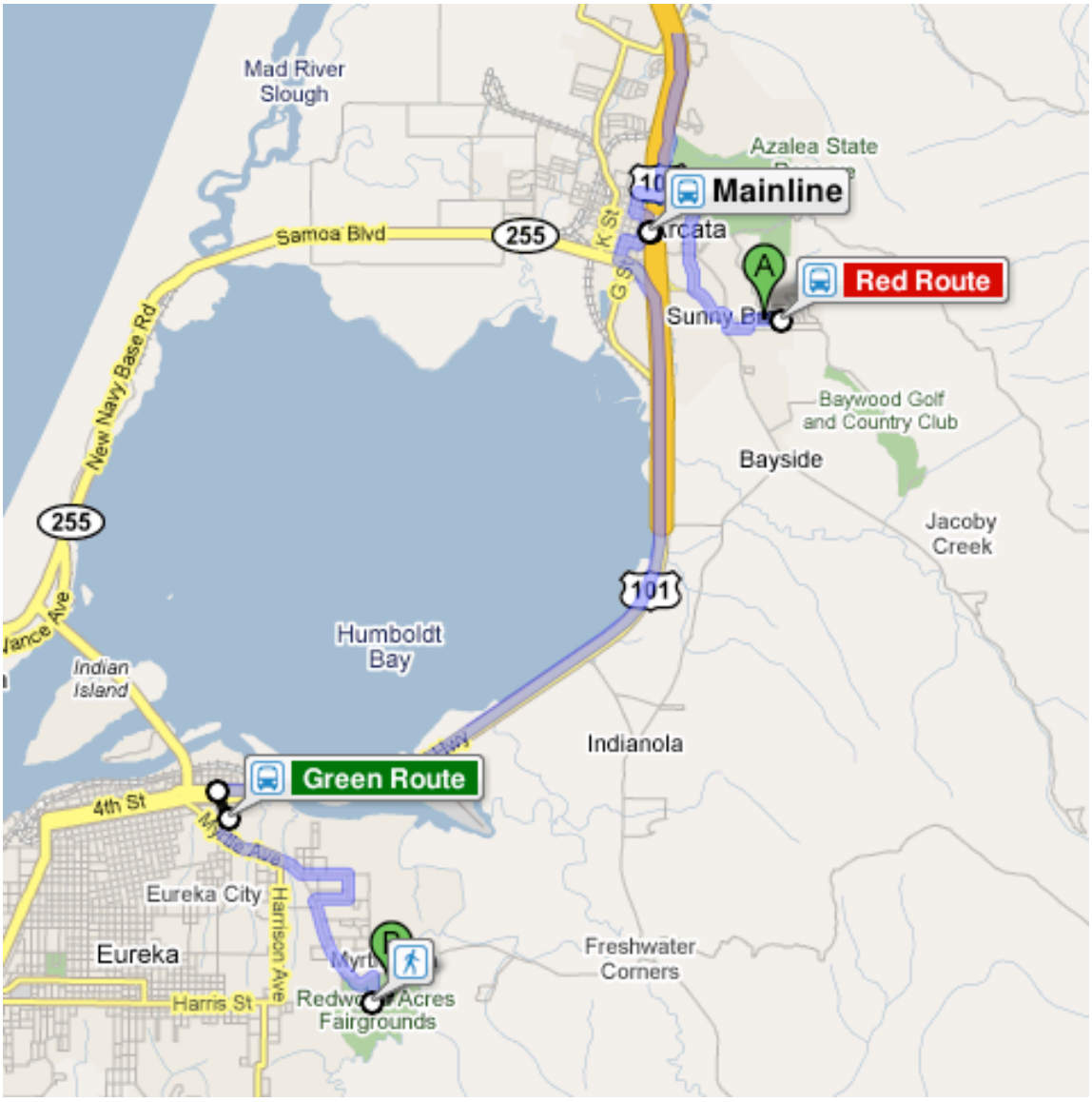


Figure 10. Screenshot of trip itinerary maps (with shapes)



Specify preferred transfer points

In instances where a passenger must transfer between vehicles to make a trip, the Google Transit trip planner automatically identifies transfer opportunities. With a recent extension to the Google Transit feed, it is possible for an agency to specify preferred transfer locations.

Install location

The Excel GTFS tools are installed and run on a desktop computer. The other options from Iteris, Trillium Solutions, Next Insight, Trillium Insight, and Avego are web-based. The end-

user does not need to install any software besides a web-browser to access the Google Transit Feed creation tools.

Iteris tools are not currently hosted on a public server. There would be costs to purchase a server, connect it to the internet, and install and configure web-server, database, and Bus Feeder software. The time and travel cost for Iteris staff to install Bus Feeder alone would be $2,500.

Next Insight, Trillium Solutions, Trillium Insight and Avego offerings are hosted subscription-based offerings. They follow a model for delivering software known as "Software as a Service" (or SaaS). Under this model, an application is licensed for use as a service provided to customers. Since the application is hosted centrally, for multiple clients, this approach can reduce the costs and hassles of installation and hardware purchasing upfront and of ongoing software maintenance, patches and version updates.

Technical requirements

The only Google Transit feed creation tool with significant requirements is the Iteris Bus Feeder tool, which would require a web-server running Microsoft SQL Server. Trillium and Next Insight tools require a web-browser. The Excel GTFS tools require Microsoft Excel, both common desktop applications.

Ongoing costs

There would be no subscription costs for Excel GTFS creation tools. However, there may be ongoing training or consultant costs to assist agencies with using the tools or make updates for them because the Excel GTFS tools can be difficult for new users.

There would be ongoing costs for the Iteris Bus Feeder tool to maintain the web-server, its software, and connect it to the internet, and to update the Bus Feeder software in response to new agency requirements or changes to the Google Transit Feed Specification. There may be ongoing training costs.

There would be ongoing service subscription fees for Trillium Solutions, Next Insight, Trillium Insight, and Avego tools. The listed costs in the matrix would include software updates and service/support.

Chapter 5. Opportunities to leverage GTFS

The Google Transit Feed Specification (GTFS) has become the world's most widely used data standard for public transportation schedule and geographic information. At least 52 agencies make their Google Transit feeds publicly available at the GTFS Data Exchange website[38] and Google's PublicFeeds page[39].

Besides Google Maps, there are many software applications that consume GTFS for purposes such as trip planning, mobile data access, timetable publishing and others. Potential uses of GTFS data are presented here, along with current software applications that serve this use.

The Headway Wiki[40] and Transit Developers Google Group[41] are among the best ways to track GTFS-compatible software.

The purpose of this chapter is to:

- Identify potentially useful purposes for GTFS data
- Identify opportunity to save costs by leveraging existing data for other projects and purposes
- Identify selected currently available software and its developers

Applications of GTFS data

Trip planning

Other trip planning software ingests GTFS besides Google Maps/Transit. These trip planners can offer more direct agency control over trip planning functions, plan trips with additional modes (biking, rideshare, vanpool, etc.), or use a incorporate a customized road network layer.

Mobile information access

Some applications for mobile handsets such as the iPhone and Blackberry provide access to transit schedule and map information, even when the device is not connected to a network. The majority of these applications are for urban and commuter rail systems, but at least

[38] www.gtfs-data-exchange.com

[39] code.google.com/p/googletransitdatafeed/wiki/PublicFeeds

[40] http://headwayblog.com/wiki/

[41] http://groups.google.com/group/transit-developers

one application includes schedule data for rural systems. This schedule data is imported from GTFS.

Visualization

Planners use visualization tools that import and display GTFS data to understand existing transit systems. Riders and prospective riders use visualization tools to plan where to live and work for convenient transit access.

Existing visualization tools for GTFS data are included in Table 11 (page 63). Planning efforts may also benefit from methodology and tools to import information about transit services and facilities into existing planning tools.

Local GIS resources

The need to import GTFS data into local Geographic Information Systems (GIS) was identified by a stakeholder at the project kick-off meeting. At this time, there is no documented methodology to accomplish this. Importing GTFS data into a geodatabase for use in a GIS does appear to be technically feasible, however.

Environmental Systems Research Institute's (ESRI) ArcGIS software is the standard GIS software used in most planning departments and agencies. Data used by ArcGIS is managed by ArcSDE, which enables ArcGIS to access data in a relational database management system (RDBMS).

If the desktop install of the ArcGIS system is using Microsoft Access Personal Geodatabase as its storage engine, it may be possible to maniupulate and import data from GTFS comma-separated values files. A similar process would be used with an enterprise database. Note that graphserver[42] includes a loader for importing GTFS data into a PostGIS database.

California Transportation Investment System (CTIS)

The 2008 California Statewide Rural Intercity Bus Study describes the goal of creating a web-based interface for the California Transportation Investment System (CTIS) utility that shows a map-based view of existing and planned components of the statewide transportation system.

An increasing number of transit providers throughout the state publish GTFS. Loading GTFS information into the CTIS to maintain current information on transit facilities and services is a technical possibility. This may merit future study and consideration.

[42] http://graphserver.sourceforge.net/

Timetable publishing

Some transportation providers use GTFS or schedule data in relational databases to automatically create the timetables that are posted online and at bus stops, and are included in printed schedule books.

Accessibility

One commercially available product uses GTFS data to make transit data accessible to transit passengers who are sight impaired. The mobile product provides information to users through synthesized voice technology and a refreshable Braille display. A pilot research project uses mobile GPS technology and GTFS data to provide instructions to riders both on and off the transit vehicle.

Interactive voice response (IVR)

Interactive voice response systems allow customers to query for information like scheduled arrival times or even to plan trips on public transportation with a conventional phone.

Table 11. Software to leverage GTFS

Purpose	Tool / software	Author(s)	Participating / using / included agencies	Software license	Details
Trip planning	Libroutez	William Lachance	Metro Transit (Halifax)	Open source	Includes utility functions for converting GTFS and OpenStreetMap[43] data into software's storage format
	Goose Networks trip planner	Goose Networks, Inc.	Numerous	Commercial	Software primarily provided for corporate customers. Displays carpool, vanpool, transit and bike options. Includes reservation system. Imports GTFS for transit
	Graphserver	Brandon-Martin Anderson		Open source / BSD license	Multi-modal route finding engine
	Maps.trimet.org	TriMet, The Open Planning Project	TriMet	Various; Technology stack is primarily open source	Example of combined closed and open source technology. Software can import GTFS
	PublicRoutes.com	PublicRoutes.com	Various	Closed source / free participation	Public, universal transit trip planner site imports GTFS. Current status of company and website unknown.
Mobile schedule access	Unibus (iPhone)	Zhenwang Yao	Nearly all agencies on public GTFS page; approx 30. Includes several rural / small agencies.	Commercial	Provides offline access to transit schedules on iPhone and iPod touch. Available for $1.99 as download through the iTunes store.
Visualization	Public Transportation Service Finder	Devin Braun, San Diego MTS	Austin Capital Metro, San Diego MTS, Sacramento RT, Trimet, Unitrans	Application © MTS 2008	Imports GTFS information to show stop locations and route alignments in web-based map for planners.
	Walk Score Transit Time Map	FrontSeat, Brandon Martin-Anderson	TriMet, BART, SF Muni, King County Metro, WMATA (Washington DC)	Open source	Provides map-based display of transit travel times from a chosen location. Imports GTFS to calculate travel times.
	Schedule viewer	Google, various	Numerous	Open source	Application for validating and proofing Google Transit data
Timetable publishing	TimeTable Publisher	Frank Purcell, TriMet	New York State DOT, TriMet, Hampton Roads Transit (Virginia)	Open source / Mozilla Public License 1.1	Automatically produces web and print-ready timetables from GTFS information. Compare tools for proofing schedule updates.
Accessibility	BrailleNote/VoiceNote	Sendero Group	TriMet, others	n/a: hardware	"Talking" GPS with refreshble Braille display. Transit point-of-interest libraries, derived from GTFS, allow people who are sight-impaired to lookup transit stops and "see" nearby stops and transit services.

[43] http://www.openstreetmap.org/

Purpose	Tool / software	Author(s)	Participating / using / included agencies	Software license	Details
	Travel Assistant Device[44]	University of South Florida	Florida pilot agencies	n/a, unknown: includes hardware	Pilot research project. Allows sight-impaired or cognitively disabled passengers download trip plan to a GPS-enabled mobile phone with the travel assistant software installed. The phone gives audio and vibrating alerts when it is time for the passenger to pull the stop cord and alight from the bus.
Interactive voice response	TransitSpeak and TravelSpeak	LogicTree	Various	Commercial / proprietary	Phone-base trip planning using voice recognition. Pricing depends on features selected, agency and region size, and call volume
	BusLine	Ontira Communications, Inc.	Various	Commercial / proprietary	Phone-base trip planning using voice recognition. Pricing depends on features selected, agency and region size, and call volume

[44] Final report, released October 2008, is available at http://www.nctr.usf.edu/abstracts/abs77711.htm

Chapter 6. Implementation plan

Implementation status

Table 12. Status of stakeholder agencies with regard to Google Transit

Agency	Status				
	Pilot participant	In preview	Outstanding issues (high/critical)	Awaiting additional agency feedback	Planning to "go live"
ESTA/Inyo & Mono		Not applicable	Not applicable	Not applicable	
LRB/Lassen		Not applicable	Not applicable	Not applicable	
Plumas Transit	X	X	X		Not until current issues are resolved
RABA/Shasta	X	X	X		YES
STAGE/Siskiyou	X	X			YES
TRAX/Tehama	X	X			YES
Trinity Transit	X	X			YES

Five of the seven stakeholder agencies are currently participating in the trip planner pilot. The remaining two agencies, LRB and ESTA, have expressed strong interest in participating in the implementation phase.

Lead agency

A lead agency will have several roles in a regional Google Transit implementation project. These roles include administration of funding, project management and oversight, facilitating integration and coordination with related projects, and performing region-wide project evaluation.

The optimal approach, whether coordinated with a lead agency or separate projects pursued by individual agencies, will depend on ongoing project goals and stakeholder agency commitment and preference.

Purposes for a region-wide/lead-agency approach

- Improves eligibility and ability to apply for some funding sources by having a joint application from regional partners and stakeholders.
- Promotes consistent participation and coordination within a region (ie: may prevent customer confusion in a region where some services are included in Google Transit and others are not).
- Offers an opportunity to tie Google Transit to other regionally coordinated Intelligent Transportation Systems (ITS) projects in conformance with the national ITS Architecture.

Roles and responsibilities of lead agency

- Project Management. *Oversee full implementation of Google Transit, including for non-pilot agencies ESTA and LRB.*
- Coordinate with Caltrans Division of Mass Transportation for next phase.
- Solicit agency stakeholder input for the selection of a GTFS publishing tool.
- Select GTFS publishing tool.
- Conduct evaluation
- Ensure integration with other projects

Potential lead agency candidates

- **Shasta County RTPA.** SCRTPA has performed as lead agency over the course of this project. As the lead agency, SCRTPA developed the Request for Proposals and solicited responses from consultants. SCRTPA has overseen the consultant's work over the course of the project and partnered with the consultant in stakeholder outreach phases. SCRTPA has directed the consultant to achieve project goals. The agency has received comments from stakeholders ensured these comments are addressed in the final report.

  If SCRTPA continues to function as lead agency, amended contracts with Caltrans DMT and the consultant would allow the project to continue.

- **Caltrans District 2 and Division of Mass Transportation**. Caltrans District 2 and DMT served on the advisory committee for this project. If Caltrans is selected as a lead agency for the implementation and ongoing maintenance phases of this project, local (District 2) staff would manage this project with direction from Caltrans DMT.

- **Modoc CTC.** The MCTC Executive Director served on the advisory committee for this project.

- **Redding Area Bus Authority.** RABA is a stakeholder agency in this pilot planning project.

If Caltrans D2/DMT, Modoc CTC, or RABA manage this project on an ongoing basis, the selected agency will assume responsibility for service and software procurement and stakeholder partnership. The agency would receive funds from available sources. New contracts between funder and a selected GTFS publishing service vendor and consultant would need to be created and executed.

Table 13. Lead agency candidates

Lead agency candidate	Geographic jurisdiction	Related projects for which agency has management responsibility	Pro	Con
Shasta County RTPA	Shasta County	Shasta County Intelligent Transportation System (ITS) Architecture and Deployment Plan	Through role as lead agency in pilot and Feasibility Study stage, SCRTPA can leverage existing stakeholder relationships and project knowledge	
Caltrans District 2 with DMT	Caltrans D2 includes Lassen, Modoc, Plumas, Shasta, Siskiyou, Tehama, and Trinity counties	Caltrans District 2 Intelligent Transportation System Architecture and Strategic Plan	Closest agency to statewide goals and funding source	
Modoc CTC	Modoc County	CALnections pilot trip planner project	Experience with CALnections; Direct experience-based understanding of peer stakeholder transit agency needs and requirements	Isolated location may make holding stakeholder meetings more challenging
Redding Area Bus Authority	Greater Redding area	Agency-specific marketing project	Direct experience-based understanding of peer stakeholder transit agency needs and requirements	Redding Area Bus Authority has little available staff capacity to take on regional projects

If a lead agency is designated, recommended criteria for choosing the lead are:

- Staff capacity to take on administrative responsibilities

- Interest in project
- Existing understanding of technical, funding, and local issues
- Existing role in related regional or coordinated ITS and mobility management projects. *Is the agency involved in or leading other regional projects that may be related to Google Transit? Examples: 2-1-1, mobility management call center, regional AVL purchasing.*

Case examples

These are examples of other regionally coordinated projects:

- **Sacramento Regional Transit** publishes GTFS for many smaller agencies in their region. The agency publishes GTFS for agencies using their Trapeze software.
- **Virginia State Department of Transportation.** The Virginia DOT has overseen and funded a project to publish GTFS for 22 transit systems. The effort designated a single project manager and consultant for the project.
- **Idaho State Department of Transportation.** The Idaho Statewide Advanced Public Transportation Systems Assessment Study[45] was begun in 2006 with Iteris, Inc. One of the original goals was to publish GTFS for transit agencies in the State of Idaho. At this time, no Idaho state agency is live on Google Transit.
- **Humboldt Transit Authority.** Humboldt Transit Authority received State Transit Assistance funding for countywide Google Transit implementation and website implementation, including for the non-Humboldt Transit Authority funded service, Arcata and Mad River Transit System. After implementation, the individual transit agencies have been responsible for ongoing maintenance costs.

Recommendation

A lead agency will oversee and facilitate an ongoing Google Transit maintenance effort. It is recommended that Shasta County Regional Transportation Planning Agency should continue to perform as the lead.

As the lead agency for the implementation phase of the project, SCRTPA is positioned to apply knowledge and experience of broad technical and funding, and as well as stakeholder-specific issues encountered in the pilot project. This will enable SCRTPA to work efficiently with stakeholders and provide direction to a GTFS publishing consultant. The choice of lead agency should be determined with consideration of stakeholder agency preference.

The involvement of a lead agency should not compromise any control local agencies have in data publishing operations. In order to accomplish this goal, transit agencies should communicate directly with the GTFS publishing consultant in the implementation and maintenance phases.

[45] Idaho Transit Technologies. Iteris, Inc. 18 June 2009 <http://www.aptsidaho.org/>.

Individual transit agencies should determine whether or not they will participate and how their services should be represented in published data feeds. These agencies should have full ownership and rights to GTFS data for their service.

GTFS creation and maintenance tools

Individual agencies should consider available GTFS publishing tools based on the following criteria:

- **Availability of service and support.** Is timely and affordable technology support available for the GTFS publishing tool? Can a consultant and transit agency staff access and work with the same data?
- **Ease-of-use.** How much training and staff time is needed to familiarize agency staff with tools?
- **Data visualization tools.** Does the tool allow agency to "see" their data (stop locations, trip patterns, etc.) in order to make data entry and maintenance easier and more accurate?
- **GTFS publishing features.** Does the tool support optional GTFS elements such as preferred transfers, fares and fare rules, and shapes / route alignments?
- **Data ownership.** Transit agencies should require that they have full ownership and rights to the published GTFS for future technology flexibility and the GTFS data can be leveraged for other purposes.
- **Data validation features.** Does the data tool conduct automatic "pre-flight" checks to identify potential problems with exported GTFS?
- **Initial, ongoing, and overall cost.** Overall cost includes costs for subscription license costs, additional software and hardware, agency staff time, and consultant or IT staff time.
- **Upgrade path.** The Google Transit Feed Specification is periodically updated with additional capabilities. Will the chosen solution grow with GTFS updates and transit agency needs? Will it allow transit agencies to take advantage of new features and upgrades seamlessly, without reconstructing data?

Recommendation

Statewide consistency of Google Transit feed creation and maintenance software for transit agencies and operations offers various benefits and limitations depending on the approach that will be used for funding rural California Google Transit implementation.

If the Caltrans Division of Mass Transportation takes a direct role in providing funding for a statewide rural Google Transit implementation project, then implementing with a single variety of software tool will be essential for reasonably managing costs.

An advantage of implementing one GTFS tool statewide is that vendors may be willing to offer their products and services at lower prices for a statewide contract, reducing overall cost. The cost savings of a statewide effort are key in light of the state's current economic challenges.

However, one concern of this approach would be potential impacts to marketplace competition for GTFS publishing in the state over the long-term. In an environment where individual agencies have a choice of vendor, vendors are held directly accountable to their customers for improving ease-of-use and adding necessary features as Google Transit capabilities and agency needs evolve. This encourages continual improvement and innovation.

In addition, it is difficult to predict the landscape of future GTFS creation and maintenance offerings at this relatively early stage of GTFS and Google Transit. The best available tool today for a particular agency may not be the best in one year. As an example of the rapid change, Avego FutureFleet recently entered the marketplace as a GTFS publishing option.[46] Also, the FTA has funded a project to create an open source GTFS publishing tool but which has not yet been completed.[47]

From a technical perspective, a common data standard (GTFS) makes a diversified software landscape possible because data can be easily exchanged between systems. This is analogous to the way in which common email standards allow internet users to use their choice of email software (Outlook, Eudora, Thunderbird, or web-based Gmail, Hotmail, etc. for example), or web formats like HTML allow internet users to use their choice of browser (Internet Explorer, Firefox, or Safari for example).

The most important criteria for choosing a GTFS export tool is that transit agencies should have full ownership over their GTFS data. The next most important criteria are high-quality and responsive technical support (available to answer questions about Google Transit, not just data publishing tool), inclusion of optional GTFS features such as route alignments and transfer preferences, software ease of use, and overall cost. Support should include validating data and looking into issues with the Google Transit trip planner in addition to support for the GTFS publishing tool.

The data publishing tool should be selected by individual transit agencies or the agency selected to manage the project on an ongoing basis. This must be determined in future implementation and planning meetings between Caltrans and stakeholder agencies.

[46] Avego. "Funding for Futurefleet." Weblog post. 28 Apr. 2009. 21 June 2009 <http://blog.avego.com/blog/?p=572>.

[47] "Google Transit Data Tool for Small Transit Agencies." 2009. Transportation Research Board. 21 June 2009 <http://www.trb.org/TRBNet/ProjectDisplay.asp?ProjectID=2695>.

Implementation phases and evaluation

Cost for full implementation

Implementation for the selected pilot agencies is more than 90% complete as of October 16, 2009. The two remaining agencies in the study area are Lassen Rural Bus (LRB), and Eastern Sierra Transit Authority (ESTA).

Since the consultant team gathered data for some transit systems during the pilot (Plumas/PTS, Siskiyou/STAGE) and some agencies gathered their own data or contributed existing GIS data (Shasta/RABA, Siskiyou/STAGE, Tehama/TRAX, Trinity/TT), the costs of data entry and validation and stop location data gathering by handheld GPS are listed separately.

In April 2009, the MCTC's ITS projects passed to Trillium a complete set of bus stop locations and schedules for Eastern Sierra Transit Authority (ESTA) and Lassen Rural Bus. This data may be a useful reference for locating stops. However it will be necessary to perform validation and, likely, additional data gathering. ESTA has added additional services since the data was originally gathered. The Lassen Rural Bus manager's review this dataset revealed location accuracy issues.

Table 14. Additional cost for full implementation

Agency	Implementation step	Base Cost	Consultant data gathering additional cost
Pilot agencies (Plumas, Shasta/RABA, Siskiyou/STAGE, Tehama/TRAX, Trinity)	Launch all interested agencies currently in the trip planner preview	$500	n/a
Inyo/Mono/ESTA	Consultant performs manual data entry and validation; cost can be reduced if agency staff enters data	$4,000	$3,225
Lassen/LRB	Consultant performs manual data entry and validation; cost can be reduced if agency staff enters data	$3,000	$2,225

Data maintenance

Maintaining current Google Transit feed data will require agency staff or a consultant to enter schedule, fare, and bus stop locations information when changes occur. These scheduling and route alignment/stop location updates are distinct from regularly scheduled service calendar changes, for a school calendar or seasonal schedule, for example.

In the Resources Survey, agencies were not able to provide a precise number of schedule changes that occur in a given year, but most Google Transit partner agencies make about four schedule updates per year.

It is recommended that agencies should plan to spend four days of staff time, distributed throughout the year, to make updates to Google Transit data as necessary, or budget $400 year for consultant time to perform the manual data entry task.

Promotion and marketing

Successful deployments of Google Transit, defined by ridership increases and increased awareness and understanding of transit services, often depend on coordinated promotion and marketing to achieve potential effects.

Case examples

Redwood Transit Authority increased ridership by 40% year-over-year following implementation of several improvements and enhancements including launching and promoting Google Transit, introducing a university bus pass program, new websites (with trip planner form), and increasing service frequency over a period of two months.

Bus ridership in Duluth, Minnesota increased by 12% in one year after a marketing initiative that included and highlighted Google Transit.[48]

Existing local programs

Existing and planned marketing programs were noted from a literature review. Recommendations are intended to pinpoint synergies where Google Transit and the existing marketing program can be coordinated for more successful overall outcomes.

[48] Dolmetsch, Chris, and Ari Levy. "Google May Start New York Transit Guide to Boost Ads." Bloomberg.com 24 Aug. 2007. 21 June 2009 <http://www.bloomberg.com/apps/news?pid=20601204&sid=aslR2A2kKcuY>.

Table 15. Agency-targeted marketing opportunities and recommendations

These recommendations and opportunities are generated from the content in existing plans and documents. Only documents for RABA and STAGE contained information on current marketing and customer information initiatives. These recommendations assume these agencies will launch on Google Transit, which, due to trip planner issues and agency preference, may not happen immediately, if at all.

Program, objective or goal	Existing program or goal details	Additional opportunity / recommendation	Cost
Redding Area Bus Authority (RABA)			
Enhance Community marketing	Recruit community marketing partners to improve ridership[49]	Encourage and provide links and trip planner form for community partners to link to transit service information. Incorporate Google Transit into local online event calendar like at northcoastjournal.com.	Staff time + $400 technical staff time
Reduce phone hold instances	2 out of 5 phone callers to RABA report being placed on hold.[50]	Promote Google Transit to reduce trip planning customer service burden. Include web-address in off-hours and hold message to encourage callers to use the web.	None
Improve youth/student ridership	3% of current riders are under 18, but 10% of service area population is under 18.[51]	Many young people are comfortable using the internet and have access to the web at home or school. Use Google Transit as tool to recruit youth riders.	None
Introduce Employer-based marketing program	Distribute public transit information through employers and offer employer transit pass programs.[52]	Include information on Google Transit in distributed employee packets. Make transit time maps available to help people plan employment and living choices for mobility options and to help employers market transit to employees. Sell tickets and passes at the worksite.	Google transit information: cost of printing. Transit time maps: unknown.
Employ Marketing representative	Hire in-field part-time marketing representative.[53]	Provide information and direct representative to use, explain and demonstrate Google Transit.	None

[49] Redding Area Bus Authority. 2009-2010 Marketing Plan. By Illium. 2009. Page 2.
[50] Ibid. Page 2.
[51] Ibid. Page 3.
[52] Ibid. Page 16.
[53] Ibid. Page 17.

Reach out to "New moves"	Mail transit information materials to households after recent move.[54]	Include information on Google Transit.	Cost of printing.
Conduct College marketing	Reach out to college student audience.[55]	Link to trip planner from college website; there is only one page on Shasta College Transportation website that mentions RABA[56]	None
Conduct Benchmark survey	Random phone survey of travel habits.	Include questions related to internet access at home & work, mobile data usage, use of internet for travel planning in general, and transit planning specifically.	May add small cost to survey
Revise RABA website	"Web is the most effective, least expensive option for providing transit information to the public."[57]	Put Google Maps trip planner form on main page.	None
Siskiyou Transit and General Express			
Employ Targeted marketing initiatives	Siskiyou SRTP outlines targeted marketing initiatives (direct mail, schedule distribution, newspaper advertisements, on-board surveys, first time rider program, shopping center underwriting, college outreach, employer pass subsidy program, outreach to minority and low-income groups)[58]	Market Google Transit as customer information tool in targeted marketing to help new and choice riders understand unfamiliar service.	None
Conduct "Public education program"	Recommended in the Siskiyou County Coordinated HST-PT Plan[59]	Utilize Google Transit in public education program	None

[54] Ibid. Page 12.

[55] Ibid. Page 15.

[56] http://www.shastacollege.edu/cms.aspx?id=3866&terms=raba

[57] Ibid. Page 39.

[58] Siskiyou County Local Transportation Commission. Siskiyou County 2007-2012 Short Range Transit Plan. By Fehr and Peers Transportation Consultants.

[59] Siskiyou County Transportation Commission. Siskiyou County Coordinated Public Transit – Human Services Transportation Plan. By NelsonNygaard Consulting Associates, Inc. 2008.

Generalized promotion and marketing recommendations

In order to achieve the goal of integrating Google Transit into customer information and marketing programs to increase ridership and improve understanding of available transit service, the following implementation steps are recommended for participating agencies.

Table 16. Google Transit promotion and marketing recommendations

Recommendation	Details	Example(s)	Timeframe	Estimated cost
Incorporate trip planner form into agency website	A form, rather than a link to Google Transit, gives travelers familiar visual cues to help them understand and use the trip planner	Redwood Transit System (www.redwoodtransit.org) , Santa Cruz (www.scmtd.com), VTA (www.vta.org)	Immediate; simultaneous with launch	Agency web-master time: 30 min
Give transit website short, easy-to-use URL (web-address)	The URL should be easy to remember and short enough to say, print on marketing materials, and paint on buses	www.taketrax.com	Immediate; simultaneous with launch	Domain names with forwarding service to existing website is available for $20/year
Print agency URL on customer information	Print agency URL on bus stop signs, timetables	TriMet system in Portland, Oregon	At next revision of customer information or signage	None, if it is incorporated in existing information updates. Referring customers to the web, rather than phone, will reduce customer service costs.
Paint agency URL on vehicles	A large-type, short URL painted on Humboldt Transit Authority buses generates significant website traffic	Humboldt Transit Authority	With next refresh of vehicle wraps	Unknown

Press release	Use Google Transit as opportunity to generate "earned media" for transit	Mountain Line in Flagstaff, Arizona raffled off a notebook computer to entice people to try using Google Transit during Earth Week.[60] Also see trilliumtransit.com/blog/tag/press/	Immediate; simultaneous with launch	Two hours of consultant or staff time
Promote and educate through existing partnership programs	Provide Google Transit use instructions to stakeholders such as social service agencies	Humboldt Transit Authority distributes information on Google Transit on "Senior mobility day"	Ongoing	Unknown
Online cross-linking partnership	Partner with online event calendars and other websites to integrate transit travel directions	North Coast Journal and Humboldt Transit Authority in Humboldt County, CA[61]		

2-1-1 Integration

The Northern California 2-1-1 "Virtual Call Center" is tentatively planned to begin operations in the first quarter of 2010. The project is currently in the scoping phase.

First phase integration steps to facilitate providing fixed-route transportation through 2-1-1 are:

- Develop use manuals and train phone operators to use Google Transit
- Implement quick links to Google Transit from 2-1-1 call center software

Subsequent planning for deeper integration of 2-1-1 and travel information would address technology and implementation steps to import GTFS data into a multi-modal travel search system. Because 2-1-1 operators will not necessarily be locally based, it is crucial for travel information provided through Google Maps to be of high quality.

Evaluation

Evaluating Google Transit's effectiveness for disseminating transit information is an important step for prioritizing continued technology and marketing investments.

[60] "Map out bus trip on Google Transit." Arizona Daily Sun 15 Apr. 2009. 21 June 2009 <http://azdailysun.com/articles/2009/04/15/news/local/20090415_local_194565.txt>.

[61] Antrim, Aaron. "Help new riders discover transit for events." Weblog post. Trillium Solutions Blog. 19 Sept. 2009. 21 June 2009 <http://www.trilliumtransit.com/blog/2008/09/19/help-new-riders-discover-transit-for-events/>.

An ideal opportunity for evaluation is at the 9-month or 1-year milestone following implementation. This will provide enough time for the community to become familiar with Google Transit. After this milestone, it is recommended to:

- Gather, analyze, and summarize end-user feedback on trip planning tools
- Gather, analyze, and summarize transit agency stakeholder feedback on GTFS publishing tools and trip planner usefulness
- Evaluate administrative component; summarize lead agency experience
- Compare ridership pre- and post-implementation
- Request trip planner usage data from Google and analyze, if available
- Analyze transit agency website statistics to determine online customer information use, behaviors and referring search queries
- Compare customer service call volume pre- and post-implementation
- Find out how many riders, as a percentage of overall riding population, use Google Transit and online tools to plan their trip

This evaluation process could be completed as part of an existing effort such as a Transit Development Plan or Short-Range Transit Plan update, or as part of a single focused effort. If this evaluation effort is coordinated across the project study area, a lead agency will need to coordinate this effort.

Implementation phases

Table 17. Recommended implementation and evaluation steps

Phase	Details	Start date	End date	Cost
Resolve trip planner pilot issues	Coordinate between agencies, Caltrans DMT, Google, and data publishing consultant to resolve trip planner issues	July 1, 2009	Ongoing	Approximately $1,500 for consultant communication time.
Launch pilot agencies	Launch all interested agencies currently in the trip planner preview with desired strategy. Continue to track and resolve trip planner issues.	July 1, 2009	November 15, 2009	Consultant time for coordination with agency & Google: $500
Google Transit promotion, marketing and education	Agencies choose appropriate marketing strategies	July 1, 2009	Ongoing	Agency time + minimal consultant time; Depends on strategy
Ongoing data maintenance	4 schedule updates per year is typical for most agencies. Ideally, updated Google Transit feeds for new service or updated schedules should be published one month in advance of the service start date.	July 1, 2009	Ongoing	$8,000 for hosted software license. Estimated: 1 day of agency staff time per quarter for data entry, $400 consultant time/year per agency.
Leverage GTFS	Make validated GTFS public so that application developers other than Google can incorporate transit data into software, products, and services. Consider projects to utilize GTFS data.	July 1, 2009	Ongoing	There is no cost to make data public. IVR, timetable publishing, and other projects will incur some costs (unknown).
Seek funds for continued maintenance	See section on next page. Consider and pursue funding sources for continued implementation and maintenance.	July 1, 2009	Ongoing	Agency time
Collect customer feedback	Collect customer feedback through the trip planner through a web-based forms	November 1, 2009	Ongoing	Agency time

Phase	Details	Start date	End date	Cost
Launch remaining stakeholder agencies	Two remaining stakeholder agencies, ESTA and LRB are interested in joining Google Transit	November 1, 2009	February 31, 2009	$7,000
2-1-1 Virtual Call Center Integration	Train Northern California 2-1-1 call center operators to use Google Transit to respond to client needs for travel planning. Integrate links to Google Transit into 2-1-1 call center software. Prepare plan for deeper integration of GTFS data into mobility management and 2-1-1 operations.	February 31, 2010	May 1, 2010	Unknown
Evaluation	Review and summarize customer and stakeholder feedback, compare ridership trends and volume of trip planning customer service calls pre- and post-implementation. Wait for at least 9 months after implementation so that customers can understand and adopt trip planning tool.	May 1, 2010	June 31, 2010	$5,000

Conclusion

At the time of this writing, pilot agencies Siskiyou Transit and General Express (STAGE), Trinity Transit, Redding Area Bus Authority (RABA), and Tehama Area Rural Express (TRAX) are planning to go live on Google Transit. Staff at these agencies have determined the trip planner is presently useful and valuable for customers.

These transit agencies have identified some issues with the trip planner. For STAGE and Trinity Transit, high priority issues, specifically, are low maximum walking distance to transit and the 48-hour window limitation between queried and available service to return trip planner results. RABA finds that some addresses are incorrectly located and newly constructed streets are not included in Google Maps.

