SunRail Electronic Trip Planning Study Final Report

March 2013

PROJECT NO.
FDOT Technical Assistance

PREPARED FOR
Florida Department of Transportation
# Table of Contents

1.0 Introduction ......................................................................................................................... 1

2.0 Summary of Coordination Activities with other Regional Transit Providers ...................... 1

2.1 August 2012 Meeting with VoTran ...................................................................................... 2

2.2 August 2012 Meeting with LYNX .................................................................................... 2

3.0 Electronic Trip Planning Marketplace .................................................................................. 3

3.1 Vendor Supplied Trip Planner .............................................................................................. 4

3.2 State DOT 511 Trip Planners .............................................................................................. 6

3.3 The Evolution of Self-Supported Trip Planners to Third Parties and Open Data ............ 8

3.4 Extending the “Open” Concept to Transit Software ............................................................... 9

3.4.1 OpenTripPlanner ............................................................................................................. 10

3.5 Creating and Disseminating GTFS Datasets ....................................................................... 12

3.6 Overview of GTFS .............................................................................................................. 12

3.7 Creation and Maintenance of the GTFS dataset ................................................................. 13

3.7.1 In-house ......................................................................................................................... 13

3.7.2 Outsource ....................................................................................................................... 13

3.8 GTFS Data Dissemination ................................................................................................... 13

3.8.1 Benefits for Public Dissemination of Data .................................................................. 13

3.8.2 Risks for Public Dissemination of Data ...................................................................... 14

3.9 Terms of Use for Public Data .............................................................................................. 15

3.10 Dissemination Methods for Public GTFS Datasets ............................................................ 15

3.11 Highlighting Transit Application Powered by GTFS Data ................................................. 16

3.12 Providing a Transit Application Programming Interface (API) to Application Developers .......................................................................................................................... 16

4.0 Applications Based on GTFS .............................................................................................. 17

4.1 Mobile Applications ........................................................................................................... 17

4.1.1 Google Maps .................................................................................................................. 17

4.1.2 The Transit App for iPhone ......................................................................................... 18

4.1.3 RouteShout .................................................................................................................... 18

4.1.4 Hopstop ......................................................................................................................... 19

4.2 Accessibility ....................................................................................................................... 19

4.2.1 Sendero Group BrailleNote GPS ............................................................................... 19

4.2.2 Travel Assistant Device (TAD) .................................................................................. 20

4.3 Desktop & Enterprise Applications ...................................................................................... 20

4.3.1 Bing Maps ..................................................................................................................... 20

4.3.2 MapQuest ...................................................................................................................... 20

4.3.3 Mapnificent .................................................................................................................. 21

4.3.4 Walkscore ...................................................................................................................... 22

4.4 Real-time Transit Information ............................................................................................. 22
4.4.1 OneBusAway................................................................. 23
4.4.2 NextBus................................................................. 24
4.4.3 TransLōc............................................................... 24

5.0 Recommendation of Activities for SunRail Trip Planning ....................... 24
  5.1 Recommended Action Plan.............................................. 26
  5.2 Policy & Administration.................................................. 27
  5.3 Data Dissemination......................................................... 29
  5.3 Performance Monitoring and Feedback............................... 32

Endnotes.............................................................................. 36
Images

Image 1: Ann Arbor Transit's Trapeze Trip Planner ................................................................. 4
Image 2: Goroo Interface ........................................................................................................ 5
Image 3: New York DOT 511 Trip Planner ........................................................................... 6
Image 4: San Francisco 511 Real Time Transit Information .................................................. 7
Image 5: Florida Transit 511 Links .......................................................................................... 8
Image 6: Screenshot of OpenTripPlanner showing a transit and bike trip in Portland, Oregon (rtp.trimet.org) ........................................................................................................... 10
Image 7: Screenshot of OpenTripPlanner transit and bicycle trip preferences selector .......... 11
Image 8: Open Data Request List ............................................................................................ 16
Image 9: The Transit App ......................................................................................................... 18
Image 10: HopStop Web Interface .......................................................................................... 19
Image 11: Bing Maps ................................................................................................................ 20
Image 12: Step Based Recommendations for Trip Planning Activity ..................................... 27
Image 13: Open Data Commons Graphic ................................................................................. 29
Image 14: PSTA Developer Webpage ..................................................................................... 30
Image 15: Trip Planning Contact List ..................................................................................... 31
Image 16: TriMet App Center .................................................................................................. 33

Figures

Figure 1: A GTFS dataset from a transit agency consists of several text files within a ZIP file ....... 12
Figure 2: An excerpt of a plain text view of a GTFS-realtime Trip Updates feed, which shows real-time estimated delays for particular trips and stops .................................................. 23
1.0 Introduction

Knowing accurate information about transit services is critical to users of public transportation. Since buses and trains run on a schedule set by the agency, for the transit riders to know when a bus is expected to arrive, the transit agency must share their schedule with riders.

However, even if riders have access to a printed transit schedule, this does not necessarily mean they can successfully plan a trip from one location to another. In a 2004 study, approximately half of surveyed riders could not successfully plan an entire trip on a fixed-route transit system using printed information materials.

To help reduce the transit rider learning curve, many transit agencies have turned to website-based trip planners that give a traveler specific step-by-step direction on which routes to take from one location to another, based on a source and destination entered by the traveler. The use of smart phones and other mobile technology has put these tools into the hands of the riding public. Given that SunRail will attract commuters and other discretionary riders, these tools are likely to be well utilized as demonstrated in other cities with rail systems.

FDOT has requested assistance in advance of the operational launch of the SunRail system that is intended to position the rail service to be available via these trip planners. In trip planners, it is necessary to include greater accessibility, awareness and seamless interaction with partner agencies to develop ridership markets.

In the past, efforts to create electronic trip planners have produced mixed results nationally, some of which have been costly and at times, ineffective and since been abandoned. However, in recent years commercial industry and other transportation service providers have driven the trip planning platform with ever more valuable features for transit users. This technical report documents these developments and analyzes various on-line trip planning options for SunRail to consider; from the creation of in-house, standalone trip planners, to third party providers evolving with open source software solutions.

The report includes outreach performed to other area transit agencies, including the current status and future plans of their respective trip planning capabilities. The importance of partner transit agencies will be realized when customers of LYNX and VoTran choose to use SunRail and vice versa. The use of any service should include the ability to obtain a trip planned across all agencies. Florida 511 offers an opportunity to disseminate traveler information for transit as well. Its current capability and future for transit data and trip planning are described in this document.

This study concludes with a recommended action plan for SunRail, with a timetable of tasks to complete that result in widespread saturation of the rail service in trip planners everywhere.

2.0 Summary of Coordination Activities with other Regional Transit providers

SunRail can present a comprehensive regional approach in identifying trip planning services, routines for data production and maintenance, as well as the contact information needed to initiate rail inclusion start-up. While featuring SunRail will be of value to users, a more complete network of transit options in the central Florida area will address mobility gaps by affording opportunities to include
connecting bus service information. This is particularly true in the case of LYNX, the metro Orlando area bus service provider which will likely be used by riders as part of some trips taken on commuter rail. So, before SunRail can fully explore its options, it is beneficial to understand where its regional partners in transit provision stand on existing and future trip planning capabilities.

This outreach has taken the form of meetings between the CUTR study team and management and staff of two future SunRail connecting transit services; LYNX of Orlando and VoTran of Daytona Beach. The intent of these meetings was to inform the bus service providers of the study purpose, anticipated outcomes of the technical assistance and desire for continued coordination in the future on matters of customer information. The following summaries describe what was learned about the two transit providers’ activities on web based trip planning tools.

2.1 August 2012 Meeting with VoTran

VoTran has contracted with their electronic fleet management and transit information systems provider, Avail, to produce the necessary data for Google Transit, the most widespread web based trip planning service. That data is now ready and available. VoTran is anticipating being included in Google Transit by the end of the 2012. VoTran reports their customer service call volume has recently increased primarily for requests for bus locations and directions. VoTran hosts real-time bus tracking on its website and the availability of this information has led to more requests for it by phone. VoTran is expecting an increase in call volume when SunRail goes into operation and is interested in regional trip planning for both its customer service representatives and customers. The agency currently provides the ability for customers to track the location of buses but does not provide travel planning applications.

There have been anecdotal observations by VoTran Customer Service Representatives of an increased number of passengers with smart phones. A customer survey is underway which will include measuring customer use of and access to web based applications. VoTran believes its customers would make use of web and mobile transit trip planning and service information. It is hoped that trip planning information will provide more convenient access to riders and reduce customer service call volume.

VoTran has hired a company called Solodev to create a new website for the agency and to create other web development tools. LYNX reportedly uses this same vendor for similar purposes.

