Agenda

Motivation and Objectives

Model Design and Input Preparation

Model Specifications, Interface and Validation

Modeling Tools
Motivation and Objectives

- History of the model in Riverside County
  - Developed in 2010
  - Based on 2008 SCAG RTP
  - Outdated infrastructure and land use

- Respond to stakeholders' priorities
  - Improve transparency
  - Improve runtime
  - Better reflect local conditions
  - Documentation and training
Motivation and Objectives

► Retain consistency with SCAG assumptions and projections
  ✓ Updated as needed to reflect local conditions
  ✓ Simplify as needed to reduce runtime and facilitate model maintenance
  ✓ Upgrade as needed to capture unique Riverside County travel patterns

► Extensive involvement with local jurisdictions for accuracy of model inputs, including SED and networks.
Model Design

- RIVCOM has
  - A more focused model area than RIVTAM and SCAG Model
  - More detailed network and zone system
  - Jurisdiction-approved socio-economic input data
  - A base year of 2018 and a future year of 2045
  - Post-processors for legislative requirements
  - Improved run time compared to the current RIVTAM/SCAG models
  - Version-controlled code base accessible to model users
  - Up-to-date documentation
Riverside County
Orange County
SB Valley
San Diego County

Balance desire to internalize inter-county trip prediction
Model Design – TAZ Delineation

Criteria:
1. Follow SCAG Tier 1 TAZ structure
2. Aggregated based on the freeways or major arterials, but with more detail for areas along SB/IB
3. Under general professional judgement to ensuring model accuracy

TAZ Structure Outside Riverside County/OC/SD Valley/SD

1. CC/IB Valley: Extract TAZ from SCAG Tier 1 TAZ Structure
2. SD County: Review geographic information from SANDAG models
3. Aggregate TAZ in Orange County/IB Valley/SD County

Jurisdiction Outreach

Finalize TAZ Structure

TAZ Structure within Riverside County

1. Extract Riverside County from SCAG Tier 3 TAZ Structure
2. Integrate City-Wide Model TAZ Structure
3. Adjust TAZ to existing boundaries
4. Finalize TAZ Structure

External Stations

1. Review External Stations in the existing SCAG/MTAM/SANDAG models
2. Refine External Stations
3. Finalize External Stations

Site/Oil New Modeling Region

Finalize TAZ Structure
RIVCOM TAZ System

- 3,482 TAZs
- Nest within SCAG TAZs
- Riverside County
  - 3,299 TAZs
  - Preserve/increase zone detail in more urbanized areas
  - Add detail in growing areas
  - Consistent with city boundaries
- Outside Riverside County
  - 99 in SB Valley, 70 in OC, and 14 TAZs in SD County
  - Recognize interaction across the county border
Input Data Preparation

- Consistent with SCAG 2020 RTP/SCS
- Significant involvement with local jurisdictions to refine input data
Model Specification, Interface and Validation
Model Specification

- Trip-based (four-step) model framework in TransCAD 8.0
- Stand-alone model – not derived from the SCAG model but...
  - Consistent with SCAG Tier 3 zones, networks, and regional SED control totals
  - Consistent with SCAG predicted external station volumes
  - Certain model components calibrated based on SCAG model outputs
- Three time-of-day periods
  - AM Peak 6:00 AM - 9:00 AM
  - PM Peak 3:00 PM - 7:00 PM
  - Off Peak 9:00 AM - 3:00 PM & 7:00 PM - 6:00 AM
Model Process

External Trips
  - EE
    - External trips are a percentage of external gate AWD
  - IEEI
    - IEEI trips are OD balanced from remainder of external gate demand
    - Same Segmentation as EE

Internal Trips
  - Population Synthesizer
    - Households and Persons in region with attributes such as size, auto-ownership, employment status, student status, etc.