Plumas Transit is declining to go live on Google Transit at this time but may choose to in the future. Their decision hinges on the resolution of critical and high priority issues such as Plumas Transit Reno-Quincy service being inexplicably unavailable in the trip planner,

It is recommended to address these issues through coordination between Caltrans DMT and Google to identify the highest priority issues and begin an issue resolution effort. Following this, the technical consultant, agencies, and Google will continue to collaboratively identify, investigate, report, and define solutions for issues.

Google takes an incremental approach to improving Google Transit; in fact some trip planner and Google Maps issues have been resolved over the course of this project. It is unrealistic that all identified trip planner issues will be solved at the same time. It is recommended that transit agencies launch when critical and high priority issues are sufficiently resolved to make Google Transit a viable customer information tool. After launch, the data publishing consultant and transit agencies should continue to work with Google to incrementally solve issues in a post-launch evaluation and issue-resolution phase.

Agencies who wish to go live on Google Transit with a "soft launch" may include information on their website to inform the public that the service is a "public beta." The trip planner form included on agency websites can be configured to display a disclaimer message when passengers click "Get directions." RABA plans to pursue this "soft launch" strategy. In all cases, individual transit agencies should determine whether and how to go live on Google Transit for their agency.

For ongoing data maintenance, a GTFS creation tool must be selected. If a statewide, or regional, approach to publishing GTFS for rural transit agencies is chosen, the lead agency, with stakeholder agency input, may select a single GTFS publishing tool.

The utility of Google Transit for passengers and agencies increases with each additional participating agency. Broader participation regionally and worldwide expands the number of Google Transit users and increases the prospective audience for transit information. When connecting services participate in Google Transit it enables customers to plan more easily trips that involve multiple transit services.

Regional and statewide coordination of online transit trip planning and customer information tools enhances the effort to improve transit trip planning in California by promoting widespread participation. Coordination assists to identify, prioritize and overcome problems and barriers.

Successful plans and programs must provide the flexibility to respond to change. Transit and online information fields are both changing quickly. Over the course of this project, several new features were added to Google Transit and GTFS publishing tools. New software and tools emerge quickly. Existing tools evolve.

Implementation of Google Transit throughout the project study area will not occur at once, or function flawlessly from its initial public launch. The effort will require engagement and ongoing commitment from many stakeholders, including Google, transit providers, transit customers, Caltrans, Shasta County Regional Transportation Planning Agency, and local transportation commissions and planning agencies. A successful effort will be facilitated by continued collaboration to identify of needs and issues and share effective strategies.

Appendix A:

Northern California Google Transit Feasibility Study and Pilot Project Kickoff Meeting Summary, January 8, 2009

Northern California Google Transit Feasibility Study and Pilot Project

January 8, 2009

Caltrans District 2 Office; 1657 Riverside Drive, Redding, CA

Meeting Summary

I. Welcome and Introductions

District 2 Regional Transportation Planning Agency Task Force members and guests were welcomed to the Google Transit meeting and asked to introduce themselves. A list of all attendees is attached to this meeting summary.

Kimberly Gayle presented the background to the Goggle Transit Feasibility project. She said that one of the recommendations of the Intercity Bus study completed in 2008 is to enhance dissemination of transit information in rural areas through online information systems. Caltrans is providing 100% funding for this project with Ronaldo Hu acting at the project manager for Caltrans Headquarters. Shasta County is the lead on the project with Caltrans in a supporting role. Kimberly Gayle further explained that the Google Transit project is similar to the CALnections project Pam Couch is managing in Modoc County. Caltrans is also partnering with the statewide 211 project.

Kimberly Gayle introduced Sue Crowe of Shasta County, who is serving as the lead on the project. Sue then introduced Aaron Antrim of Trillium.

II. Trillium Team Presentation

Aaron Antrim began by introducing the consultant team including Brendan Ford-Sala of Trillium and Jeremy Nelson and Linda Rhine of Nelson\Nygaard Consulting Associates. Aaron then presented an overview of the Google Transit Feasibility Study.

III. Facilitated Discussion

Aaron asked the Task Force to confirm the key stakeholders for this project. In addition to the agencies and organizations already identified, additional suggestions included the transit operators and their contract operators as well as the Google Transit team. Aaron Antrim noted that he has already contacted Jessica Wei at Google Transit and Kimberly Gayle also has reached out to her. The objective is to help Google understand that it is in their strategic interest to focus on rural areas as there is a huge audience for this service. They will keep in touch with her to ensure Google is responsive and adheres to the project schedule. In response to a question from Pam Couch, Aaron explained that the engineers will be the

contacts at Google for the technical aspects of the project but Jessica will be the contact for issues related to project management, prioritization, etc..

Aaron explained that the consulting team met with the 211 team in the morning and are exploring ways to work together on the Google project. It was noted that there is opportunity for coordination between the two projects (e.g. calls to 211 can be directed to Google Transit in a disaster situation). Kimberly said that Amtrak is conducting a Google project including Amtrak Thruway buses. Aaron explained that the project does not include the Coast Starlight, although a riders group is working on a separate project to include Coast Starlight.

Barbara O'Keefe thanked Kimberly and Caltrans for providing 100% funding for the project. Sue Crowe said that the Request for Proposals identified $115,000 for the project and RTPA staff time. Shasta County RTPA will provide additional support if necessary.

Pam Couch said that she would like to see more than four transit operators included in the pilot project. She said that the Stage, Lassen County Transit, Plumas Transit and Eastern Sierra Transit Authority (ESTA) already have geo-coded data and should be included in the pilot as well as other counties in this nine county region.

Linda Rhine and Jeremy Nelson of Nelson\Nygaard posed three questions to the Task Force, and led the group in a brief discussion of each question with all feedback be recorded visually in real-time in order to confirm that participants' issues and ideas were being understood and accurately recorded for consideration by the project team. The questions and participants' feedback on each are summarized below.

1. **What defines a successful project? What does success look like?**

- Identify how Google works differently in Rural Areas
    - Layover times
    - How accessible is it for end users
    - Overcome any technical issues and make it a priority for Google

- Demonstrate the value to transit agencies:
    - Staff
    - Riders
    - For example, distinguish what Google Transit can and can't do

- Ensure this isn't a burden for agencies

- Prove benefits
    - Labor savings
    - Cost savings
    - Other benefits (how can data be leveraged, synergies)
    - For example – the project should allow for conversion, to use Google Transit Feed Specification (GTFS) into blueprint planning

- We don't want the data flow to be one-way: typically the data flows from the local jurisdiction to state, for this project it should travel both ways

- Increase ridership by making transit
  - Seamless
  - Connected
  - Easy to use

- Dependability/Reliability

- Needs to show all service options

- All 7 public transit operators should be included in the final trip planner

- At a minimum, include agencies that have currently existing data

2. What should the criteria be for selecting pilot agencies?

- Identify agencies with existing data

- Connectivity/Seamlessness Factor:
  - Transfers with other agencies
  - Key corridors
  - Cross gaps/boundaries

- Biggest "bang for the buck"

- Focus on key target populations
  - Low income
  - Regular transit riders

- Timing:
  - Who is ready?
  - Schedule changes don't hold up project (major schedule overhauls vs. minor changes)

- Visibility / Promotion for riding public

3. How Should Transit agencies be contacted for the operations survey?

- Trinity County – Polly Chapman
- Lassen County – Dan Douglas
- Tehama County – Barbara O'Keefe
- Inyo/Mono County – Will forward contact

4. **Are there other comments, questions, or concerns?**
   - Q: Once Google Transit is in place, how will it be maintained? A: Study will recommend implementation plan – the key is sustainability – maintaining data.

   - Q: What are the criteria for evaluating who should maintain the data? A: Pilot will establish different potential implementation model(s).

   - Long term financial sustainability is very important.

   - Q: Will this include other (non public) operators? A: This pilot will include public operators only – future plans may consider other transit services.

   - The 2000 US Census revealed a higher percentage of elderly (over 65years of age) in Mono and Siskiyou Counties and possibly others. The implication is that this project may require more outreach to this population as they may not be computer literate and additional financial resources may be needed for elderly to access to computers and for interface design. It was noted that the elderly may have assistance in trip planning by their caretakers, family members, etc. who are savvy with computers. There may be multiple/public access points for promoting this project, such as:
     - Libraries
     - Community mobility centers
     - Kiosks

Summary of NE California Google Transit kick-off presentation (Trillium)

The Northern California Internet Trip Planner Feasibility Study project includes three major deliverables:

1. ***Resources Survey***
2. ***Pilot project*** trip planner for 4 agencies, potentially including Greyhound and Amtrak
3. ***Final study report***

A ***Resources Survey*** will begin the week of January 20. The consulting team will deliver a text survey to the directors of stakeholder agencies, and subsequently follow up by phone with them or their designee.

Here are a few of the key questions that the ***Resources Survey*** will cover:

- Existing software tools & systems?
- Who maintains and publishes schedules offline and/or online?
- How many staff hours for trip planning help?
- How many schedule updates/year?

The ***Pilot project,*** a test of the Google Transit trip planner, consists of 6 steps:

1. Consultant team will recommend 4 agencies to participate in pilot project based on the selection criteria discussed at the January 8 meeting.
2. Stop location and route data will be gathered by staff riding buses with handheld GPS unit or from GIS libraries or other sources
3. Trillium will present a range of options for producing Google Transit Feed Specification (GTFS) data. GTFS is the format that Google requires agency data to be in to launch the Google Transit trip planner. This format represents stop locations, stop times, routes, service calendars, holiday service calendars, zones, and fares.
4. Trillium will publish Google Transit feed data using the selected option. The options available include Trillium's WebSchedule, Iteris's BusFeeder, software from NextInsight Transportation Software, LLC, and the free Microsoft Excel GTFS tools.
5. Trillium will work with Google to make a password-protected preview trip planner available. There is currently a backlog of a few months for agencies that wish to participate in Google Transit. This potential delay would expand the project timeline. There was discussion of how to avoid this delay by encouraging Google to understand this project is of strategic interest, so that a preview would be "fast-tracked." Agency-authorized users can use the trip planner preview to test planning trips and identify any irregularities that need to be corrected. Trillium will work with Google to correct any irregularities.
6. If agencies deem their trip planner is ready for public use, it will be launched, or "go live."

The ***Final Study Report*** will:

- Inventory and report on available software tools to help agencies publish & maintain data
- Report on and appreciate agency constraints (staff, $$, technical readiness) from ***Resources Survey***
- Report on pilot project experiences, challenges, and solutions/approaches
- An overarching goal of the ***Final Study Report*** will be to emphasize what's necessary for *sustainability:* ongoing costs, staff and technical commitments and strategies to keep data current in Google Transit.

Project management and communication

We are using Basecamp to manage client-consultant communication. The presentation showed a video of Basecamp, a password-protected space available to stakeholders for sharing files and exchanging and searching through messages related to the project. Aaron Antrim is happy to help anyone who needs help with Basecamp to use the project management space.

Appendix B:

Resources Survey

Nelson|Nygaard
consulting associates

785 Market Street, Suite 1300
San Francisco, CA 94103
(415) 284-1544 FAX: (415) 284-1554

M E M O R A N D U M

To: Aaron Antrim, Trillium Transit Solutions

From: Linda Rhine, Jeremy Nelson, and Magnus Barber

Date: March 13, 2009

Subject: Northern California Google Transit Feasibility Study & Pilot Project – Summary of Resource Interviews with Transit Operators

Purpose of this memo

This memo is a summary of the "Resource Interviews" with Northern California transit operators that were conducted in late January 2009 as part of the Northern California Google Transit Feasibility Study & Pilot Project (hereafter the Project). This memo contains the following sections:

1. Transit agency contacts interviewed
2. Interview methodology
3. Executive summary of responses
4. Appendix A: The questionnaire used in each interview session

Detailed summaries of agency representative's responses to the survey questions are available on request.

The relationship between various agencies and their affiliations will be addressed in the next phase of the study.

Transit agency contacts interviewed

The consultant team conducted interview sessions to gather information about seven (7) transit services and to identify the level of interest for different transit operators to participate in a pilot test as part of the Project. Each transit agency was represented by one or more

staff members during the interviews. An appropriate contact at each transit agency was identified at the kick-off meeting of the Technical Advisory meeting on January 7, 2009, or via follow-up communication.

The list below shows agency contacts who participated in interviews, grouped by interview date.

January 20:

- Jimmy LaPlante, Transit Manager, Plumas Transit
- Jill Batchelder, Program Coordinator, Eastern Sierra Transit Authority (ESTA)

January 21:

- Tom Anderson, Transportation Service Manager, Richard Keiser, Transportation Services Coordinator and Leah Maples, Siskiyou Local Transportation Commission (LTC)
- Adam Hansen, Associate Transportation Planner, Tehama County Transportation Commission (CTC)

January 22:

- Sue Hanson, Transit Planner and Jim Coats, GIS Manager, Redding Area Bus Authority (RABA)

January 23:

- Polly Chapman, Associate Transportation Planner, Trinity County Transportation Commission (TCTC)

January 30:

- Dan Douglas, Transportation Planner, Lassen CTC

Modoc Transportation Agency/Sage Stage is not included in this project, because they have already implemented Google Transit.

Interview Methodology

Interviews were conducted via phone and co-facilitated by consultant staff from Nelson\Nygaard (Linda Rhine and Magnus Barber) and Trillium Transit Solutions (Aaron Antrim).

Each interview session followed a similar format using the same set of questions provided in advance via e-mail. Prior to distributing the survey questionnaires, the consultant team inserted information for each transit service based on existing documents, websites, and other sources. During the interview sessions, the pre-filled survey information was reviewed and confirmed and the remaining questions were discussed – to the extent possible during an interactive session – in a consistent order and with similar phrasing.

The questions addressed three broad issues relevant to the project relative to each transit system:

1. Background information about each transit agency, especially ridership trends over the last two years.

2. The transit agency's interest in taking part in the pilot project.

3. The transit agency's resources available to the project, in terms of staffing, equipment, agency resources, and existing information technology.

Appendix A presents the interview questionnaire with all questions asked of each respondent.

Executive Summary of Responses

An overview of the major themes that emerged during interviews is described in the following section. Figure 1 summarizes the responses from each agency that were deemed most relevant to this project by the consultant team.
Agencies are generally supportive of this project, but all face challenges in terms of budget and personnel to dedicate time to the pilot project and are concerned about sustaining their involvement on an ongoing basis. Assisting potential travelers with trip planning takes up a considerable amount of time for some agencies, while other agencies rely on their contract operator to serve this function.
The complete responses of each of the agency contacts, summarized from the consultant team's interview notes are available on request.

Level of Interest in the Project

Most agencies are quite positive about the project, rating their level of interest 7 to 10 (on a scale from 1 to 10 with 1 being "not at all interested"). Those who have expressed reservations are concerned about the sustainability of the project – both commitment from Google regarding Google Maps geodata which sometimes is out of date in rural locations and the level of agency staff commitment required to maintain and update data. Other concerns are that the project could increase costs making it harder to meet required farebox recovery ratios, and the practicality and usefulness of the project in rural settings where residents are either not "tech savvy" or lack computer access.

Ridership

Most agencies carried between 30,000 and 90,000 one-way trips annually, though the range extended from barely 10,000 riders at the smallest agency to almost 750,000 at the largest.

Ridership has mostly remained relatively stable during the last two years, though some respondents reported ridership increases in 2008 which correlated with the spike in fuel prices.

Staff Resources

Most agencies have 2-3 administrative staff dedicated to transit services, providing a range of functions, from planning and scheduling, to responding to trip planning inquiries as well as management and contract oversight roles. Some agencies supplement their full-time office staff with part time assistants, or drivers that also spend part of their time in the office. Other transit services are part of a county with the ability to rely on other departments for support services.

Most agencies spend less than 30% of their time on trip planning (assisting the public), though some have outsourced this to their day-to-day contract operator.

All counties have a Social Services Transportation Advisory Council (SSTAC), though meetings are infrequent and tend to occur during the Unmet Transit Needs process. Some agencies feel the SSTAC or select members of the SSTAC may be interested in the testing phase of Google Transit. Other agencies suggested working with regular transit riders may be preferable. Some agencies have frequent contact with local social service agency staff, who could be good candidates to participate during the testing phase.

Route and Schedule Information Requests

Most agencies do not formally track the number or type of information requests received. Agency estimates vary between less than 20 requests/month to 2000 requests/month. Requests typically are made via telephone but some agencies also stated that “walk-ins” occur on periodically.

Most agencies do not have an automated telephone system for responding to transit information requests, requiring person to person communication. Some agencies have an answering machine (providing “24/7” information) to inform customers about basic transit information.

Planned Schedule Changes

Most agencies have minor schedule changes planned in the next six months. In some cases these are routine seasonal changes such as running routes later in the evening during the winter ski season in Mammoth Lakes. Other planned changes are small tweaks to optimize existing routes.

Information and Communications Technology

All agencies have high-speed Internet connections at their administrative offices. Most do not use specialized software for dispatch or scheduling, using instead standard office software applications.

None of the transit services currently use Automated Vehicle Locator (AVL) technology, though several are looking into the option of a joint procurement with other northern California operators. While the agencies are interested in proceeding with AVL technology, group procurement will not likely move forward in the immediate future because of constrained

funding. About half of the agencies have routes and stop locations encoded in a Geographic Information System (GIS) format.

Agency Websites

All transit operators in the survey area maintain websites, with the vast majority providing route maps and information about fares and schedules. Most websites are maintained in-house, and updated as needed. Only RABA tracked the number of visitors to their website. The City of Redding hosts the RABA website and maintains visitor statistics. For the period of December 1, 2008 to March 2, 2009, there were an average of average of 95 visits and 302 page views per day. None of the other websites tracked the number of visitors, and operators were very interested to learn about Google's free "Google Analytics" program for analyzing web site visitor behavior. Following the survey, Tehama CTC has now implemented Google Analytics.

Project Updates

To keep apprised about the progress on the project, most of the stakeholders indicated a preference for email updates. When asked about the frequency of updates, they requested either on a regular basis or when major milestones have been reached. Several also mentioned that conference calls would be good, because calls would allow interaction, sharing of ideas and experiences among participating agencies.

Figure 1: Summary of Relevant Responses by Agency

County	Entity	Ridership	Staff Resources			Route & Schedule Information Requests				Planned schedule changes?	Information & Communication Technology						Website					Project updates
		Fiscal year	FTE Management	Time on trip planning	SSTAC	Work with other advisory groups	Track requests	How many?	Automated phone system?		High speed/ Dial up?	Specialized software	AVL?	GIS information	Work with other agencies?	Projects that might work with Google Transit?	Level of interest	Exists?	Content	Updates?	Visitor tracking?	
Inyo/ Mono	Eastern Sierra Transit Authority	06/07: 177,683 07/08: 342,801	2 management, 4 administrative	50%	Yes, but infrequent meetings		No log kept	Est. 20-25/day (420-525/month)	No	Seasonal changes + some route changes expected	High speed	Yes	No. Plans exist, pending budget	Some through Calnections	Calnections	No	7	Yes	Routes, fares, maps	Regularly	No	Email & calls
Lassen	Lassen County Transportation Commission	06/07: 73,735 07/08: 74,198	2 management	8%	Yes, but infrequent meetings	Social services, senior services, homeless services	No log kept	Est. 10-15/month	No	None planned	High speed	No	No	Some through Calnections	Calnections & TRIMS	No	7	Yes	Routes, fares, maps and more	As needed	No	Email & calls
Plumas	Plumas Transit	07/08: 50,755	2 management	20%	No	Transportation Commission	No log kept	4-8/day (42-84/month)	Answering machine w/ basic info	None planned	High speed	No	No	No	No	No	10	Yes	Routes, fares	As needed	No	Conference call
Siskiyou	Siskiyou Local Transportation Commission/ Transit	06/07: 95,204 07/08: 95,124	12	10% (and contractor in addition)	Yes, but infrequent meetings	Ad hoc paratransit committees	No log kept	Est. 2000/month	Answering machine w/ basic info	Additional fixed route service is being considered, may not happen due to budget cuts	High speed	No	No. Plans exist, pending budget	Yes	Caltrans	No	5-6	Yes	Routes, fares	2 months ago	No	Prefer email, conference call ok if there's something big
Shasta	Redding Area Bus Authority	06: 755,184 trips 07: 751,572 trips (calendar year)	1 (but RABA purchases staff time from city/county as needed)	180 hours	yes	Shasta County Mental Health	Tracked by contractor	30 hours	Awaiting feedback	No major changes planned, minor changes within 4 months	High speed	Yes	No. Plans exist, pending budget	Stops, routes, fare zones	No	No	5	Yes	Routes, fares, maps	Coming soon	Awaiting response from IT	Prefer email
Tehema	Tehama County Transportation Commission	Fixed route: 06/07: 69,281 07/08: 67,200 General public dial-a-ride: 06/07: 14,346 07/08: 16,153	Currently 2, hope to hire a 3rd within 6 months	10%	Yes, but infrequent meetings		Tracked by contractor	Est. 20-50/day (420-1050/month)	Yes, but doesn't provide transit information	Minor restructuring Q1 '09, plus adding 2 new routes	High speed	Yes	Within 6-8 months, have budget allocated for it	Stops , routes	No	No	10	Yes	Routes, fares, maps	As needed	No	Basecamp, plus monthly update
Trinity	Trinity County Transportation Commission	06/07: 9,456 07/08: 9,314	Less than 2 FTE on admin	30%	Yes		On paper, loosely compiled	Est. 70/month	Answering machine w/ basic info	No changes planned, but they will be adding a route	Dial-up in office dealing with public inqueries	No	No. Plans exist, pending budget	Maybe	Humboldt County	No	8	Yes	Routes, fares	As needed	No	Email preferred, even if it's a reminder to check Basecamp. Bi-monthly updates & milestones

Stakeholder Interview Questionnaire

Northern California Internet Trip Planning Feasibility Study

Resources Survey

Project Background

Caltrans Division of Mass Transportation completed a Statewide Rural Intercity Bus Study. One of the recommendations of the study was to implement a transit trip planner to help people find and use available services.
Trillium Solutions and Nelson\Nygaard Consulting Associates have been retained by the Shasta County Regional Transportation Planning Agency (RTPA) to study the feasibility of using Google Transit for rural transit agencies in nine Northern California counties. The three major tasks in this project are to:

1. Conduct a survey of transit agencies to understand agency operations, routing and scheduling and software in use;

2. Conduct and evaluate a pilot project of Google Transit feed with four select agencies, and

3. Develop an implementation plan for using Google Transit with agencies in all nine counties.

At this stage of the project we are asking all the public transit operators in the study area to participate in a "Resources Survey." As part of the Resources Survey, we need to ask a few questions about your agency, including the staff, software, and other resources you use for marketing, customer information, scheduling and other functions. The survey should take about 15 to 30 minutes to complete. To assist you, we have taken the liberty of filling out some information for you. A member of the consulting team will call you to set up a mutually agreeable time to review the survey and answer any questions you may have. We will want to review and confirm the accuracy of the survey data during our telephone conversation. Thank you in advance for participating in the survey.

[begin survey]

Ridership

What was your annual ridership for FY 2006/07 (Jul 1, 2006 – June 30, 2007)?
For FY 2007/08 (Jul 1, 2007 – June 30, 2008)?

[this information should be filled in; we'll ask for a confirmation of the numbers on the phone]

	2007	2008
Fixed-route		
General public dial-a-ride		

Staff Resources

Next, we'd like to ask a few questions about how many staff your agency employs and what they spend their time on.

How many full-time employee equivalents (FTEs) did you agency maintain for FY 2007/08?

Among administrative and office staff, what percentage of total staff time is devoted to the following functions (FY 2007/08)? If consultants were retained to perform any of these functions, please estimate the total consultant cost during the past three fiscal years.

Function	Percent of staff time in FY 07/08 (doesn't need to add up to 100%)	Consultant cost over past three fiscal years
Marketing & advertising		
Information technology		
Scheduling		
Planning		
Trip Planning (Customer Service)		
Other, specify:		
Other, specify:		
Other, specify:		

Do you have a citizen advisory committee, Social Services Transportation Advisory Council (SSTAC) or other passenger/rider user group that you meet with on a regular basis?

If yes, would you be willing to work with this advisory group to involve them in testing and assessing the Google Transit preview?

Route & schedule information requests

Does your agency track the number of route & schedule information inquires?

How many queries for route & schedule information and fixed-route trip planning assistance does your agency receive each month?

Are you using an automated phone system to answer route, schedule, and trip planning information requests?

Schedules changes

Do you plan on any major schedule or route changes in the next six months? If yes, when?

Information & communication technology

What sort of internet access do you have, if any, at your location(s) for administration and scheduling/dispatch? If there are multiple locations, please specify for each location.
(Please note if there are multiple locations with different kinds of internet access.)

- High-speed (Leased-line, DSL, cable modem)
- Dial up

What, if any, software do you use for…

1. Dispatch?

2. Scheduling?

Do you use AVL technology? If so, what vendor? Do you have any plans to incorporate this technology in your operations?

What information do you have on hand about fixed-route stop locations?

- Just the schedules
- Spreadsheet with stop name and details (intersection, landmarks)
- Spreadsheet with names and latitude/longitude coordinates for stops
- GIS library with stop locations

Do you work with or coordinate other agencies (i.e. County or City GIS Bureau or social service agency) to maintain information about your services? If so, which agencies, and should we contact them?

Are you planning any project that could share functionalities with Google Transit (i.e., online customer information, maps, trip planner, reservations)?

How ready and interested is your agency to commit to implementing Google Transit and maintaining the data on a scale of 1 to 10, with 1 being 'Not ready or interested at all' and 10 being 'Ready to commit'?

Website

[we'll fill this out, and then confirm on the phone]
Is there a website?

- Yes
- No

URL:
If you do not have a website with service information, can we receive schedule and service information from your agency?

What information is available on your website?

- Route maps
- Route schedules
- Fares
- Other:

When was the website last updated?

Do you have an idea of how many visits your website has every month?

Project updates

We had an initial project kick-off meeting on January 8 at the Caltrans District 2 office in Redding. We have two more in-person meetings scheduled. In between these meetings, we want to remain in touch with you over the course of the project. What would be your preferred way of staying in the communication loop?

Would you like to dial into regular (monthly) project update phone conferences to hear a progress report and ask questions of the consultant team directly?

Would you like to receive regular email updates with links to online resources and contact info for the consultant team for any follow-up questions? If so, how often?

Thank you for your participation in this survey. If you have questions, please call….

