Forum Agenda

• Welcome and Introductions
• Travel Model Visualizations
• What Feeds the Beast
• Project Updates
Welcome and Introductions

• Staffing Updates
  – Welcome Pat Landrum!
    • Director of Data and Modeling
  – Welcome back Susan Xu!

• New Model Website
• Return to 401 B Street
• Pending Retirement: ABM1
TRAVEL MODEL VISUALIZATIONS

Gregor Schroeder
Jeff Yen
Setting Up BI Tools for Success!

• What happens when an ABM2+ Model Run is completed?
  1. ABM model run notifies a Microsoft Azure SQL Server database instance that the model run is complete and ready to be loaded
  2. Each night the SQL Server instance looks for new notifications from ABM model runs and loads the final data files into the database.
  3. This is done for every ABM model run. The database instance can hold thousands of ABM model runs.

• Why is this important?
  1. Makes management of thousands of ABM model runs possible
  2. Allows analyst access to thousands of ABM model runs with minimal effort
  3. Enables development of automated reporting procedures and helps to unlock the power of BI software.
Data Model Powers Up BI Tools

• Entity-Relationship Model
  1. Relational. Third Normal Form (3NF). Prioritizes referential integrity, reducing data duplication. Can be slow and difficult to work with in BI software.

• Dimension Model
  1. Star Schema. Prioritizes ease of use and speed. Everything is just one join away! BI software is made for this!!!
Mode Choice Report

**DEMOGRAPHICS**

<table>
<thead>
<tr>
<th>Metric</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population</td>
<td>42,112</td>
</tr>
<tr>
<td>Households</td>
<td>16,353</td>
</tr>
<tr>
<td>Household Size</td>
<td>2.48</td>
</tr>
<tr>
<td>Employed Residents</td>
<td>19,714</td>
</tr>
<tr>
<td>Employees</td>
<td>11,382</td>
</tr>
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</table>

**STUDY AREA TRIPS**

<table>
<thead>
<tr>
<th>Metric</th>
<th>Value</th>
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<tbody>
<tr>
<td>MGRA Intra-zonal</td>
<td>2,311</td>
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<tr>
<td>MGRA Inter-zonal</td>
<td>30,575</td>
</tr>
<tr>
<td>Total Trips</td>
<td>303,322</td>
</tr>
<tr>
<td>MGRA Intra-zonal Pct</td>
<td>.75</td>
</tr>
</tbody>
</table>

Study Area Internal Vehicle Capture Rate: 83.6%

**AVERAGE TRIP LENGTHS**

<table>
<thead>
<tr>
<th>Metric</th>
<th>Value</th>
</tr>
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<tbody>
<tr>
<td>Resident Person Trip Length</td>
<td>6.39</td>
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<tr>
<td>Resident Auto-Trip Vehicle Trip Length</td>
<td>6.80</td>
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<tr>
<td>All Model Person Trip Length</td>
<td>6.47</td>
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<tr>
<td>All Model Vehicle Trip Length</td>
<td>6.84</td>
</tr>
<tr>
<td>Resident Round-Trip Commuter Tour Length</td>
<td>22.44</td>
</tr>
<tr>
<td>Employee Round-Trip Commuter Tour Length</td>
<td>29.02</td>
</tr>
</tbody>
</table>

**DAILY MODE CHOICE**

<table>
<thead>
<tr>
<th>Mode</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Drive Alone</td>
<td>50.2%</td>
</tr>
<tr>
<td>Shared Ride 2</td>
<td>3.6%</td>
</tr>
<tr>
<td>Micromobility &amp; Microtransit</td>
<td>0.2%</td>
</tr>
<tr>
<td>School Bus</td>
<td>0.7%</td>
</tr>
<tr>
<td>Shared Ride 3+</td>
<td>15.9%</td>
</tr>
<tr>
<td>Taxi &amp; TNC</td>
<td>6.6%</td>
</tr>
<tr>
<td>Transit</td>
<td>2.2%</td>
</tr>
<tr>
<td>Walk</td>
<td>3.8%</td>
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</tbody>
</table>