Overall, VoTran is very receptive to this SunRail assessment of trip planning options and will be a willing partner to participate in its development. The availability of necessary data is a positive sign and SunRail would be amenable to publishing it to the general public, which is a key for more widespread inclusion in a variety of planning services. VoTran would participate in a group meeting with LYNX and SunRail to discuss the findings of this study and possible partnerships moving forward.

2.2 August 2012 Meeting with LYNX

LYNX has implemented or is currently implementing several technology projects that are either directly or indirectly related to the SunRail trip planning effort. LYNX has been using Google Transit, yet is not a featured transit service. VoTran does not currently have web-based trip planning capability.

VoTran has produced the data required to be featured in Google Transit and other services (GTFS).

VoTran is anticipating making web based trip planning available to its users.

VoTran is open to publishing their data and future coordination with partners for providing customer information.
property based on the list of participating agencies on the Google Transit website. A Google Transit interface is embedded on the golynx.com website and allows users to obtain transit directions there. LYNX is also using the same data that powers trip planners for operating their enterprise T-BEST modeling platform (the only transit property to do this). LYNX is both invested and committed to the data production that will be necessary to support the SunRail project. This data production and its accessibility could provide an excellent opportunity for a SunRail / LYNX partnership. A real-time bus location system is being implemented by their transit information systems vendor, Mentor Engineering.

LYNX is focusing on developing their new neighborhood flexible bus services. One question to be addressed in this project is how these trip planners could accommodate flexible transit services, which feed fixed routes and is a viable transportation option to connect with SunRail. LYNX staff cited Goroo, the metro Chicago transit trip planning application as a point of interest due to its data quality and scope. The group discussed this type of effort, a custom solution which reportedly cost the RTA upwards of one million dollars to develop.

LYNX is very interested in communicating with its passengers and is interested in publishing their data to third parties. LYNX is partnering with a local realtor association and wants to make home buyers familiar with transit services as a selling point. LYNX is also hiring a social media specialist and full-time software developer.

LYNX expressed interest in participating in a group meeting with LYNX and SunRail to discuss the findings of this study and possible partnerships moving forward.

### 3.0 Electronic Trip Planning Marketplace

In the current environment for sharing public transit information, there are an ever expanding number of options to consider. These options generally fall into one of the following categories:

- A self-hosted, vendor-furnished, web trip planner that is typically proprietary
- Participation with the Florida State Department of Transportation 511 website
- Third party-hosted services which are comprised of:
  - Mobile applications
  - Accessibility applications
  - Desktop & enterprise applications
  - Real time information systems
3.1 Vendor Supplied Trip Planner

Before the advent of a widely accepted data standard for electronic trip planning, transit agencies and more specifically, large multi system transportation authorities, had few options for allowing riders to plan multi-jurisdictional trips. The primary option for many years had been to purchase software and integration services from a private vendor to create and maintain a web-based trip planner for a transit provider. The need for electronic trip planners was particularly great where several transit agencies operated within a region or metropolitan area, but each had their own system maps and schedules.

Transportation management authorities (TMAs) and regional transportation authorities (RTAs) are often formed to address issues such as this. The question of how to make independently operating, yet adjoining transit systems seamless with one another can be answered in part with information technology innovations in trip planning. For SunRail, there are two vendor supplied projects that can provide lessons learned when considering this option for deployment.

A local example of this process can be cited from the South Florida Regional Transportation Authority (SFRTA). SFRTA was formed in 2003 assuming responsibility for Tri-Rail commuter rail and coordinating region-wide activities for Miami Dade Transit, Broward County Transit and Palm Tran. Shortly after its formation, SFRTA and Miami Dade Transit led an effort to deploy a multi county/multi system electronic trip planner. This technology was relatively new at the time and little guidance was available on how to create such a service.

Therefore, the group of transit agencies worked used a product from Trapeze, a transit scheduling software provider that also offers a web based trip planner. The interface of this product looked similar that of Ann Arbor Transit (see image), also a Trapeze trip planning service. Working with a vendor supplied trip planner had its advantages and disadvantages. By virtue of its other product line, Trapeze already had the schedules needed to feed the trip planning application. The trip planning product also had already the ‘routing engine’ developed that was necessary to calculate the optimum transit trip path while allowing the user to choose the least expensive and lowest travel time options.

At the time, the features could only be found in vendor supplied products, and the costs to build and maintain such service were typically burdened entirely to the deploying agency. Fees had also been incurred for the software license, consultation, set-up and maintenance of these systems. Technical issues also arose as the project team had to rely on street network data that contained many inaccuracies, thereby producing
trips for users that were not usable. Also, when the system launched to the public, it provided distances in kilometers not miles.

As a result, the product wasn’t well utilized and eventually discontinued as other options emerged.

A better documented example of the costs and benefits of a vendor provided and supported solution can be found at the Chicago RTA and its web-based multi-modal trip planner, “goroo”. As part of this technical assistance, the research team reviewed an evaluation conducted by the Federal Transit Administration (FTA) in 2010 and followed up with a phone interview with the project manager of the effort in September 2012.

In 2004, FTA funded the Chicago RTA with more than one million dollars to create a state of the art, door to door, multimodal trip planning system that could be transferable to other agencies wishing to provide those same services. Its goal was to integrate transit, driving, walking, bicycling and rideshare transportation in a single end to end trip for users. Multi-modal trip planning did not exist in the US at the time, with only limited applications in Europe. Although the Transit Communications Interface Protocol Standard (TCIP) was the initially preferred data interchange format for the system, practicality forced the project to use an adapted vendor furnished application that had been used in London. A national peer panel was assembled to oversee the project and it had planned to make use of a Systems Engineering Management Plan (SEMP) and Alternatives Analysis (AA).

Early in the process, the challenges of an agency standalone product became clear. The RTA had to secure funding from its partner agencies for operation and maintenance of the trip planner. Partners had to provide datasets

**SFRTA Vendor Product Advantages:**
- Mostly turnkey system
- Provided high level of functionality for its time
- Capitalized on existing transit schedule capacity

**SFRTA Vendor Product Disadvantages:**
- High cost to procure and maintain
- Technical issues in getting to work properly
- Difficult to maintain over time
to RTA to feed the trip planner in a non industry standardized format. The lack of vendor support for TCIP-SCH, hindered the adoption of the TCIP standard for the project, and forced instead the use of proprietary formats. Around this same time in 2005, Google Transit was emerging as an alternative to the standalone agency-supported model with advantage of simpler dataset format that could more easily be produced, as well as charging no fees to the transit agency for participation.

User surveys, stakeholder interviews and market research were undertaken to tailor the goroo application to user needs. A summary of costs associated with outreach and utilization from the goroo effort (see below) provide a baseline of what this type of effort could entail for SunRail.

There are several benefits of the system, many of which are realized due to the large metropolitan area over which goroo covers. There is local control over the trip planner and its evolution, which can grow to meet the needs specific to its ridership base. Chicago can implement features at its own pace and discretion, accelerating certain functions such as car and bike sharing, which is not a priority feature of competing products. Chicago is also perfecting its real time information delivery, which will lead to a desired system enhancement, dynamic trip planning which responds to environmental conditions.

Over the course of a multiyear, phased approach, the risk of technology becoming outdated is high. The rapid development of third party web hosted trip planning services throughout the course of the goroo implementation made those products the predominant method for agencies seeking to provide trip planning capability. It may be that in the certain situations, an intensively maintained, self supported trip planner is preferable. However, for most agencies, the ease of entry into web based trip planning is best accomplished with minimal effort and cost.

3.2 State DOT 511 Trip Planners

Another outlet for web-based trip planning is via state-administered traveler information systems. In recent years, online traveler information systems have often been labeled as part of the “511 system”, after the nationally standardized telephone number that travelers can dial to retrieve traveler information over the phone. These systems provide real-time roadway information on major corridors with road closures, accidents, incidents and traffic. In locations where transit is a viable alternative to personal auto travel, being able to compare the road and transit network side-by-side can help travelers make informed decisions about mobility.

<table>
<thead>
<tr>
<th>Goroo Market Research Costs:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Focus Group - $40,000 / User Research Study - $100,000 / Search Engine Optimization - $48,000</td>
</tr>
</tbody>
</table>

**Anticipated Costs per Goroo website visit:**

23 cents per visit over 10 years  
Source: 2010 DOT Evaluation Study

Image 3: New York DOT 511 Trip Planner
Expansion of 511 capabilities is seen in the New York State 511 web portal. Here, you can not only find traffic information but transit as well. This includes public transit agencies and private over the road intercity bus service.

Other 511 sites feature real time arrivals and departures for transit. The 511 webpage in the San Francisco Bay area was one of the first to launch and hosts transit information that is updated continuously.