Appendix C: Screenshots of GTFS publishing tools

Agency landing page / dashboard

Figure 11. Trillium WebSchedule, landing page

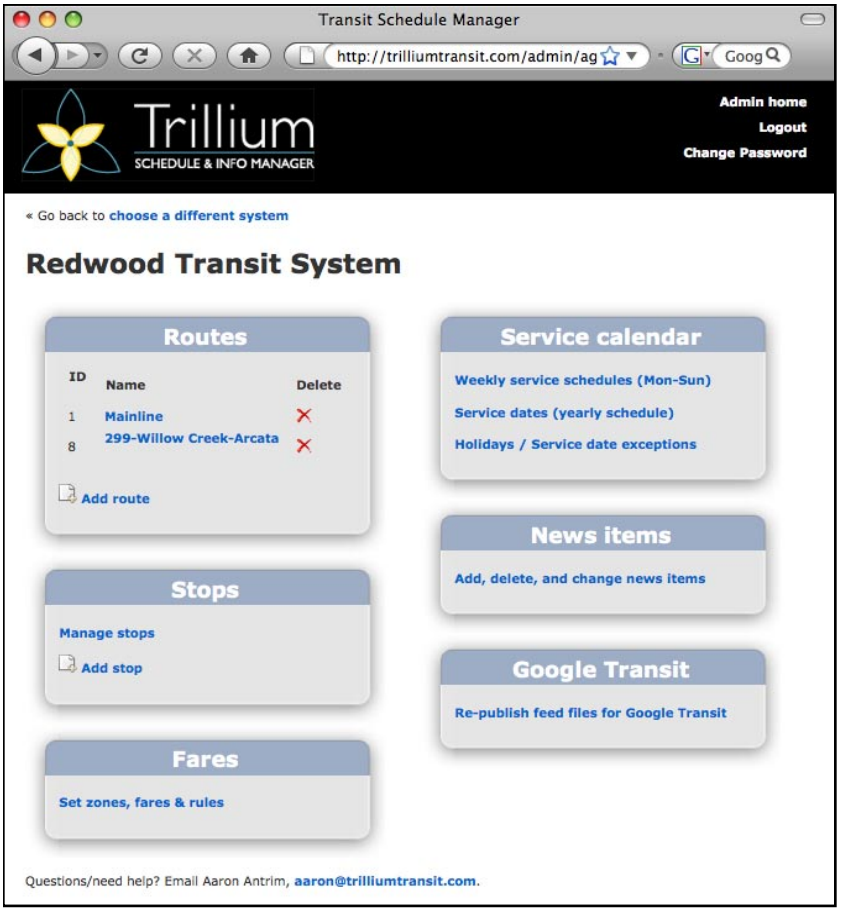


Figure 12. Iteris BusFeeder, landing page

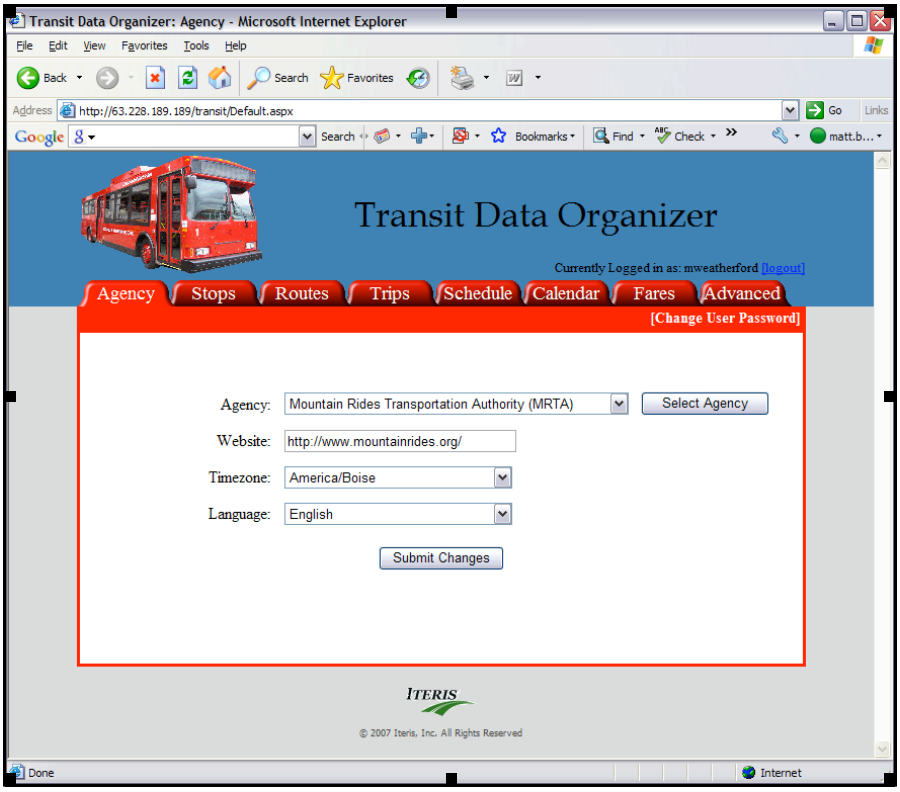


Figure 13. Excel GTFS Tools, landing page

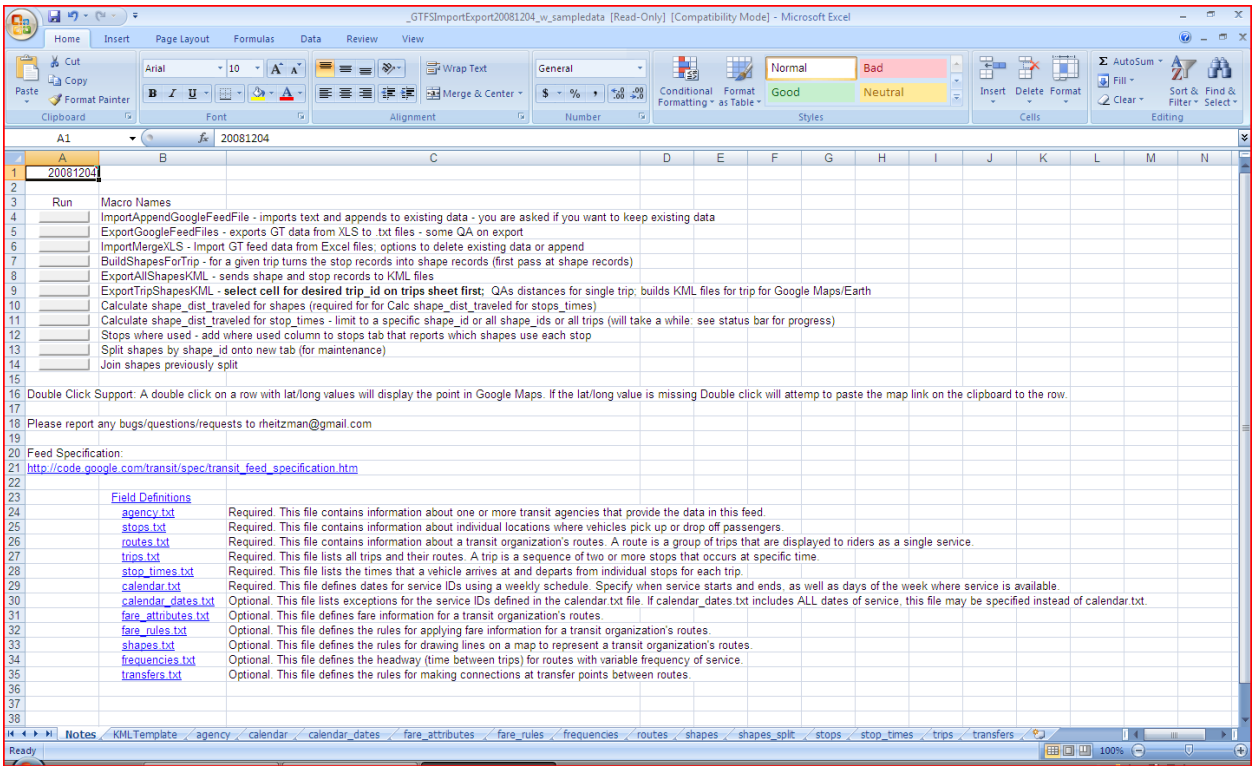


Figure 14. Next Insight GTFS tool, landing page

List of stops

Figure 15. Trillium WebSchedule, list of stops

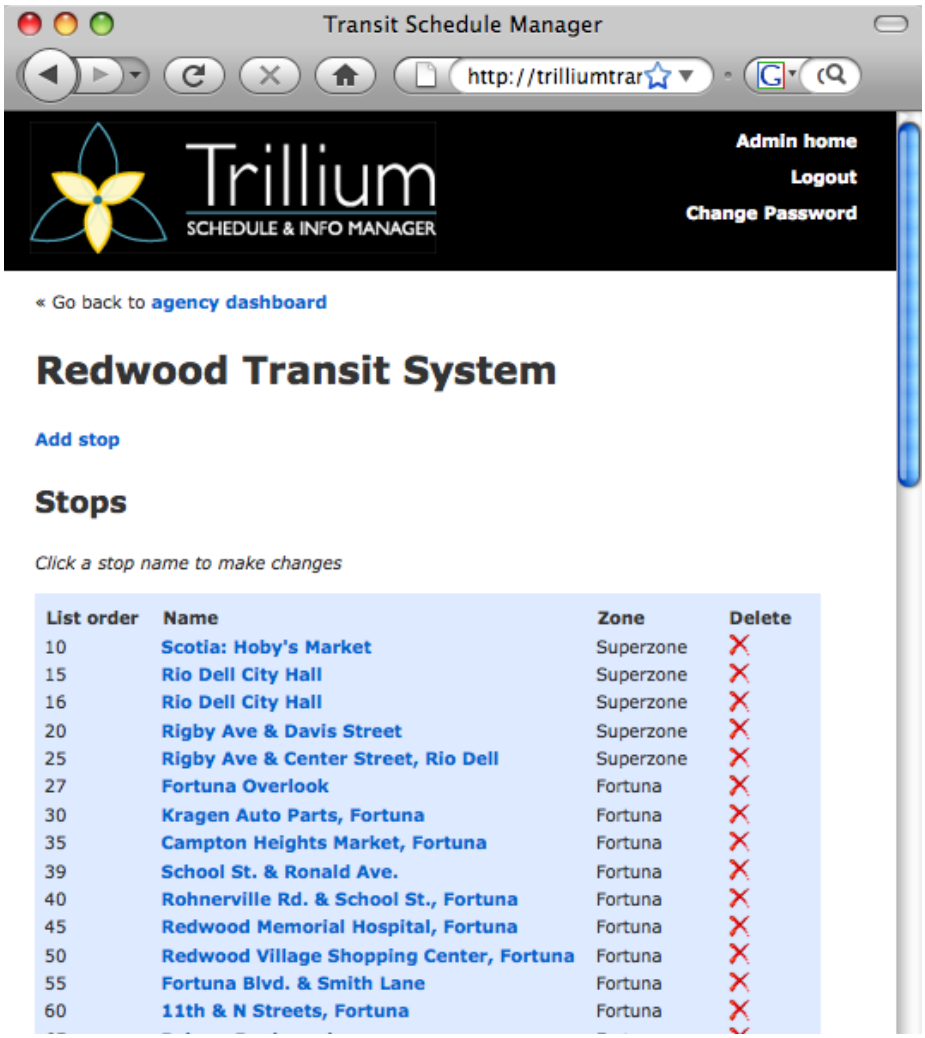


Figure 16. Iteris BusFeeder, list of stops

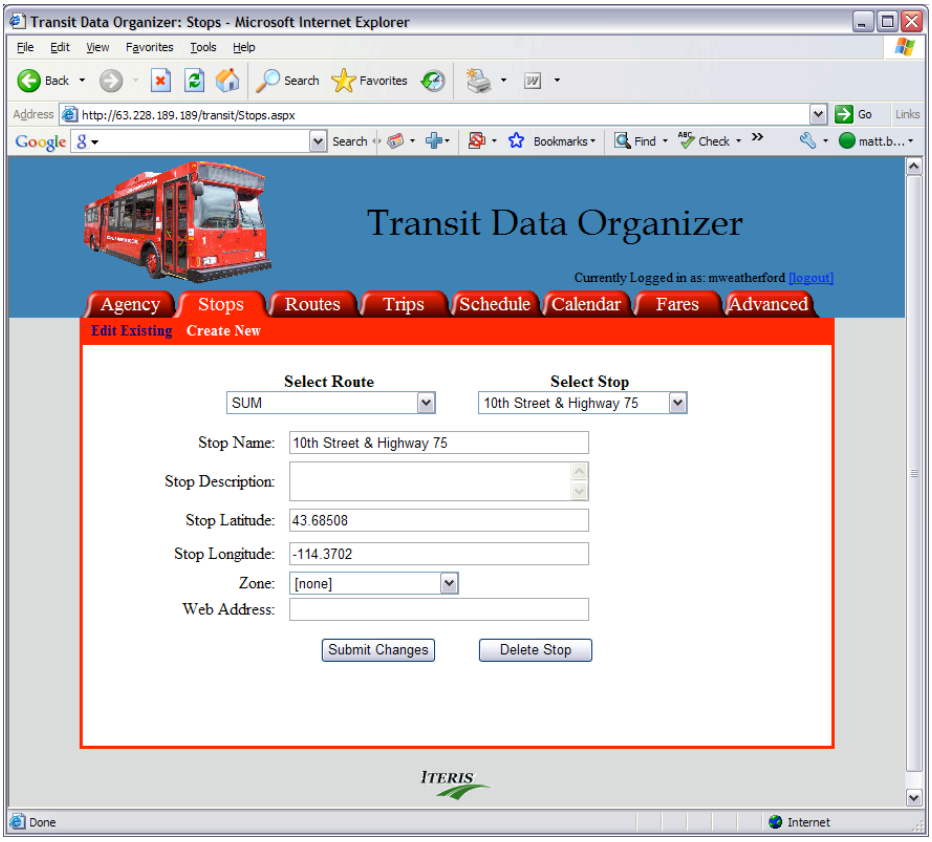
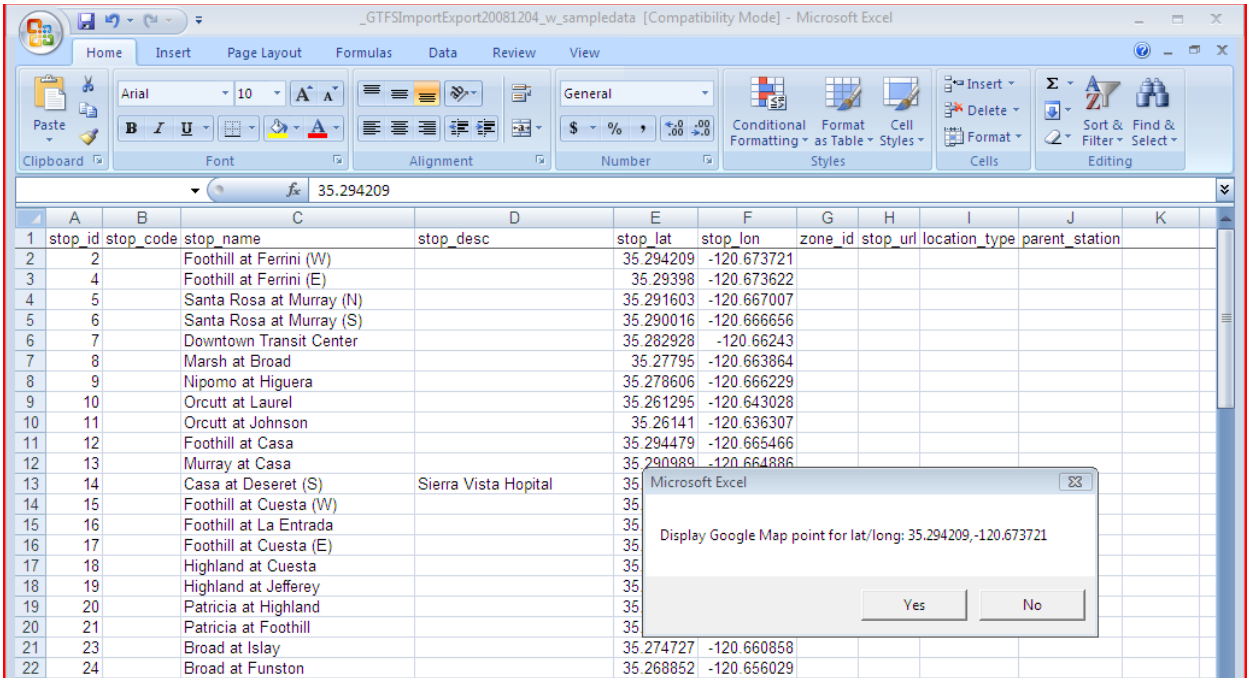
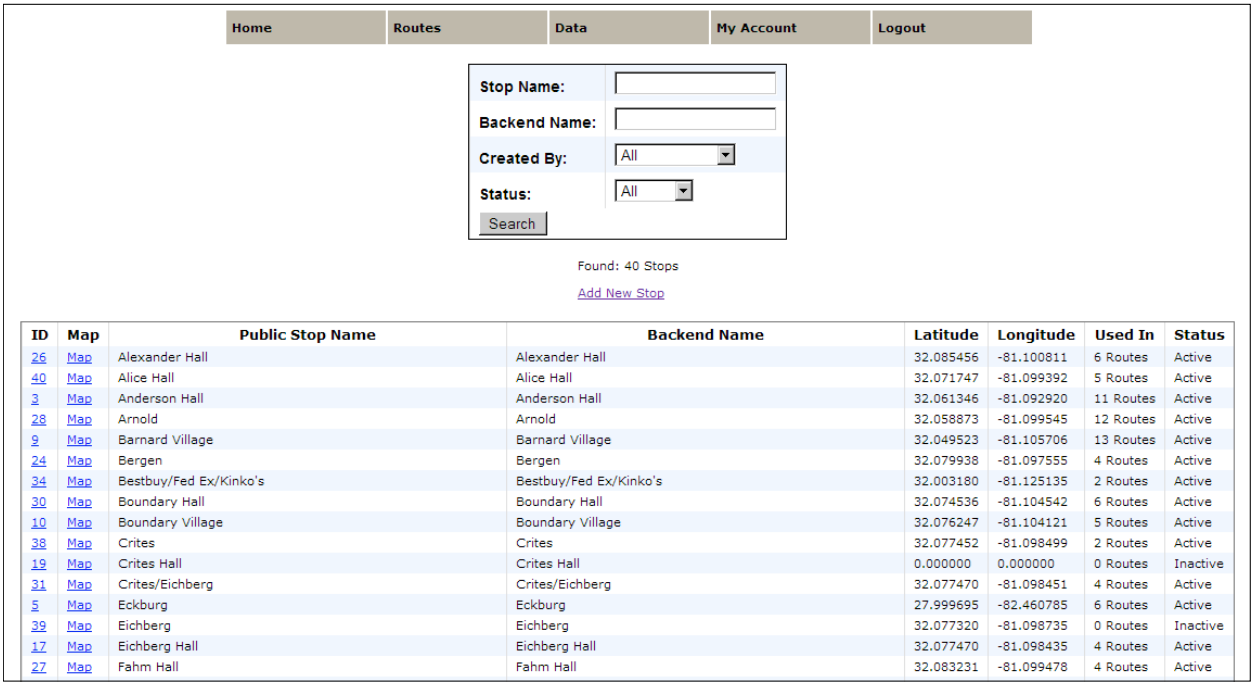


Figure 17. Excel GTFS tools, list of stops



	A	B	C	D	E	F	G	H	I	J	K
1	stop_id	stop_code	stop_name	stop_desc	stop_lat	stop_lon	zone_id	stop_url	location_type	parent_station	
2	2		Foothill at Ferrini (W)		35.294209	-120.673721					
3	4		Foothill at Ferrini (E)		35.29398	-120.673622					
4	5		Santa Rosa at Murray (N)		35.291603	-120.667007					
5	6		Santa Rosa at Murray (S)		35.290016	-120.666656					
6	7		Downtown Transit Center		35.282928	-120.66243					
7	8		Marsh at Broad		35.27795	-120.663864					
8	9		Nipomo at Higuera		35.278606	-120.666229					
9	10		Orcutt at Laurel		35.261295	-120.643028					
10	11		Orcutt at Johnson		35.26141	-120.636307					
11	12		Foothill at Casa		35.294479	-120.665466					
12	13		Murray at Casa		35.290989	-120.664886					
13	14		Casa at Deseret (S)	Sierra Vista Hopital	35						
14	15		Foothill at Cuesta (W)		35						
15	16		Foothill at La Entrada		35						
16	17		Foothill at Cuesta (E)		35						
17	18		Highland at Cuesta		35						
18	19		Highland at Jefferey		35						
19	20		Patricia at Highland		35						
20	21		Patricia at Foothill		35						
21	23		Broad at Islay		35.274727	-120.660858					
22	24		Broad at Funston		35.268852	-120.656029					

Figure 18. Next Insight tools, list of stops



Home | Routes | Data | My Account | Logout

Stop Name:
Backend Name:
Created By: All
Status: All
Search

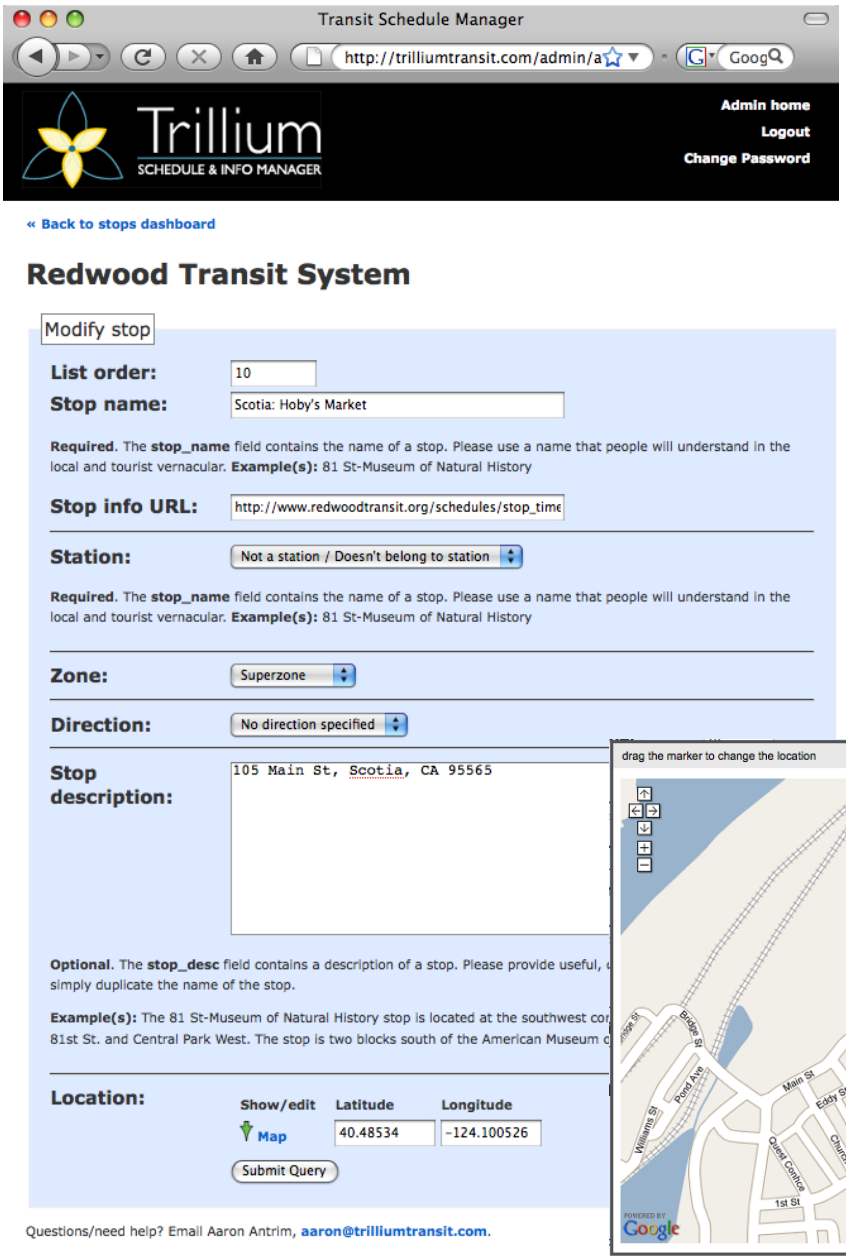
Found: 40 Stops

Add New Stop

ID	Map	Public Stop Name	Backend Name	Latitude	Longitude	Used In	Status
26	Map	Alexander Hall	Alexander Hall	32.085456	-81.100811	6 Routes	Active
40	Map	Alice Hall	Alice Hall	32.071747	-81.099392	5 Routes	Active
3	Map	Anderson Hall	Anderson Hall	32.061346	-81.092920	11 Routes	Active
28	Map	Arnold	Arnold	32.058873	-81.099545	12 Routes	Active
9	Map	Barnard Village	Barnard Village	32.049523	-81.105706	13 Routes	Active
24	Map	Bergen	Bergen	32.079938	-81.097555	4 Routes	Active
34	Map	Bestbuy/Fed Ex/Kinko's	Bestbuy/Fed Ex/Kinko's	32.003180	-81.125135	2 Routes	Active
30	Map	Boundary Hall	Boundary Hall	32.074536	-81.104542	6 Routes	Active
10	Map	Boundary Village	Boundary Village	32.076247	-81.104121	5 Routes	Active
38	Map	Crites	Crites	32.077452	-81.098499	2 Routes	Active
19	Map	Crites Hall	Crites Hall	0.000000	0.000000	0 Routes	Inactive
31	Map	Crites/Eichberg	Crites/Eichberg	32.077470	-81.098451	4 Routes	Active
5	Map	Eckburg	Eckburg	27.999695	-82.460785	6 Routes	Active
39	Map	Eichberg	Eichberg	32.077320	-81.098735	0 Routes	Inactive
17	Map	Eichberg Hall	Eichberg Hall	32.077470	-81.098435	4 Routes	Active
27	Map	Fahm Hall	Fahm Hall	32.083231	-81.099478	4 Routes	Active

Stop details

Figure 19. Trillium WebSchedule, stop details



Enter and update information about stop details on this page. Click map to relocate a stop by dragging and dropping the location marker.

Figure 20. Excel GTFS tools, stop detail

To view locations, the tool sends users to a link at maps.google.com.

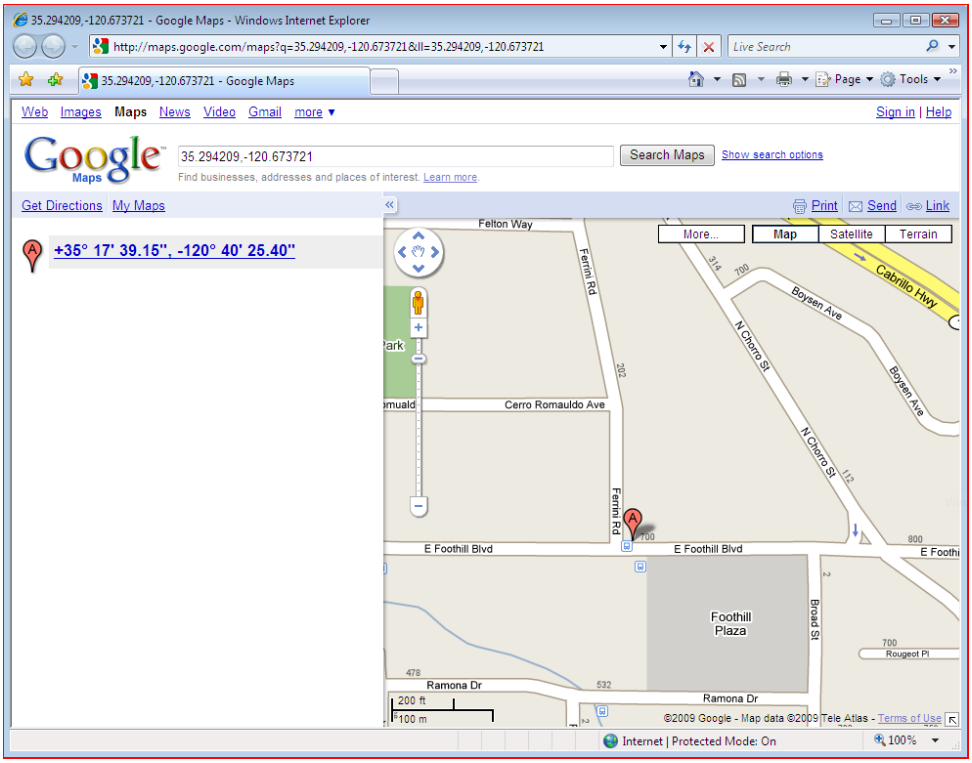


Figure 21. Iteris BusFeeder, stop detail

The stop detail and stops list pages are integrated for this tool. See previous page.

Figure 22. Next Insight GTFS tool, stop details

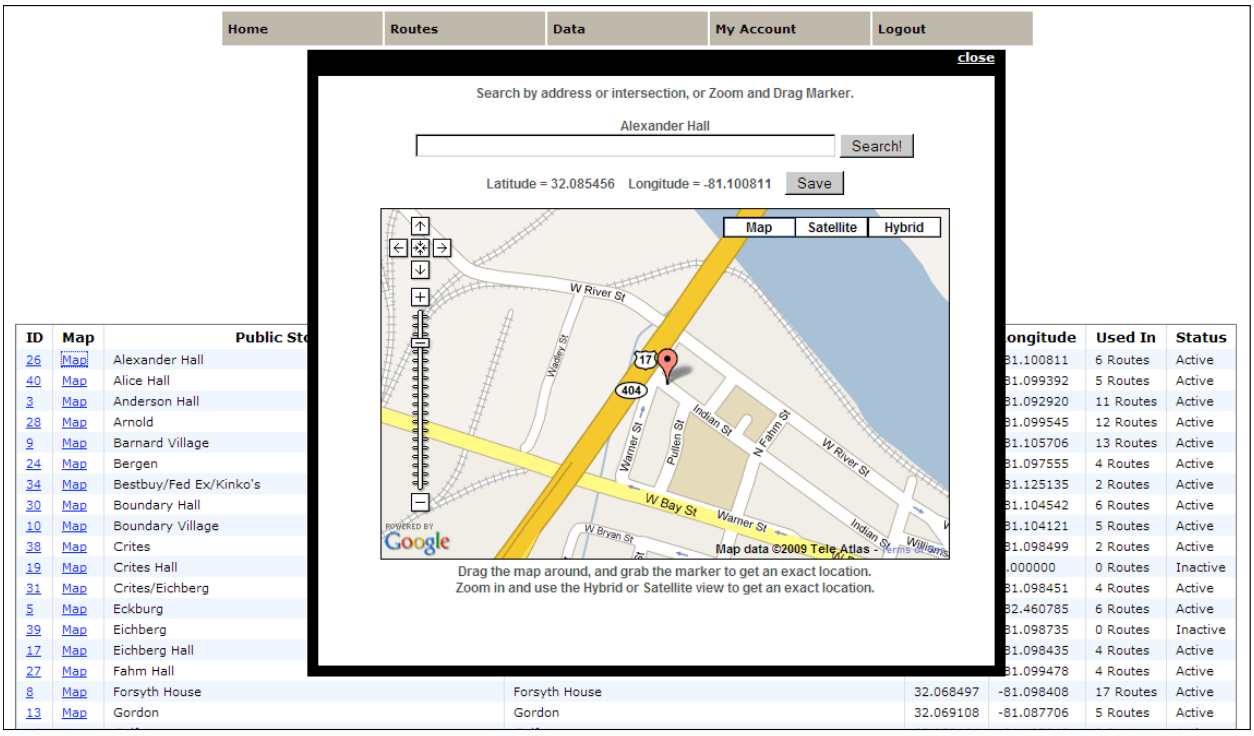
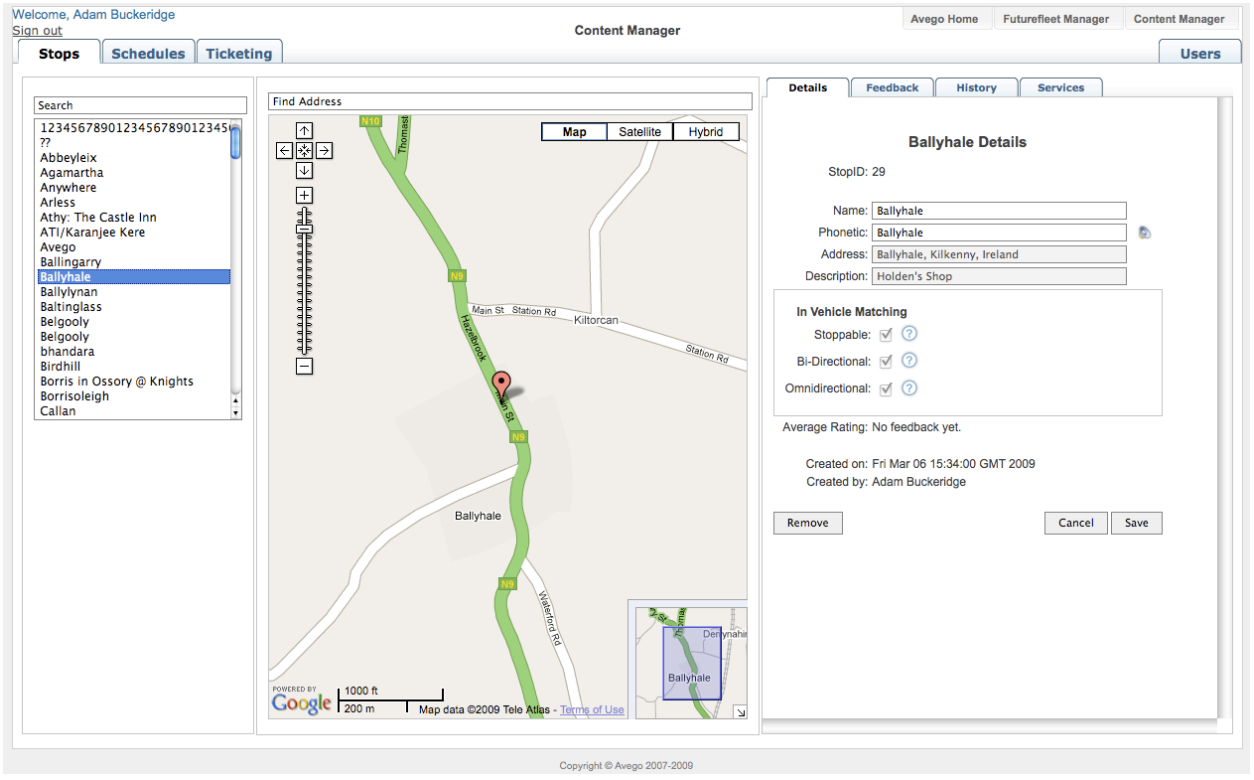


Figure 23. Avego FutureFleet, stop details



Stop times, trips, timetables

Figure 24. Trillium WebSchedule, trip stop times

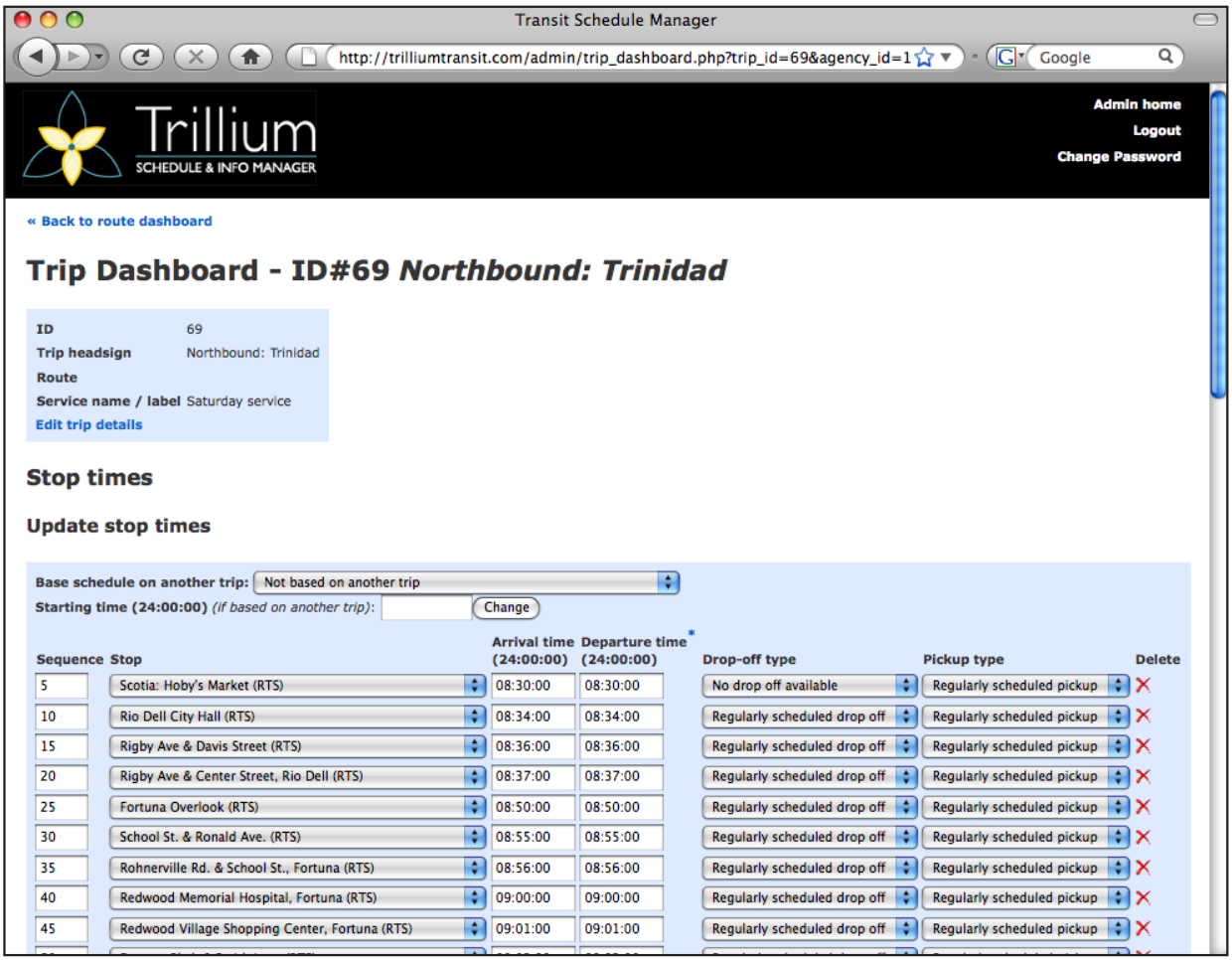


Figure 25. Iteris BusFeeder, trip stop times

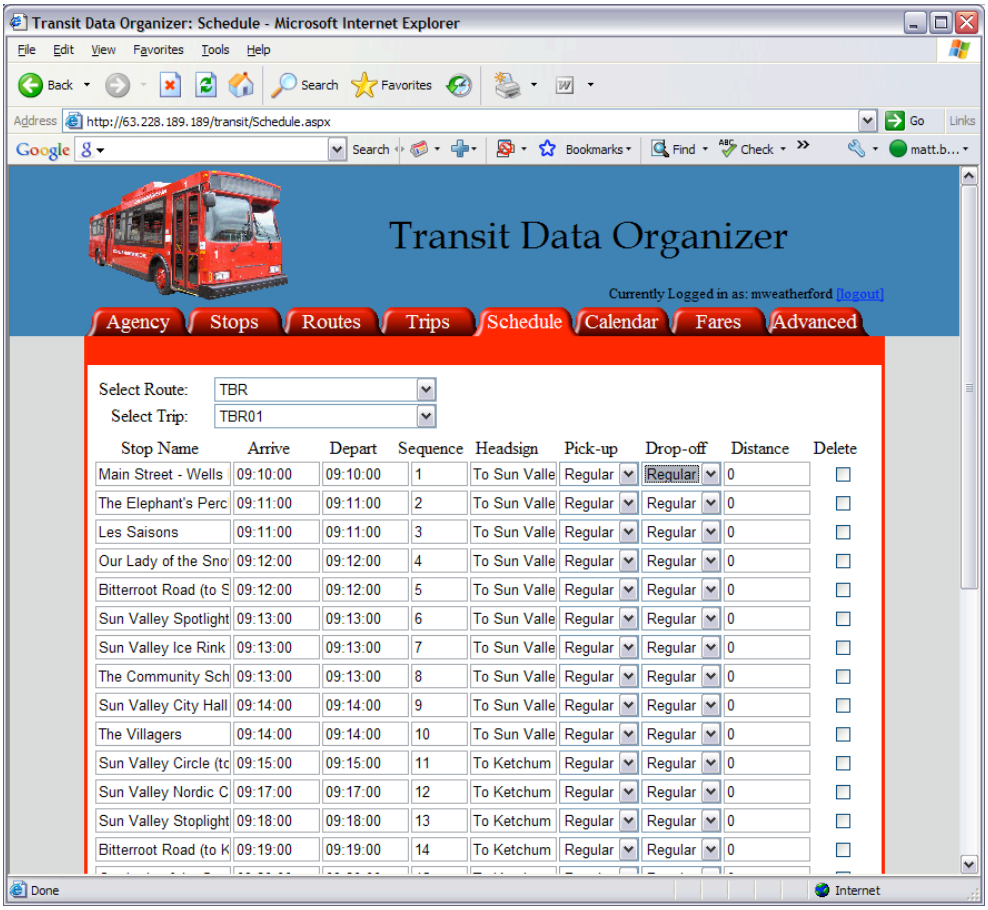


Figure 26. Excel GTFS tools, trip stop times

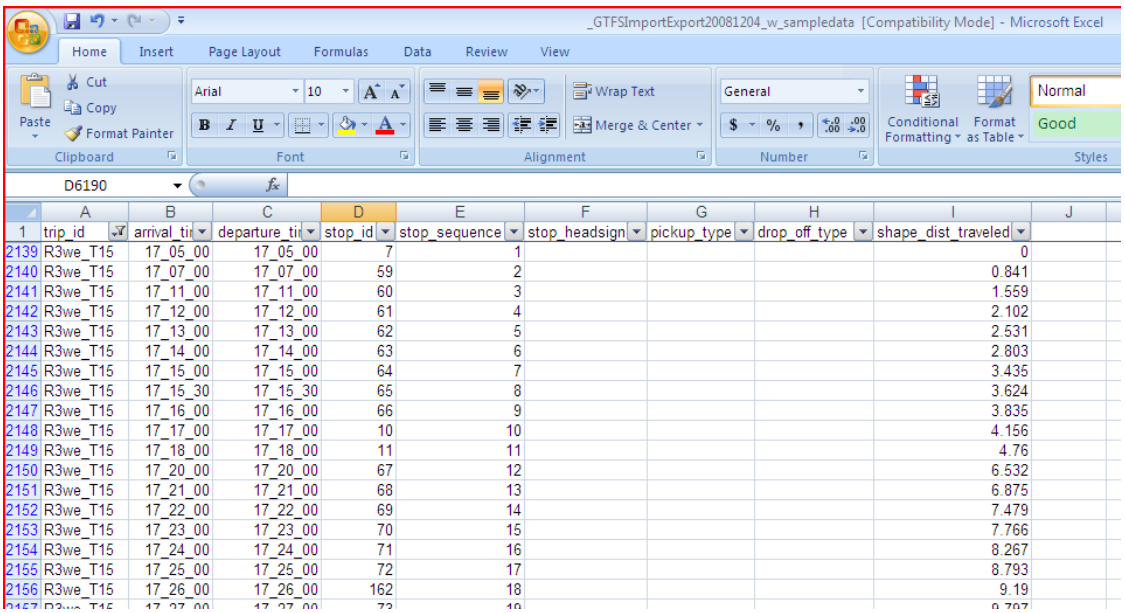
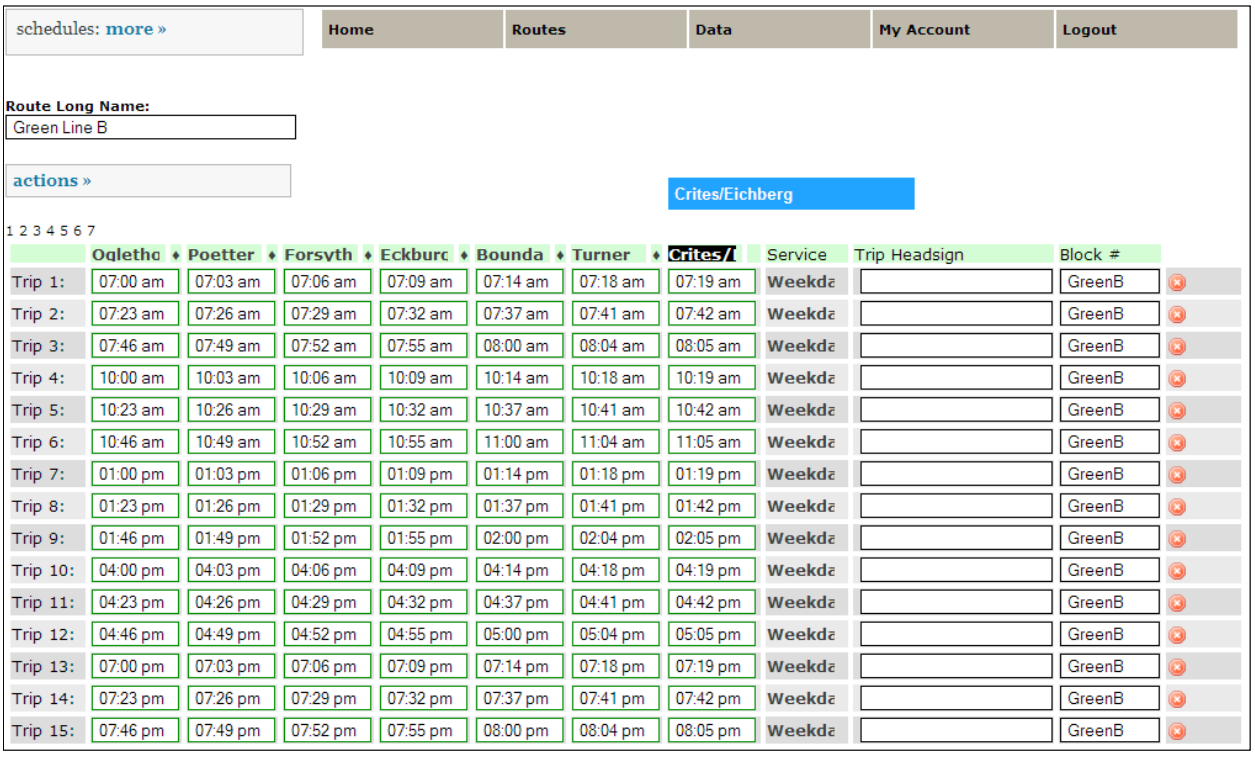