Trip Generation
  - Home-based Work (HBW)
  - Home-based School (HBSC)
  - Home-based University (HBU)
  - Home-based Shop (HBSH)
  - Home-based Other (HBO)
  - Non-home-based (NHB)
  - 5 Segments:
    - 0 Autos
    - Insufficient Low & High Income: Autos = 1 & Workers > 1 for HBW (Autos = 1 & Persons > 1 for HBO)
    - Sufficient Low & High Income: Rest of the Households

Time of Day
  - Three time periods: AM, PM, Off-Peak

Trip Distribution
  - HBSSH* purpose aggregated to HBO

Mode Choice
  - All purposes and segmentation are by three time periods
  - Destination Choice Model Adapted from NRV Model
  - Auto: drive alone, shared ride, shared ride 3+
  - TNC
  - Transit: walk, pnr, knr access to transit
  - Non-motorized: walk

Highway Assignment
  - AM, PM, Off-peak

4 Segments:
  - Drive alone
  - Shared-Ride 2
  - Shared Ride 3
  - Trucks

Same Segmentation as Trip Generation
Population Synthesizer

- A Standalone PopSyn III implementation of the population synthesizer (JavaPop)
- To synthesize the resident population and group-quarter populations
- Two controls files - TAZ level controls and Regional controls
- 5-year ACS PUMS data for 2014-2018
Trip Generation

- **Resident Trips**
  - HBW/HBSH/ HBSC/HBU/HBO/NHB
  - A standard cross-classification approach for trip production
  - A simple rate model for trip attraction

- **Truck Trips**
  - Commercial Vehicles/Single Unit Trucks/Multi-Unit Trucks
  - Truck trip generation from a function of employment variables

- **External Trips**
  - Based on volumes at all the external stations/TAZs
Trip Generation

- Five Market Segmentations for Resident HBW and HBO
  - Zero autos
  - Low income insufficient
  - Low income sufficient
  - High income insufficient
  - High income sufficient
Trip Distribution

► Resident Trips
  ✓ Discrete destination choice models
  ✓ The utility of a destination is a function of:
    o multi-modal accessibilities and preferences
    o the attractiveness of the destination zone
    o person and household attributes
    o other unknown, un-included attributes of the trip maker or the destination zone

► Truck Trips and External Trips
  ✓ The gamma function friction factor-based gravity models
Mode Choice

<table>
<thead>
<tr>
<th>Home-based work</th>
<th>Home-based other</th>
<th>Non-home-based</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zero autos</td>
<td>Zero autos</td>
<td></td>
</tr>
<tr>
<td>Low income insufficient</td>
<td>Low income insufficient</td>
<td>School</td>
</tr>
<tr>
<td>Low income sufficient</td>
<td>Low income sufficient</td>
<td>University</td>
</tr>
<tr>
<td>High income insufficient</td>
<td>High income insufficient</td>
<td></td>
</tr>
<tr>
<td>High income sufficient</td>
<td>High income sufficient</td>
<td></td>
</tr>
</tbody>
</table>
Trip Assignment

- San Diego County and Orange County links are preloaded
  - Based on OCTAM and SANDAG model outputs.
- Uses NCFW algorithm
- BPR Volume-Delay Function
- The number of iterations is determined by a user defined closure parameter (0.0001), or a maximum number of iterations (400).
Model UI

- Installation
  - Zip file with a double click installer

- Simple interface with four tabs
  - Create Scenario Tab
  - Run Model Tab
  - Utilities Tab
  - Post-process Tab
Model UI
Model UI

PopSyn Settings
- PopSyn input folder: 2018_popsyn_inputs
- Run PopSyn
- Exit

Fixed OD Settings
- Select Source Scenario
- New Scenario Name
- Network File
- Run Fixed OD
- Exit
## Static Validation