The state of Florida 511 website has been active with limited transit information for the past several years. It contains a transit menu option from the homepage with a listing of every public transportation provider in the state.

The list is hyperlinked to the homepage of each transit agency. This ‘hand off’ to the agencies for transit information acts as a placeholder for hosting future transit trip planning capabilities. FDOT 511 project management has been exploring multi-modal trip planning, including integrating multi-modal functionality in the most recent solicitation for management services due to be awarded sometime in 2014. Recent activity by FDOT included data acquisition from select Florida transit agencies in anticipation of this service. However, that has been stalled due to the organizational issues with the existing vendor.

In summary, it is unlikely transit trip planning will be available via Florida 511 within the window of SunRail launch. For the future, SunRail should continue to coordinate within FDOT regarding the availability of traveler information systems.
3.3 The Evolution of Self-Supported Trip Planners to Third Parties and Open Data

TriMet in Portland, Oregon was one of the first public agencies to try and tackle the problem of online transit trip planners through the use of open datasets that are shared with the general public\(^5\). In 2005, TriMet approached Google, as well as a few other driving trip planner vendors, and asked if they had any plans on incorporating transit in their trip planners based on public TriMet data. Google was the only vendor to reply to TriMet’s request. TriMet and Google then decided to team up to implement a transit trip planner in Portland.

One of the first issues that TriMet and Google faced was the problem of sustainable data – in order to provide quality trips, the trip planner would need quality transit schedule, route, and stop data in an electronic format that was consistently up-to-date. TriMet worked with Google to format their transit data into an easily maintainable and consumable format that could be imported into Google Maps. This transit data format became known as the Google Transit Feed Specification (GTFS)\(^5\). In 2005, this trip planning service was launched as Google Transit.

After a successful launch with TriMet, Google Transit offered their trip planner service for free to any agency that formatted and maintained their data in the GTFS format. In 2006, five more agencies
were added. Google Transit’s success continued as more and more agencies wanted access to a free trip planner, and were willing to put their data into the GTFS format to get it.

Since its creation in 2005, GTFS has become the most popularly-used data format to describe fixed-route transit services in the world. Many agencies have decided to share their GTFS data openly with the public, while others choose to restrict access only to select partners (e.g., Google Maps). There are an estimated 261 transit agencies worldwide, including 227 transit agencies in the U.S., that share their GTFS data openly with the general public. Google states that their Google Transit service is offered to around 500 cities around the world and is the defacto standard for this type of data. Therefore, the total number of GTFS feeds in existence, both openly shared and restricted, is likely well over 400.

Even though many transit agencies created GTFS feeds with the primary purpose of benefiting from the free Google Transit trip planner, application developers, often not affiliated with the agency or Google, quickly realized that they could also create many new types of services based on the same GTFS transit data.

As a result of third-party developer innovation, GTFS data is now being used by a variety of third-party software applications for many different purposes beyond trip planning, including ridesharing, timetable creation, mobile data, visualization, accessibility, analysis tools for planning, real-time information and interactive voice response (IVR) systems. In fact, in 2010, the GTFS format name was changed to the General Transit Feed Specification to accurately represent its use in many different applications outside of Google products.

In the following sections, a brief summary of the GTFS format, methods to create GTFS datasets, and considerations for sharing GTFS data with the public are discussed. Then, an overview of the many different types of applications beyond online trip planners that are powered by GTFS data is presented.

### 3.4 Extending the “Open” Concept to Transit Software

Over the last five years, the widespread availability of open transit data in the GTFS format has led to another event: the creation of open-source software that can consume GTFS data and provide customer-facing transit services such as trip planning or real-time arrival information.

“Open-source” means that the source code of the software application can be openly downloaded and examined. The software code can be modified by a qualified software developer to customize and augment the software for particular local needs. Support can be provided by an in-house software developer or consulting software developer, giving the agency flexibility over how and when the software is modified and avoiding vendor “lock-in”. Since developer communities often form around open-source projects, users of open-source software can benefit from the implementation of new features or the fixing of certain bugs by other users in the community. So, if Transit Agency A fixes a bug in open-source transit software and contributes this code-change back to the community, Transit Agency B can benefit from this same bug fix without spending time to implement the same software changes. Therefore, open-source projects can create a shared investment in a single product that is much larger and potentially more cost-effective than a project that any individual user could create on their own.

“Open-source” differs from “closed-source” application software, which is typically purchased from a software vendor; subsequently the application code is only modified through updates issued by that software vendor, and even the agency that purchased the product doesn’t have access to the source code. If the original vendor goes out of business, it can be very expensive or even impossible to find another vendor to support the same product. If the existing product can’t be supported, the agency must purchase an entirely new product from a new vendor to replace the existing product, which can be very costly.
It is important to note that open-source software can be released under a variety of licenses, some of which control the use of any derivative works of the source code. A detailed discussion of the advantages of open-source software is beyond the scope of this paper, so the interested reader is referred to additional resources.

Notable open-source transit software using GTFS data that has been publicly deployed in production use at transit agencies includes OpenTripPlanner (http://opentripplanner.org), a true multimodal trip planner, and OneBusAway (http://onebusaway.org/), a customer-facing real-time estimated arrival information system. Since this report focuses primarily on trip planning, the OpenTripPlanner software will be discussed in detail below. OneBusAway in the “Real-time Transit Information” section is discussed later this report.

3.4.1 OpenTripPlanner

OpenTripPlanner\(^6\) (OTP) is an open-source multimodal trip planner. OTP has been deployed at several sites in the United States and internationally, with statuses ranging from technology demo to official production deployments. TriMet in Portland, OR launched an official production trip planner using OTP software (http://ride.trimet.org/) (Image 6) in August 2012, following a 10-month beta version deployment.

![Image 6: Screenshot of OpenTripPlanner showing a transit and bike trip in Portland, Oregon (rtp.trimet.org)](Image 6)

The multi-modal aspect of OTP means that it is possible to plan many types of trips using the trip planner, including transit-only (with walking), bike and transit, driving and transit (utilizing park and ride locations), bike-only, walking-only, or driving-only trips.
The multimodal bike/transit trip planning features of OpenTripPlanner are especially useful for areas with many bike-and-ride customers, or bicycle facilities.

Street, bike path, and pedestrian path data for OTP typically comes from OpenStreetMap (http://www.openstreetmap.org/), which is a global “Wikipedia” for geographic data that anyone with a registered account can contribute information to. As the name suggests, OpenStreetMap data is open for anyone to use, and therefore it can be used in OpenTripPlanner. If agencies have more traditional spatial datasets from a system such as ArcGIS, this data can also be used. Transit data for OTP comes from GTFS datasets. TriMet has undertaken efforts to enhance the OpenStreetMap data in their coverage area to ensure that walking and biking directions are based on accurate data.

As mentioned earlier, since OpenTripPlanner is open-source agencies have the ability to closely control trip planner results and the way in which information is presented to customers. Modifications to OTP can be done by any vendor or even by the agency itself since the OTP source code is openly available. TriMet chose to use the non-profit organization OpenPlans (http://openplans.org/) to help maintain their OTP software, although the software is hosted on TriMet servers.

OpenPlans also provides a free “OTP Deployer” service (http://deployer.opentripplanner.org/) for agencies to preview OTP for their transit network. OTP Deployer requires. $5,000 is an estimated baseline cost for basic deployment and maintenance of OTP for one year. This estimate assumes 25 consulting developer hours at $100/hr, and a hosting cost of $2,500.

OpenTripPlanner also provides an API that allows 3rd party transit applications easy access to transit trip plans without having to process GTFS data directly.

A regional-implementation approach for OpenTripPlanner seems to offer the greatest benefit for transit passengers and agencies in a region, as many agencies can pool resources to create a trip planning product that works across multiple connected systems. To pursue a regional trip planner approach, transit agencies would need to identify and work with partner agencies. An ideal lead agency should have information technology and/or GIS staff experts to manage the implementation process.
3.5 Creating and Disseminating GTFS Datasets

Before SunRail can benefit from Google Transit and many other transit applications, they must create and disseminate their data in the GTFS format.

Creating and disseminating a GTFS dataset involves the following general process:

1) The agency should understand the GTFS format, and determine how their data will fit into this format.
2) Determine if SunRail going to create and maintain the GTFS data in-house, or whether they will depend on external organizations for this service.
3) Select a process for GTFS creation and dissemination that matches with the SunRail’s requirements.
4) Determine if the SunRail is going to share their GTFS data publicly, or whether they will only share with select vendors (e.g., Google Maps).
5) Choose a dissemination method that maximizes the exposure of the SunRail’s GTFS data for the chosen audience.
6) Share a list of third-party transit application using the SunRail’s GTFS data with the general public.

In the following sections, a more detailed discussion of the above steps is provided.