Figure 27. Next Insight GTFS tools, timetable view



	Ogletho	Poetter	Forsyth	Eckburc	Bounda	Turner	Crites/I	Service	Trip Headsign	Block #
Trip 1:	07:00 am	07:03 am	07:06 am	07:09 am	07:14 am	07:18 am	07:19 am	Weekda		GreenB
Trip 2:	07:23 am	07:26 am	07:29 am	07:32 am	07:37 am	07:41 am	07:42 am	Weekda		GreenB
Trip 3:	07:46 am	07:49 am	07:52 am	07:55 am	08:00 am	08:04 am	08:05 am	Weekda		GreenB
Trip 4:	10:00 am	10:03 am	10:06 am	10:09 am	10:14 am	10:18 am	10:19 am	Weekda		GreenB
Trip 5:	10:23 am	10:26 am	10:29 am	10:32 am	10:37 am	10:41 am	10:42 am	Weekda		GreenB
Trip 6:	10:46 am	10:49 am	10:52 am	10:55 am	11:00 am	11:04 am	11:05 am	Weekda		GreenB
Trip 7:	01:00 pm	01:03 pm	01:06 pm	01:09 pm	01:14 pm	01:18 pm	01:19 pm	Weekda		GreenB
Trip 8:	01:23 pm	01:26 pm	01:29 pm	01:32 pm	01:37 pm	01:41 pm	01:42 pm	Weekda		GreenB
Trip 9:	01:46 pm	01:49 pm	01:52 pm	01:55 pm	02:00 pm	02:04 pm	02:05 pm	Weekda		GreenB
Trip 10:	04:00 pm	04:03 pm	04:06 pm	04:09 pm	04:14 pm	04:18 pm	04:19 pm	Weekda		GreenB
Trip 11:	04:23 pm	04:26 pm	04:29 pm	04:32 pm	04:37 pm	04:41 pm	04:42 pm	Weekda		GreenB
Trip 12:	04:46 pm	04:49 pm	04:52 pm	04:55 pm	05:00 pm	05:04 pm	05:05 pm	Weekda		GreenB
Trip 13:	07:00 pm	07:03 pm	07:06 pm	07:09 pm	07:14 pm	07:18 pm	07:19 pm	Weekda		GreenB
Trip 14:	07:23 pm	07:26 pm	07:29 pm	07:32 pm	07:37 pm	07:41 pm	07:42 pm	Weekda		GreenB
Trip 15:	07:46 pm	07:49 pm	07:52 pm	07:55 pm	08:00 pm	08:04 pm	08:05 pm	Weekda		GreenB

Figure 28. Avego FutureFleet, timetable view

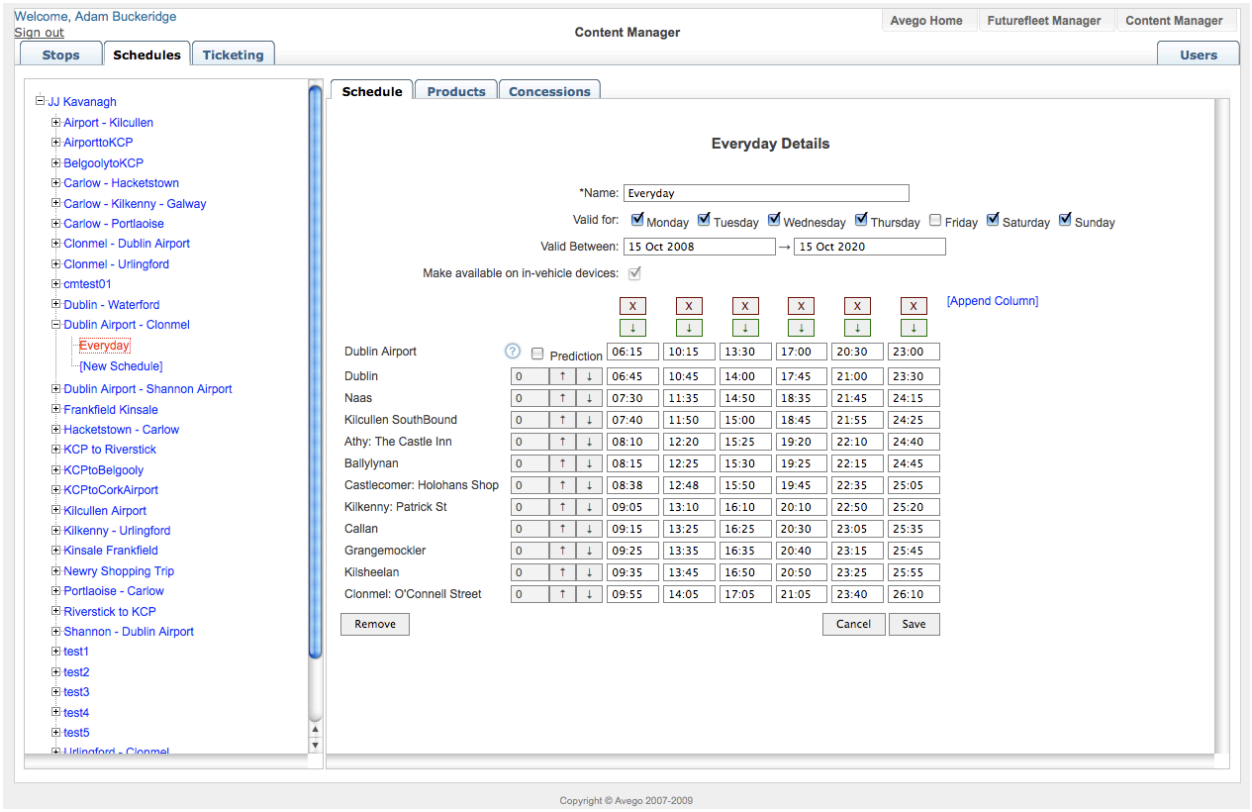
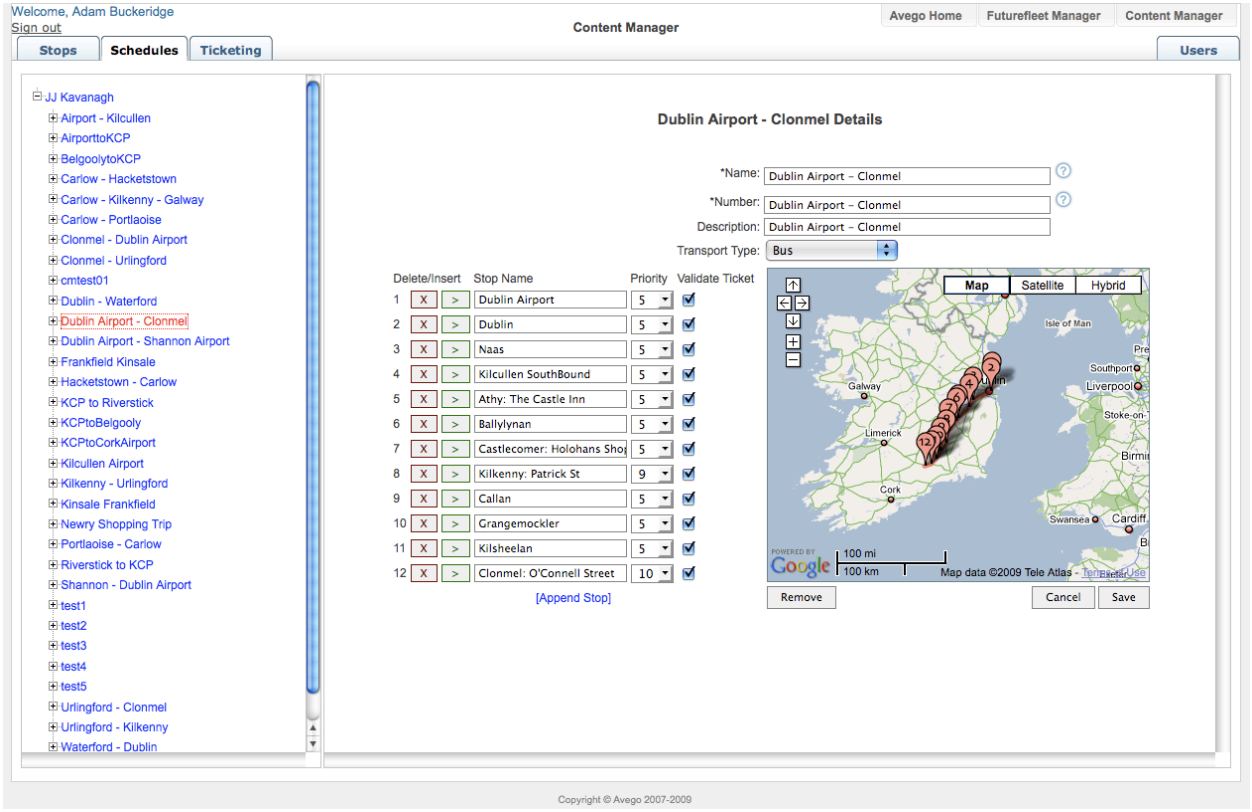


Figure 29. Avego FutureFleet, trip pattern view



Appendix D:

Guide for transit agencies: How to use schedule viewer to proof your data

Guide for transit agencies: How to use Schedule Viewer to proof your data

A quick guide to using schedule viewer for checking schedule & location accuracy.

Schedule viewer is an open source tool created by Google and the software development community. It is not meant to be customer-facing. More information can be found at http://code.google.com/p/googletransitdatafeed/wiki/ScheduleViewer

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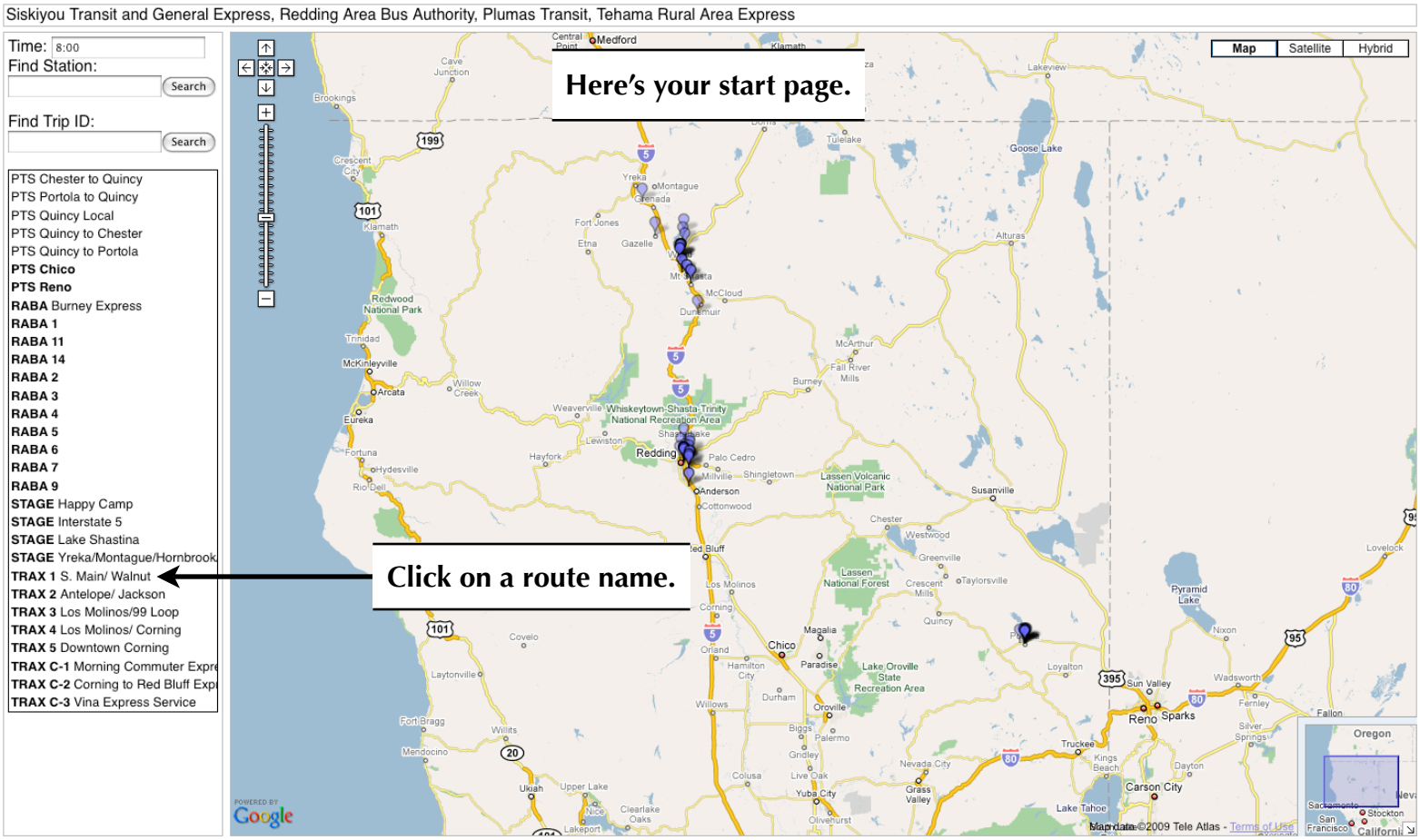
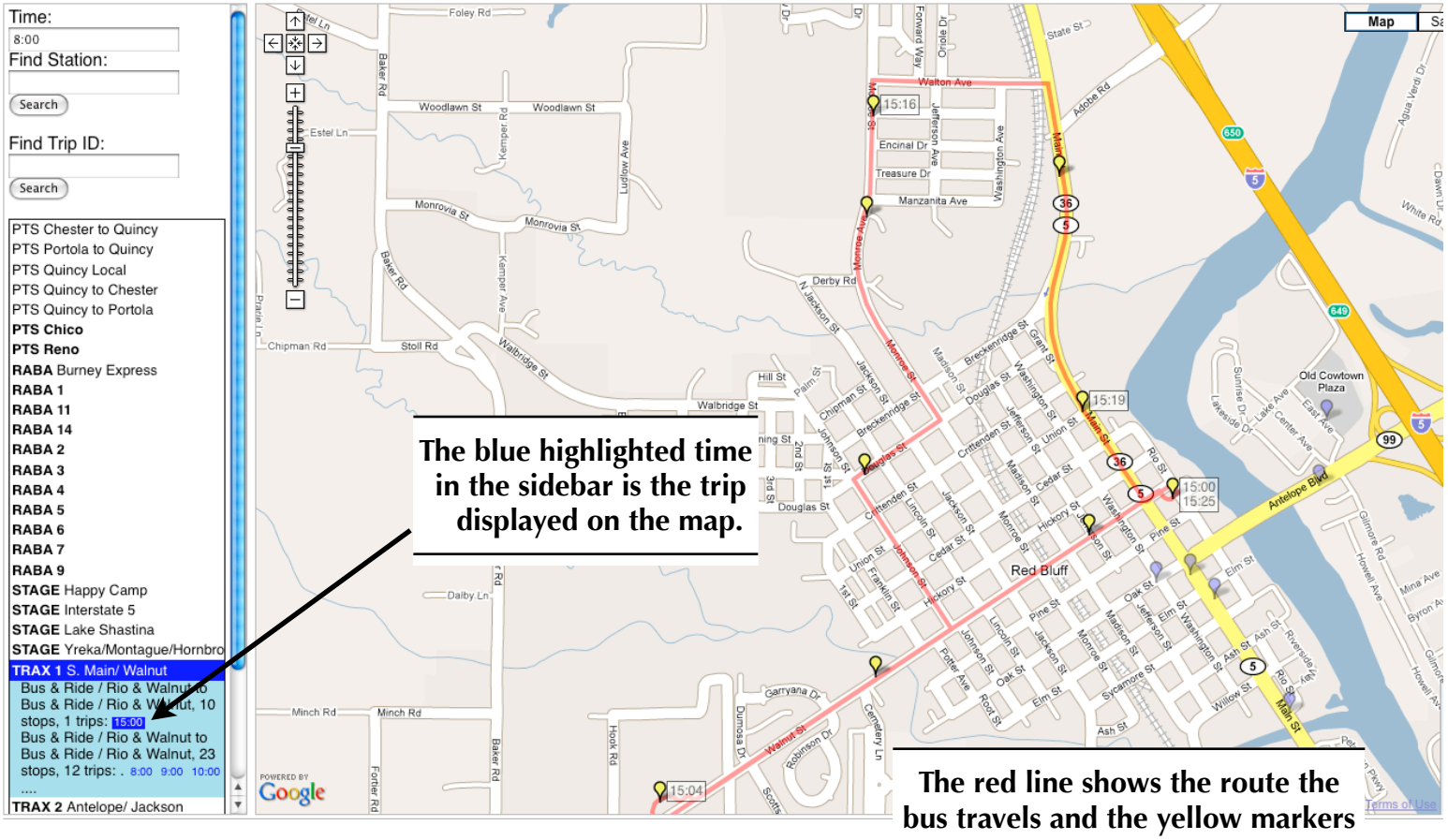
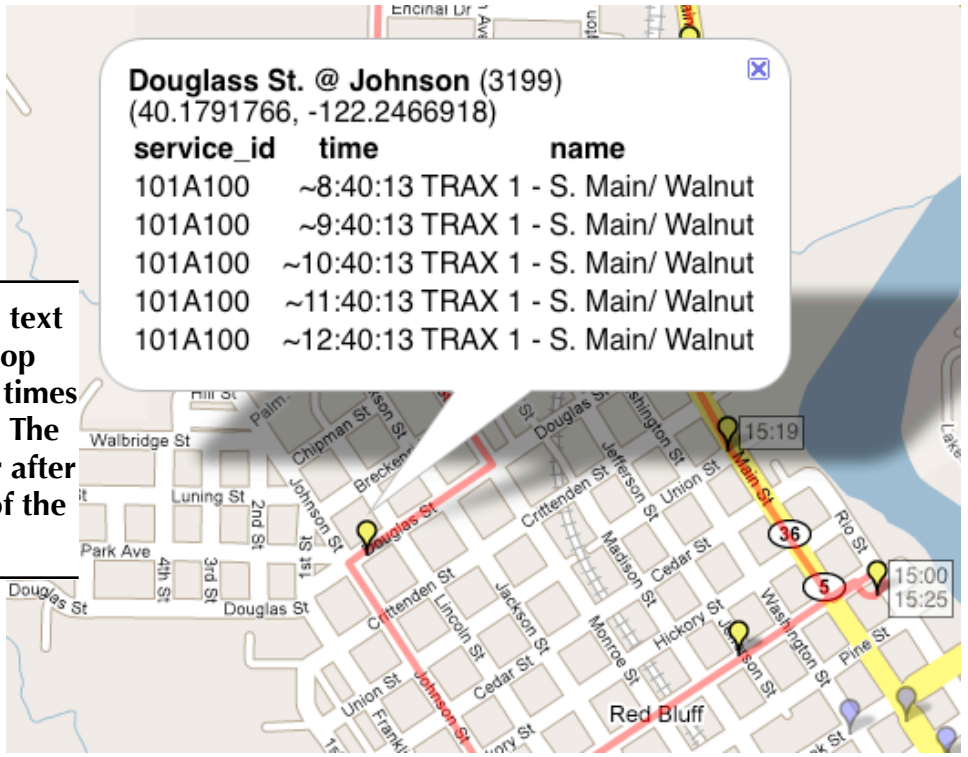


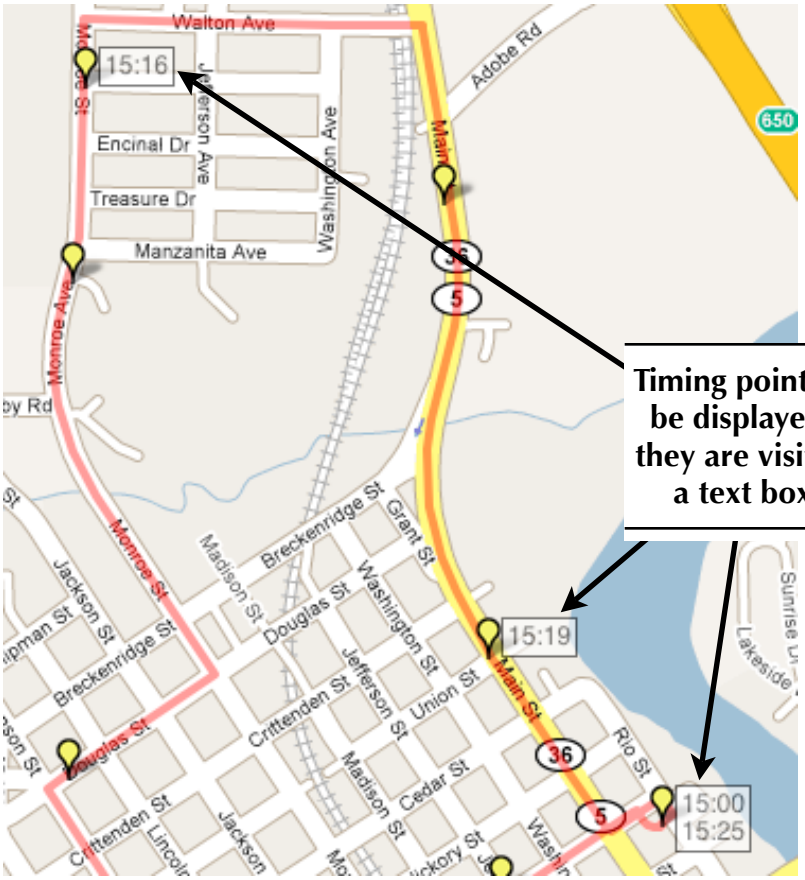


The blue highlighted time in the sidebar is the trip displayed on the map.

The red line shows the route the bus travels and the yellow markers show the bus stops visited in the currently selected trip.



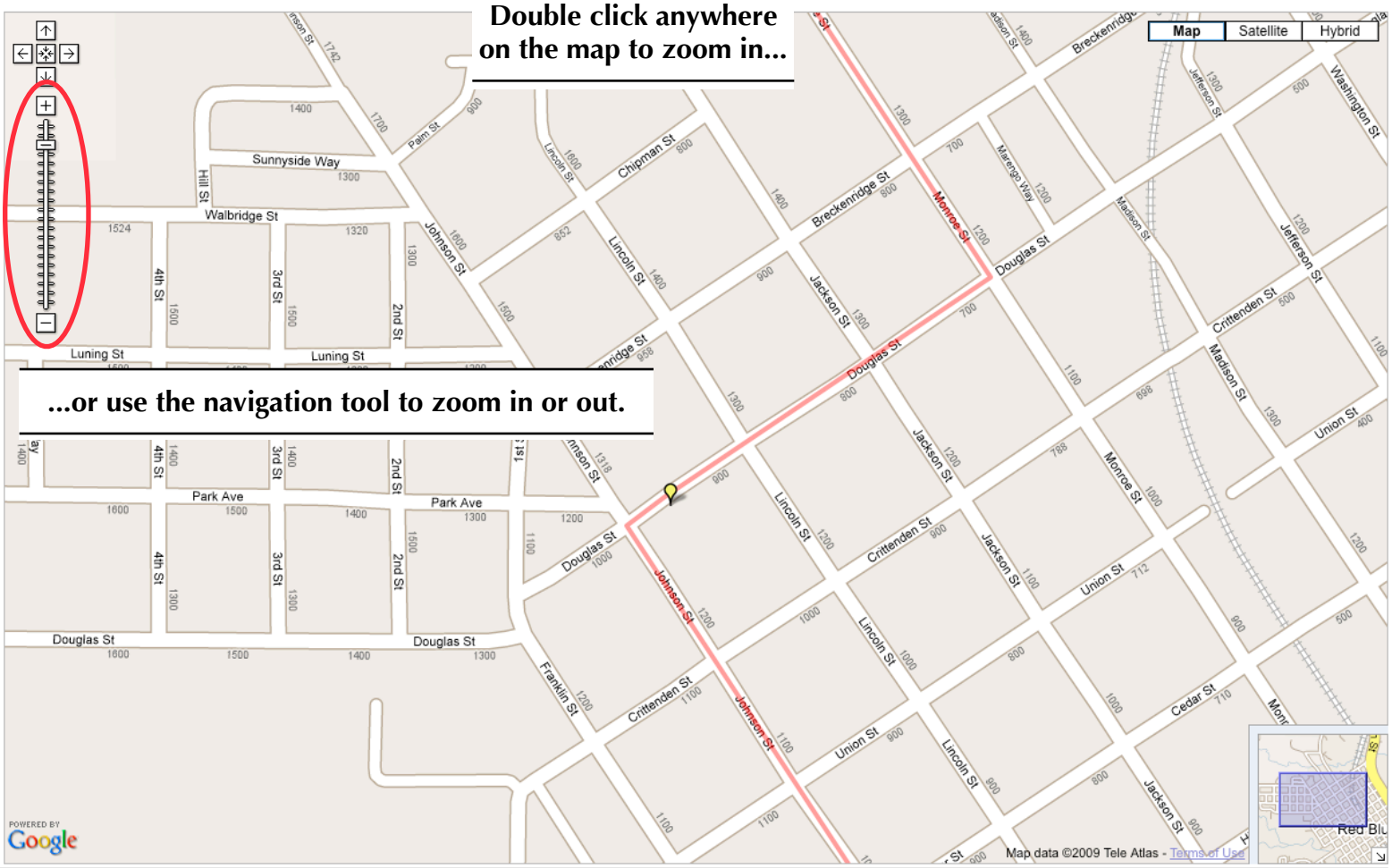
Click on any of the yellow markers. A text bubble will appear that shows the stop name, location (lat/lon), and up to five times where the stop is serviced by a route. The times shown will be the first that occur after the time currently entered at the top of the left sidebar (for more see page 5).



Timing points for this trip will be displayed with the times they are visited on this trip in a text box next to them.

Double click anywhere on the map to zoom in...

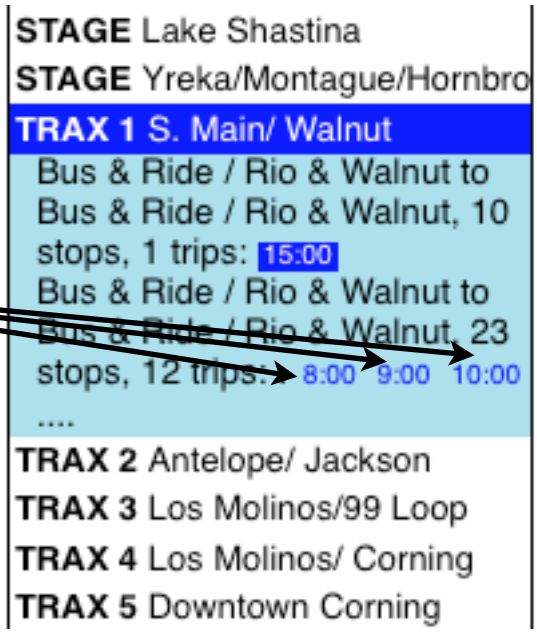
...or use the navigation tool to zoom in or out.

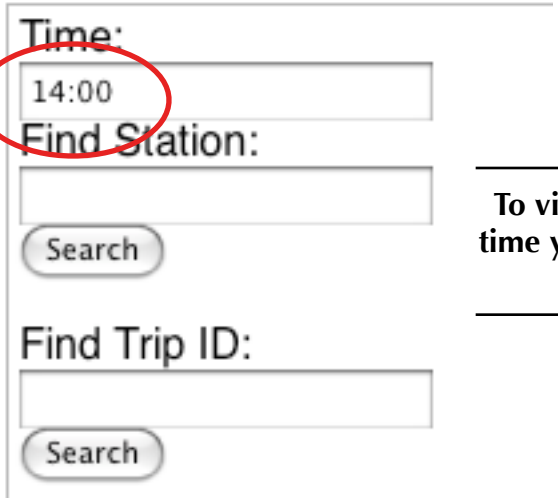


The boxes in the upper right corner allow for different views: map, satellite, and hybrid (shown here).

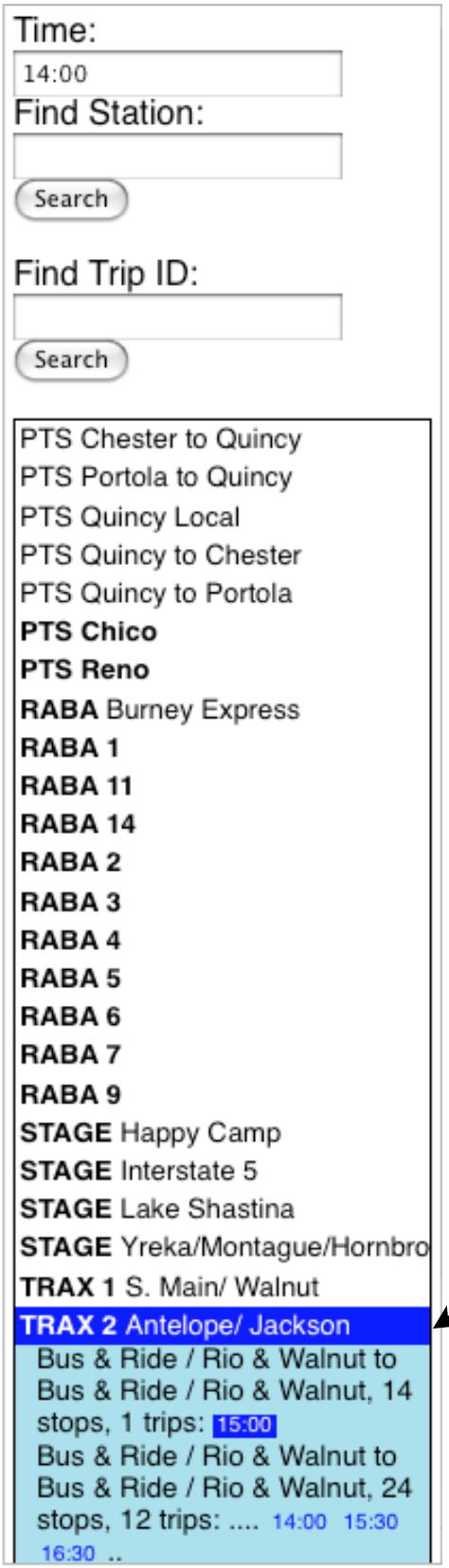
Finding trips at different times

By default, schedule viewer displays only 3 trips (indicated by start time) per unique trip pattern.





To view trips at different times, enter the time you want to see trips after (remember to use military/24 hour time).



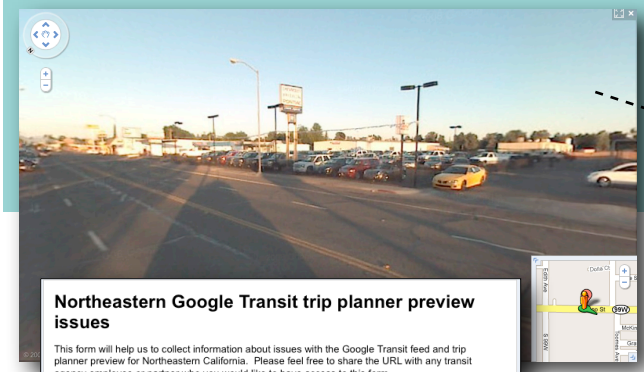
Click on any route name to update to the new time.

Appendix E:

Guide for transit agencies: How to correct street network data, addresses and places of interest in Google Maps

Reporting issues with Google Maps

for Northeastern California Transit Agencies



Northeastern Google Transit trip planner preview issues

This form will help us to collect information about issues with the Google Transit feed and trip planner preview for Northeastern California. Please feel free to share the URL with any transit agency employee or partner who you would like to have access to this form.

Agency

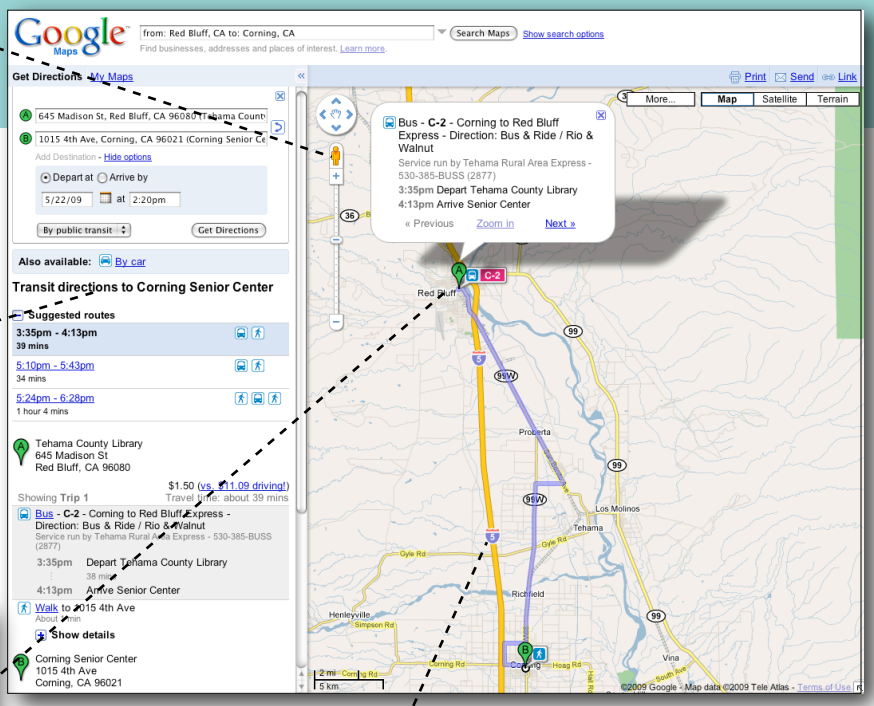
Which agency's information is this about?

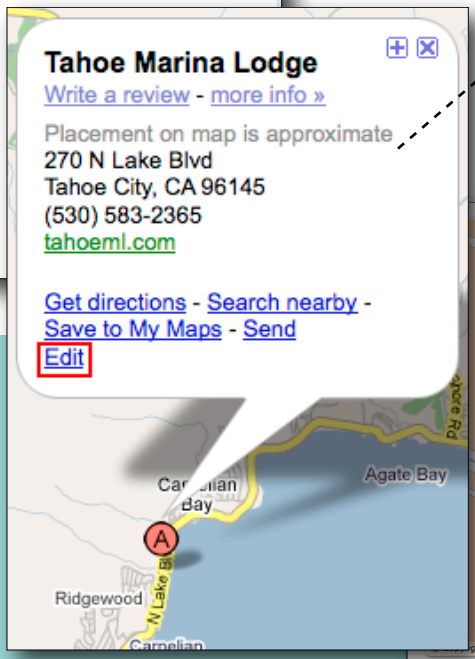
- Plumas Transit
- Shasta/RABA
- Siskiyou/STAGE
- Tehama/TRAX
- Trinity Transit
- Other:

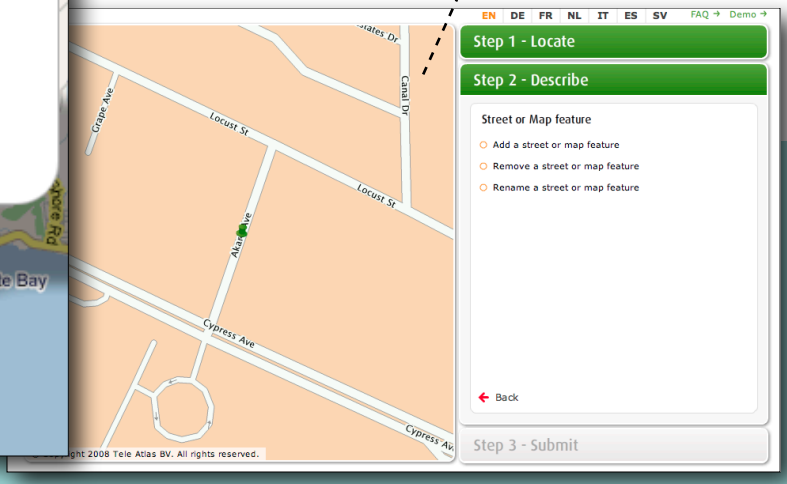
Route(s)

Nature of the issue

- Shape (the bus route path is off)
- Missing bus stop location
- Includes incorrect bus stop location
- Incorrect time
- Incorrect transfer
- Blocking / interlining
- Incorrect name for a location
- Calendar (service schedule issue)
- Service isn't showing up
- Display issue - route colors, etc.
- Route names & directions
- Incorrect streets and highways
- Incorrect location for address
- Other:







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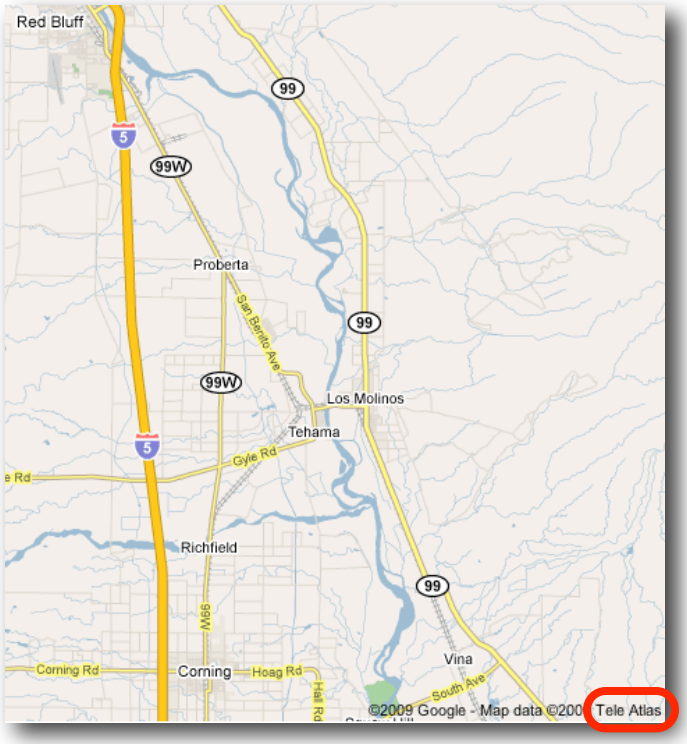
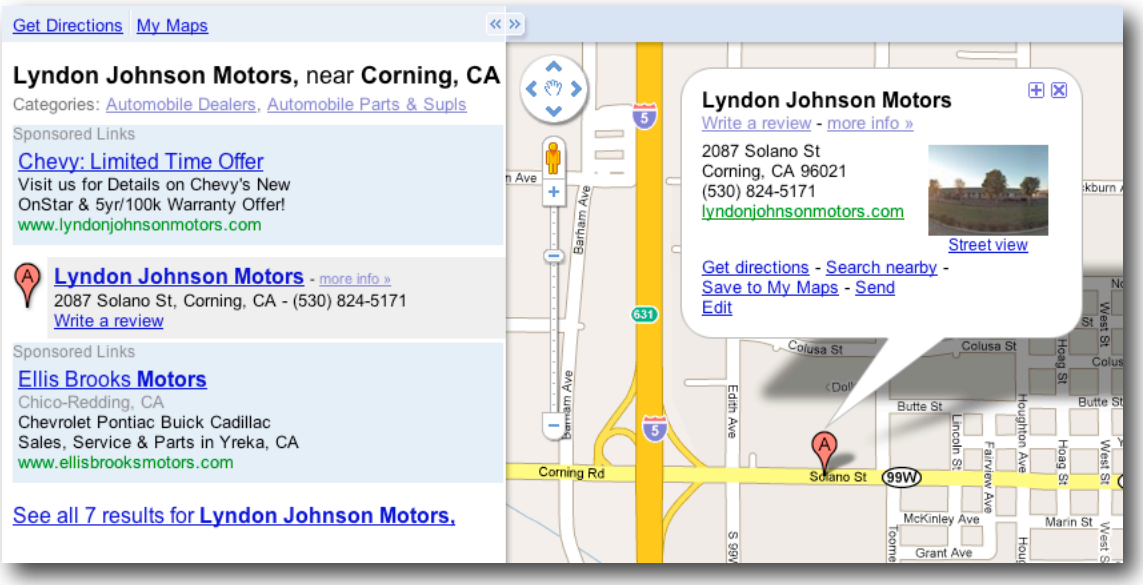
Introduction to layers

Google uses a number different layers of data to provide as much information as possible.