### Facility Type Highway Validation Statistics

<table>
<thead>
<tr>
<th>Facility Name</th>
<th>Number of Links</th>
<th>Mean Count</th>
<th>Mean Volume</th>
<th>Percent RMSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freeways</td>
<td>122</td>
<td>73329</td>
<td>73299</td>
<td>15.95%</td>
</tr>
<tr>
<td>HOV</td>
<td>50</td>
<td>15994</td>
<td>15882</td>
<td>31.49%</td>
</tr>
<tr>
<td>Principal Arterial</td>
<td>154</td>
<td>21243</td>
<td>23554</td>
<td>33.77%</td>
</tr>
<tr>
<td>Minor Arterial</td>
<td>175</td>
<td>15615</td>
<td>15072</td>
<td>35.95%</td>
</tr>
<tr>
<td>Major Collector</td>
<td>121</td>
<td>9015</td>
<td>8747</td>
<td>50.75%</td>
</tr>
<tr>
<td>Minor Collector</td>
<td>4</td>
<td>6886</td>
<td>7202</td>
<td>38.42%</td>
</tr>
</tbody>
</table>

### Volume Group Highway Validation Statistics

<table>
<thead>
<tr>
<th>Count Volume Group</th>
<th>Number of Links</th>
<th>Mean Count</th>
<th>Mean Model Volume</th>
<th>Percent RMSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;=5000</td>
<td>65</td>
<td>3064</td>
<td>3615</td>
<td>108.34%</td>
</tr>
<tr>
<td>5000-24999</td>
<td>374</td>
<td>14195</td>
<td>14862</td>
<td>39.1%</td>
</tr>
<tr>
<td>25000-49999</td>
<td>80</td>
<td>32527</td>
<td>34143</td>
<td>27.08%</td>
</tr>
<tr>
<td>50000-99999</td>
<td>90</td>
<td>75309</td>
<td>73577</td>
<td>16.2%</td>
</tr>
<tr>
<td>&gt;=100000</td>
<td>17</td>
<td>116484</td>
<td>114237</td>
<td>9.55%</td>
</tr>
<tr>
<td>Total</td>
<td>626</td>
<td>26946</td>
<td>27298</td>
<td>27.33%</td>
</tr>
</tbody>
</table>
## Static Validation

<table>
<thead>
<tr>
<th>City Group</th>
<th>Number of Links</th>
<th>Mean Count</th>
<th>Mean Volume</th>
<th>Percent RMSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>BEAUMONT_BANNING</td>
<td>28</td>
<td>12795</td>
<td>10237</td>
<td>38.44%</td>
</tr>
<tr>
<td>COACHELLA_PALM SPRINGS</td>
<td>126</td>
<td>14133</td>
<td>15750</td>
<td>35.27%</td>
</tr>
<tr>
<td>CORONA_RIVERSIDE</td>
<td>162</td>
<td>26107</td>
<td>27008</td>
<td>26.49%</td>
</tr>
<tr>
<td>MORENO VALLEY_PERRIS</td>
<td>41</td>
<td>17817</td>
<td>17361</td>
<td>26.23%</td>
</tr>
<tr>
<td>San Bernardino County</td>
<td>131</td>
<td>46666</td>
<td>47306</td>
<td>23.61%</td>
</tr>
<tr>
<td>SAN JACINTO_HEMET</td>
<td>8</td>
<td>16817</td>
<td>16282</td>
<td>22.35%</td>
</tr>
<tr>
<td>TEMECULA_LAKE ELSINORE</td>
<td>82</td>
<td>24309</td>
<td>21429</td>
<td>24.72%</td>
</tr>
<tr>
<td>Unincorporated Riverside County</td>
<td>48</td>
<td>31839</td>
<td>34289</td>
<td>22.78%</td>
</tr>
</tbody>
</table>
Dynamic Validation

- A series of tests to evaluate how well the model responds to input changes
  - Add or remove households in a TAZ
  - Add or remove employments/jobs in a TAZ
  - Add or remove lanes in an arterial roadway segment
  - Toll a section of the highway

- Results showed good model sensitivity
  - Roadway volume changes
  - VMT changes
Dynamic Validation
Model Specifications

Modeling Tools
Modeling Tools

- For SB 743 analysis purpose
- VMT by purpose and by TAZ
- Boundary VMT

- VMT by speed bin
- Automate the process to:
  - update EMFAC template
  - run EMFAC, and
  - report emission outputs

- Estimates on active transportation strategies
- Multinomial logistic regression technique
- Outputs:
  - Mode share and trips by mode and by zone
  - VMT reduction by zone, etc.