In the following sections, a brief summary of the GTFS format, methods to create GTFS datasets, and considerations for sharing GTFS data with the public are discussed. Then, an overview of the many different types of applications beyond online trip planners that are powered by GTFS data is presented.

3.6 Overview of GTFS

GTFS represents fixed-route schedule, route, and bus stop data in a series of comma-delimited text files compressed into a ZIP file.

Figure 1 shows the contents of a GTFS ZIP file from Hillsborough Area Regional Transit (Tampa, FL) (HART) and the contents of the stops.txt file within it that contains information about the name, ID, and location of every HART bus stop.

![Image of GTFS dataset]

Figure 1: A GTFS dataset from a transit agency consists of several text files within a ZIP file.
The routes.txt file contains information about the routes of the transit agency, the calendar.txt and calendar_dates.txt files contain schedule information, and the trips.txt and stop_times.txt files contain information about the order of visitation of bus stops for a particular route according to a particular schedule. The shapes.txt file contains the spatial representation of a route alignment so it can be accurately drawn on a map.

A full explanation of all GTFS files and data fields is available on the GTFS reference website.

### 3.7 Creation and Maintenance of the GTFS dataset

SunRail would first want to make the decision whether to format and maintain a GTFS dataset using their own personnel, or if they are going to outsource this task.

It is important to consider that a new GTFS dataset will need to be produced every time there is a change to the schedule to keep the transit services based on GTFS data up-to-date. Major schedule changes can occur 3-4 times a year for large agencies, although, rail systems may change them much less frequently. Therefore, when identifying a GTFS creation process, the maintenance and sustainability of the process must be considered.

#### 3.7.1 In-house

If the agency has sufficient in-house technical expertise, they may wish to produce and maintain the GTFS feed themselves. Several of the industry-standard scheduling software packages from vendors such as Trapeze, HASTUS, Connexiozn, and Mentor Engineering (similar to LYNX) can often export agency data into the GTFS format, facilitating the GTFS creation & maintenance process. However, agencies should not necessarily assume that the output of these tools produces perfect GTFS data, as agencies have indicated that they often still need to perform manual data processing on the GTFS data exported from these tools before it will be acceptable for application use.

If SunRail will not use scheduling software, there are free spreadsheet-based tools for creating and maintaining GTFS data such as and XLS Tools for Google Transit, which was repackaged as “GTFS Builder” by the Rural Transit Assistance Program. OpenPlans, a nonprofit 501(c)3 that produces open-source civic software, is working on an open-source web-based GTFS Editing Tool.

#### 3.7.2 Outsource

Vendors such as Trillium Solutions, Inc., TransitEditor, and Next Insight Transportation Software provide tools and services that could aid SunRail in formatting and maintaining its data in GTFS format, ranging from online tools that are operated by the agency to a full service model where the vendor creates the GTFS data for the agency.

The cost for a transit agency to hire a vendor or consultant to create GTFS data is usually around $200-$500 per route, depending on the level of effort required. Level of effort is determined by the number of stops or stations, complexity and variation of the routes and schedules, and the availability and quality of existing stop or station location, schedule, and route alignment data.

### 3.8 GTFS Data Dissemination

#### 3.8.1 Benefits for Public Dissemination of Data

Once SunRail has determined a method for producing and maintaining GTFS datasets, they would next consider who they will share the data with.
As mentioned earlier, some transit agencies choose to share their data only with select vendors (e.g., Google Transit). However, 49 of the top 50 largest transit agencies (by passenger miles) in the continental United States have openly shared their GTFS data\(^7\). Open data policies are not limited to only the largest agencies, though. According to Wong et al., agencies of all sizes have opened their data. Among all agencies, in 2010 approximately 85 percent of transit miles traveled in the U.S. were on transit systems with open data\(^8\). The U.S. federal government has also prioritized an “open data initiative” to encourage government agencies to release their data to the public, and therefore open data has also been embraced on a federal level. Globally, there are estimated 261 agencies worldwide that have chosen to share their data publicly\(^9\).

Wong et al. provide an extensive discussion of the industry status and benefits of open data, including significant cost savings to the agency, as of July 2012, based on interviews with Southeastern Pennsylvania Transportation Authority (SEPTA) in Philadelphia, the Chicago Transit Authority (CTA), Bay Area Rapid Transit (BART) in San Francisco, the New York Metropolitan Transportation Authority (NYMTA), and the Massachusetts Bay Transportation Authority (MBTA) in Boston, and therefore we refer interested readers to this paper for detailed information.

### 3.8.2 Risks for Public Dissemination of Data

Transit agencies often cite concerns regarding perceived risks of releasing their data to the public, including:

1) Legal exposure due to the lack of accuracy of data  
2) Loss of control of agency brand  
3) Loss of advertising revenue on the agency homepage (if Internet traffic is directed to other sites, such as Google Transit, that provide transit services)  
4) Loss of control of dissemination of transit service information  

Wong et al. conclude that legal and brand usage concerns can be overcome, based on the authors’ interviews with SEPTA, CTA, BART, NYMTA, and MBTA, as well as their first-hand experience assisting in the public release of GTFS data for the Metropolitan Atlanta Rapid Transit Authority (MARTA) in Atlanta, Georgia\(^10\). Additionally, none of the agencies from this study reported any serious legal issues resulting from the release of GTFS data to the public. TriMet also confirmed with an author of this study that they have not experienced any legal issues related to open data. Readers interested in the legal aspects of open data may want to consult a presentation by the Open Knowledge Foundation on this topic\(^11\).

An author of this paper has discussed the issue of loss of web traffic and loss of control of dissemination of transit service information with TriMet in Portland, Oregon. Carolyn Young, Executive Director, Communications and Technology at TriMet, said, “The [TriMet] trip planner has been the most requested page on the TriMet website for the last six years. The number of visits to the trip planner has been growing every year and did not decline with the advent of Google Transit. We believe Google Transit is a valuable tool primarily for new riders and visitors who may not be familiar with the TriMet website.”

In some ways, TriMet feels that they have better control over transit information dissemination by openly sharing a GTFS dataset then they had previously without open data. McHugh states, “The data is already out there. Developers can screen-scrape [the information off our website if we weren’t sharing our GTFS data] which isn’t ideal for the customers or the agencies.” By openly sharing GTFS data with a “Terms of Use” agreement, TriMet has a contractual relationship with all the data disseminators and is able to directly control what data developers consume, ensuring that they are getting quality TriMet data. As far as controlling the quality of third-party apps themselves, McHugh says, “If we get customer complaints, I direct them back to the [third-party] developer. It’s not an issue and we don’t receive that many complaints. Most people know to contact them directly.”\(^12\)
3.9 Terms of Use for Public Data

As mentioned in the previous section, if SunRail should decide it wants to publicly share its data, it should examine possible guidelines for data users. Some providers of GTFS data provide a “Terms of Use” or a developer/license agreement that define guidelines for application developers using the agency’s open GTFS data feed.

Below are examples of agencies that have a “Terms of Use” agreement that application developers must agree to when using the agency’s data:

1. TriMet (Portland, OR) 13
2. BART (SF Bay Area) 14
3. Corona, CA 15
4. PSTA (Clearwater, FL) 16
5. HART (Tampa, FL) 17

Other providers of GTFS data do not provide a license or terms.

The data described in GTFS is not sensitive or proprietary; rather it is information about services that is also published through printed timetables, maps, and fare schedules. If the agency does not deem it necessary to seek legal counsel, it may choose to release data without a license or with guidelines for use.

Based on existing examples in the industry as cited above, these agreements generally contain the following statements:

1. The agency reserves the rights to its logo and all trademarks. These marks should be an indicator used for official information from the agency only.
2. The data is provided without warranties.
3. No availability guarantees are expressed or implied.
4. The agency retains full rights to the data.

3.10 Dissemination Methods for Public GTFS Datasets

After any transit agency has created the GTFS zip file and decided whether or not to include data use guidelines, it can be shared with application developers so that applications (e.g., Google Transit) can use the data. GTFS data is typically made publicly available by sharing the data at a publicized URL. Developers and consuming applications can download GTFS data from the specified URL.