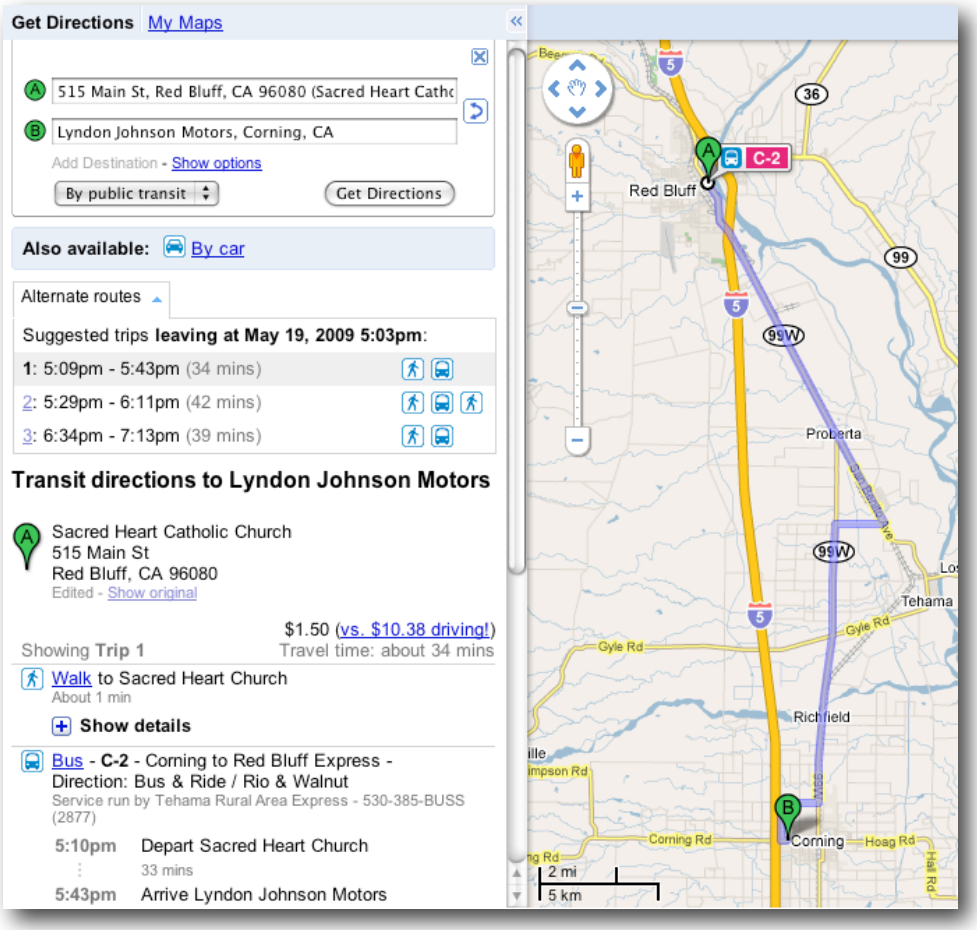
Map layer - This is the base layer of streets, highways, cities, and geographic information. The data is supplied to Google by Tele Atlas.



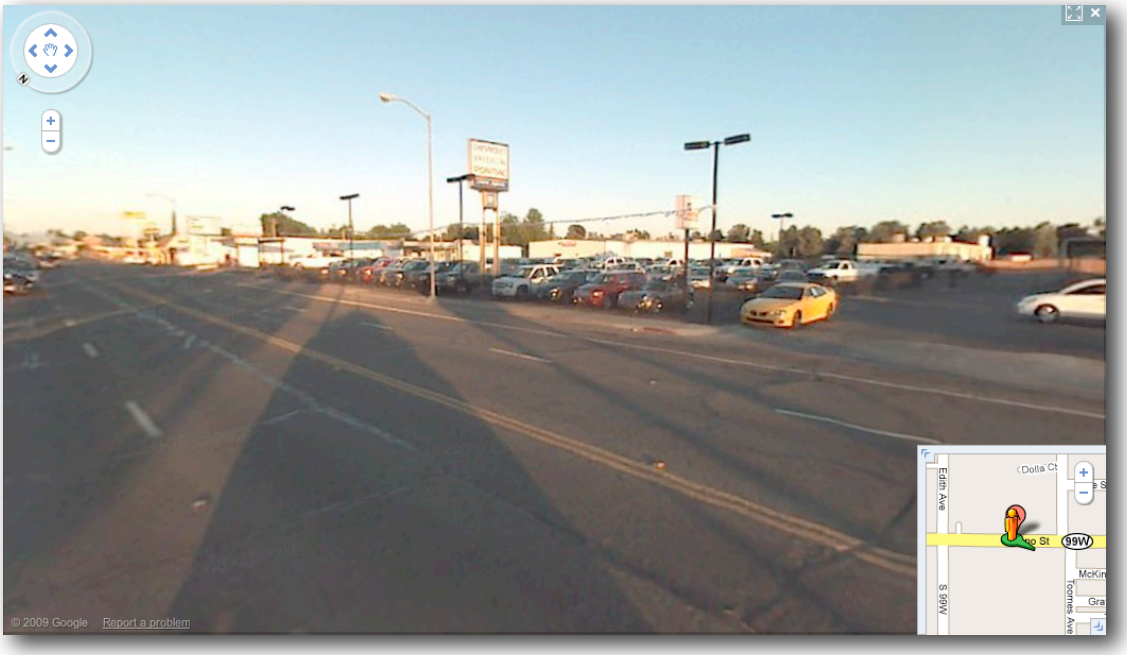
Business and places of interest layer - Provides information about businesses and other places of interest. Can be edited in Google Maps.



Transit layer - Provides transit directions with the Google Transit trip planner. The output is a combination of the Google Transit Feed provided by the transit agency and how the feed interacts with the trip planner's software.



Street view layer - Provides a street level, 360 degree, navigable, photographic view of many streets and highways. This data is collected by Google and issues can be reported in the Street view mode.



Business and places of interest layer:

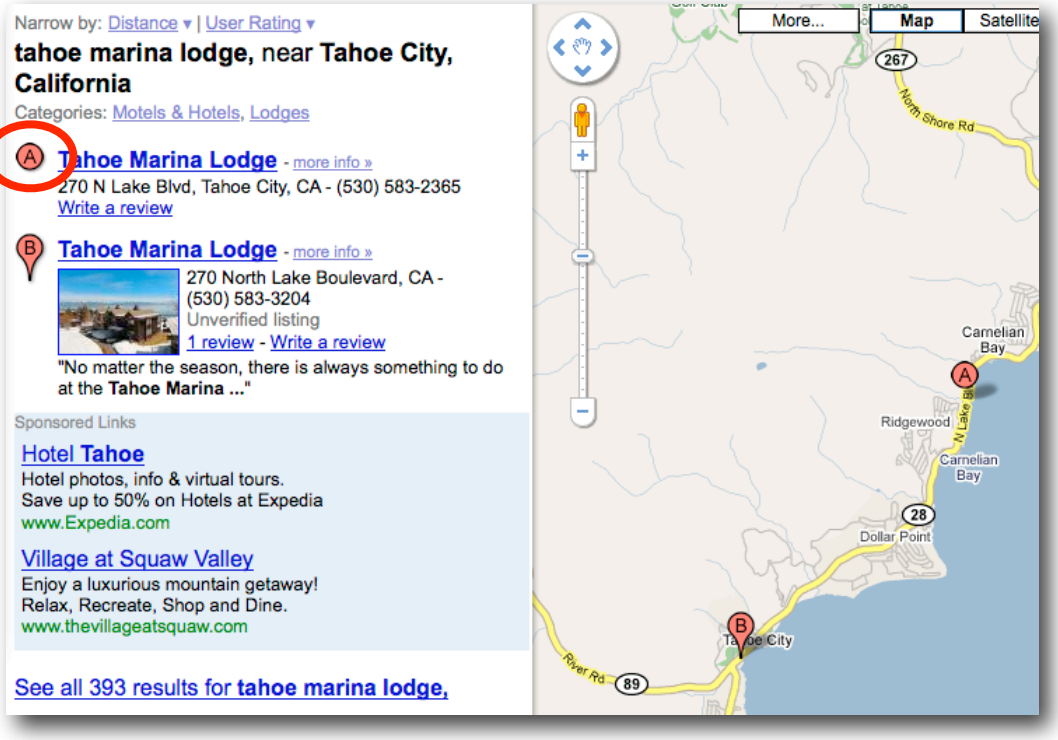
Removing duplicate map locations

If a location is misplaced, is duplicated, or is not included, there are several options available to solve this.

Here's an example where there are duplicate locations for Tahoe Marina Lodge and one needs to be removed.

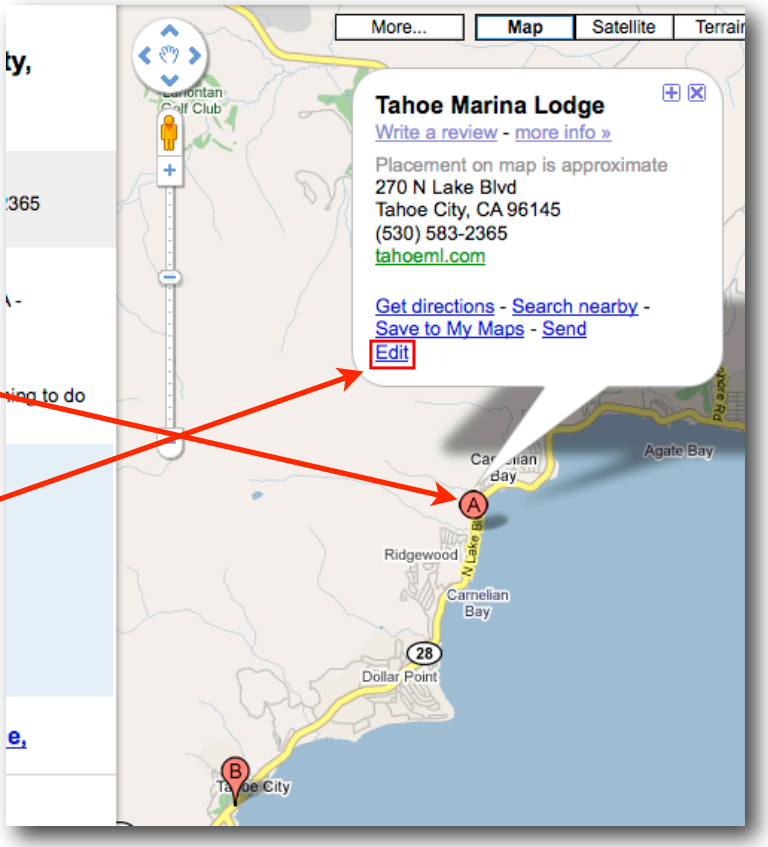
Step 1. Search for the location you want to remove.

The first result "A" is imprecisely located, so that's the one we want to remove.

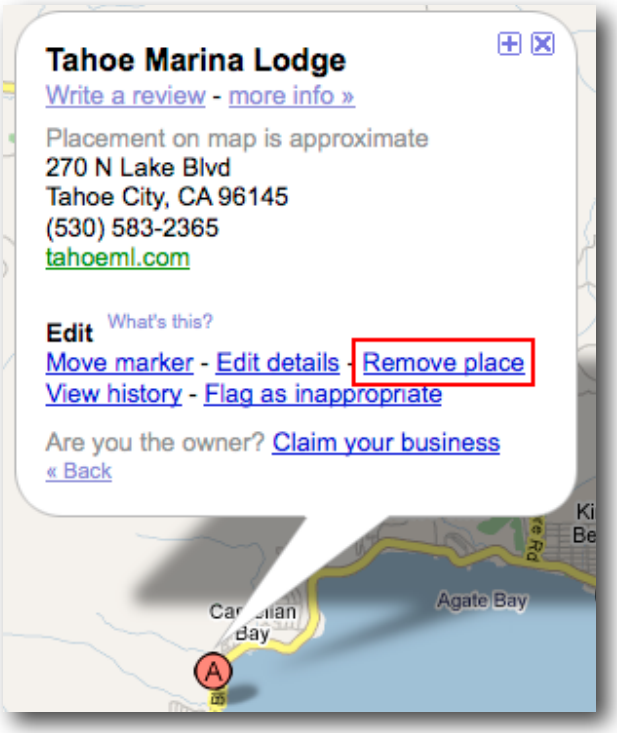


Step 2. Click the location to be removed to open the info box.

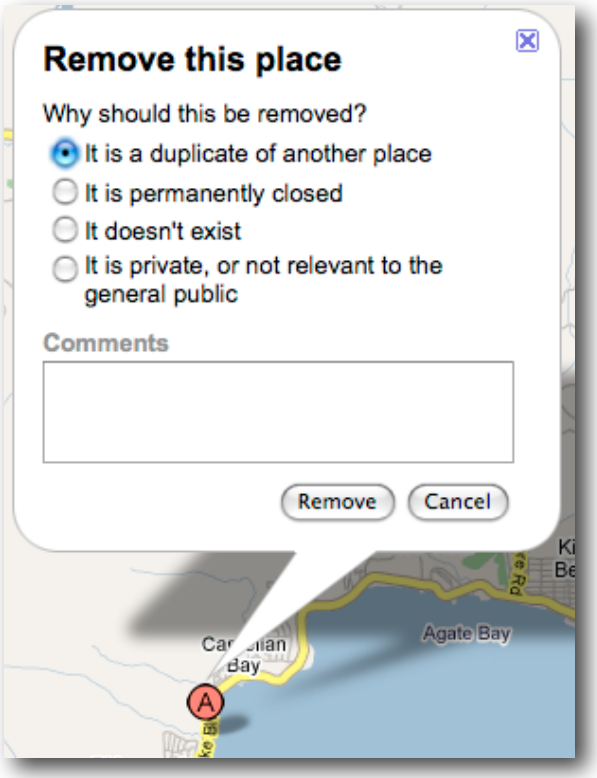
Step 3. Click edit.



Step 4. Click "Remove place."



Step 5. Specify why the location should be removed and click "Remove."



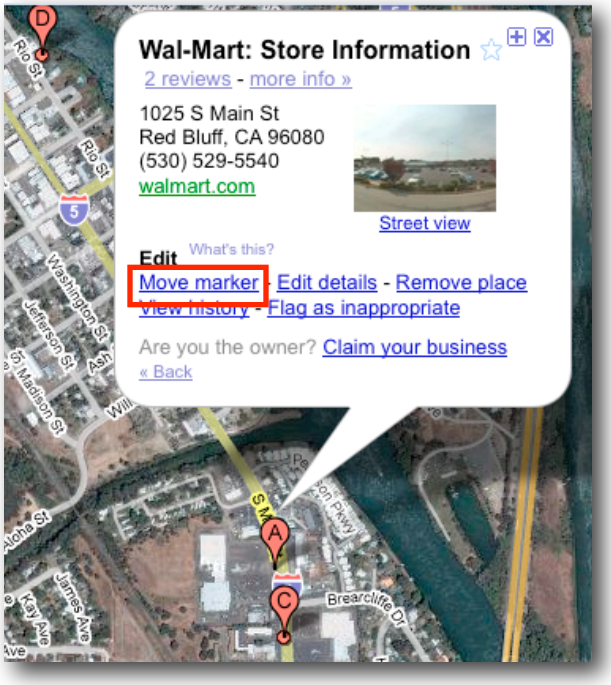
Business and places of interest layer:

Moving markers

If a marker is located incorrectly, the process is similar to removing locations.

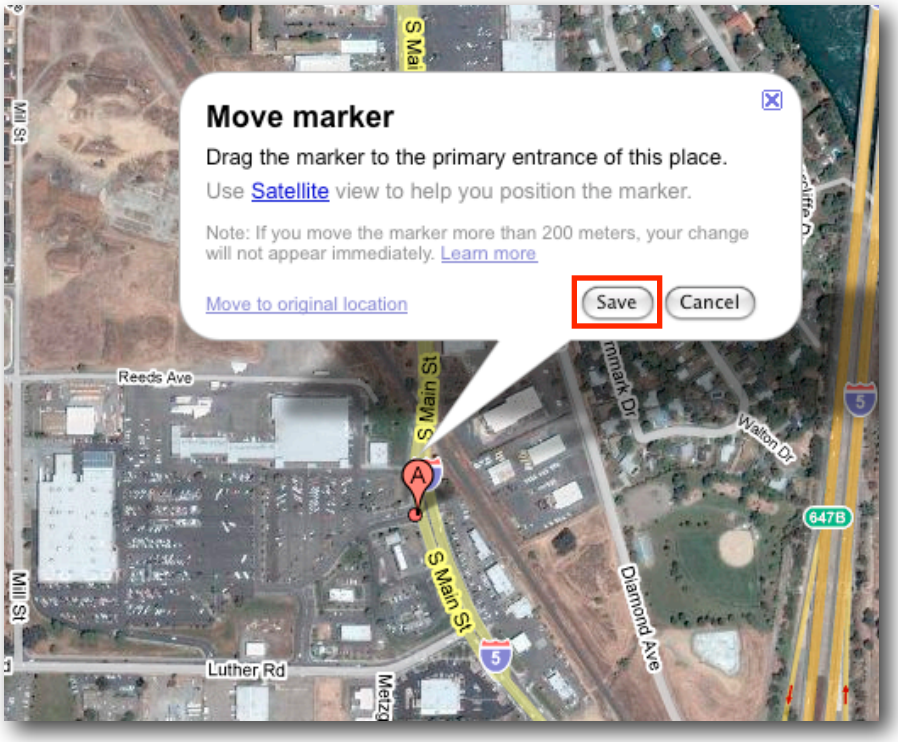
Follow steps 1-3 from the above section, “ Removing duplicate map locations.”

Click “Move marker”



Now you can click and drag the marker to the primary entrance of the place.

Click “Save”



If you’ve moved the marker more than 200 meters, the marker will go back to it’s original location. The change will be reflected in the future.

Maps layer:

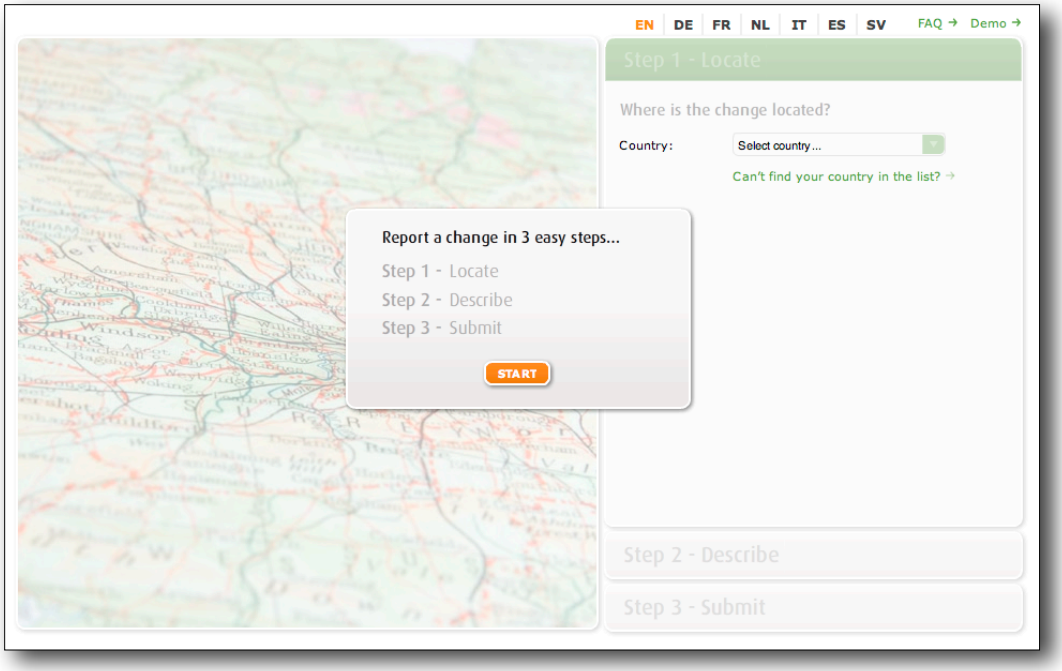
Reporting issues with streets or highways

Sometimes streets or highways in Google Maps are misnamed, located incorrectly, addresses are off, or traffic regulations are wrong.

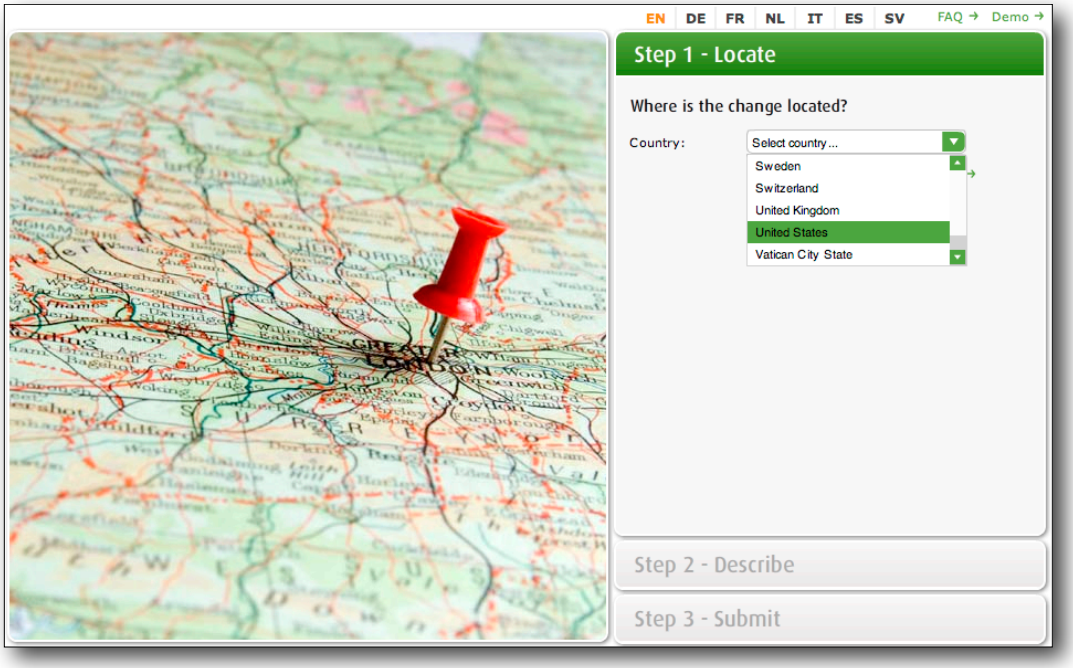
Google’s street data is supplied by Tele Atlas, whom you can direct issues with the map layer to.

Step 1: Point your browser to http://mapinsight.teleatlas.com/mapfeedback/index.php

After selecting your language, you’ll see the start page to the right.



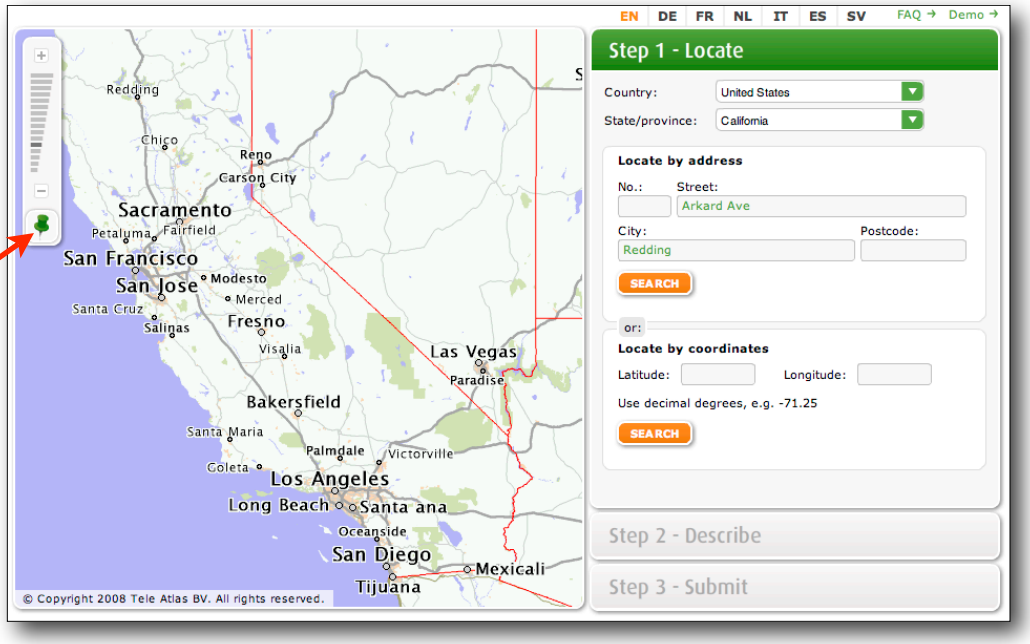
Step 2: Select your country.



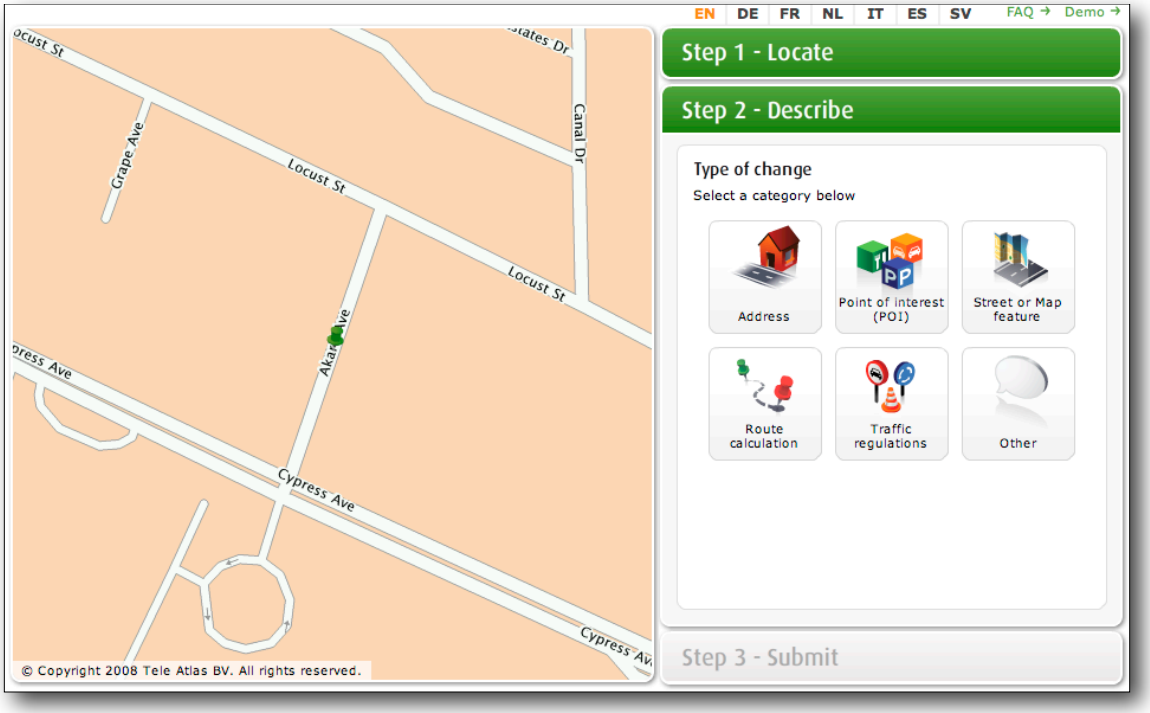
Step 3: Enter your specific location. You can enter the address or lat/lon coordinates of the issue.

If you enter an address, Tele Atlas will ask you to drag and drop the green marker to the specific location.

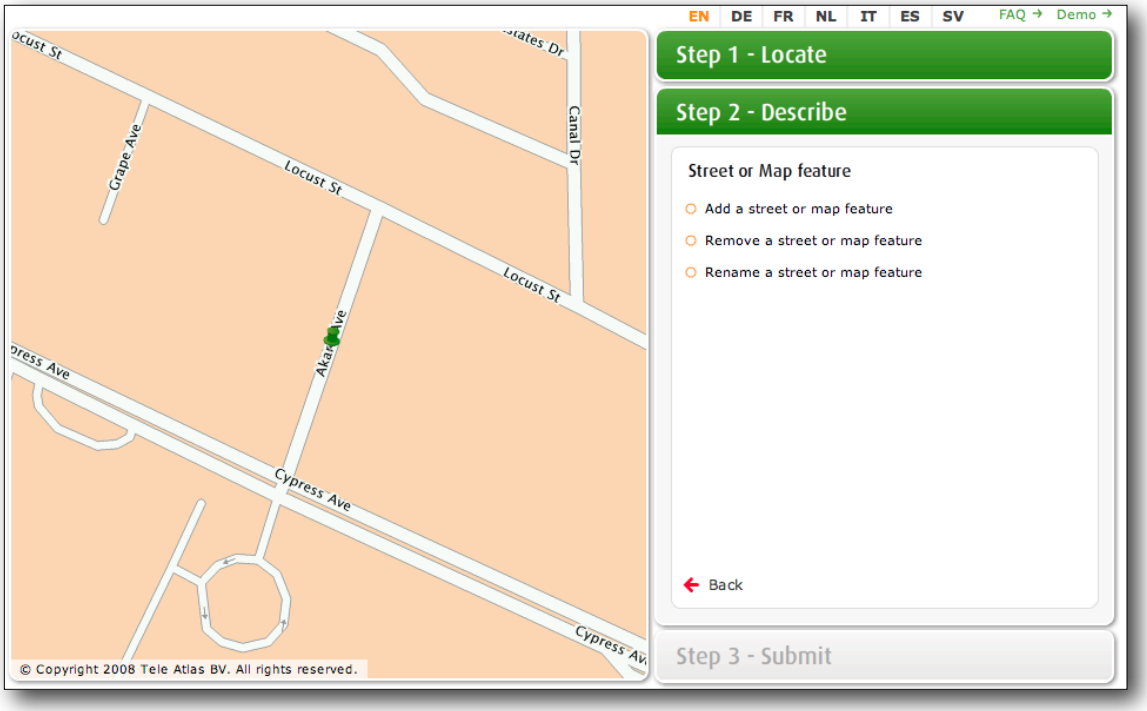
If your issue involves a more general location, you will have a chance to indicate this in the comments section.



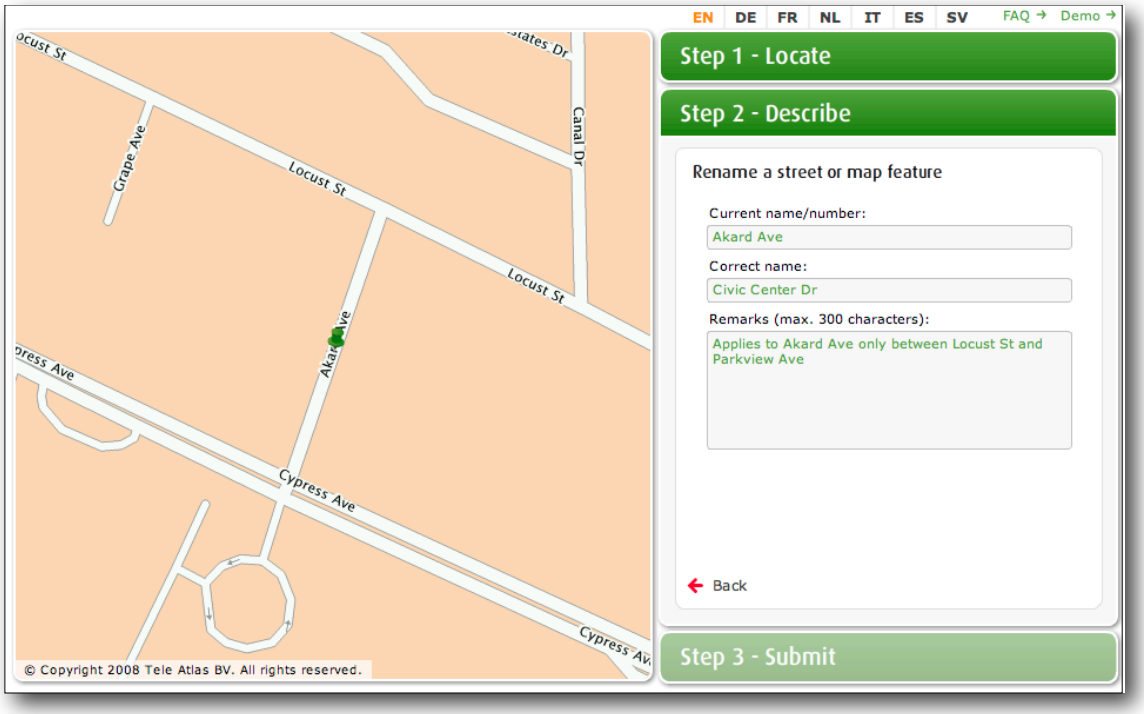
Step 4: Select your type of change.