Total Trips: 100.0%

**PEAK COMMUTE MODE CHOICE**

<table>
<thead>
<tr>
<th>Mode</th>
<th>Percentage</th>
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</thead>
<tbody>
<tr>
<td>Drive Alone</td>
<td>79.1%</td>
</tr>
<tr>
<td>Shared Ride 2</td>
<td>4.2%</td>
</tr>
<tr>
<td>Micromobility &amp; Microtransit</td>
<td>0.3%</td>
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<tr>
<td>School Bus</td>
<td>10.4%</td>
</tr>
<tr>
<td>Shared Ride 3+</td>
<td>4.2%</td>
</tr>
<tr>
<td>Taxi &amp; TNC</td>
<td>0.3%</td>
</tr>
<tr>
<td>Transit</td>
<td>3.7%</td>
</tr>
<tr>
<td>Walk</td>
<td>1.0%</td>
</tr>
</tbody>
</table>

Total Trips: 100.0%
ABM2+ Base Year Validation

Jeff Yen
Overview

- What’s travel model validation?
- Traffic flow validation
- Major improvements
- Data visualization of ABM validation results
What’s Travel Model Validation?

“The set of processes to verify the travel models have enough fidelity”
Traffic Volume Validation

• Data:
  - Observed counts obtained from SANDAG, local jurisdictions, and Caltrans District 11.
  - PeMS stations five-minutes data.
  - SANDAG roadway network.

• Workflows:
  - Cross-reference PeMS stations with SANDAG roadway network.
  - Produce Annual Average Count.
  - Perform ABM validation and visualize the results.
Cross-reference SANDAG HwycoV with PeMS stations

- I-5S GP station
- I-5N GP station
- Station out of distance threshold (150ft)
Major Improvements

• Automated the cross-referencing processes using Python.
  – Enable the program reusability.

• Added more observed PeMS counts for ABM freeway validation.
  – Current: 612; before: 331.

• Enabled dynamic count inventory update in old Excel validation templates.

• Introduced new validation templates using Power BI.
  – Enhanced data visualization of model validation result.
  – Enabled the template shareability and reusability.
Data Visualization Enhancement by Power BI
WHAT FEEDS THE BEAST

Grace Chung
David Tedrow
Land Inventory System

Regional Forecast

Subregional Forecast

Detailed Demographic Forecast

Transportation Model (ABM)

Current housing, jobs, & population
Local land plans & policies
Jurisdictional review

Historical data
Current demographics
DOF projections
Demographic trends
Expert review
Land Inventory System

Base Year Info
- Land Use
- Housing Unit
- Housing Type

General Plan
Housing Capacity
Sched Dev Project
Constraint

Subregional Growth Forecast Model
SANDAG’s Land Inventory System

1971

1981

2020
SANDAG’s Land Inventory System

Parcel Integration Process

- Annual Process
- SanGIS Parcels and ROWs
- “LANDCORE” (Land Use Inventory editing layer)
LAND USE CODES

Sandag’s Land Inventory System

Land Use Codes

<table>
<thead>
<tr>
<th>Land Use Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1000</td>
<td>Residential</td>
</tr>
<tr>
<td>2000</td>
<td>Commercial</td>
</tr>
<tr>
<td>3000</td>
<td>Industrial</td>
</tr>
<tr>
<td>4000</td>
<td>Transportation</td>
</tr>
<tr>
<td>5000</td>
<td>Light Industry</td>
</tr>
<tr>
<td>6000</td>
<td>Hospitals</td>
</tr>
<tr>
<td>7000</td>
<td>Military Use</td>
</tr>
<tr>
<td>8000</td>
<td>Schools</td>
</tr>
<tr>
<td>9000</td>
<td>Open Space/Public</td>
</tr>
</tbody>
</table>

Sandag Land Use Coding

<table>
<thead>
<tr>
<th>Land Use Code</th>
<th>Description</th>
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<tbody>
<tr>
<td>1000</td>
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<td>3000</td>
<td>Industrial</td>
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<tr>
<td>4000</td>
<td>Transportation</td>
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<td>5000</td>
<td>Light Industry</td>
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<td>6000</td>
<td>Hospitals</td>
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<td>7000</td>
<td>Military Use</td>
</tr>
<tr>
<td>8000</td>
<td>Schools</td>
</tr>
<tr>
<td>9000</td>
<td>Open Space/Public</td>
</tr>
</tbody>
</table>

SANDAG GIS Last refreshed: September 10, 2007

Land Use Definitions

1000 SPACED RURAL RESIDENTIAL - Single family homes located in rural areas with lot sizes greater than 1 acre. Most residential areas may have small schools, parks or small service buildings associated with the residential dwelling unit.