Two websites currently serve as the primary global directories of publicly accessible data:

- GTFS Data Exchange 18
- Public Feeds wiki page on Google Transit Data Feed Google Code project 19

Another example of GTFS data publishing is a regional approach where all GTFS data feeds for a number of nearby agencies are listed on a single centralized site so they are easily discoverable by application developers. The following agencies publish a list of all the publicly available GTFS data for all agencies in the respective state:

- Oregon Department of Transportation Public Transit Division 20
- New York State Department of Transportation 21
- Massachusetts Department of Transportation 22
3.11 Highlighting Transit Application Powered by GTFS Data

When applications are created by third-party developers using a transit agency’s GTFS data, the agency may choose to make transit riders aware of these applications. One method of increasing awareness is to showcase certain applications on the agency’s website. TriMet, BART in San Francisco, Metropolitan Transportation Authority (MTA) in New York, Chicago Transit Authority, GoTriangle in North Carolina, HART in Tampa, FL, MBTA in Massachusetts, KCATA in Kansas City, and Utah Transit Authority are all examples of medium to large transit agencies that publish information about third-party applications in “App Center” websites. City-Go-Round is a global directory of third-party transit applications. In fact, City-Go-Round hosts what it calls its ‘Most Wanted’ board, which is a list in order of agency size, of transit agencies that do not provide open data. LYNX is second on this list of “Largest transit agencies with no open data”. This demonstrates an unmet demand from the application development community to add the region to trip planning websites and apps.

3.12 Providing a Transit Application Programming Interface (API) to Application Developers

In addition to sharing GTFS datasets, some agencies may wish to provide a more detailed interface to their transit information to lower the amount of effort required for third-party application developers to launch mobile apps for their agency.

Typically, in order to utilize a GTFS dataset in a third-party application, a developer must maintain a server that downloads and processes the GTFS data into a specific format for their application. This server is the component that actually plans trips from one location to another, and a mobile application simply requests and displays this information that was calculated by the server. For example, the mobile app may make a request to the server that asks “What routes and stops should be used to get from Stop ID 356 to Stop ID 928?” The server will respond with a series of routes, stops, and transfers in a particular format, which are the instructions that are shown to the user. For real-time information, the request may be “How long until the next bus on Route 5 arrives at Stop ID 295?” with the response being “5 minutes”. Maintaining the server that processes and calculates this information is an extra cost and effort for a developer.

Many transit providers have chosen to set up their own interfaces and servers, called Application Programmatic Interfaces (APIs), in order to reduce this burden on third-party application developers.

Open-source applications such as OpenTripPlanner have reduced the necessary effort to establish a scheduled transit trip planning API for an agency, since OpenTripPlanner uses GTFS data to create the API.

Real-time transit information APIs typically require integration with a transit agency’s automatic vehicle location (AVL) system, and therefore are more difficult to create and maintain. However, making real-time information available to transit riders will likely have a larger positive impact on transit riders than static information alone. For example, in Puget Sound, WA, Watkins et al. found that when riders...
had access to real-time information, their average perceived wait time was 7.5 minutes versus 9.9 minutes of actual wait time, a difference of about 30%. Therefore, rider’s perception of transit performance increased when they had access to real-time information. Real-time transit information as related to the GTFS format is discussed in detail in the “Real-time transit information” area of the next section in this report.

Establishing an official transit agency API requires technical expertise at the agency or one of their consultants or vendors. Therefore, creating an official API for transit data (either static or real-time) is not required, but it will likely result in more 3rd party mobile applications being developed with the agency’s data than releasing GTFS data alone.

4.0 Applications Based on GTFS

After an agency has created a GTFS feed and shared it with the public, it is able to access many different types of applications that are based on GTFS data. In the following section, web-based trip planners that use GTFS data are presented. However, many different types of applications beyond web-based trip planners become possible when using GTFS data.

An overview of these different types of applications is provided in the next several sections:

- **Mobile applications** – “apps” for mobile devices that provide transit information
- **Accessibility** – applications that assist transit riders with disabilities in using public transportation
- **Desktop & Enterprise applications** – fixed desktop services that include transit trip planning functionality
- **Real-time transit information services** – specialize in vehicle location and predictions

It should be noted that only a subset of all applications that use GTFS data are presented in this report. This report discusses applications that provide services based on many transit agencies’ GTFS data, and therefore are relevant on a country-wide scale beyond a specific city-sized geographic area. It is estimated that hundreds of GTFS-based applications exist around the world and provide information for only one or a handful of local agencies within a metro area. For example, City-Go-Round lists 188 apps that are available for various localities around the world. Interested readers are referred to City-Go-Round and other resources referenced in this report to discover these local GTFS-based applications.

4.1 Mobile Applications

The below software applications make transit information available to users of mobile phones through native mobile apps. These applications typically provide additional functionality beyond the general web-based trip planners that are tailored to the mobile device interface, such as real-time transit navigation directions.

4.1.1 Google Maps

Google Maps contains a transit trip planner, which is available for several devices including Android mobile phones, iPhones, and Blackberries. Features vary by mobile platform. Currently, Google Maps for Mobile seems to be focus primarily on Android, although other platforms such as Windows Mobile and Java Micro Edition have been supported in the past. Google Maps for mobile supports location-positioning on all devices that offer GPS features. Google Maps for Android devices offers the most
complete feature-set, including a “Transit Navigation” feature that notifies transit passengers in real-time when they need to make transfers and alight from the vehicle for their destination.

How to be added to Google Maps:

SunRail should host their GTFS data and contact Google to notify them it is publicly available at https://support.google.com/transitpartners/bin/request.py.

4.1.2 The Transit App for iPhone

Not to be confused with the OpenPlans application of a similar name, The Transit App for iPhone is a subscription based commercial app that offers users a transit planning and navigation tool for a monthly fee. The Transit App is one of the first to integrate with iOS 6 and new Apple Maps. Useful features include the ability to preload data for trips so cellular and wifi connections are not required. The app offers real time information support and bills itself as context aware which recalls your previous travel history. There are currently 25 USA and Canadian properties listed.

How to be added to The Transit App for iPhone:

Similar to Google Maps, the only thing required is a static URL that will point to the latest GTFS all the time. The Transit App supports GTFS-realtime and NextBus services out of the box. Email Guillaume Campagna [info@thetransitapp.com]

4.1.3 RouteShout

RouteShout is an application that allows users to receive scheduled and predicted arrival times via SMS or mobile application. Transit agencies that wish to be included in the application can request to be added; GTFS data is required to import service and schedule data. Real-time data can be incorporated if there is an installed AVL and arrival estimate system with the necessary interface. RouteShout also offers an API interface for accessing transit data.

Basic services are provided for free to participating transit agencies. SMS services are available at an extra subscription cost to agencies. A RouteShout administration interface (also available only with paid access) allows transit agencies to push alerts to customers that sign up to receive information pertaining to particular services.

How to be added to RouteShout:

SunRail should host its GTFS data and fill out the contact form at http://www.routeshout.com/support/transit-contact.
4.1.4 Hopstop

Hopstop provides door-to-door transit, walking, biking, taxi and hourly car rental directions in over 200 cities. This popular ‘lifestyle’ app can also find places to visit, eat, drink, and sleep in a City Guide.

A summary of HopStop functionality includes:
* Directions by email directly from the website
* Plan a trip with multiple destinations
* Estimate travel time and cost for a taxi
* Get estimates for calories burned and carbon emissions savings for your route
* Find wheelchair accessible and stroller friendly routes
* Check out Real-Time Alerts and Planned Service Changes

How to be added to HopStop:

HopStop accepts data in the in GTFS format either pulled from a designated website, or sent directly to a HopStop administrator. The email contact is Doug Stone, doug@hopstop.com.

4.2 Accessibility

Several applications have been developed with the purpose of assisting transit riders with disabilities. These applications also import GTFS data to obtain knowledge of the transit system.

4.2.1 Sendero Group BrailleNote GPS

The Sendero Group makes a line of BrailleNote devices and mobile applications. The BrailleNote devices are portable computers with refreshable braille displays for people who are blind or seeing-impaired. The BrailleNote GPS devices and LookAround mobile applications allow users to find transit stops from many major U.S. transit agencies. The company will incorporate transit stops into their database from public GTFS data for any agency based on user request.
4.2.2 Travel Assistant Device (TAD)

The Travel Assistant Device (TAD) mobile application grew out of a research project conducted at the University of South Florida’s National Center for Transit Research. The travel assistance system for sight-impaired or intellectually-disabled passengers allows them to plan a transit trip and download information to a GPS-enabled mobile phone with the TAD mobile app installed. Phones with the application installed give audio and vibrating alerts when it is time for the passenger to pull the stop cord and alight from the bus.

The TAD system uses GTFS data to import up-to-date schedule and stop. The product is being commercialized by DAJUTA, a Florida-based company. Updates on the TAD project can be found at the USF TAD website.

4.3 Desktop & Enterprise Applications

For travel planning capability that is not inherently mobile, many serviceable web based trip planners are available. Often, much like planning an auto trip, these tools can be used well in advance of a trip to guide decision making. They also heavily rely on the GTFS data format and often possess other functionality as well.

4.3.1 Bing Maps

Featured within Microsoft’s Bing Maps web service is transit travel planning. It includes major transit authorities that cover over 70% of all transit rides in North America. This includes real time arrivals in 5 properties. There is also an extension of the service as a mobile app across several platforms including Windows based phones.