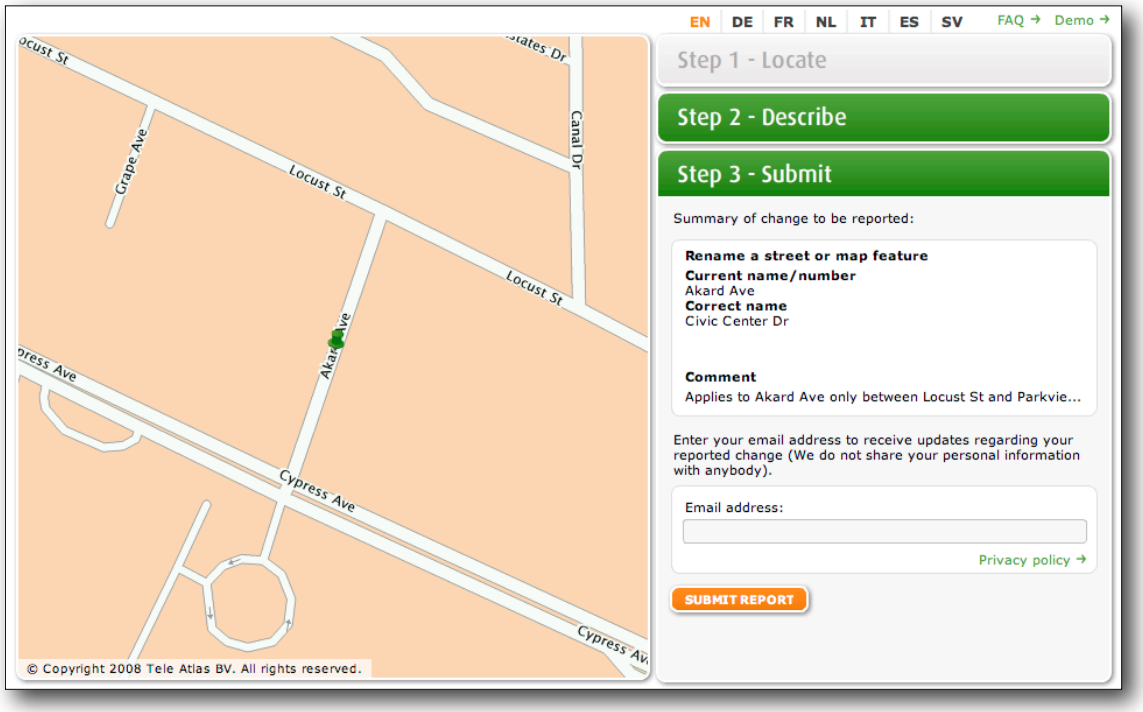
Step 5: Describe your change in more detail.



Step 6: Provide more information. In this case, we are changing the name of a street. There is a field for the current name and a field for the correct name. There is also a section for comments to specify your issue in more detail.



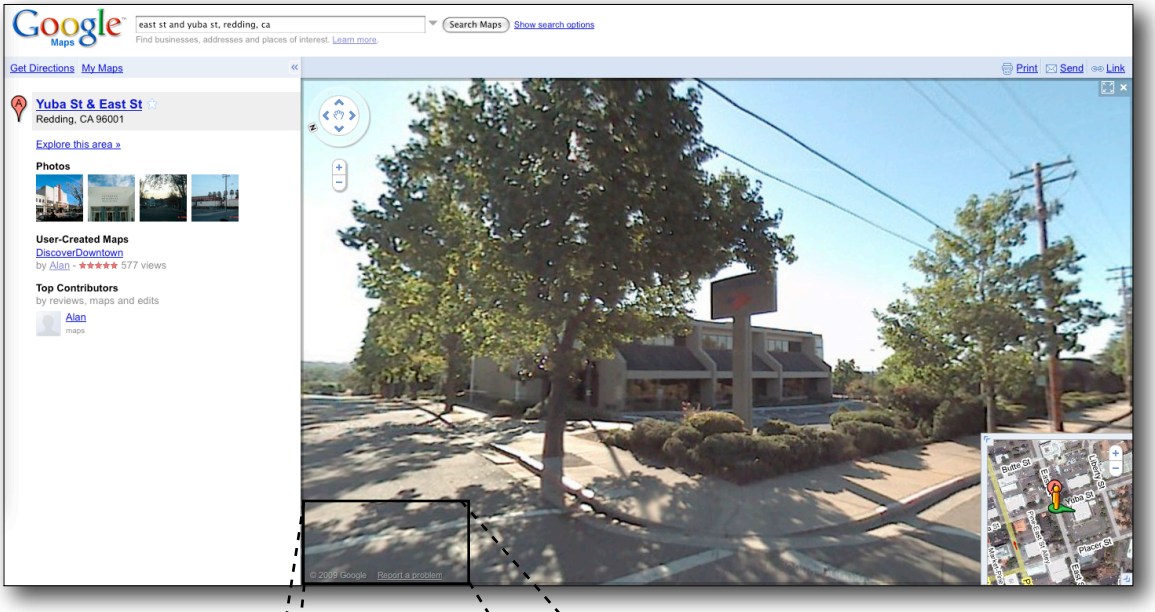
Step 7: Enter your email address if you'd like to receive updates about your change and click submit.



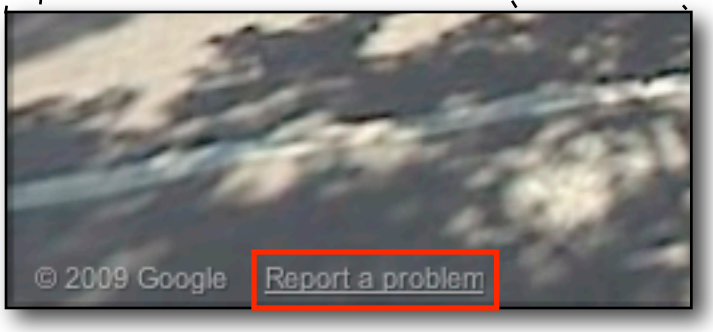
Street View layer:

Issues with Street View

Problems you may find in Street view and want to report to Google include;
-misplaced image
-wrong address
-misaligned navigation arrows
-bad image quality
-privacy concerns
-inappropriate content



Step 1: Navigate to where the issue is you want to report.



Step 2: Select “Report a problem.”

Step 3: Click other and select your problem type.

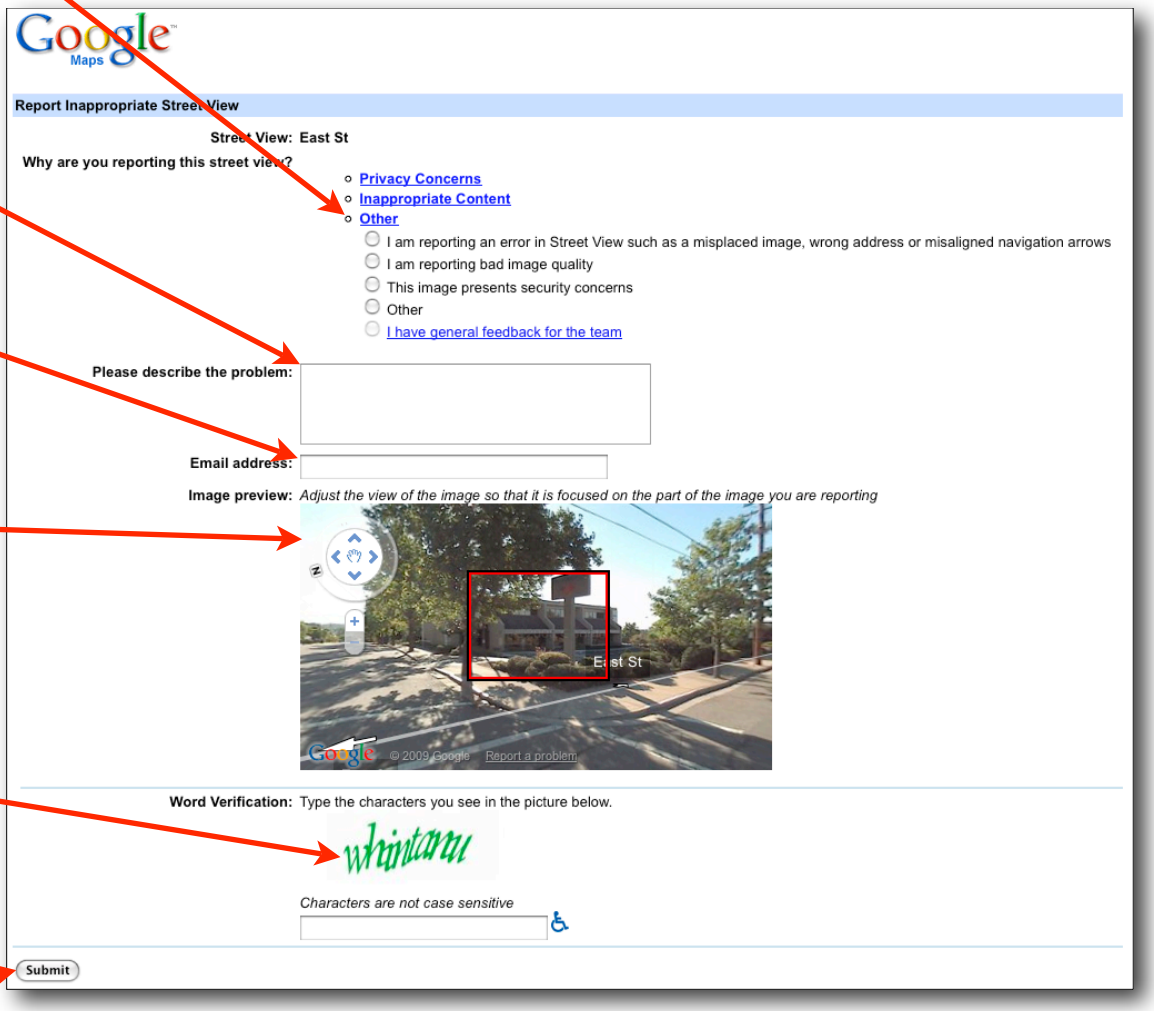
Step 4: Describe the problem.

Step 5: Enter your email address.

Step 6: Change the image view so that it is focused on the part of the image with the problem you are reporting.

Step 7: Type the word you see in the word verification section.

Step 8: Click the submit button.



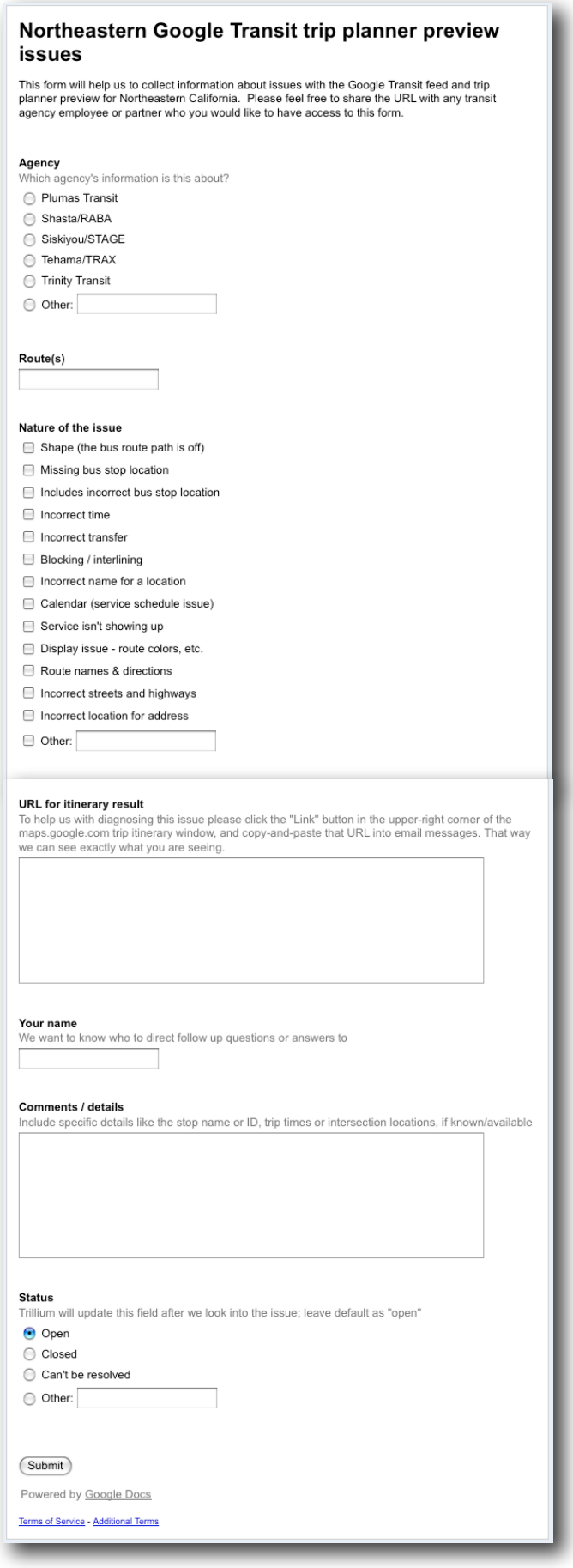
Transit layer:

Reporting issues with the transit layer

Issues you may encounter with the transit layer include:

- Shape (bus route path is off)
- Missing bus stop location
- Incorrect bus stop location
- Incorrect time
- Incorrect transfer
- Blocking / interlining
- Incorrect name for a location
- Calendar (service schedule issue)
- Service isn't showing up
- Display issue - route colors, etc.
- Route names & directions

Trillium Solutions has created the form show here for Trillium-supported agencies to report problems with the transit layer.



Northeastern Google Transit trip planner preview issues

This form will help us to collect information about issues with the Google Transit feed and trip planner preview for Northeastern California. Please feel free to share the URL with any transit agency employee or partner who you would like to have access to this form.

Agency
Which agency's information is this about?
- ○ Plumas Transit
- ○ Shasta/RABA
- ○ Siskiyou/STAGE
- ○ Tehama/TRAX
- ○ Trinity Transit
- ○ Other:

Route(s)

Nature of the issue
- ☐ Shape (the bus route path is off)
- ☐ Missing bus stop location
- ☐ Includes incorrect bus stop location
- ☐ Incorrect time
- ☐ Incorrect transfer
- ☐ Blocking / interlining
- ☐ Incorrect name for a location
- ☐ Calendar (service schedule issue)
- ☐ Service isn't showing up
- ☐ Display issue - route colors, etc.
- ☐ Route names & directions
- ☐ Incorrect streets and highways
- ☐ Incorrect location for address
- ☐ Other:

URL for itinerary result
To help us with diagnosing this issue please click the "Link" button in the upper-right corner of the maps.google.com trip itinerary window, and copy-and-paste that URL into email messages. That way we can see exactly what you are seeing.

Your name
We want to know who to direct follow up questions or answers to

Comments / details
Include specific details like the stop name or ID, trip times or intersection locations, if known/available

Status
Trillium will update this field after we look into the issue; leave default as "open"
- ◉ Open
- ○ Closed
- ○ Can't be resolved
- ○ Other:

Submit

Powered by Google Docs

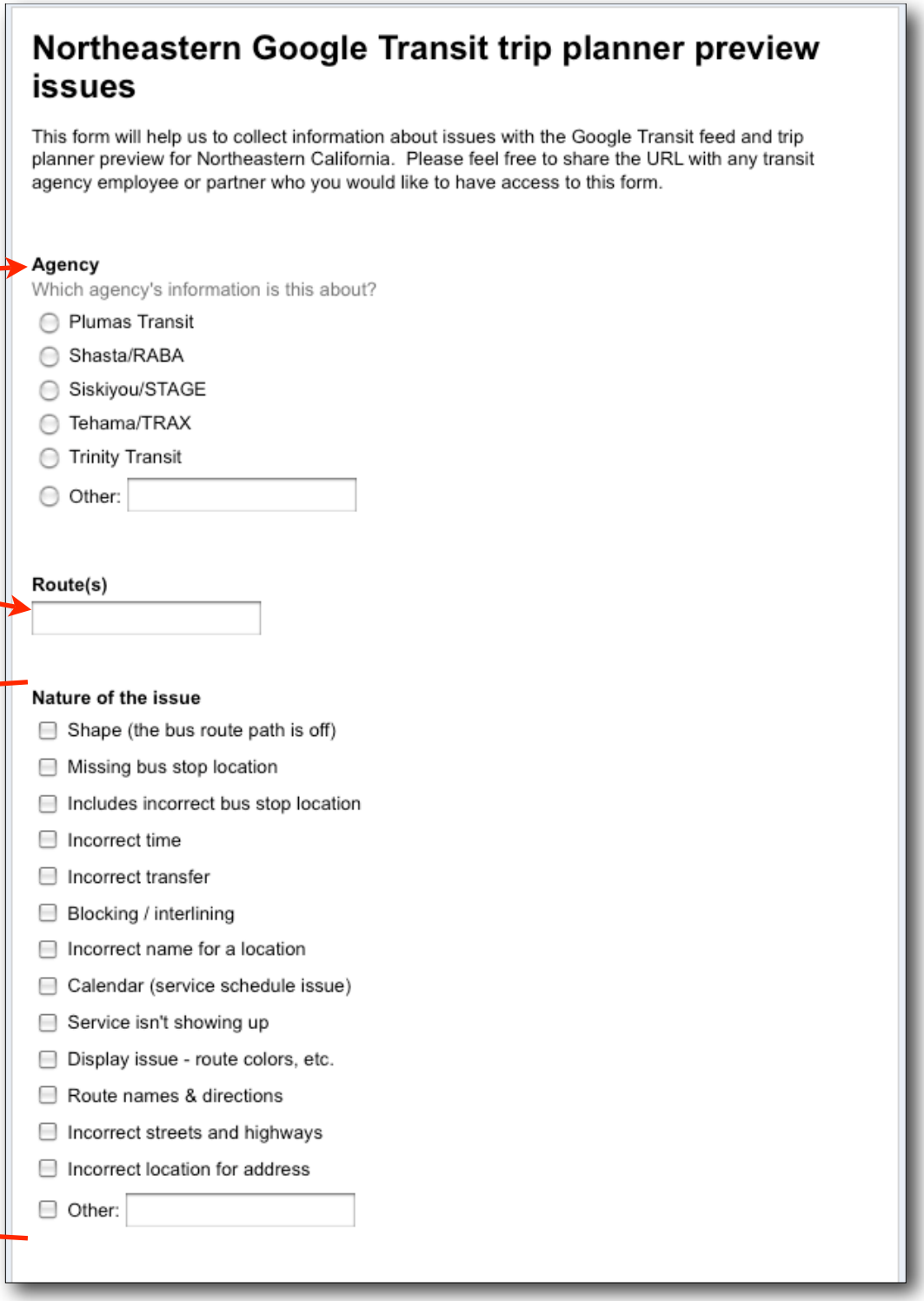
Terms of Service - Additional Terms

Step 1: Point your browser to http://tinyurl.com/d9n5hj

Step 2: Select your agency.

Step 3: Indicate the route(s) effected.

Step 4: Indicate the nature of your issue.



Northeastern Google Transit trip planner preview issues

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Agency

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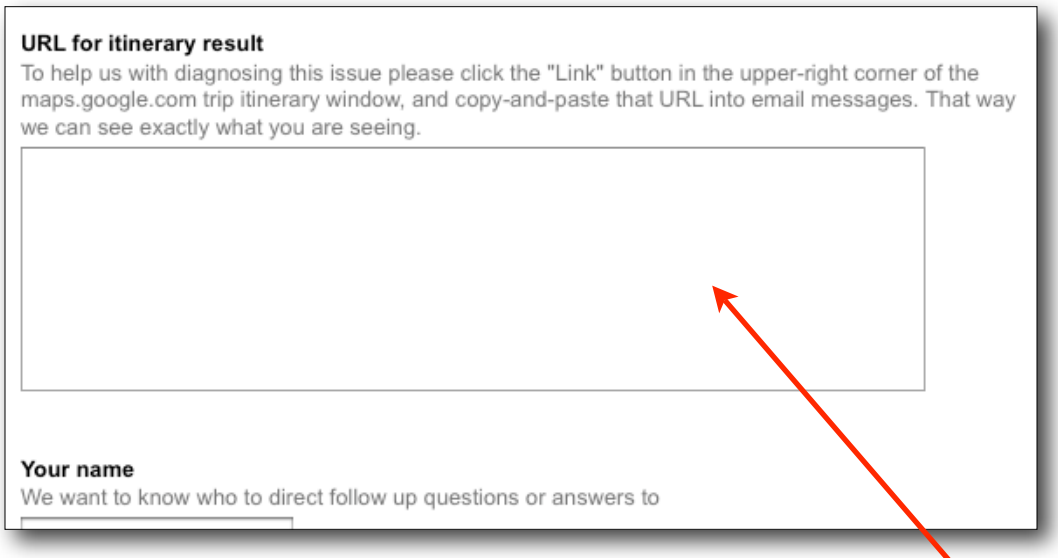
- ○ Plumas Transit
- ○ Shasta/RABA
- ○ Siskiyou/STAGE
- ○ Tehama/TRAX
- ○ Trinity Transit
- ○ Other:

Route(s)

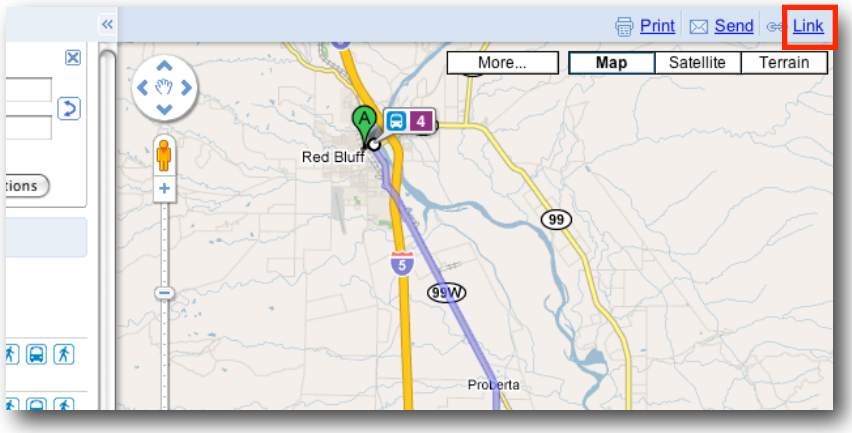
Nature of the issue

- ☐ Shape (the bus route path is off)
- ☐ Missing bus stop location
- ☐ Includes incorrect bus stop location
- ☐ Incorrect time
- ☐ Incorrect transfer
- ☐ Blocking / interlining
- ☐ Incorrect name for a location
- ☐ Calendar (service schedule issue)
- ☐ Service isn't showing up
- ☐ Display issue - route colors, etc.
- ☐ Route names & directions
- ☐ Incorrect streets and highways
- ☐ Incorrect location for address
- ☐ Other:

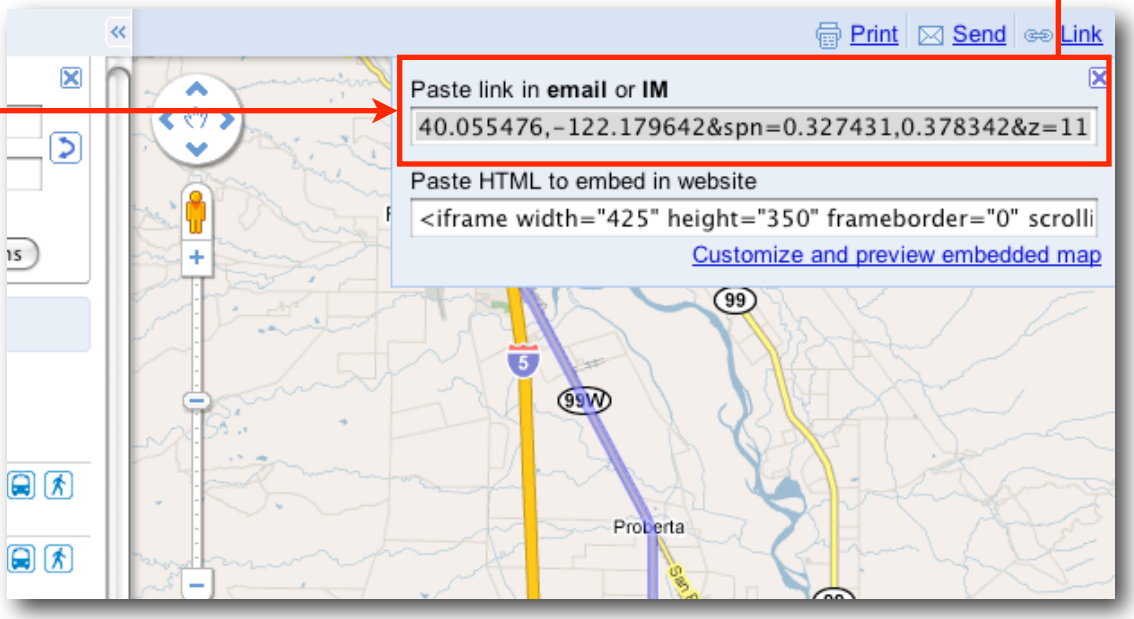
Step 5: Copy and paste the URL for the problem that you are describing. This is extremely important information for diagnosing the problem.



Click the “Link” button in the upper right of the map.



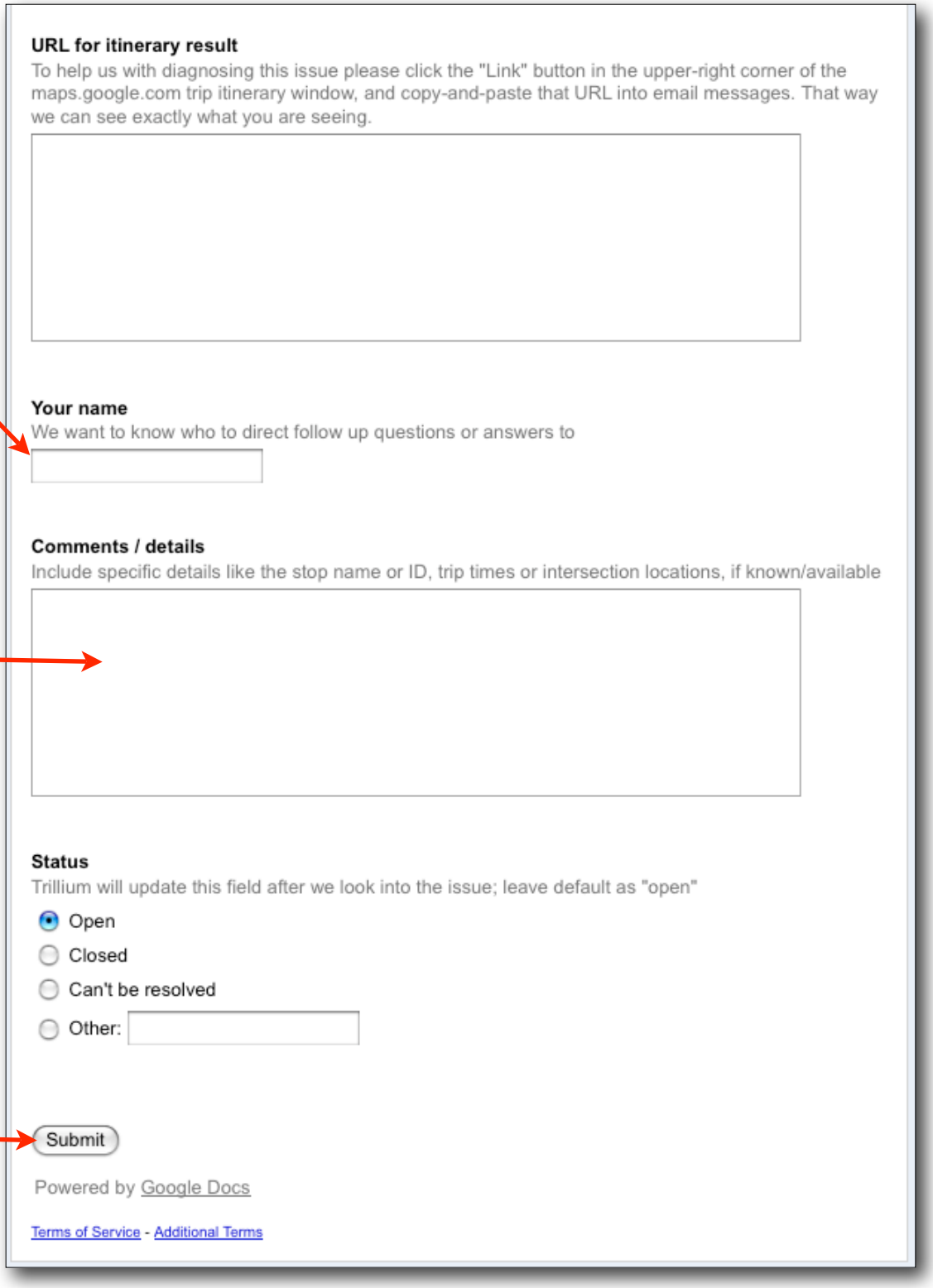
Copy and paste the link into the “URL for itinerary result” section of the issue reporting form.



Step 6: Enter your name so that we know who to correspond with.

Step 7: Enter any comments or details that may help with diagnosing the problem, such as what the problem is, stop name, trip times or intersection locations.

Step 8: Click “Submit.”



URL for itinerary result

To help us with diagnosing this issue please click the "Link" button in the upper-right corner of the maps.google.com trip itinerary window, and copy-and-paste that URL into email messages. That way we can see exactly what you are seeing.

Your name

We want to know who to direct follow up questions or answers to

Comments / details

Include specific details like the stop name or ID, trip times or intersection locations, if known/available

Status

Trillium will update this field after we look into the issue; leave default as "open"

- (•) Open
- ( ) Closed
- ( ) Can't be resolved
- ( ) Other:

Submit

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Terms of Service - Additional Terms

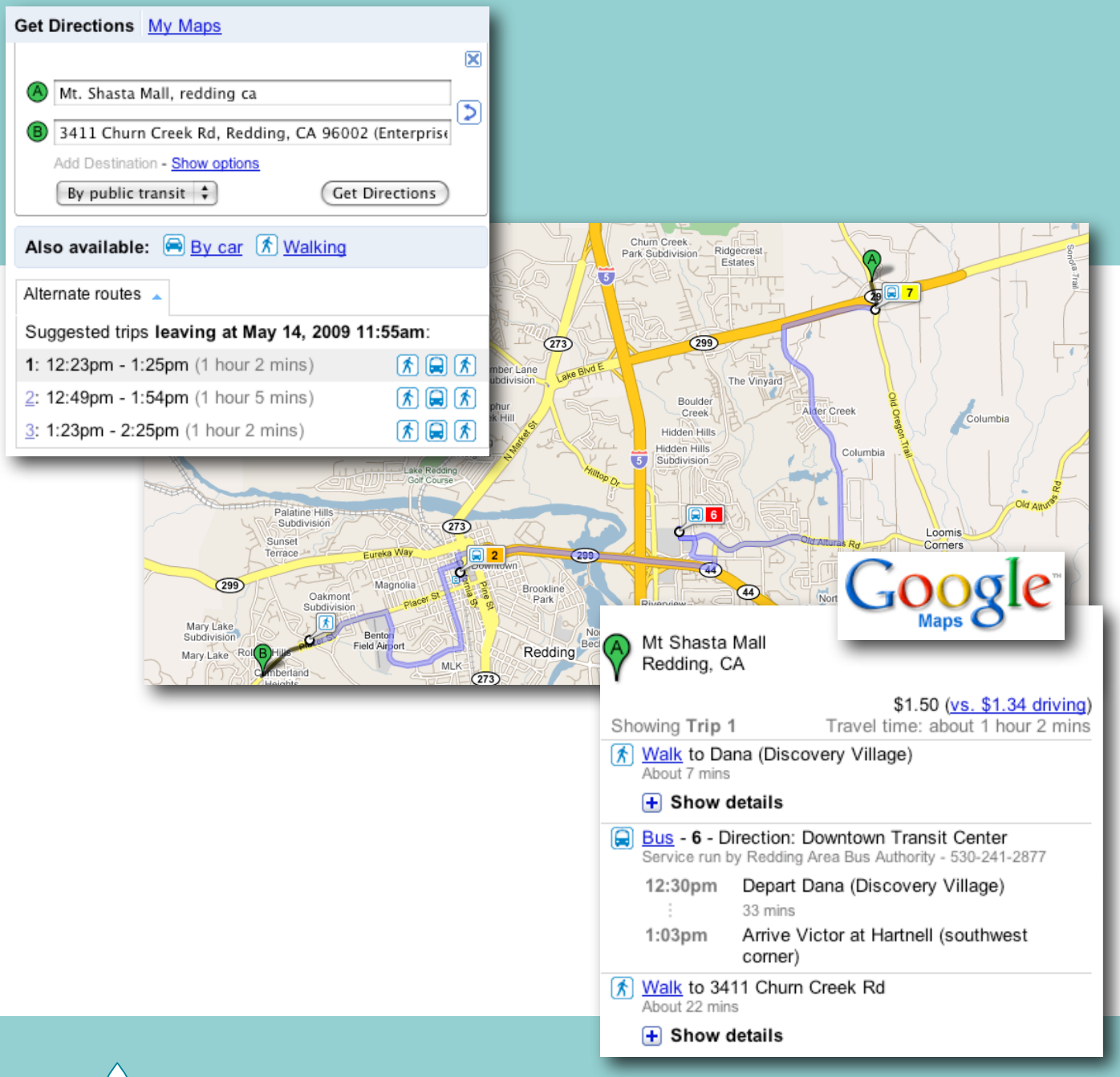
Appendix F:

Using the Google Transit trip planner preview for RABA

Using Google Transit

Non-public preview version

REDDING AREA BUS AUTHORITY



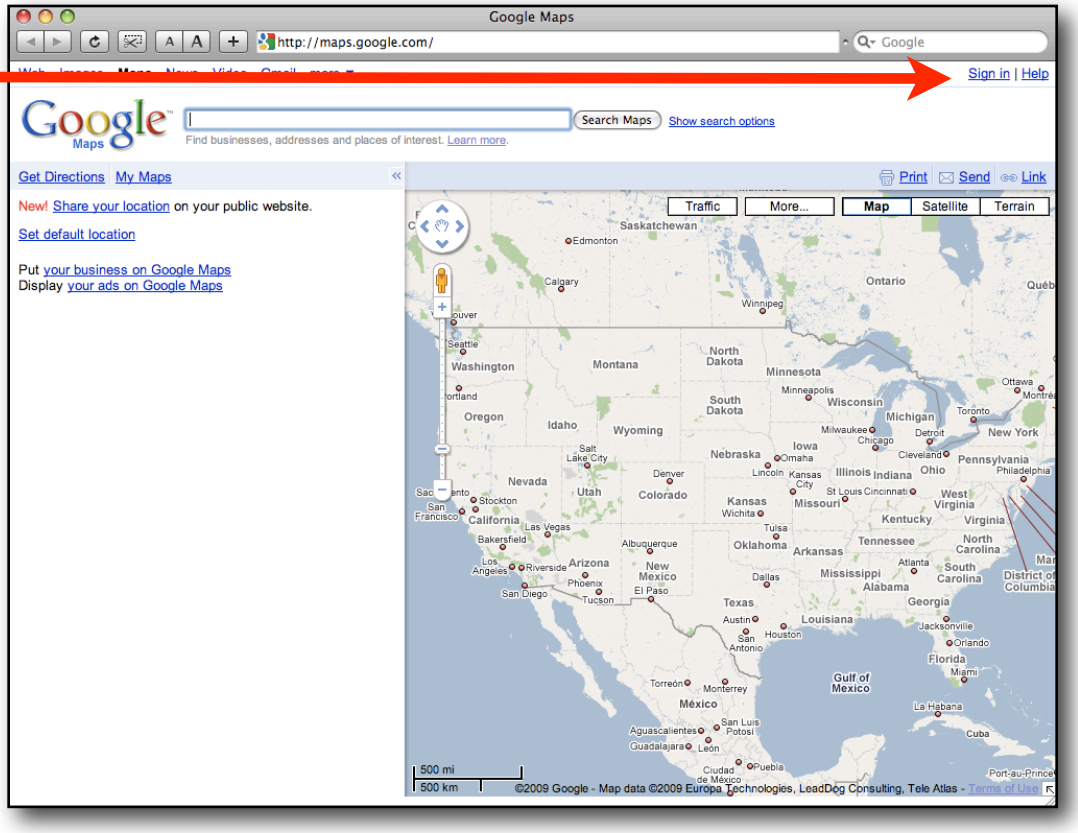
Trillium

TRANSIT INTERNET SOLUTIONS

Signing in

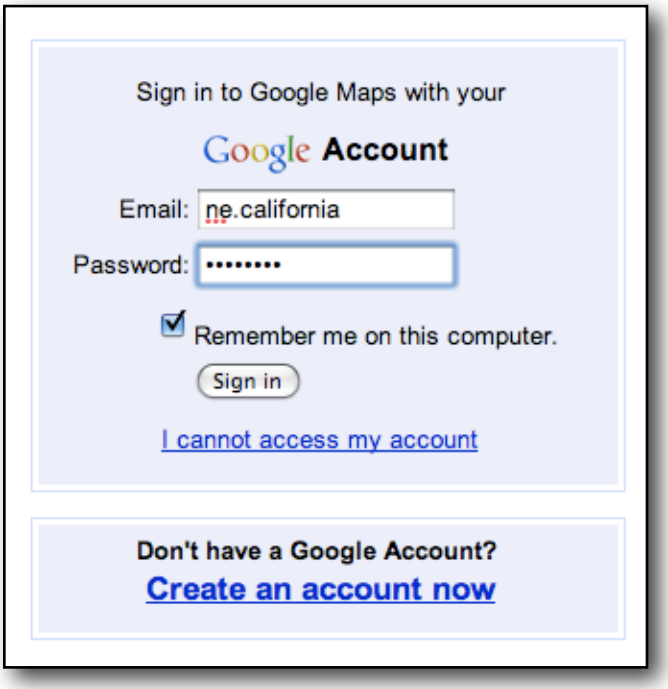
First, point your web browser to maps.google.com

Click “Sign In” in the upper right corner.



