Small Urban and Rural GTFS: From Zero to a Service Planning

Shuman Tan, AICP
Texas A&M Transportation Institute (TTI)
Outline of Topics
For today’s presentation

Overview of TTI Practice
Building GTFS from Zero
Using GTFS in Service Planning
Lessons Learned
OVERVIEW

TTI’s Experience on GTFS
TTI’s Methodology for Feed Preparation
Google Maps Transit
A Efficient Trip Plan Tool

- Google launched the Google Transit Partner Program in December 2005.
- To join the program,
  1. Prepare a dataset that meets GTFS
  2. Contact the Google Transit Team to sign up for a partnership and test the data.

Image Source: addtransit.com and Google Transit
What is GTFS?
A question transit agencies may ask

- General Transit Feed Specification
- Standards/rules for organizing data
- Two types of GTFS: GTFS Static and GTFS RealTime
- GTFS Static Data Feed = 13 text files created following GTFS
- 13 text files = 6 required text files + 7 optional text files

One example:

---

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Required</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>trip_id</td>
<td>Required</td>
<td>The trip_id field contains an ID that identifies a trip. This value is referenced from the trips.txt file.</td>
</tr>
<tr>
<td>arrival_time</td>
<td>Required</td>
<td>The arrival_time specifies the arrival time at a specific stop for a specific trip on a route. The time is measured from &quot;noon minus 12h&quot; (effectively midnight, except for days on which daylight savings time changes occur) at the beginning of the service date. For times occurring after midnight on the service date, enter the time as a value greater than 24:00:00 in HH:MM:SS local time for the day on which the trip schedule begins. If you don’t have separate times for arrival and departure at a stop, enter the same value for arrival_time and departure_time.</td>
</tr>
</tbody>
</table>
Our Experience
From four GTFS projects we completed in recent three years

Prepared static GTFS data feed for:

- Capital Area Rural Transportation System, Texas in 2014 (Small urban and rural)
- Port Arthur Transit, Texas in 2015 (Small urban)
- Beaumont Municipal Transit, Texas in 2015 (Small urban)
- Abilene CityLink, Texas in 2016 (Small urban)

https://tti.tamu.edu/group/transit-mobility/
Our Methodology
From four GTFS projects we completed in recent three years

Four steps:
- Step 1: Shapefile Preparation
- Step 2: GIS Processing
- Step 3: Excel Processing and Formatting
- Step 4: Feed Validation

TTI toolset can be downloaded from here:
https://sites.google.com/site/gtfspreparationtools/home/TTI%20GTFS%20Feed%20Preparation%20Toolset.zip?attredirects=0&d=1
Our Methodology
From four GTFS projects we completed in the past three years

Toolset applicable transit agency

The transit agency runs a small urban transit system
- With less than 100 fixed-routes, and
- Each route has less than 100 stops

Software requirement
- ArcGIS for Desktop version 10.1 or higher with advanced license (formerly known as ArcInfo)
- Microsoft Excel 2007 or advanced version
Step 1. Shapefile Preparation
Create route and stop shapefiles for each route

Routes:
Several ways
TIGER/Line shapefiles
Draw in ArcMap, etc.

Stops:
Several ways
Add XY via existing inventory,
Draw in ArcMap, etc.

We recommend the Google My Maps
Step 1. Shapefile Preparation

Organize attribute tables, for the shapefiles you have already created

Routes:
Two fields required: R_GTFSID, R_Name

<table>
<thead>
<tr>
<th>OBJECTID *</th>
<th>Shape *</th>
<th>R_GTFSID</th>
<th>R_NAME</th>
<th>Shape_Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Polyline</td>
<td>Route01</td>
<td>Downtown/Carver</td>
<td>0.06906</td>
</tr>
</tbody>
</table>

Stops:
Three fields required: R_GTFSID, S_ID, S_Name

<table>
<thead>
<tr>
<th>OBJECTID *</th>
<th>Shape *</th>
<th>R_GTFSID</th>
<th>S_ID</th>
<th>S_NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>24</td>
<td>Point</td>
<td>Route01</td>
<td>Route0101</td>
<td>Transit Center</td>
</tr>
<tr>
<td>1</td>
<td>Point</td>
<td>Route01</td>
<td>Route0102</td>
<td>Cypress &amp; N. 2nd</td>
</tr>
<tr>
<td>2</td>
<td>Point</td>
<td>Route01</td>
<td>Route0103</td>
<td>Cypress &amp; N. 5th</td>
</tr>
<tr>
<td>3</td>
<td>Point</td>
<td>Route01</td>
<td>Route0104</td>
<td>N. 6th &amp; Cedar</td>
</tr>
</tbody>
</table>
Step 2. GIS Processing
Organize ArcCatalog to prepare shapefiles for running Python scripts
Step 2. GIS Processing
General function of TTI python scripts