1000 SINGLE FAMILY RESIDENTIAL - Single family detached housing units, not less than 1 story. Never developments may include classrooms, recreation areas, pools, tennis, etc., located rural and associated with the residential development. It is required permits for designated use are on record.

1000 SINGLE FAMILY MULTIPLE UNITS - Includes single family structures and recreation areas (parks, play areas) with associated recreation areas (parks, play areas)

1000 MOBILE HOME PARKS - Includes mobile home parks with 50 or more spaces that are presently or eventually are occupied by mobile homes, mobile home spaces, mobile home terraces, mobile home lots.

1000 GHOST QUARTERS - Vacant or abandoned ghost towns or mining districts or mining camp districts associated with or within historic towns, mining districts, mining camp districts, mining district districts.

2000 EXTRACTIVE INDUSTRY

2200 EXTRACTIVE INDUSTRY - Mining, sand, and gravel extraction, oil and gas production.

2200 DEPOSITARY INDUSTRY

2200 DEPOSITARY INDUSTRY - Primary use is the mining of sand, gravel or other materials.

2300 PUBLIC STORAGE - Public storage buidings are typically long, rectangular and closely spaced. Also includes RV storage areas.

2300 BILLY LIGHT INDUSTRY

2300 BILLY LIGHT INDUSTRY - Usually located near town or village which is situated within 30-50 miles of the city limits.

2300 HEAVY INDUSTRY - Usually located near town or village which is situated within 30-50 miles of the city limits.

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SANDAG’s Land Inventory System

<table>
<thead>
<tr>
<th>General Existing Land Use</th>
<th>Commercial Office</th>
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</thead>
<tbody>
<tr>
<td>Existing Land Use</td>
<td>6001 Office - High Rise</td>
</tr>
<tr>
<td>Planned Land Use</td>
<td>6001 Office - High Rise</td>
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<tr>
<td>Existing Ownership</td>
<td>500 Private</td>
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<tr>
<td>Dwelling Units</td>
<td>0</td>
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<tr>
<td>APN 8</td>
<td>53352211</td>
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<tr>
<td>Parcel ID</td>
<td>27949</td>
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SANDAG’s Land Inventory System
Land Inventory System

~830,000
Land Inventory System

Base Year Info
- Land Use
- Housing Unit
- Housing Type

General Plan
- Planned Land Use
- Housing Density

Housing Capacity
- Housing Capacity (unit)
- Housing Type

Sched Dev Project

Constraint

Subregional Growth Forecast Model
Land Inventory System

General Plan (or community plans from local jurisdictions)
Housing Capacity
Land Inventory System

Base Year Info
- Land Use
- Housing Unit
- Housing Type

General Plan
- Planned Land Use
- Housing Density

Housing Capacity
- Housing Capacity (unit)
- Housing Type

Sched Dev Project
- Project Name
- Housing Type/Unit
- Jobs

Constraint

Subregional Growth Forecast Model
Land Inventory System

Scheduled Development Project
Land Inventory System

Development Constraints

- Steep Slope
- Floodplain/Floodway
- Williamson Act Ag Land
- Wetland
- Environmental Constraints
Beast

Base Year Info
- Land Use
- Housing Unit
- Housing Type

General Plan
- Planned Land Use
- Housing Density

Housing Capacity
- Housing Capacity (unit)
- Housing Type

Sched Dev Project
- Project Name
- Housing Type/Unit
- Jobs

Constraints
- Conserved Land
- Steep Slopes
- Flood Plains
- Fire Hazard Zones

Subregional Growth Forecast Model
Regional Growth Forecast

DOF Population Forecast
- By age by gender by race-ethnicity
- Annual from current year through horizon year

Census Data
- Trends in headship rates and household size
- Vital Statistics
- Migration

Economic Model
- Labor force participation rates
- Unemployment
- Inflation
- GRP
Regional Growth Forecast

Mandates
- Sufficient housing for region’s jobs
- Latest local plans
- RHNA
- GHG