How to be added to Bing Maps:

Send an email to: bingmapstransit@microsoft.com
Include Contact name, email, phone and URL of GTFS file to fetch data.

4.3.2 MapQuest

The service provides routing between two or more latitude/longitude points and includes driving, walking, biking and transit directions. Rail transit directions are now available in major metros which have large subway, elevated and/or commuter rail networks. Rail transit is integrated with walking directions, allowing travelers in these cities to route between towns, addresses, points of interest, or specific transit stations. At one time, MapQuest was number one transit directions app from Apple store.
How to be added to MapQuest:

Share the GTFS URL location on a MapQuest web form located at http://help.mapquest.com/contact-us/.

![Mapquest](Image 12: Mapquest)

4.3.3 Mapnificent

Mapnificent shows how far it is possible to travel on public transportation from a given location for over 50 cities throughout the world. The application interface provides a slider control to adjust maximum travel time. As the slider is adjusted, the highlighted area on the map showing travel range expands and contracts. Mapnificent uses public GTFS from GTFS Data Exchange. Not every agency with a public feed is included, but the developer, Stefan Wehrmeyer, will often add agencies if requested. It is cost-free for transit agencies to participate.

How to be added to Mapnificent:

Stefan requires a URL pointing to a GTFS feed to integrate SunRail into Mapnificent. He also encourages publication of the GTFS at gtf-data-exchange.com where more developers will find uses for it. Additionally SunRail would need to include a ‘terms of use’ license for the data. He recommends the Open Database License at [http://opendatacommons.org/licenses/odbl/1-0/](http://opendatacommons.org/licenses/odbl/1-0/). Stefan can be emailed at mail@mapnificent.de.
4.3.4 Walkscore

Walk Score is a website created by the not-for-profit organization Front Seat. The purpose of the website is to help people quantify “walkability” through a numerical score. “Walk Scores” indicate the number of nearby amenities that are within walking distance. Walk Score’s primary use has been for buyers of real estate who wish to convenience access to amenities. Walk Score is also used by people selecting an apartment or home to rent.

Walk Score incorporates a Transit Score and commute reports. Transit Score uses a 0-100 rating indicating how well an address is served by public transportation. Walk Score also offers a Public Transit API. Another useful feature is called “Apartment Search.” This includes a “Near Transit” button which allows the user to see all properties that are within a given distance to a transit stop. These applications helps transit agencies’ target customers (whether discretionary riders or transit-dependent riders) locate themselves in such a way that they’ll become more inclined ride transit frequently. These applications can help a community to value transit service and walkability. Real-estate agents can also use these resources with their clients to emphasize properties that are easily accessible via walking or transit.

How to be added to Walkscore:

Upload data to the GTFS data exchange or email Walkscore at www.walkscore.com/contact-us.php

4.4 Real-time Transit Information

The basic GTFS format contains only static (i.e., infrequently changing) transit information such as schedules, routes, and bus stops. Therefore, a GTFS dataset alone will not enable real-time transit information services for a transit agency. However, for many real-time applications GTFS data is also required to describe basic information about the transit system.

GTFS-realtime and SIRI are emerging formats implemented by a number of agencies for real-time transit data such as estimated arrival times based on real-time vehicle positions. This information is refreshed by the agency approximately every few minutes to keep applications up-to-date on the status of the transit system, and any potential deviations from scheduled arrivals.
As mentioned earlier, real-time transit APIs typically require integration with a transit agency’s automatic vehicle location (AVL) solution, and therefore require significant technical expertise at the agency or selected vendor to create and maintain.

Several applications are presented below for real-time transit information that requires the basic GTFS dataset in addition to another real-time information source. These applications aren’t usable without the basic GTFS dataset, so GTFS plays an important role in these applications.

### 4.4.1 OneBusAway

OneBusAway is an open-source software system for real-time transit information that grew out of research at the University of Washington. The initial OneBusAway deployment was in the Puget Sound area in Washington, although OneBusAway is in the process of being deployed in several other locations in both production and development deployments. MTA in New York is using OneBusAway software as the foundation of their Bus Time system.

OneBusAway uses GTFS data for the basic description of the transit system. Real-time information can be injected into the OneBusAway system using a variety of formats, including GTFS-realtime, SIRI, and ACS Orbital Orbcad.

As the OneBusAway software is open-source, it can either be maintained by the transit agency (if the agency has significant in-house technical expertise), or it can be maintained by a contracted vendor that is willing to support open-source software. For example, MTA in New York has contracted with the non-profit OpenPlans as well as Cambridge Systematics to maintain their AVL system and their OneBusAway-based MTA BusTime transit information system.
4.4.2 NextBus

NextBus is a vendor that provides real-time information service for many transit agencies in the United States. While another data source such as an AVL system must provide real-time data information, NextBus uses GTFS data to import basic information about the transit agency’s routes, stops, and schedules.31

4.4.3 TransLōc

TransLōc is a vendor that provides real-time information and visualization for transit and shuttle systems. TransLōc reports that their software imports GTFS as the basis of their transit network and schedule data.32

5.0 Recommendation of Activities for SunRail Trip Planning

With an expected launch of service in May of 2014, SunRail staff has sufficient time to plan and undertake activities preparing for some level of web based trip planning availability for its riders. This section includes a recommended timetable for actions based on limited discussion with staff. It is intended to reflect what may be considered ‘best practice’ at this time.

The first question to be addressed is whether to pursue a self-hosted vendor supported solution, a third party web service provider, or an open-source solution such as OpenTripPlanner.

Trip planner categories, listed in order of the most outdated methods to the most recent cutting-edge model:

- **Self-hosted vendor-supported proprietary solution (e.g., Trapeze)** - As previously described, self-supported trip planners that exist outside of state 511 applications are becoming increasingly uncommon. This is due to a number of factors, but primarily the cost and level of effort required maintaining the system.
- **Third-party trip planner providers (e.g., Google Transit)** – Third-party trip planning sites and mobile apps are well-established at this point and can often provide significant services for little to no cost to the agency, especially if the agency already has a GTFS dataset. However, agencies typically have little control over the trip planning service or the 3rd party’s actions – this means that at any given moment the 3rd party trip planner provider could shut down without any contractual obligation to the agency.
- **Open-source trip planner (e.g., OpenTripPlanner)** – OpenTripPlanner33 is emerging as a robust and cost-effective trip planning solution for agencies, especially those who want control over the trip planner presentation and results without being tied down to a single proprietary vendor product. OpenTripPlanner also differs from most other trip planners in that it is open-source, which allows agencies to have unprecedented control over the implementation of the service (including the option to modify it in-house, or outsource the modifications to any willing software developer/vendor) and how trip information is presented to the users. OTP also allows users to plan multimodal trips using transit, bike, and walk. However, there is still a cost to maintaining an open-source trip planner, although the risk in investing in open-source products seems to be far less than the risk of using a proprietary closed-source trip planner.
The following rationale for and against creating and sustaining a trip planner by SunRail is based on the South Florida Tri-Rail experience, Chicago RTA interview and evaluation and state of the industry of third party applications and open-source software.

Scenarios where a proprietary vendor-furnished trip planner may be preferred:

- When control over the methods of delivery of transit information are a greater priority than cost and effort to maintain the system.

- When interoperability with other current and planned transit information systems and dissemination methods (e.g., mobile apps, SMS, mobile phone payment) is not a priority to the agency

- When the agency is comfortable with the risk that comes with an investment in a proprietary product that can only be maintained by a single vendor

- When the agency has an existing relationship with a specific vendor and the proprietary trip planner is a marginal cost as part of a larger software purchase.

- When a vendor offers a proprietary trip planning product at little to no cost to the agency (e.g., in return for an opportunity to monetize the trip planner through ads).

To date, these scenarios have been rarely encountered. Many of the newly developed self-supported trip planners are components of state 511 systems, and therefore part of a larger system. The 511 concept has within its mission an objective to provide multi-modal transportation information to travelers. The remainder of self-supported transit trip planners are legacy systems implemented prior to the rapid expansion of third party web-hosted products, with the exception of OpenTrip Planner.

Scenarios where third party web hosted trip planners may be preferred:

- When the agency seeks a large saturation in the open marketplace of mobile apps and other services.

- When insufficient resources (staff and money) are available to implement a self-sustained product across many different platforms (e.g., Web, SMS, iPhone, Android, Windows Phone)

- When the agency is comfortable ceding responsibility to third parties for trip planner aesthetics, functionality, availability, usability and development.

Scenarios where an open-source trip planner may be preferred:

- When there is functionality required of the trip planner that is not currently found in commercial third party services. Examples include multimodal (e.g., transit, bike, and walk) directions within a single trip, as well as car and bike-sharing.
• When the agency wants to control trip planner aesthetics, functionality, availability, usability and development.