Sign in using the following login information:

Email: ne.california
Password: mobility

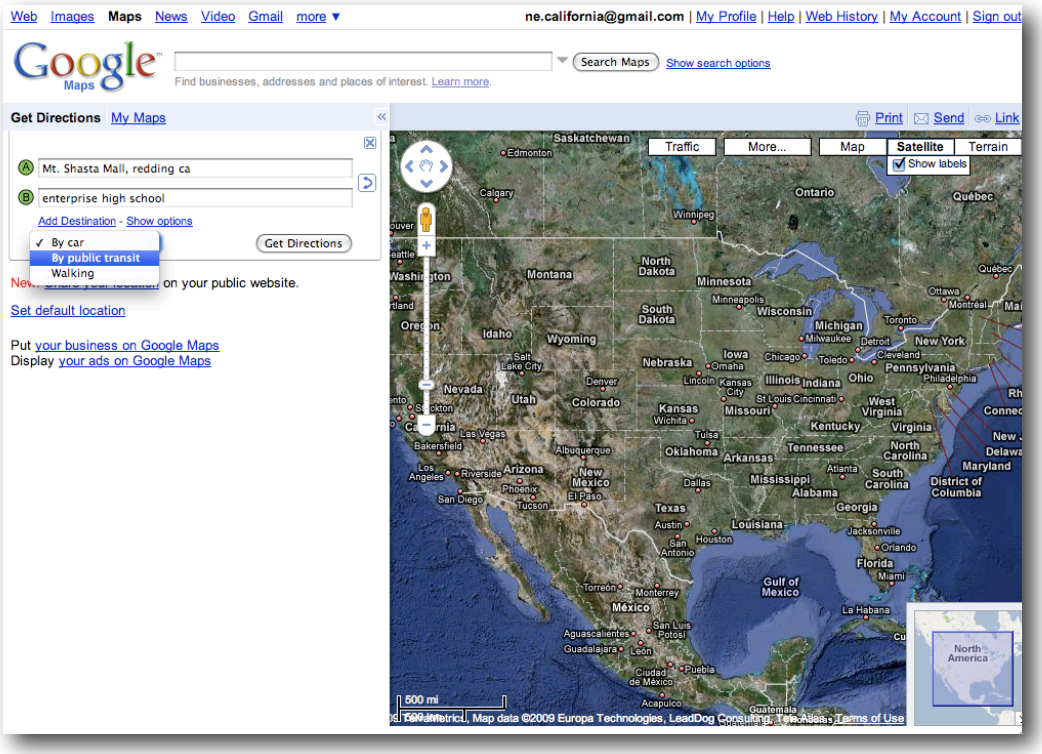


Planning a trip

Now you can search for a trip.

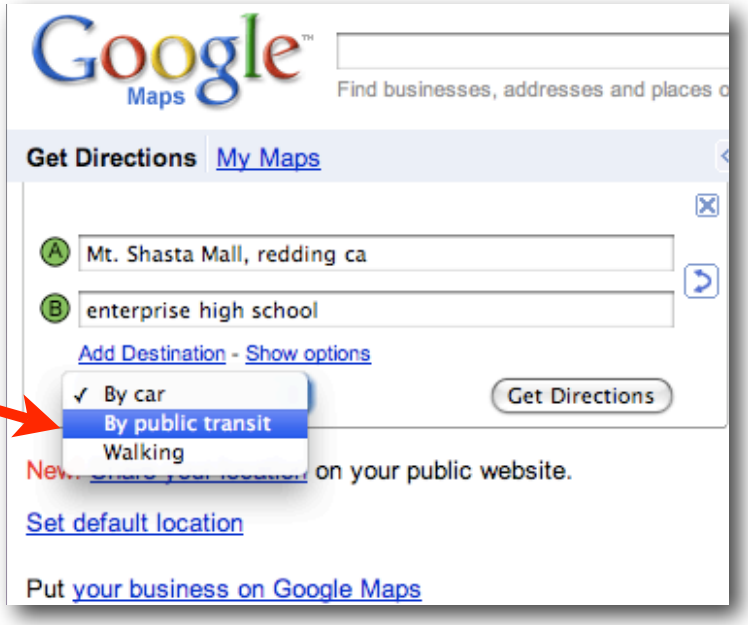
Enter your origin in the box next to the green “A” circle.

Enter your destination in the box next to the green “B” circle.

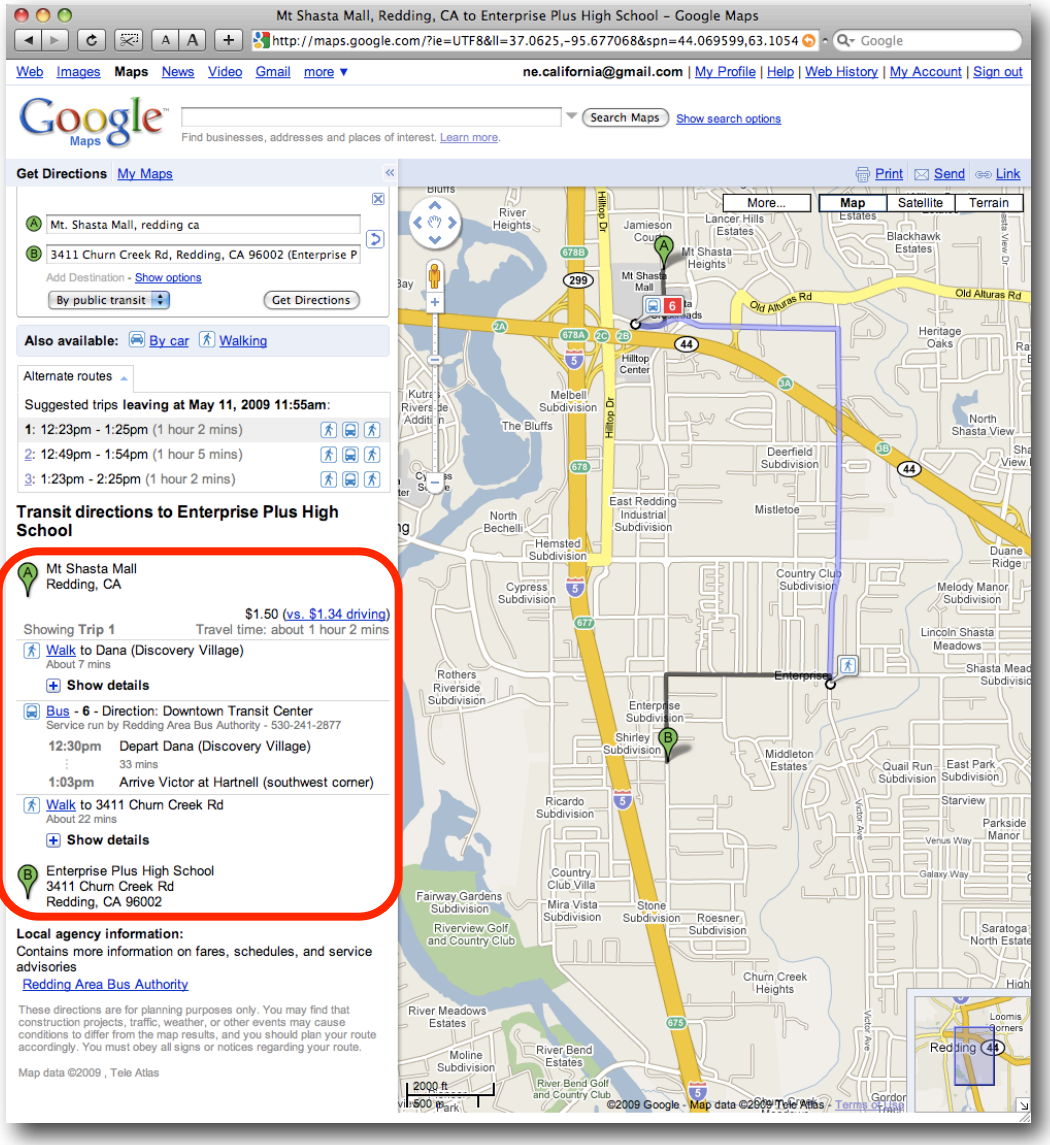


Select “By public transit”

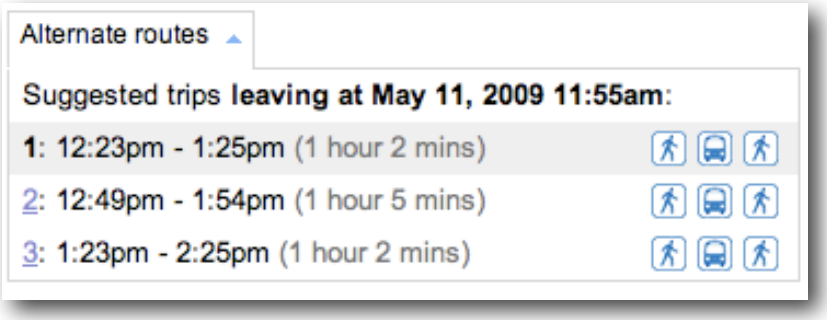
and click the “Get Directions” button.



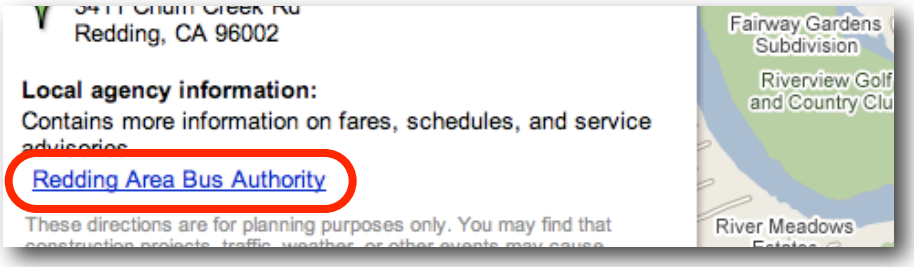
The trip planner will show you an itinerary with walking and transfer directions as necessary...



...options for different trips, which you can see by clicking on them...

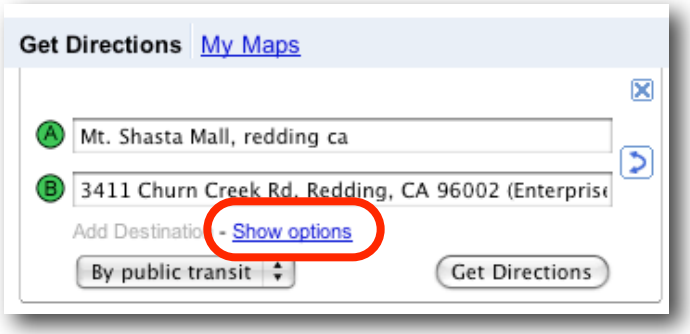


...as well as a link to RABA's website where you can find more detailed information about the agency's services.

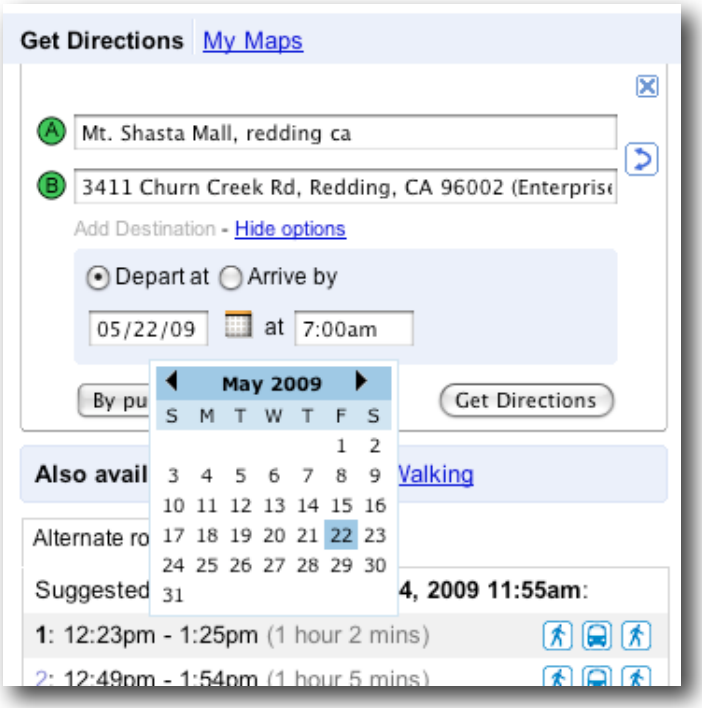


Selecting specific dates and times

To search for trips at different times or dates, click “Show options.”

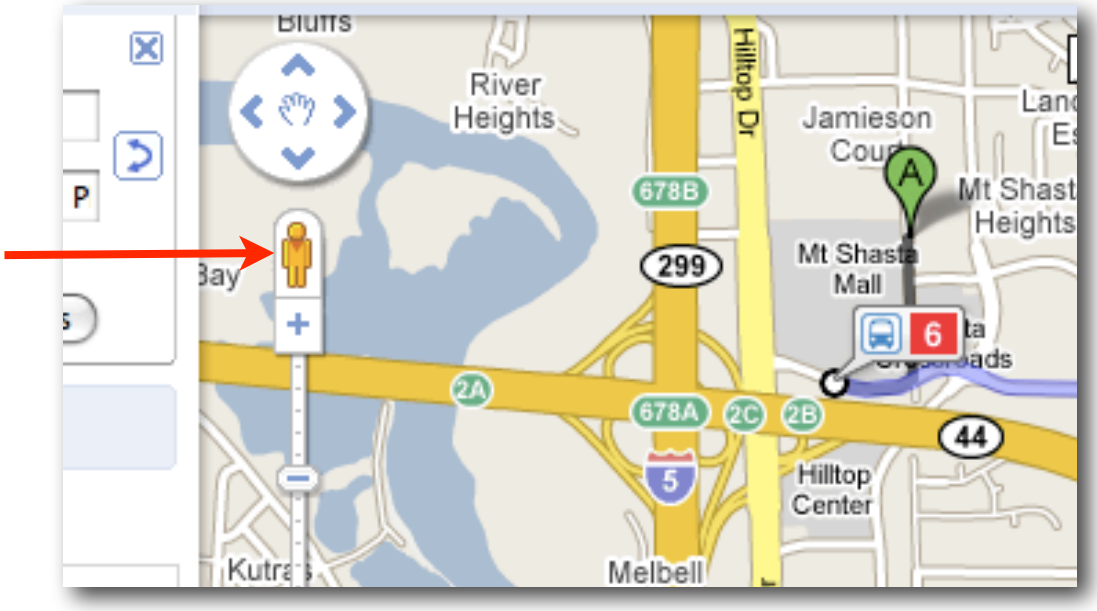


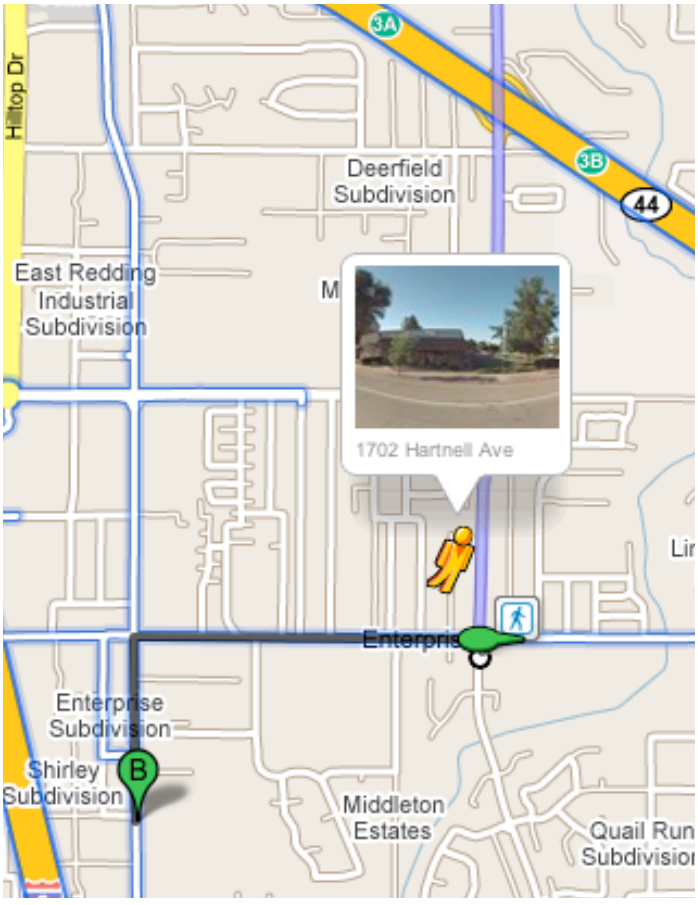
Enter the date and time you want to depart at or arrive by and click “Get Directions.”



Street view

To see what a bus stop looks like from the street level, drag and drop the orange Street View man to the location on the map you want to see.

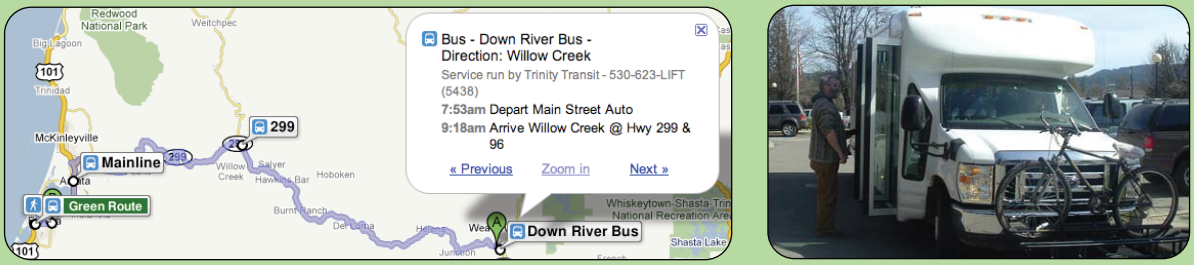


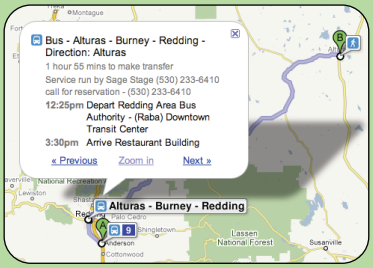


Northern California Google Transit Feasibility Study

FINAL

Pilot project and full implementation roadmap for
Inyo, Lassen, Modoc, Mono, Plumas, Shasta,
Siskiyou, Tehama, and Trinity counties





Shasta County Regional Transportation Planning Agency

October 2009

Trillium
TRANSIT INTERNET SOLUTIONS

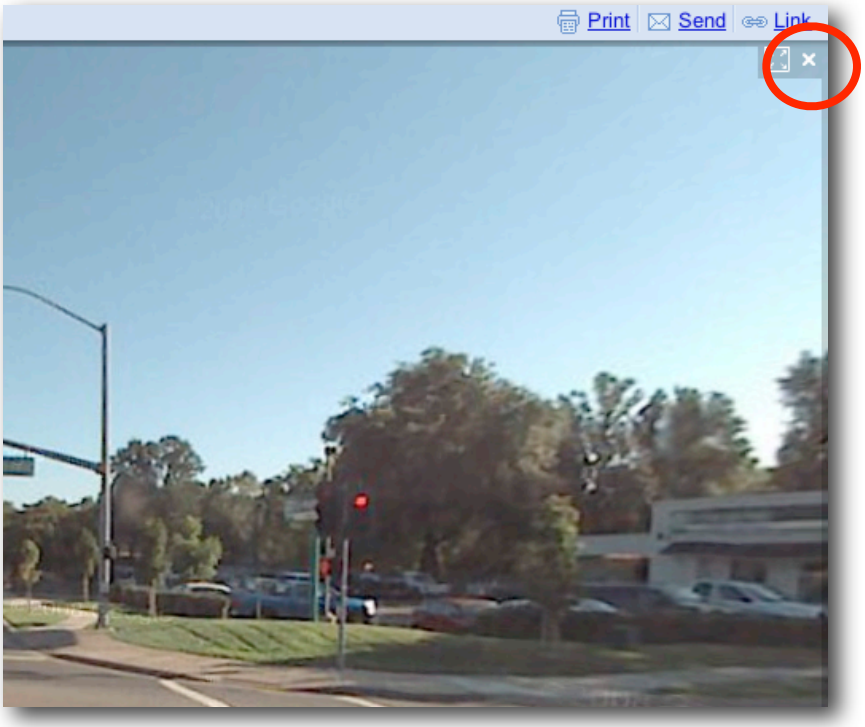
in association with

Nelson|Nygaard
consulting associates

You can see a 360 degree view by grabbing a part of the screen with your cursor and pulling it right or left.

To move along the street, click the arrows alone the grey street line.

To return to the map view, click the “x” in the upper right corner of the screen



Appendix G:

Google Transit trip planner survey for RABA

[This is a copy of the draft electronic survey intended for distribution to Shasta SSTAC.]

Redding Area Bus Authority is in the process of evaluating Google Transit as a new passenger information tool. Your assistance to evaluate the tool will help improve it. Please complete this survey after you have used the Google Transit trip planner preview for RABA. Thank you for your help!

All questions are optional.

Your name (optional): _____

What are your role(s) related to public transit?

- Public transit user
- Social service provider
- Other: _____

Have you used the internet for travel planning before? (including driving directions, public transit directions, walking direction, etc)

- Yes
- No

If yes, how often do you use the internet for travel planning?

- A few times per year
- 1-3 times per month
- More than once per week
- Other: _____

Do you think Google Transit would meet your public transit trip planning needs?

- Yes
- No
- No sure
- Other: _____

What types of information would be most useful to you or your clients?

Are there any ways that the interface could be improved to be easier to use?

Did you experience any specific problems with the trip planner? If yes, please describe.

Do you see yourself using this tool in the future ...for yourself ... for social service clients ? Do you see your clients using this tool directly?

Appendix H: Literature review

The following documents were reviewed in the preparation of this document:

- "211 California Rural Mobility Management Planning Study" prepared for Caltrans Division of Mass Transportation by 2-1-1 California (February 2009)
- Eastern Sierra Transit Authority Business Plan (2008)
- Draft Inyo County Regional Transportation Plan (2008)
- Draft Eastern Sierra Transit Authority Short Range Transit Plan (2008)
- Lassen County Transit Development Plan (December 2006)
- Modoc County Regional Transportation Plan (2005)
- Non-emergency Medical Transportation Coordination Plan for Modoc, Lassen and Plumas Counties, prepared for Modoc County Transportation Commission (October 2006)
- Redding Area Bus Authority Marketing Plan (2009-2010)
- Shasta County 2009-2010 Unmet Transit Needs Assessment
- Siskiyou County Short Range Transit Plan (2007-2012)
- Trinity County Transit Development Plan (March 2009)
- Tehama County Transit Development Plan (2002-2007)
- Tehama County Regional Transportation Plan (2005)
- Coordinated Human Services Transportation — Public Transit Plans for Lassen, Inyo, Mono, Modoc, Plumas, Shasta, Siskiyou, Tehama, and Trinity Counties (2008 & 2009)
- Trinity County Transit Development Plan (March 2009)
- California Statewide Rural Intercity Bus Study (2008)

Appendix I: Selected bibliography

Cain, Alasdair. Design Elements of Effective Transit Information Materials. Rep. Nov. 2004. National Center for Transit Research Center for Urban Transportation Research, University of South Florida. 22 Apr. 2009.

Study describes methodology for assessing customer information products. Describes issues with traditional transit wayfinding products.

"California Coordinated Plan Resources Center." California Department of Transportation.. 21 June 2009 <http://www.dot.ca.gov/hq/MassTrans/Coord-Plan-Res.html>.

Source for strategies, plans, and barriers to coordinated coordinated mobility throughout California.

California Department of Transportation. Division of Mass Transportation. 211 California Rural Mobility Management Planning Study. By 211 California Partnership under the leadership of 211 LA County. 2009.

Outlines goals, strategy, and opportunity for integrated 2-1-1 Information & Referral and Mobility Management throughout California.

Google Maps Help Group. 13 July 2007. Google. 18 June 2009 <http://tinyurl.com/mfrq88>.

Google Maps issues are discussed here. Archives are searchable.

"Google Transit Feed Specification." Google Code. 29 Apr. 2009 <http://code.google.com/transit/spec/transit_feed_specification.html>.

Describes the data format for Google Transit feed data.

"Google Transit Partner Program." Google Transit Paterner Program FAQ. Google. 29 Apr. 2009 <http://maps.google.com/help/maps/transit/partners/faq.html#genq2>.

Overviews requirements for agencies to participate in Google Transit.

Johnson-Weinberger, Dan; Sly, Tom. "Googling the future." More Riders Magazine, Spring 2009. Volume 1, Issue 2, Pages 5-18. <http://www.trilliumtransit.com/blog/2009/04/30/how-google-transit-is-more-than-just-another-trip-planner-more-riders-magazine/>.

Interview with Tom Sly of Google on the Google Transit project.

McHugh, Tim; McHugh Bibiana; and Antrim, Aaron. "Open source and open data make for transit innovation." More Riders Magazine Sept. 2008. 11 Sept. 2008. <http://www.trilliumtransit.com/blog/2008/09/11/trimet-innovations-in-transit-data-publishing/>.

Interview on TriMet (Portland, OR) open data practices and benefits.

"Trend Data | Pew Internet & American Life Project." Pew Internet & American Life Project. Pew Research Center. 29 Apr. 2009 <http://www.pewinternet.org/Data-Tools/Download-Data/Trend-Data.aspx>.

Snapshot of internet user demographics in the United States.

Appendix J:

Communication with Google

Topic: Representing deviated routes and dial-a-ride service in GTFS

From: Aaron Antrim <aa...@arcatacommunity.org>
Date: Sat, 21 Mar 2009 15:06:29 -0700
Local: Sat, Mar 21 2009 3:06 pm
Subject: Discussion: deviated fixed route / flex routes / general service dial-a-ride

This is an ambitious proposal, but this need has been coming up more frequently in my work recently, so I'm trying to get a conversation started. Hopefully this is a useful jumping-off point.

NEED
- An increasing number of agencies that offer deviated fixed route or flexible route service and/or a mixture of deviated with conventional fixed routes are interested in participating in Google Transit.
- Some agencies have chosen not to participate in Google Transit because they offer some deviated fixed-route service. Participating without representing their deviated fixed-route service would mean that passengers would receive accurate trip itineraries where fixed-route service is the only available travel option, but would be misled without seeing all available transportation options in cases where deviated fixed-route service is available.
- At least two agencies I know of that currently participate in Google Transit offer forms of deviated fixed-route or flexible service, Dallas Area Rapid Transit and Rio Vista Delta Breeze. There are likely more.
- Some areas offer general service dial-a-ride, which can be a useful alternative mode for people evaluating transportation options on Google Maps.

BACKGROUND / DEFINITIONS
- Deviated fixed route is service service that runs along an established path, and arrives/departs timing points at preset times, but which can deviate from the established path for door-to-door pickups and drop-offs within specific defined areas or zones, and then returns to the fixed route path. With these types of service, there is frequently a tiered fare structure, with one fare for curb-to-curb service (with both pickup & dropoff along the fixed route), and an additional fare for door-to-door service (where the vehicle travels off of the fixed route)
- Point-deviation services also keep to a timetable, however, vehicles do not follow a specific route. Rather, vehicles will stop at designated bus stops at scheduled times, but during the time between two scheduled stops drivers will pick up and drop off passengers with advanced reservations over a dispersed area. (from http://tinyurl.com/d62smv)
- General service dial-a-ride is the most extreme form of flexible service. In most areas, dial-a-ride service is only available to eligible seniors or disabled citizens, but in some areas, these services are available to the general public.
- For these types of service, advance reservations are usually required.

PREVIOUS DISCUSSION Gregory J Feazell and Joe Hughes had a short discussion about this issue in Sep 2008, http://tinyurl.com/czjk8p

IDEAS

GTFS additions/changes:

- Add a shape_id field to stops.txt. shape_id would reference a shape in shapes.txt. Shapes referenced by a stops.txt record would be treated as closed polygons that indicate the bounds of a service area for dial-a-ride or flex route service. Referencing demand service bounds through stops.txt would mean the existing zone_id field in stops.txt could be used in defining fare_rules for travel between demand response service, or fixed route service zones.
- shape_dist_traveled would be ignored for every stop_times.txt row that references a stop which references a polygonal zone.
- modification of route_type field based on existing proposal (http://tinyurl.com/dkz7by) with the addition of values for dial-a-ride, deviated fixed route, and point deviation.
- addition of adv_reservation_secs field to routes.txt that indicates how soon reservations must be made for travel on the service in seconds.
- change meaning of value 2 for pickup_type and drop_off_type to "Advance reservations required," rather than "Must phone agency…," because more agencies are looking into, or implementing web-based reservation systems
- incorporate proposal similar to proposal for agency_ticket_url (http://tinyurl.com/c547mk) to enable advance reservations for a demand response trip through an agency's own web-based system

Representing common forms of service in GTFS:
- A general dial-a-ride service could be described by a trip with only two stop times, both of which reference stop locations that include a shape_id for polygonal bounds. A row in frequency.txt would indicate the bounds of service hours.
- A deviated fixed route trip could be described by stop_times.txt rows that reference discrete stop locations interspersed with rows that reference polygonal bounds.

Potential trip planner behaviors/display:
- Deviations within the service bounds would be indicated by arrows in a similar fashion to Google Transit's walking indicator prior to the introduction of beta walking directions (the "before" in this image: http://tinyurl.com/d2m4dg). The fixed route of the vehicle for a journey would be drawn as it usually is now, by drawing lines between discrete stop locations referenced in a trip in stop_times.txt, or by the segment of a trip traveled which is described in shapes.txt.
- For itineraries where advance reservations are required (involving an origination or destination location where pickup_type or drop_off_type is 2), a message will be displayed that says "Reservations are required x hours x minutes in advance", or, for agencies that use agency_ticket_url, the trip planner will provide a link to a web-based reservations/ticketing system.
- It may be necessary to suppress exact times from being shown in an itinerary for demand response services where travel time depends less on traveler choice and more on agency scheduling and availability. This behavior could be controlled with values in route_type.

Thoughts? Needs? Problems?

From: Roger Selvin
Date: Sun, 22 Mar 2009 10:30:35 -0000 (UTC)
Local: Sun, Mar 22 2009 3:30 am
Subject: RE: [gtfs-changes] Discussion: deviated fixed route / flex routes / general service dial-a-ride

Aaron

Perhaps I can offer the following comments in relation to how the UK standards deal with related issues, and also on what limitations I see with any approach. This explanation relates to UK standards for regional and national journey planners - from which two regions are now exporting selected data to Google Transit. If we are to generate data for Google related to flexible services we would need to the concepts to be broadly the same.

In the UK we have the usual differences in flexible services.

We have Hail-and-Ride operations where a bus will stop anywhere along a section of route (rather than having defined fixed stopping points). Schedules of such services are fixed - but we have the concept of a stop which has an anchor location, together with an entry location and an exit location for the section of road that is Hail-and-Ride. We aim for each section to be along only one named road - but on long roads we would break the sections every half-mile or so ... in order that journey plans can be reasonably precise. We also needed a notation on mapping to show what segments of a route were hail-and-ride.

We then have dial-a-ride (demand responsive) services which range from many-to-one through to full many-to- many operations - with or without a published "schedule". Some are semi-fixed route (fixed route with some deviations) ... others are completely flexibly routed. For all these services there is an implicit conflict between journey planning which relies on the certainty of a schedule, and the operation of a service which by its very nature is uncertain in demand-responsive mode. What we find we have to use comprises stop zones - similar to the Hail-and-Ride stop in that it has an anchor point, but instead of it having an entry and exit point, it instead has a polygon defined by multiple points that contain the local area in which the service is available. To give some certainty for journey planning times, we seek to limit the zones to perhaps a 1 mile radius - but each location requires different treatment. We then have a timetable which can be reasonably conventional if the route is "fixed with deviations" ... albeit every time has to be commented that it is approximate because of the effect of deviations along the way. But for many-to-many operations the timetable is a work of fiction - and contains unachievable times between points in the service area, simply because most O/D pairs of zones would not be covered in any single vehicle working. But what it does is to allow a journey plan to be offered with the need to "pre-book - when more accurate times will be confirmed". The skill is in creating the dummy timetable so that it works reasonably well for most types of journey - and particularly the ones that are made most often. And so that it creates good connections to trunk services - as these types of demand-responsive services are often used in feeder mode to longer distance services.

So from our experience with this suggests that we need to be able to define different stop types "Hail-and-Ride" and "Flexible Service Zone" - both of which have an anchor location, and then supplementary location data (two for HAR stops for entry/exit and multiple points for FLX zones).

We do not use shape files in our offerings to Google so I have not thought about how these arrangements would work with them.

And then there needs to be clear and clever guidance about how to specify a timetable for such services - so that journey plans for the more flexible demand responsive operations are credible without necessarily being "accurate" until the journey is booked with the operator/agency.

I look forward to seeing other contribuitions to this discussion.

Best wishes

Roger
traveline south east, UK

From: Aaron Antrim <aa...@arcatacommunity.org>
Date: Tue, 24 Mar 2009 22:05:52 -0700 (PDT)
Local: Tues, Mar 24 2009 10:05 pm
Subject: Re: Discussion: deviated fixed route / flex routes / general service dial-a-ride

Roger: I think that the service types you listed could be adequately described in GTFS with something like my proposed extension.

For hail-a-ride service, it is possible to add a dense row of stops along the street in a hail-a-ride zone. Not very clean GTFS data, but maintaining this could be automated in a GTFS publishing tool.

Many-to-one (I think this means several passengers from different locations all going to the same destination) service availability could be indicated with a stop time that references a service area (shape) and a later stop time at a discrete stop location.

Many-to-many service availability could be indicated by two (or more) service boundaries (shapes) referenced in a trip.

Note that I don't think it will be possible to return maps and trip itineraries that show how the vehicle will actually travel, because this travel will depend on demand. Rather, the goal here is to describe service availability and give enough information to send passengers to the right place to reserve their travel.

How would you suggest representing the services you described in GTFS?

From: Joe Hughes <joe.hughes.c...@gmail.com>
Date: Tue, 31 Mar 2009 23:08:19 -0700
Local: Tues, Mar 31 2009 11:08 pm
Subject: Re: [gtfs-changes] Discussion: deviated fixed route / flex routes / general service dial-a-ride

Thanks for posting such a thorough and thoughtful proposal on these issues, Aaron!

A few quick thoughts on this:

* This one's going to need a great deal of testing; it would be very helpful to have one or more sample feeds that we can iterate on for the purposes of discussion.

* It's clear that we'd need some way to represent polygons for flexible coverage areas. Rather than overloading shapes.txt (which comes close to acting as a way to define route patterns), it'd probably be better to add a new "polygons.txt" file for representing closed regions/shapes.

* Is anyone in the group using existing software/databases to represent this kind of information? We'll get the most benefit from this proposal if we end up with a model that's compatible with existing data. (Roger, thanks for your comments in this direction.)

Joe

From: "Roger Slevin" <ro...@slevin.plus.com>
Date: Wed, 1 Apr 2009 07:29:10 +0100
Local: Tues, Mar 31 2009 11:29 pm
Subject: RE: [gtfs-changes] Re: Discussion: deviated fixed route / flex routes / general service dial-a-ride

Joe

I am very short of time to follow this up right now - but I can tell you that my colleagues on traveline east midlands have many flexibly-routed services in parts of their region - and data about these services is being supplied already in the traveline east midlands feed to Google Transit.

I have not examined how we are handling this in detail ... but I suspect that we are simply using the anchor point in each service zone (polygon) and presenting each of these as if they were a conventional stop. That allows journey planning to happen (but it probably misses the key information that pre-booking is required) - and the transit "bubbles" likewise will show indicative times without any indication that most of them are unlikely to represent actual bus movements at that location (or even in that particular service zone) as the timetable includes far more service zones than could actually be served at any particular time ... each declared time at a particular zone's anchor represents an "opportunity" for a service to run at about that time.

I will try to get back to looking at this in more detail - but it is unlikely to be until sometime next week that I will be able to do so.