We developed *seven* python scripts.
Step 3. Excel Processing and Formatting

stops, stop_times, and shapes.txt
Step 3. Excel Processing and Formatting

The remaining text files

Toolset Part 3 interface

SUBSTEP 1
Specify Path to Your Folder: C:\Users\tan\Desktop\GTFS Tools Development\Processing\GTFS Feed

SUBSTEP 2
CLICK HERE
TO SPLIT THIS WORKBOOK TO SEPARATE SHEETS

SUBSTEP 3
Check Your Folder and Continue to STEP 4

CONTENTS IN GREEN AREAS ARE EXAMPLES. REPLACE THEM WITH YOUR AGENCY’S INFORMATION.
COPY AND PASTE STOPS, STOP_TIMES, AND SHAPES FROM TOOLSET PART 2.
End Product of Step 3
What will you have by the end of step 3?

A set of CSV files.
Step 4: Feed Validation

- Download GTFS validator from here: https://github.com/google/transitfeed/releases
- Test GTFS feed
- Revise the data feed until “feed validated successfully”
USING GTFS IN SERVICE PLANNING

An Example: El Paso County, Texas
1. Compare Transit Need and Supply
Transit Need vs. Transit Supply
Transit Need Index: Four Measures

- Population Age 65 and Older
- Household with Individual with Disability
- Population Below Poverty Level
- No Household Vehicle Available
Transit Supply Index: Three Measures

- % of Transit Supportive Census Blocks with Transit Coverage
- Average Bus Trips Per Stop Per Day
- Hours of Operation
2. Identify Potential Locations/Corridors
Access to Work
Job Density vs. Service Coverage
Access to Work
Job Density vs. Service Frequency

![Map showing job density and service frequency](image-url)
Access to Medical Facility

Medical Facility Density vs. Service Coverage

El Paso County Medical Facility Kernel Density

- Sun Metro Bus Routes
- El Paso County Rural Transit Bus Routes

Number of Medical Facilities per Square Mile

<table>
<thead>
<tr>
<th>Number Range</th>
<th>Number of Facilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.15 - 0.88</td>
<td></td>
</tr>
<tr>
<td>0.89 - 2.89</td>
<td></td>
</tr>
<tr>
<td>2.9 - 4.9</td>
<td></td>
</tr>
<tr>
<td>4.91 - 6.91</td>
<td></td>
</tr>
<tr>
<td>6.92 - 8.91</td>
<td></td>
</tr>
<tr>
<td>8.92 - 10.92</td>
<td></td>
</tr>
<tr>
<td>10.93 - 12.93</td>
<td></td>
</tr>
<tr>
<td>12.94 - 14.94</td>
<td></td>
</tr>
<tr>
<td>14.95 - 16.95</td>
<td></td>
</tr>
<tr>
<td>16.96 - 18.96</td>
<td></td>
</tr>
<tr>
<td>18.97 - 20.97</td>
<td></td>
</tr>
<tr>
<td>20.98 - 31.12</td>
<td></td>
</tr>
</tbody>
</table>
Access to medical facility

Medical Facility Density vs. Service Frequency

El Paso County Medical Facility Kernel Density

Kernel Density of Daily Bus Trips at Each Bus Stop in El Paso County (Weekday)
LESSONS LEARNED

Problems and Opportunities
Lessons Learned

What did we learn from our experience?

- Google requires at least 4 minutes to enable a transfer. Schedule may need to be revised slightly to make transfer display correctly.
- Google Maps Transit always display next available service. This may cause confusing for transit agencies without weekend service.
- Small urban transit agencies often operate loops, \textit{direction\_id} could be tricky.
- Most rural transit agencies operate demand response service for the general public. Look forward to GTFS Flex.
- Integrated GTFS data are powerful, especially with the support of other data.
- GTFS maintenance is necessary and a key to maximize riders’ experience.
THANK YOU AND QUESTIONS?

Contact Information

Shuman Tan
713-613-9207
s-tan@tti.tamu.edu