• When the agency wants to avoid the risk of “vendor lock-in” that can come with proprietary products.

• When the agency wants to control trip planner aesthetics, availability, usability and development.

• When the agency wants to control trip planner aesthetics, availability, usability and development.

• When the freedom of choice to either internally manage or outsource management to any willing software developers/vendors to maintain and improve the system is important to the agency.

• When interoperability with other current and planned transit information systems and dissemination methods (e.g., mobile apps, SMS, mobile phone payment) is a high priority to the agency.

• When there is a desire for tight coordination with other regional entities, and a desire for control over how a trip planner suggests how passengers should transfer from one service to another.

• When there is a desire to either build a product user information database or monetize the web planner and its accessibility.

It is also possible for an agency to both host and maintain a transit trip planner (either proprietary or open-source) while the agency shares its data with third party developers to supplement the service the agency is providing. Based on the experiences of agencies that have shared their data, there appears to be few downsides and many benefits to publicly sharing transit data with third-party developers. This is especially true if the agency is not currently providing the many types of third party services that are discussed earlier in this report.

Currently, the maintenance of a proprietary trip planner is only likely to be done within existing state 511 infrastructure. There doesn’t appear to be a benefit to any local agency startup for this type of initiative and no cases for 511 system information distribution were identified for analysis.

5.1 Recommended Action Plan

Since discussion with SunRail staff indicated there were no internal initiatives to pursue its own trip planner and funding was not likely to be available to build out a system, the implementation of an open-source trip planner may not currently be a feasible option for SunRail. Therefore, the following recommendations are based upon the assumption that SunRail would primarily rely on third party web based services for transit trip planning at the time of SunRail launch. If SunRail or other connecting systems are able to obtain funding for a regional trip planning solution in the future, an examination of the OpenTripPlanner software is suggested.
5.2 Policy & Administration

Step 1: Create a policy and procedures for generating GTFS data  
Timeframe: Begin immediately

A first step to take as an organization would be to adopt an internal policy and set of procedures to generate GTFS data. As an example, many transit agencies choose to generate their GTFS data at the same time they are processing schedule changes, several weeks prior to them going into effect. At minimum, this would include the standard GTFS data feed and ideally GTFS real-time data. It should be noted that GTFS data generation is not a one-time event, but a process that must be repeated every time there is an update to the transit schedule, routes, or stops so that third-party application display the most current information to users. However, given that there will likely be a small number of changes to the SunRail system once it’s deployed, the repeated generation of GTFS data is not expected to be a labor-intensive task. This repeated data generation could be accomplished internally within the organization, performed by an experienced partner agency, or be done by a contractor to SunRail. Language to require GTFS data generation of a third party contractor to SunRail has been provided as part of this technical assistance. Should that option be exercised, SunRail may want to use the awarded contractor’s proposed methodology and incorporate that activity into standard operating procedures.
(SOP). That ensures GTFS data generation becomes as engrained to agency operation as any other mission critical task.

**Step 2: Coordinate with regional transit partners on goal setting and technical issues**

**Timeframe: Begin immediately**

There are several benefits to coordinating activities with LYNX and VoTran on trip planning. The first is that GTFS data could be simultaneously released by LYNX, VoTran, and SunRail. The importance of this is to lower the effort required for developers to create a seamless network of regional transit travel planning. For example, if providers such as HopStop or The Transit App do not have GTFS data for the transit agencies connecting to SunRail, the system as a whole becomes less useful as the trip planning options for the user are incomplete. By releasing GTFS data simultaneously for all connecting agencies and promoting other regional datasets on each agencies site (e.g., LYNX including a link to SunRail’s developer page with GTFS data on their site, and vice versa), third party providers will likely add all regional data to their system at the same time. When the provider has GTFS data for all regional parties, it can then plan regional trips with connecting from one system to another. This is also true of real-time data. Cutting edge trip planners include the real time status of rail and bus departure times, which allows regional transit riders to have confidence that they will be able to make their transfer to the connecting service on time. SunRail, LYNX and VoTran all have, or will have, real-time data which could be packaged.

There are also technical reasons to coordinate. As the SunRail GTFS feed is created for the first time, there is an opportunity to build logical connections to its partner agency data. An example of this would be the matching the unique identification numbers of its rail stations to the connecting LYNX transit bus stops. By doing this, trip planning tools could recognize the shared ID number and recommend rail to bus transfers more easily, without having to guess that two nearby stops with different IDs might actually be the same physical location. Similarly, any generation of real-time data (e.g., GTFS-realtime) should be aligned with the GTFS data. For example, the tripIDs and stopIDs that identify particular transit service in the GTFS data should match up with the same tripIDs and stopIDs that describe that same transit service in the real-time data. Matching these IDs across datasets, both at the same agency and across agency boundaries, will lower the effort required for third-party providers to create quality services with seamless regional connectivity.

At the conclusion of this technical assistance, CUTR will host a web enabled coordination meeting to set an agenda for future cooperative activity among partners.

**Step 3: Draft and approve a user agreement that accompanies the data**

**Timeframe: Six to nine months prior to SunRail launch**

The SunRail GTFS user agreement will define the Terms of Use of the data. Based on existing examples from industry, licenses typically contain the following content:

- The agency reserves the rights to its logo and all trademarks. These marks should be an indicator used for official information from the agency only.
- The data is provided without warranties.
- No availability guarantees are expressed or implied.
- The agency retains full rights to the data.
The opendatacommons.org website hosts an easy to understand graphic (see above) to help visualize what the user agreement should contain in its most basic form. Any restrictions by the agency can be put in the section “As long as you:”.

Adding a Terms of Use is optional and not required if the agency does not want to attach any conditions to the data. To fully understand the legal ramifications of providing or not providing a Terms of Use agreement, the agency should consult with legal counsel.

5.3 Data Dissemination

All data dissemination activities are dependent upon the first set of GTFS data becoming available. It is possible that schedule and station identification data which are needed for trip planning, will not be available until closer to system operation than the following timeframes allow for. Therefore, they should be considered an ideal timeframe but could conceivably be compressed due to data availability.

Step 4: Create a publicly accessible web address that contains SunRail’s GTFS data

This is considered the first task of two related steps that can quickly establish a home for SunRail GTFS data that is easily discoverable by developers and third party service providers. SunRail should host their GTFS data (e.g., google_transit.zip file) on a publicly-accessible SunRail web server. The URL to the GTFS data that is shared with the public should always point to the most recent SunRail GTFS dataset. For example, whenever HART uploads a new GTFS dataset to their website, it has the same name as the prior GTFS dataset - http://gohart.org/google/google_transit.zip. A consistent file name ensures that third party providers can always retrieve the most recent transit data by visiting this URL. SunRail should not require authentication (e.g., a username and password) for someone to download the GTFS data, as this makes the automation of data updates very difficult for third party providers, and would deter providers from keeping their SunRail data up-to-date. Instead, the GTFS URL should be an openly accessible web address that anyone could enter in a web browser to download the data.

Step 4a: Create a developer webpage that links to the GTFS data and user agreement

Timeframe: Two to three months prior to SunRail launch
SunRail should consider creating a developer webpage that contains links to the GTFS data, Terms of Service agreement (if any), and any application programming interface (APIs) information. An API is an access point for software programmers to access specific transit data (e.g., real-time estimated arrival information. Having all information and data that a developer would need to implement a third party transit service in one web location increases the likelihood that the local community would create apps that incorporate SunRail’s data.

Additionally, the SunRail Developer Page should contain a link to Developer Pages of other connecting regional service, such as Lynx and VoTran.

![Image 16: PSTA Developer Webpage](image)

Step 5: Use email blasts to notify third party service providers and the Transit Developers Google group

Timeframe: Three months prior to SunRail launch

Hosting the GTFS data and a Developer Page, as described in Steps 4 and 4a, will establish a home for others to retrieve SunRail data along with any additional documentation. Once SunRail has a publicly accessible GTFS data file and developer page, it should notify third party developers that their data is available for public use. This notification can be done via email and message-board posts. All notifications, in emails and via message board posts, should contain URLs for the SunRail GTFS file as well as a link to the SunRail Developer Page, as well as the planned date when SunRail will begin service and will be open to the public.
The following contact list should be used to send notifications that GTFS for SunRail has become available. This list represents a diverse, but necessarily comprehensive, set of third party service providers that should quickly import the SunRail GTFS data feed into their respective trip planning utilities.

