Integrating Ride App Vehicles into the SFO Curbside Traffic Model

ESRI User Conference
San Diego
July 11, 2019
Terminal Area
Terminal Area
Roadways

Each roadway has an inner (terminal-adjacent) and outer (island) curbside zone

During curbside study:
Upper level: All drop-offs, courtesy shuttles, and ride app pick-ups
Lower level: All other pick-ups
Curbside Modeling

- VISSIM microsimulation models for each of the four curbside roadways (domestic and international, upper and lower)
  - Created in 2008 by SFO and HNTB
  - Previously updated in 2011 for the reopening of Terminal 2
From 2011 to 2016...

- Terminal 2 reopened (April 2011)
- Passenger traffic grew from 41.0 million annual passengers (MAP) to 53.1 MAP
- Transportation Network Companies (TNCs or ride apps) began operating (licensed in September 2014)
  - From 0 (2011) to 14,000 (2016) daily trips
  - As of 2019, over 30,000 daily trips
- Roadway congestion increased
Ride Apps at SFO

- Regulated by the California Public Utilities Commission (CPUC)
- Required to maintain CPUC and SFO permits
- Trip fees assessed using an in-app reporting system
  - Developed in-house by SFO and licensed to AAAE
  - Geofence-based
Ride App Growth at SFO

Year over Year Growth Rate

- YOY growth, pick-ups per 100 deplanements
- YOY growth, drop-offs per 100 enplanements
Curbside Congestion Study
2016-17

• In 2016, the Airport decided to perform a Curbside Congestion Study
  – First time integrating ride apps into the model
• Data sources
  – Traditional surveys
  – Tube counts
  – Commercial vehicle transponder data (cordon lines)
  – **Ride app trip data**
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Trip Fee Reporting

Purple: drop-offs
Green: pick-ups
GIS Curbside Features, Schematic

Terminal 3 Schematic View

Begin T3, 2,170
End of delineators separating traffic merging from the outer roadway, 2,350
Door 8 and AirTrain bridge, 2,730
Door 9 crosswalk, 2,850
Door 9, 2,840
Door 11 crosswalk, 2,950
Door 11, 2,960
End T3, 3,140
ModelBuilder Model

- X-Y table
- Make XY Event Layer
- TNC_layer
- Feature To Point
- Temp
- Near
- Upper roadway sections
- Near_Object
Python Script

# Import arcpy module
import arcpy
import sys

# Script arguments
Raw_TNC_data_table = arcpy.GetParameterAsText(0) + "\page$"
if Raw_TNC_data_table == '#' or Raw_TNC_data_table == "\page$" or not Raw_TNC_data_table:
    sys.exit("No file selected.")

# Local variables:
Layer_Name_or_Table_View = "page$ Layer"
Temp_Zones = "Data.gdb\Temp_Segments"
Temp_Zones_2 = Temp_Zones
Zones = "Data.gdb\UpperRoad_sections"
Output_folder = "Distribution\"

# Process: Make XY Event Layer
print("Making XY layer...")
arcpy.MakeXYEventLayer_management(Raw_TNC_data_table, "lon", "lat", Layer_Name_or_Table_View, "GEOGCS['GCS_WGS_1984',DATUM['D_WGS_1984',SPHEROID['WGS_1984',6378137.0,298.257223563']],PRIMEM['Greenwich',0.0],UNIT['Degree',0.00174532925199432]]","")

# Process: Feature To Point
print("Feature to point...")
arcpy.FeatureToPoint_management(Layer_Name_or_Table_View, Temp_Zones, "CENTROID")

# Process: Near
print("Near...")
arcpy.Near_analysis(Temp_Zones, "Upper_road_sections", "120 Feet", "NO_LOCATION", "NO_ANGLE", "PLANAR")

# Process: Add Join
#arcpy.AddJoin_management(Temp_Zones, "NEAR_FID", "Zones", "OBJECTID", "KEEP_ALL")

# Process: Table to Table
print("Exporting table...")
arcpy.TableToTable_conversion(Temp_Zones, Output_folder, "Output" + str(time.time()) + ".csv", "", "LOCAL_TNC_TIMEST \"LOCAL_TNC_TIMEST\" true true"

# Process: Delete
print("Cleaning up...")
arcpy.Delete_management(Temp_Zones, ")
Heat Mapping
Drop-off Data Analysis

TNC drop-offs versus first Southwest door

TNC drop-offs versus first Delta door

TNC drop-offs versus first United door
Data Analysis
Confirms, Confirmed by Firsthand Observations

• Complemented traditional curbside validation process (camera and in-person observation and discussions with Airport Duty Managers and Police Service Aides)
• Transaction locations aligned with stakeholders’ impressions of curbside “hot spots”
• For drop-offs, the transactions patterns were also applied to taxis and private vehicles
Procedural Changes

Cumulative Distribution of TNC Pick-Ups

Distance Along Curb

Pick-ups - Sample 1  Pick-ups - Sample 2
Procedural Changes

Terminal 3 TNC Activity, 6:00-9:59, Sample 2
Visualization

Blue: Drop-Offs
Red: Pick-Ups
Findings

- Using GIS tools to perform analysis of TNC activity allowed the Airport to update its VISSIM model with unprecedented accuracy for:
  - Volume
  - Desirability of curb segments
- GIS analysis, and subsequent visualizations, allowed the Airport to make procedural changes to improve traffic flow
- Changes in pick-up or drop-off policy, or in-app behavior, can be analyzed immediately
Thank You

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