Using GTFS Transit Data in Transportation Modeling

presented by
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Presentation Outline

• GTFS Overview
• GTFS User Applications
• Data and Format
• Current Transit Modeling Practice
• Benefits of Using GTFS
• Challenges of Using GTFS
• GTFS – The Big Picture
What is GTFS?

- GTFS = the General Transit Feed Specification
- Is a common format for public transportation schedules and associated geographic information
- “Feeds” allow transit agencies to publish their transit data and developers to write applications
- It is a collection of text tables
- De-facto standard among public agencies
- Common amongst route planning applications

Example 1. Real Time Route Planning
Example 2. Real Time Bus Location

GTFS Tables

- Trips
- Stop Times
- Routes
- Calendar
- Geometry
- Agency
- Stops
- Fare Rules
- Transfers
- Fare Rules and Attributes
GTFS Schedule

<table>
<thead>
<tr>
<th>Trip</th>
<th>6:00 AM</th>
<th>6:10 AM</th>
<th>6:12 AM</th>
<th>6:13 AM</th>
<th>6:20 AM</th>
<th>6:20 AM</th>
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</thead>
<tbody>
<tr>
<td>Trip 1</td>
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<td>Trip 2</td>
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<td>Trip 6</td>
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</tbody>
</table>

Transit Modeling Elements

- Complex transit network
  - Path could include a combination of modes
  - Several transfer opportunities

- Transit elements
  - In-vehicle times
  - Out-of-vehicle times – access, xfer, xfer wait, egress
  - Fares
Manually drawing routes from non-GIS sources is error prone, time-consuming, and hard to maintain.

Current Transit Modeling Practice

- Current Transit Modeling Practice
  - Network coding is time consuming and error prone
  - Periodic updates required – also time consuming
  - Unconflated transit network – introduces inaccuracies
  - Inaccurate access information – links need to be built manually in many cases
  - Many of the bus travel times are “model defaults”
  - Initial wait times – typically half the headway
  - Timed transfers – difficult to model
- Using GTFS could alleviate these limitations
Benefits – GTFS in Transportation Modeling

- Used by several agencies – e.g., Brevard, Miami-Dade, Hillsborough and Space Coast
- Higher accuracy – geometry, stop detail, travel times, frequency based on schedule
  - Therefore improved calibration
- Easier to update – can be automated
  - Will need QA/QC
- Ability to integrate data from other agencies using GTFS
- Price is right – it’s free!

Challenges Using GTFS Data

- Challenges
  - Map the network agnostic routes to our network
  - Integration with highway network
  - Updating select data when importing
  - Data formatting issues while importing/exporting
Challenge – Map Matching the GTFS Routes

Stop: closest Node in the Physical Roadway Network

GTFS Route

Stop: closest Node in the planning network

Physical Roadway Network

Transportation Planning Network
GTFS Data and Map-Matching

- The higher detail in the roadway network the easier it is to match an accurately coded route to the planning network
- Map matching is available now and has high success
- Knowledge of the GTFS data in the study area and collaboration with public agencies is necessary

Current State-of-the-Practice

- Trips → Demand Estimation (Trip Based or Activity Microsimulation)
- Demand Estimation (Trip Based or Activity Microsimulation) → Static Transit Assignment (no Simulation, headway based)
- Static Transit Assignment (no Simulation, headway based) → LOS
- LOS → Static Highway Assignment (no Simulation, no Traffic Dynamics)
- Static Highway Assignment (no Simulation, no Traffic Dynamics) → Trips

GTFS
Dynamic Traffic & Transit Assignment

- Dynamic Transit Assignment uses schedule-based transit information instead of frequencies
  - Service and demand are time dependent while individual travelers can be microsimulated
  - Capacity, crowding, information provision, and service irregularities are modeled explicitly
- Dynamic Traffic Assignment can be the most appropriate tool for modeling traffic congestion
  - Realistic traffic dynamics that do capture congestion
  - Enhanced multiparametric route choice
  - Can use mesoscopic, microscopic, or a combination of both traffic simulation methodologies
Traffic Dynamics In DTA

Freeway merge section

Static Model

1 lane
2 lanes 3 lanes 2 lanes
v/c > 1

DTA Model

1 lane
2 lanes 3 lanes 2 lanes
v/c = 1

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