<table>
<thead>
<tr>
<th>Third Party Service</th>
<th>Contact Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Google Maps</td>
<td><a href="https://support.google.com/transitpartners/bin/request.py">https://support.google.com/transitpartners/bin/request.py</a></td>
</tr>
<tr>
<td>Open Trip Planner Transit App</td>
<td><a href="http://www.openplans.org">www.openplans.org</a></td>
</tr>
<tr>
<td>The Transit App for iPhone</td>
<td><a href="mailto:info@thetransitapp.com">info@thetransitapp.com</a></td>
</tr>
<tr>
<td>Routeshout</td>
<td><a href="http://www.routeshout.com/support/transit-contact">http://www.routeshout.com/support/transit-contact</a></td>
</tr>
<tr>
<td>HopStop</td>
<td><a href="mailto:doug@hopstop.com">doug@hopstop.com</a></td>
</tr>
<tr>
<td>Bing Maps</td>
<td><a href="mailto:bingmapstransit@microsoft.com">bingmapstransit@microsoft.com</a></td>
</tr>
<tr>
<td>MapQuest</td>
<td><a href="http://help.mapquest.com/contact-us">http://help.mapquest.com/contact-us</a></td>
</tr>
<tr>
<td>Mapnificent</td>
<td><a href="mailto:mail@mapnificent.de">mail@mapnificent.de</a></td>
</tr>
<tr>
<td>Walkscore</td>
<td><a href="http://www.walkscore.com/contact-us.php">www.walkscore.com/contact-us.php</a></td>
</tr>
</tbody>
</table>

Image 17: Trip Planning Contact List

The first step the agency should take is to visit the Transit Developers Google Group page (https://groups.google.com/forum/?fromgroups#!forum/transit-developers) and the Google Transit Data Feed Google Group page (https://groups.google.com/forum/?fromgroups#!forum/googletransitdatafeed) to join each group, based on the instructions on both sites. An agency must be a member of the group before they can post a message to the group. These lists are monitored by many third party application developers that provide services based on GTFS data. After receiving confirmation that the agency has been added to the groups, the agency can post a message to each group by clicking the “New Topic” button on the group website, and typing a message into the window, and then clicking “Post”. Alternately, after being added to the group instead of posting via the website, they could send emails directly to the group mailing lists, transit-developers@googlegroups.com and googletransitdatafeed@googlegroups.com. These emails or posts should contain with the SunRail’s name and URL of the Developer Page and GTFS data file. This activity should result in the addition of SunRail GTFS URLs to the GTFS Data Exchange (http://www.gtfs-data-exchange.com/) and Google Transit Data Feed list (http://code.google.com/p/googletransitdatafeed/wiki/PublicFeeds) sites by the developers that control these sites. It should also ensure that SunRail does not appear on the “Largest Agencies Without Open Data” list at CityGoRound.org.

After posting to the above Google Group pages, it is recommended that SunRail also directly contacts the third party providers listed in the table above to inform them that SunRail GTFS data is available and that SunRail would like to be added to their service. It should be noted that some third party providers may add the SunRail data to their services more quickly than others, depending on the demand for the service and number of developer staff available to respond to requests.

If timely, it is recommended that the public announcement of SunRail GTFS data be coordinated with announcements of GTFS availability from the other connecting systems (e.g., Lynx and VoTran). However, an unanticipated delay for one system releasing their GTFS data should not deter the other systems from proceeding with the announcement, as developers need as must advance notice as possible to be able to import the new GTFS data into their system in a timely fashion. If Lynx decides to
share its GTFS data, this announcement stop is very important, as it would remove Lynx as the #2 entry from the “Largest Agencies Without Open Data” list at CityGoRound.org.

The last entry in the table is the link to the OpenTripPlanner Deployer site, which is a free OpenTripPlanner trial service operated by OpenPlans. If SunRail wants to see what the OpenTripPlanner service would look like for their area, SunRail can visit the site at http://deployer.opentripplanner.org/ and enter the URL to their GTFS data. The OTP Deployer site will then email SunRail a link to the trial OpenTripPlanner server after their data has been processed. If SunRail decides that it would like to provide this service for their area, there are also commercial options for long-term hosting services.

Step 6: Verify that the GTFS data is publicly available on GTFS Data Exchange, and that Lynx is removed from the CityGoRound list of agencies not publicly sharing data

Timeframe: One month prior to SunRail launch

After announcing the availability of SunRail GTFS data and its Developer Page, SunRail should check after several weeks have passed to ensure that its data has been uploaded to GTFS Data Exchange website by transit developers. If the data has not been uploaded, SunRail should send a follow-up email or post to the two Google Groups mentioned in the previous step requesting that they be added again. If the developers on the list are not responsive, an optional step would be for SunRail to manually upload the data to the GTFS data exchange, at www.gtfs-data-exchange.com. It is preferable to be added to the site automatically by developers, as they have an automated tool that will constantly keep the data at GTFS Data Exchange in sync with the most recent GTFS data posted by SunRail to the SunRail site. If SunRail manually uploads the data instead, then it must repeat this manual process each time a new GTFS file is generated.

Additionally, if Lynx decides to share its data publicly using the steps outlined above, it should check to ensure it has been removed from the “Largest Agencies without Open Data” list at CityGoRound.org.

5.3 Performance Monitoring and Feedback

Step 7: Create a SunRail ‘app center’

Timeframe: Post SunRail launch

After the SunRail GTFS data has been available to the developer community for a short period of time, SunRail should begin to discover that third party providers are starting to incorporate SunRail data into their services, including the several trip planners mentioned earlier. In the three months between the agency’s data publishing and its operational start up, the expectation is that third party providers will load and test the system in their offerings. After SunRail begins operation, apps with the SunRail data featured in them can be used by SunRail staff and customers.

One way to share some of the apps found most useful to staff and customers is through an ‘App Center’ website. An App Center is a webpage of most used or most liked apps created by the third party providers. By creating an App Center, SunRail can direct those seeking trip planning tools to the applications found to be most beneficial by the agency and riders, without necessarily giving an official endorsement of any product. A disclaimer to that effect should be included on the app center page. The app center can also filter out results by type of device, phone operating system and intended use.
Step 8: Conduct feedback surveys  
**Timeframe: 12 months post SunRail launch**

As with any initial startup project which transitions into a managed program, SunRail should inquire of/monitor the preferences of its users. This effort should include surveys to gauge satisfaction in the performance of existing trip planning tools and solicit ideas for improvement and future capabilities. Additionally, this builds awareness in the ridership community of the existence of apps that offer more than end to end trip instructions (e.g., real-time data). These additional services may be more important to daily commuters who rarely deviate from their routine trips than end-to-end trip planning services. If certain important gaps in third-party services exist, and funding is available, SunRail may want to consider filling these gaps with self-hosted services.

An example of the types of questions asked of riders regarding trip planners is featured in the 2010 evaluation study of Chicago RTA’s ‘goroo’ trip planner.
Q. 1 Did you make the trip that you planned on goroo.com?

- Yes
- No (SKIPS TO LAST PAGE)

Q. 2 Did you use the directions provided by goroo.com?

- Yes, I used the directions
- Yes, though I changed the timing or the routing a bit
- No (SKIPS TO LAST PAGE)

Q. 2a Can you please tell us why you did not use the directions provided by goroo.com?

Q. 2b Did you seek directions from another website?

- Yes (GO TO Q.2c)
- No (GO TO Q.2d)

Q. 2c What website did you use for directions?

- RTA’s original transit trip planner (tripsweb.rtachicago.com)
- Google
- MapQuest
- Yahoo
- Microsoft Bing Maps
- Hopstop
- Other

Q. 2d What type of transportation did you use to make the trip? (Select one)

- Vehicle only (drove or was driven)
- Public transportation only
- Both vehicle and public transportation
- Other (please specify)

Q. 3 What type of transportation did you use to make the trip that you planned on goroo.com? (Select one)

- Vehicle only (drove or was driven)
- Public transportation only
- Both vehicle and public transportation
- Other (please specify)

Q. 4 How would you rate the accuracy of the directions provided by goroo.com? (Select one)
Step 9: Establish an Interagency Trip Planning and Technology Group

Another activity to maintain inter-agency coordination once SunRail is operational would be to establish a working group of staff among the transit providers. A technology centered group (or subgroup) would discuss developments in the trip planning industry and ensure compatibility should any of the agencies’ IT infrastructure change. An initial step to consider staff composition and format could be accomplished in the meeting to follow up this study which shares the results among partners.

Step 10: Conduct a Public Awareness Campaign Announcing a Regional Trip Planning Center

Outreach to customer markets is essential to create trip planning product awareness and adoption. This task may be accomplished through existing communications channels but may benefit from a campaign dedicated to these tools. SunRail should consider leading an effort to market electronic trip planners as a way to ease the use of the ‘new’ commuter rail service it will provide.
ENDNOTES

1 Alasdair Cain (2004). "Design Elements of Effective Transit Information Materials," University of South Florida. Available at