From: Aaron Antrim <aa...@arcatacommunity.org>
Date: Tue, 7 Apr 2009 12:24:43 -0700
Local: Tues, Apr 7 2009 12:24 pm
Subject: Re: [gtfs-changes] Re: Discussion: deviated fixed route / flex routes / general service dial-a-ride

> * It's clear that we'd need some way to represent polygons for
> flexible coverage areas. Rather than overloading shapes.txt (which
> comes close to acting as a way to define route patterns), it'd
> probably be better to add a new "polygons.txt" file for representing
> closed regions/shapes.

Joe: I like this idea (polygons.txt). I think it may also be good to plan for open, as well as closed, shapes in this file. Roger mentioned "Hail-and-Ride" areas where a vehicle will stop at any section of a route, rather than at discrete, fixed locations.

* This one's going to need a great deal of testing; it would be very

> helpful to have one or more sample feeds that we can iterate on for
> the purposes of discussion.

I have a few current and prospective clients that are interested in publishing information on flexible and dial-a-ride services. As soon as we develop a reasonable proposal, I can work with them to create or update feeds that take advantage of it.

From: Joe Hughes <joe.hughes.c...@gmail.com>
Date: Tue, 7 Apr 2009 13:21:09 -0700
Local: Tues, Apr 7 2009 1:21 pm
Subject: Re: [gtfs-changes] Re: Discussion: deviated fixed route / flex routes / general service dial-a-ride

On Tue, Apr 7, 2009 at 12:24 PM, Aaron Antrim <aa...@arcatacommunity.org> wrote:
>> * It's clear that we'd need some way to represent polygons for
>> flexible coverage areas. Rather than overloading shapes.txt (which
>> comes close to acting as a way to define route patterns), it'd
>> probably be better to add a new "polygons.txt" file for representing
>> closed regions/shapes.

> Joe: I like this idea (polygons.txt). I think it may also be good to plan
> for open, as well as closed, shapes in this file. Roger mentioned
> "Hail-and-Ride" areas where a vehicle will stop at any section of a route,
> rather than at discrete, fixed locations.

For hail-and-ride sections along a fixed route, it seems like it would be more efficient and easier to process to specify two points along the existing trip shape (via shape_dist_traveled) than to try to match a completely separate polyline.

>> * This one's going to need a great deal of testing; it would be very
>> helpful to have one or more sample feeds that we can iterate on for
>> the purposes of discussion.

> I have a few current and prospective clients that are interested in
> publishing information on flexible and dial-a-ride services. As soon as we
> develop a reasonable proposal, I can work with them to create or update

> feeds that take advantage of it.

Great! The other ingredient we'll need is a client that can use this information; perhaps we can enlist one of the open-source routing engine projects to help experiment with this functionality.

Joe

From: Nicholas Albion <nalb...@gmail.com>
Date: Tue, 7 Apr 2009 16:20:38 -0700 (PDT)
Local: Tues, Apr 7 2009 4:20 pm
Subject: Re: Discussion: deviated fixed route / flex routes / general service dial-a-ride

Would it be more efficient to store the polygons in WKT format?

http://en.wikipedia.org/wiki/Well-known_text
(Unfortunately, WKT is comma-paired, space delimited while KML is space-paired, comma delimited)

Perhaps in the interest of keeping things simple for producers, the geometry type could be assumed to be either LINESTRING or POLYGON depending on the number of pairs of brackets and the start/end (but this would make SQL import a little more complicated)

(3 4,10 50,20 25)
((1 1,5 1,5 5,1 5,1 1),(2 2, 3 2, 3 3, 2 3,2 2))
((3 4,10 50,20 25),(-5 -8,-10 -8,-15 -4))
(((1 1,5 1,5 5,1 5,1 1),(2 2, 3 2, 3 3, 2 3,2 2)),((3 3,6 2,6 4,3 3)))

Polygons/linear rings could also be used to describe
- fare zones
- agency/feed coverage
- city/state/country borders

If either WKT or KML was adapted for a row-per-shape format, the "shapes.txt" could possibly also support the similar format as an alternative to the current row-per-node convention (and indicated as such in "feed_info.txt").

Once again, I think it would be very useful if feed producers were encouraged (or even allowed, if not enforced) to provide extra information in "shapes.txt":
-stop_id (would make route planning about 10-100 times faster)
-altitude (useful for mashing with bicycle planners, but probably too much effort for most producers)

From: "Roger Slevin" <ro...@slevin.plus.com>
Date: Wed, 8 Apr 2009 08:11:48 +0100
Local: Wed, Apr 8 2009 12:11 am
Subject: RE: [gtfs-changes] Re: Discussion: deviated fixed route / flex routes / general service dial-a-ride

Nicholas

Traveline south east does not supply Google with shapes.txt data - we have such a large network (it is the largest in Google Transit) and we have no way of creating shapes without a lot of effort - and we would have difficulties in avoiding infringing

someone's IPR in so doing. So we rely on stops to define the points which need to be connected.

In Great Britain the national data standard defines a Hail-and-Ride stop by three pairs of coordinates ... the central "anchor" which we currently send to Google (and therefore acts as a proxy for the Hail-and-Ride) ... and associated records which currently do not go to Google, which comprise the "entry" point to the Hail-and-Ride section, and the "exit" point from it.

For Demand Responsive Services which have "areas of service" then the polygons are defined by a sequential series of paired coordinates ... the first and last of which must be identical to complete the polygon (or you could work with the implication that the last one always joins back to the first one in the list).

I think these requirements need to be flagged separately ... because a Hail-and-Ride route might well be defined in such a way that would create a legitimate triangular polygon that could be a demand-responsive service area.

I don't think I have a particular preference for format - I am not technically involved in the production of the GTDF export. My assumption is that the format would be consistent with current position records - but if there is an alternative that is more helpful, I imagine we would have few problems in using one of the formats you mention.

Roger

From: T Sobota <tsob...@cityofmadison.com>
Date: Fri, 3 Apr 2009 06:44:46 -0700 (PDT)
Local: Fri, Apr 3 2009 6:44 am
Subject: Crosspost/Forward: Paratransit (demand response) addition to trip planning engine?

Suggestion on original posting below in Google Transit Trip Planner
Group to cross-post here.

---------- Forwarded message ----------
From: T Sobota <tsob...@cityofmadison.com>
Date: Apr 1, 4:12 pm
Subject: Paratransit (demand response) addition to trip planning engine?
To: Google Transit Trip Planner

Thought open for further discussion:

Under the regulations of the United States Amercians with Disabilities Act, transit operators must provide users unable to use fixed route modes of transportation complimentary service in a demand response (paratransit) environment. These guidelines broadly include items like picking up and dropping off riders at points within 3/4 of a mile of fixed route modes of transit providing "regular" service, while allowing latitude to require things like advanced booking, schedule/ travel time flexibility and fare premiums.

Presently, Google maps can generate travel itineraries for a user by foot (walking), transit (fixed route, regularly scheduled modes), and driving (personal vehicle). I can envision a fourth, albeit limited, option which would be "paratransit", with the itinerary not being timed as much as stating "eligible" or "ineligible" based on the service parameters of the transit operator. There would seem to be some relatively basic additions that could be made to a transit feed database, that could inform this "eligibility" value of Google maps' itinerary planning engine - given the traditonal user inputs of origin point, destination point, date and time. Due to the dynamic nature of paratransit service, I can't envision a "third party" trip planner being able to deliver an accurately timed itinerary (typically the user calls in advance to a request a trip at a desired time, then the trip is subsequently booked with perhaps an offset for efficiency reasons, and then the trip is open to further fluctuations at the time of actual journey).

Upon inital thought, there would need to be geographic definitions of polygons and attribute data (days and times of paratransit eligibility), fare information (to the extent it differs from fixed route modes), and perhaps service parameter rule text (users must call transit operator by a certain time, or x hours in advance of trip request).

While a paratransit rider may be able to derive an eligibility estimate by modeling a fixed route trip (does such an itinerary exist using fixed route modes from a point within 3/4 of a mile of their origin to a point within 3/4 of their destination at their request date and time of travel), limitations on the service area of paratransit trips like jurisdictional boundaries or ineligible "commuter" modes of fixed routes may obscure an accurate assessment in this manner.

Tim Sobota
Transit Planner
Metro Transit, City of Madison (WI)

From: Aaron Antrim <aa...@arcatacommunity.org>
Date: Sun, 5 Apr 2009 13:44:58 -0700
Local: Sun, Apr 5 2009 1:44 pm
Subject: Re: [gtfs-changes] Crosspost/Forward: Paratransit (demand response) addition to trip planning engine?

Hi Tim,

Last month, a discussion began on how to represent non-fixed route services in GTFS: http://groups.google.com/group/gtfs-changes/browse_frm/thread/cc18612...

So far, discussion has been oriented around representing general service flexible and dial-a-ride service, not paratransit/ADA services. However, many questions are shared: how to represent geographic boundaries, costs, service hours / days, etc.

Your comments on any additional needs or problems that you see with the (very rough draft / discussion purposes only) proposal would be useful and appreciated.

Aaron

From: T Sobota <tsob...@cityofmadison.com>
Date: Mon, 6 Apr 2009 06:17:26 -0700 (PDT)
Local: Mon, Apr 6 2009 6:17 am
Subject: Re: Crosspost/Forward: Paratransit (demand response) addition to trip planning engine?

Aaron-

I have been following the related discussion on what I was perceiving was fixed-route side DR itinerary planning. I was seeing what I understood to be goals of representing actual itinerary results, which I could envision based on the nature of fixed-route DR services (a vehicle is "scheduled" to be serving an area on a day-in day-out basis at specific times, typically with a minimum number of fixed nodes where passengers might even be able to board without advance notice to provider, etc.).

I had started a new thread to target the ADA complimentary paratransit style of demand response service. In my experience, this is much more of an ad hoc operation, indeed trips are frequently subcontracted to private taxi providers by the fixed route operator. While some paratransit riders obviously have daily travel patterns, and it could happen that a series of such passengers may be served by the same vehicle plying the same routing on a daily basis, that vehicle still does not have a "daily" schedule that fits into a trip planning model. Rather, ride requests are typically batched together on a nightly basis - then dispatched the following morning to the operating fleet, and through the course of the day rides may be added/ deleted/modified per conditions.

In sum, my paratransit concept was ignoring entirely a goal of producing an actual itinerary for a user... but rather just returning an initial analysis of whether their requested origin and destination point, at their requested date and time of travel, fell within the eligibility guidelines of the paratransit service area of the provider. From a provider persepective, this could result in some decrease in call volumes to the ride bookers/customer service staff, freeing call takers to book and confirm rides rather than determining eligibility.

From: Edward Vielmetti <edward.vielme...@gmail.com>
Date: Mon, 6 Apr 2009 09:23:19 -0400
Local: Mon, Apr 6 2009 6:23 am
Subject: Re: [gtfs-changes] Re: Crosspost/Forward: Paratransit (demand response) addition to trip planning engine?

I'll add to support for paratransit and shared ride services; there are at least three or four here in Ann Arbor, include one fueled by waste oil from fryers at a restaurant that uses it as a "burrito bus", and getting those routes or even contact and region areas into Google Transit would be a huge win for late night and weekend transit here where the fixed route operators cut back on traffic.

thanks

Ed

ps I have a SMART (metro Detroit) GTFS data set for the asking - if you asked once ask again please, I got it via FOIA.

From: Aaron Antrim <aa...@arcatacommunity.org>
Date: Tue, 7 Apr 2009 12:10:52 -0700
Local: Tues, Apr 7 2009 12:10 pm
Subject: Re: [gtfs-changes] Re: Crosspost/Forward: Paratransit (demand response) addition to trip planning engine?

Hi Tim:

Fixed route demand response service can already be described in GTFS. This looks like a trip where all pickup_type and drop_off_type for all stop times is 2. Currently, however, these services do not show up in the Google Transit trip planner (only scheduled service with drop_off_type or pickup_type of 0 or 3, regularly scheduled, or must coordinate with driver, is returned).

However, non fixed-route service availability cannot currently be described.

Representing general service dial-a-ride or flexible service and paratransit dial-a-ride or flexible service would require identical GTFS capabilities to describe the time/day and area bounds of available service. For paratransit/ADA service, individual elderly/disabled, etc. eligibility requirements would also need to be included.

Seeing this overlap, I suggest we work together for to develop one proposal for a GTFS modification to enable describing day / time and service area bounds for dial-a-ride and flex route services. The proposal could include the capability to describe elegibility requirements for paratransit services, or that could be added later.

My original post suggested a way to describe dial-a-ride.

> A general dial-a-ride service could be described by a trip with only
> two stop times, both of which reference stop locations that include a
> shape_id for polygonal bounds. A row in frequency.txt would indicate
> the bounds of service hours.

However, your point that service availability, rather a set schedule, needs to be described is key. Do you have any suggestions on how to best do this? Other thoughts / suggestions?

Aaron

Topic: Trip planner response to queries where desired travel time is more than 48 hours in advance of available service

From: Brendan Ford-Sala
Date: Wed, 6 May 2009 12:13:01 -0700 (PDT)
Local: Wed, May 6 2009 12:13 pm
Subject: Queries more than 48 hours before trip

I've been looking at the Plumas feed in preview and have found a problem with the Reno route (ID 127).

SEARCH FOR 1-2 DAY/WEEK SERVICE
This route travels between Quincy, CA and Reno, NV twice a week, Monday and Friday. If one queries more than 48 hours before the trip, a return is not generated. This is a significant limitation to using GT for 1-day and 2-day services. Is there something that can be done to change this?

Thanks,
Brendan

Trillium Solutions
www.trilliumtransit.com

From: Tom B
Date: Mon, 18 May 2009 09:36:08 -0700 (PDT)
Local: Mon, May 18 2009 9:36 am
Subject: Re: Queries more than 48 hours before trip

There is no short-term fix, but we know about the problem and will get to it.

Topic: "Direction" is irrelevant / misleading for loop routes

From: Aaron Antrim
Date: Sun, 5 Apr 2009 15:36:09 -0700 (PDT)
Local: Sun, Apr 5 2009 3:36 pm
Subject: "Direction:" is irrelevant / misleading for looping routes

The trip planner always shows a direction or headsign after the route name. For trips where a trip_headsign, was not defined, the trip planner uses the last stop name in the trip as the headsign. This is confusing in the case of looping routes.

Here is an example loop trip: http://tinyurl.com/d28um6

Screenshot highlighting the direction:
http://trilliumtransit.com/temp_files/direction_on_loop_route.png

I suggest that for trips that start and end at the same location, they should treated as direction-less, so no "Direction:" would be shown.

Topic: Specifying call-ahead and "must coordinate with driver" pick up and drop off types.

From: Aaron Antrim
Date: Tue, 24 Mar 2009 19:23:38 -0700 (PDT)
Local: Tues, Mar 24 2009 7:23 pm
Subject: pickup_type / drop_off_type

Google Transit Partner Support:

I've used the pickup_type and drop_off_type fields in stop_times.txt to specify stop times where riders must phone the agency to arrange pickup (2) and must must coordinate with the driver (3) or phone agency (2) for dropoff.

The results in the trip planner are somewhat different than I expected.

Here are examples from Redwood Coast Transit (Del Norte County, CA), currently in preview.

Trinidad, CA to Crescent City, CA: http://tinyurl.com/d39ood (This trip works as expected. Pickup and drop off types are regularly scheduled.)

Shell Station, McKinleyville, CA to Crescent City, CA http://tinyurl.com/d8qlms (The Shell Station pickup_type is 2, must phone agency. Passengers are not shown an option to board RCT Bus 20 at this location. trip_id is 1226, begins at 10:10am. stop_id is 2686.)

Crescent City, CA to Shell Station, McKinleyville, CA http://tinyurl.com/dhuzcs (The Shell Station drop_off_type is 3, must coordinate with driver. It would be useful for passengers to see a message that they need to coordinate with the driver for drop off at this stop. If they do not request drop off, it is my understanding the bus may not exit to McKinleyville. trip_id is 1221, begins at 14:20. stop_id is 2686.)

Other client agencies of Trillium which may be affected by a similar issue are:
- Rio Vista Delta Breeze (live)
- Lake Tahoe airporter (preview)
- Tehama Rural Area Express (preview)
- Plumas Transit (preview)

From: Tom B
Date: Thu, 2 Apr 2009 11:51:24 -0700 (PDT)
Local: Thurs, Apr 2 2009 11:51 am
Subject: Re: pickup_type / drop_off_type

The only thing the current trip planner does with pickup_type and drop_off_type is omit stop_times with type "1 - No pickup available" and "2 - Must phone agency to arrange drop off". In hindsight we probably didn't need the field in the original spec (released on 2006-09-25) and haven't removed it because it would break backwards compatibility of GTFS.

How important is adding a warning for stop_times with "3 - Must coordinate with driver to arrange pickup/drop off"? My guess is that asking for help when riding an unfamiliar, long distance and infrequent service is always a good idea, independent of any warning.

From: Aaron Antrim
Date: Fri, 10 Apr 2009 17:04:43 -0700 (PDT)
Local: Fri, Apr 10 2009 5:04 pm
Subject: Re: pickup_type / drop_off_type

Tom,

I've asked around about this.

Of course, it is always a good idea to coordinate with the driver on long distance trips. With the example of RCT, in fact, drivers are directed to ask passengers where they are bound. However, this doesn't happen every time. Del Norte / Redwood Coast Transit said it would be useful to have a warning that says passengers should coordinate with the driver for drop-off.

I also asked Modoc / Sage Stage about on-request stops. They are not including some request stops in their Google Transit feed without being able to indicate that more clearly.

Most agencies would like to include all or most potential stops in Google Transit. It may not always make sense or be risky to do this, however, if the bus may not take an exit or travel a side-segment if no one asks to be dropped off or calls the agency to be picked up at that location. A passenger could easily get the idea that the bus will normally stop at or travel by a particular location if Google Transit returns the stop in an itinerary.

What Trillium has started to do with some feeds we publish is change the names of certain stops to provide more information (STOP NAME... must phone agency in advance). A limitation of this approach is that it is not possible to represent reservation-only and regularly- scheduled service at that same stop (without publishing two different stop records in the same location).

It would be helpful for several agencies if it were possible to return trips that are pickup/dropoff type 2 (must phone agency) with an appropriate message, and to return a message that instructs passengers to coordinate with the driver (for drop-off / pickup type 3).

If Google decides to implement some or all of this, I'd be happy to query and work with clients to suggest language for these messages.

Topic: Frequencies and loop routes

From: Aaron Antrim <aa...@arcatacommunity.org>
Date: Tue, 10 Mar 2009 11:25:03 -0700
Local: Tues, Mar 10 2009 11:25 am
Subject: PROPOSAL: Frequencies.txt for loop routes

GTFS-changes group:

I work for several systems that operate loop routes. Usually, these involve the same vehicle traveling the route to start and end at the same location.

I do not believe it is possible to specify that reoccurring trips defined with frequencies.txt belong to one vehicle block. In order to avoid publishing a feed where the GT trip planner would tell a rider to transfer to the same route at the top of a looping schedule, I re-create trip for each looped run of the day and assign the same block_id to them.

This isn't hard to do with my software, but it seems inefficient. Here's a proposal to add a column to frequencies.txt, "block_headway_secs." This describes the interval, in seconds, between when the same vehicle will serve a given stop.

Here's an example usage:
trip_id,start_time,end_time,exact_times,headway_secs,block_headway_secs
WEEKDAY1,06:00:00,21:00:00,1,1800,3600
WEEKEND1,08:00:00,19:00:00,1,3600,3600

WEEKDAY1 shows a scenario where buses run every half-hour, but the loop takes one hour to complete. The same vehicle comes by every hour. Therefore, each frequency-based trip would be assigned to an alternating block.

WEEKEND1 shows a scenario where buses run every hour, and the loop takes one hour to complete. The same vehicle comes by every hour. headway_secs and block_headway_secs are equal. Most frequency-based loops would be like this (in fact, of the clients I have worked for, all of them have been), but I figure it is good to leave the door open for variation.

This is a first stab. Thoughts?

Aaron

On Thu, May 3, 2007 at 2:32 PM, Fred Fang wrote:

> Hi Aaron,

> We currently do not support the notion of blocks in the frequencies.txt file.
> We are investigating how best to support this. In the interim, if you require
blocks,
> please create separate trips and link them using the block id.

> Please visit the feed specification often to see how we intend to support blocks
> in the frequencies.txt file.

> Thanks!

> Fred

> On 5/2/07, Aaron Antrim <aa...@arcatacommunity.org> wrote:

>> Hi,

>> I am working to represent transit agency data with "loop" routes -
>> hourly routes where the same vehicle travels in a circle, visiting the
>> same location at the same number of minutes past the hour, every hour.

>> This means the trip reoccurs every hour, but not with a new vehicle.

>> Now with frequencies.txt it's possible to specify trip_id, start_time,
>> end_time, and headway_secs for reoccurring trips.

>> There's also the block_id field in trips.txt: "Optional. The block_id
>> field identifies the block to which the trip belongs. A block consists
>> of two or more sequential trips made using the same vehicle, where a
>> passenger can transfer from one trip to the next just by staying in
>> the vehicle. The block_id is dataset unique." (http://code.google.com/
>> transit/spec/transit_feed_specification.htm)

>> I want to specify a trip frequency, but what I read in the Google
>> Transit Feed Spec seems to suggest Google Transit will assume that a
>> new vehicle is being used for each reoccurring trip. I'm not sure I
>> see a way of using the block_id feature to help, hear, either, as
>> there are no other trips for this one "loop trip" to be associated
>> with in a block.

>> The only solution I can think of is to create many successive trips,
>> each with the same set of stop times spaced 1 hour apart and link them
>> together with one block id, but I hope there is an easier way to do
>> this that I am overlooking that will involve less redundancy.

>> Thanks,
>> Aaron Antrim

From: Tom Brown <tom.brown.c...@gmail.com>
Date: Tue, 10 Mar 2009 20:03:03 -0700
Local: Tues, Mar 10 2009 8:03 pm
Subject: Re: [gtfs-changes] PROPOSAL: Frequencies.txt for loop routes

On Tue, Mar 10, 2009 at 11:25, Aaron Antrim <aa...@arcatacommunity.org>wrote:

> GTFS-changes group:

> I work for several systems that operate loop routes. Usually, these
> involve the same vehicle traveling the route to start and end at the
> same location.

> I do not believe it is possible to specify that reoccurring trips
> defined with frequencies.txt belong to one vehicle block. In order to
> avoid publishing a feed where the GT trip planner would tell a rider
> to transfer to the same route at the top of a looping schedule, I
> re-create trip for each looped run of the day and assign the same
> block_id to them.

> This isn't hard to do with my software, but it seems inefficient.

I haven't looked at your data files but suspect we are talking about saving
~100kB-1MB. While this might be a large percentage it isn't much in absolute
terms.

Everything we add to the spec makes it a little more complex to understand
and parse. I think this change adds quite a bit of complexity (see questions
at bottom) and provides at least these benefits:
1) lower disk and network usage
2) being able to represent looping routes as continuous *and* at a fixed
frequency

Without your proposed change a looping route can be continuous using blockid
(leaving the parser to work out the frequency using heuristics) xor provide
easy to use frequency information.

Google's trip planner treats trips defined in frequencies+trips+stop_times

with exact_times=1 almost identically to those that are strictly
trips+stop_times. Do other consumers of GTFS handle frequency defined trips
in more radical ways?

> Here's a proposal to add a column to frequencies.txt,
> "block_headway_secs." This describes the interval, in seconds,
> between when the same vehicle will serve a given stop.

> Here's an example usage:
> trip_id,start_time,end_time,exact_times,headway_secs,block_headway_secs
> WEEKDAY1,06:00:00,21:00:00,1,1800,3600
> WEEKEND1,08:00:00,19:00:00,1,3600,3600

> WEEKDAY1 shows a scenario where buses run every half-hour, but the
> loop takes one hour to complete. The same vehicle comes by every
> hour. Therefore, each frequency-based trip would be assigned to an
> alternating block.

> WEEKEND1 shows a scenario where buses run every hour, and the loop
> takes one hour to complete. The same vehicle comes by every hour.
> headway_secs and block_headway_secs are equal. Most frequency-based
> loops would be like this (in fact, of the clients I have worked for,
> all of them have been), but I figure it is good to leave the door open
> for variation.

Does it make sense to use block_headway_secs when exact_times != 1?
Should we require that block_headway_secs is >= end_time - start_time?
(start_time and end_time meaning the first and last times for the trip in
stop_times)
Should we require that headway_secs > block_headway_secs?
What about transitions between frequencies.txt lines with the same trip_id
and different headway_secs?

In general I think exact_times=1 is very convenient for manually created
feeds but has yet be demonstrated as very valuable to data consumers. If
there are people manually creating looping frequency defined routes then
your proposal with the constraint headway_secs == block_headway_secs would
be very handy.

From: Aaron Antrim <aa...@arcatacommunity.org>
Date: Wed, 11 Mar 2009 20:17:05 -0700
Local: Wed, Mar 11 2009 8:17 pm
Subject: Re: [gtfs-changes] Re: PROPOSAL: Frequencies.txt for loop routes

My goal with this proposal is to reduce/streamline data complexity and
maintenance as a feed publisher, and to find a clearer way of describing
loop routes. It is more a statement of need rather than a concrete spec
change proposal.

> Without your proposed change a looping route can be continuous using blockid
> (leaving the parser to work out the frequency using heuristics) xor provide
> easy to use frequency information.

> Google's trip planner treats trips defined in frequencies+trips+stop_times
> with exact_times=1 almost identically to those that are strictly
> trips+stop_times. Do other consumers of GTFS handle frequency defined trips
> in more radical ways?

In all of the cases I have encountered, block_headway_secs would equal
headway_secs. It sounds as GTFS may already allow for what I am after in
these cases. Currently, if I were to submit a feed right now where:
- TRIP1 ran on frequency FREQ1
- was assigned to BLOCK1

- the duration of the trip (last departure_time for TRIP1 - first
departure_time for TRIP1) < headway_secs
- first stop_id of TRIP1 = last stop_id of TRIP1
then would all these reoccuring trips be considered part of the same block
in Google Transit (and they would see in-seat transfers?)

The reason I suggested adding block_headway_secs, was that I saw it as a way
of describing possible cases I assume are out there but don't have examples
for. The proposal is more theoretical than practical in that regard.

> Everything we add to the spec makes it a little more complex to understand
> and parse. I think this change adds quite a bit of complexity (see questions
> at bottom) and provides at least these benefits:
> 1) lower disk and network usage
> 2) being able to represent looping routes as continuous *and* at a fixed
> frequency

That second benefit, I think, gets at something which I may be important.

Here's an example of an itinerary on a loop route route in Arcata, CA:
http://tinyurl.com/btrkz9

In the GTFS for this agency, there are about 15 trips/day that are all
assigned to a single block. The result is that the trip planner shows two
bus segments. Segment 1: Red Route to transit center. Segment 2:
stay-on-board (continues as Red Route) to destination. The in-seat transfer
counter-intuitively involves the vehicle continuing as the same route.

I'm submitting data for an agency with about 10 loop routes this week. It
would be great to work out something, either soon or down the line, that
describes loop routes accurately and without introducing extra complexity.

exact_times=1 has been handy for me. It makes data easy to maintain.

Anyone else have specific needs for/comments on describing loop routes in
GTFS? Please share!

From: Aaron Antrim <aa...@arcatacommunity.org>
Date: Fri, 20 Mar 2009 15:53:07 -0700
Local: Fri, Mar 20 2009 3:53 pm
Subject: Re: [gtfs-changes] Re: PROPOSAL: Frequencies.txt for loop routes

I wanted to follow up on this earlier proposal (actually more of a
discussion item now).

Can I go ahead and start publishing feeds where loop trips have specified
frequencies, and where they are assigned to a vehicle block in cases where
the trip length equals the headway? Or has this already been possible?

Do any other feed publishers have a need to represent loop routes in a way
which will avoid the "continues as [same route name]" in-seat transfer
issue?

Shall I work to modify the original proposal to resolve some of the issues
and questions Tom brought up?

From: Joe Hughes <joe.hughes.c...@gmail.com>
Date: Fri, 20 Mar 2009 17:37:02 -0700
Local: Fri, Mar 20 2009 5:37 pm
Subject: Re: [gtfs-changes] Re: PROPOSAL: Frequencies.txt for loop routes

On Fri, Mar 20, 2009 at 3:53 PM, Aaron Antrim <aa...@arcatacommunity.org> wrote:
> Can I go ahead and start publishing feeds where loop trips have specified

> frequencies, and where they are assigned to a vehicle block in cases where
> the trip length equals the headway? Or has this already been possible?

If you're talking about attaching a block_id to a single trip in
trips.txt and using that trip_id in frequencies.txt, this would appear
to violate the description of block_id in the spec:
"The block_id must be referenced by two or more trips in trips.txt."

Do the trips in question have scheduled times, or are they truly
frequency-based?

> Do any other feed publishers have a need to represent loop routes in a way
> which will avoid the "continues as [same route name]" in-seat transfer
> issue?

Is this an issue that you're seeing that's specific to Google Maps?
Sounds like an implementation quirk/issue that they could improve,
rather than a limitation of the spec semantics.

> Shall I work to modify the original proposal to resolve some of the issues
> and questions Tom brought up?

We should definitely try to find a solution for expressing this information.

Joe

From: Aaron Antrim <aa...@arcatacommunity.org>
Date: Sun, 22 Mar 2009 17:42:14 -0700
Local: Sun, Mar 22 2009 5:42 pm
Subject: Re: [gtfs-changes] Re: PROPOSAL: Frequencies.txt for loop routes

To recap, my purposes with this draft proposal are:
1. to represent loop routes in a way that could eliminate the awkward
"continues as [same route]" multi-leg presentation of loop routes
2. to make data publishing and maintenance easier

The first purpose (better display of loop routes in the trip planner)
is a much higher priority.

If the trip planner showed sections of two trips with the same
route_id and block_id as a continuous trip, then this display issue
would be solved.

For the sake of continuing discussion, responses to Tom's questions:

> Does it make sense to use block_headway_secs when exact_times != 1?

Yes, I think it would make sense to use block_headway_secs in cases
where exact_times is false. I have not encountered a schedule-less
loop route in my work, but I think it must exist somewhere.

For the sake of example, UC Berkeley Bear Transit is a service where a
frequency-based display (exact_times=0) could make sense because of
the short headways. The "P Line" (http://pt.berkeley.edu/print/175)
is a loop served by two buses. Headways are 12min. It takes 24min
for each bus to complete the loop.

> Should we require that block_headway_secs is >= end_time -
> start_time? (start_time and end_time meaning the first and last
> times for the trip in stop_times)

Yes.

> Should we require that headway_secs > block_headway_secs?

No, I think a requirement for headway_secs <= block_headway_secs would
make sense. (If vehicles are added to the same loop, this decreases
headway_secs, while block_headway_secs remains the same).

Or, headway_secs / block_headway_secs = # of vehicles or blocks

> What about transitions between frequencies.txt lines with the same
> trip_id and different headway_secs?

I think this could be handled with no changes to the current spec.
"The end_time field indicates the time at which service changes to a
different frequency (or ceases) at the first stop in the trip."
http://code.google.com/transit/spec/transit_feed_specification.html#f...

In the case of the Bear Transit "P Line" example, the end_time would
be set at 19:10. So, "Bus 1" ends service at 19:10, and Bus 2 is in
the middle of its last trip at that time, which it completes through
the end of the trip.

> In general I think exact_times=1 is very convenient for manually
> created feeds but has yet be demonstrated as very valuable to data
> consumers. If there are people manually creating looping frequency
> defined routes then your proposal with the constraint headway_secs
> == block_headway_secs would be very handy.

This proposal may turn out to add too much complexity for data
consumers. Maybe this is actually shows a need for new features in
automated tools for publishing GTFS? If Google and other consumers
decide it's best not to implement this automation on their side, then
I'll plan a new feature in my GTFS publishing tool!

From: Aaron Antrim <aa...@arcatacommunity.org>
Date: Mon, 23 Mar 2009 10:15:33 -0700
Local: Mon, Mar 23 2009 10:15 am
Subject: Re: [gtfs-changes] Re: PROPOSAL: Frequencies.txt for loop routes

I thought about this a little more. It occurred to me that representing
looping frequency-based trips is also a small display issue.

Example: Reoccurring trips on Flagstaff Mountain Line are represented with
frequencies.txt and exact_times = 1.
Their feed is public:
http://code.google.com/p/googletransitdatafeed/wiki/PublicFeeds
Example itinerary: http://tinyurl.com/df844q

I think one really nice touch in the Google Transit trip planner interface
is the message "Service runs every 30 mins."

With the current spec, it is not possible to represent frequency-based loops
in a way so that the trip planner will include this message.

Topic: Service is not returning for return trip from Reno to Quincy (Plumas Transit)

From: Brendan Ford-Sala
Date: Wed, 6 May 2009 12:15:54 -0700 (PDT)
Local: Wed, May 6 2009 12:15 pm
Subject: No trip return from Reno to Quincy

I've been looking at the Plumas feed (it's in preview phase) and have found a problem with the Reno route (ID 127).

NO TRIP FROM RENO TO QUINCY
We're able to generate an accurate trip from Quincy to Reno but not the reverse (See here for Reno to Quincy trip request failure: http://tinyurl.com/da4rtc). It appear that the published feed includes all the necessary data to represent this trip. Is there something happening on Google's side that is preventing this trip?

Thanks,
Brendan

Trillium Solutions
www.trilliumtransit.com

From: Aaron Antrim
Date: Wed, 6 May 2009 20:11:55 -0700 (PDT)
Local: Wed, May 6 2009 8:11 pm
Subject: Re: No trip return from Reno to Quincy

For diagnosis, I realized the ID (1565A96B95) for the trip we expected the trip planner to return may be useful.

Aaron
www.trilliumtransit.com

Topic: Long on-vehicle time for loop routes causes trip planner to suggest unnecessary walking leg of trip

From: Aaron Antrim
Date: Sat, 20 Jun 2009 20:17:02 -0700 (PDT)
Local: Sat, Jun 20 2009 8:17 pm
Subject: Long on-vehicle time for loop routes causes trip planner to suggest unnecessary walking leg of trip

Some travel itineraries on loop routes may involve indirect travel paths and corresponding long on-vehicle passenger travel times. In cases where the trip planner calculates walking is a faster alternative to transit over all or part of a transit route, the trip planner does not display the option(s) that maximize travel by transit vehicle.

EXAMPLE: [note that Tehama/TRAX is in preview] from:Monroe Ave & Walton Ave, Red Bluff, CA 96080 to:reeds creek road & david ave, red bluff ca (Link: http://tinyurl.com/kjkthh)

This is what comes back:
http://trilliumtransit.com/temp_files/trax%20rt1%20real%20result.jpg

Here's a photoshop mockup of what I believe would be optimal:
http://trilliumtransit.com/temp_files/trax-rt1-photoshop%20mockup.jpg

The current software decision produces optimal travel itineraries for individuals that do not mind and are able to walk distances of, for example, 0.5 or more miles. However, the result does not serve the needs of mobility-limited customers or customers with heavy bags.

I recommend that the transit trip planner should always show and preference transit options over walking when available. This will enable customers to see the full

availability of transit service. Customers may choose a walking alternative by clicking the "Walking directions" option in Google Maps.

Topic: Google Transit instructs passenger end-users to transfer at the top of loop routes

From: Aaron Antrim
Date: Sat, 20 Jun 2009 20:48:31 -0700 (PDT)
Local: Sat, Jun 20 2009 8:48 pm
Subject: Google Transit instructs passenger end-users to transfer at the top of loop routes

For some trips in which the vehicle passes the endpoint of a loop route, the trip planner indicates an in-seat transfer or instructs riders to exit the bus at the endpoint and then board the same bus.

Here's an example Rt 1 trip on Tehama/TRAX (in preview):
http://tinyurl.com/n2pm6c

I've checked that all Rt. 1 trips are assigned the same block_id. Can Google confirm or tell me if I am missing something?

Appendix K: Acronym glossary

FTA	Federal Transit Administration
GIS	Geographic Information System
GPS	Global positioning system
GTFS	Google Transit Feed Specification
HTA	Humboldt Transit Authority
I&R	Information & Referral
ITS	Intelligent transportation system
IVR	Interactive Voice Response
LRB	Lassen Rural Bus
LTC	Local Transportation Commission
MCTC	Modoc County Transportation Commission
MPO	Metropolitan Planning Organization
OS	Open source
PTS	Plumas Transit System
RABA	Redding Area Bus Authority
RDBMS	Relational database management system
RTPA	Regional Transportation Planning Agency
SCRTPA	Shasta County Regional Transportation Planning Agency
SQL	Structured Query Language
SS	Sage Stage
SSTAC	Social Service Transportation Advisory Committee
STAGE	Siskiyou Transit and General Express
TDP	Transit Development Plan
TRAX	Tehama Rural Area Express
TT	Trinity Transit
UWCA	United Ways of California