Board of Directors
- Vacancy rate
- Unoccupiable units
- Household size

- Sufficient housing for region’s jobs
- Latest local plans
- RHNA
- GHG

Board of Directors
- Vacancy rate
- Unoccupiable units
- Household size
Regional Growth Forecast

**Output - Housing Units**
- Based on changing population (count by cohort (age))
- Headship rates and HH size – targeting 2010 (considered “healthy”) levels by 2035
- Considering Unoccupiable units, ADUs (if needed), vacancy rate

**Output – Characteristics**
- Census data to convert population into HHs by size and age and race/ethnicity
- Economic model for income

**Output – Jobs**
- Economic model by sector
- Labor participation rate applied to population by cohort
SCS Land Use Requirements

• SB 375 requires the Sustainable Communities Strategy (SCS) to include a pattern for forecasted growth and development that accomplishes the following:
  – When combined with the transportation network, will achieve the regional greenhouse gas reduction targets;
  – Accommodates the Regional Housing Needs Assessment (RHNA) Determination; and
  – Utilizes the most recent planning assumptions.
Jurisdictional and CPA Totals

• Region to Jurisdiction and CPA
  – Parcel level capacity (from local jurisdictions) within each
  – Scheduled development events
  – Share of region’s total capacity

• RHNA mandate
  – Each jurisdiction to meet targets by 2035
  – Increased capacity in Del Mar, Solana Beach, Coronado and Lemon Grove
  – Added to jurisdiction’s Smart Growth Opportunity Areas
MGRA Level Totals*

Process Development

• Conducted sensitivity tests with ABM2+
• Drove creation of the Mobility Hub network
• Identified priority areas for housing growth
• Developed MGRA scoring process

* Master Geographic Reference Areas
  – Similar to census blocks
  – 23k in region
Sensitivity Tests - Key Results

• As household growth is focused in low VMT areas
  – Decrease in VMT and auto ownership,
  – non-driving mode shares increase, and
  – trip length for non-work trips decrease

• Developed Mobility Hub Network to prioritize low VMT areas

• Land use mixing factor and opportunities for residential redevelopment considered in SCS Land Use methodology
Areas for future housing and job growth

• Mobility Hubs
• Smart Growth Opportunity Areas
Housing Allocation

• Defining Priority Areas by MGRA (Develop Scoring Criteria)
  – Environmental factors
  – Proximity to job spaces
  – Mobility Hub Propensity Analysis – proximity/presence by mode
  – Land Use Mixing

• For High Scoring MGRAs:
  – Utilize all planned housing capacity
  – Identify potential residential redevelopment to add housing capacity
  – 2050 housing growth not to exceed jurisdiction's planned capacity, except where needed to meet RHNA
Job Allocation

• Focus within MoHubs and SGOAs
• Jurisdiction provided parcel data
  – Supported by planned land use
  – Job capacity exists
• Presence of existing jobs
  – Share within the region
  – In-progress scheduled development
• Additional factors
  – Near new housing
  – Transit
  – Industry sectors
NAVWAR

• Includes revitalization of Navy Old Town Campus (OTC)
• Current site of the Naval Information Warfare Systems Command (NAVWAR)

• Includes a Central Mobility Hub at the OTC property
  – More than 9,500 additional housing units
  – Support employment
    • Almost two million square feet of office and retail space
    • Almost 450 hotel rooms
SCS Land Use Pattern

SB 375 Requirements

Local Jurisdiction Data

Regional Totals

Demographics

Sub-Regional Modeling

Planning Strategies

Housing Units by Type

Population Households Characteristics

Jobs by Sector

Synthetic Population

MGRA-level data
Annual, 2016-2050

Housing Units by
Single Family
Multi-Family
Mobile Homes
Occupied
Vacant
Unoccupiable

Population by
Age
Sex
Race/Ethnicity
HH Pop
Group Quarters
Military
Civilian

Jobs by
Industry Sector
NAICS Codes

Synthetic Persons
HH ID
ASE
Education, occupation, work status

Synthetic Households
Income, Poverty
Building and Unit info
Vehicles, workers
PROJECT UPDATES

Rick Curry
Mike Calandra
Wu Sun
A Vision for Economic Growth, Sustainability, Innovation, and Social Equity
State Route 11 / Otay Mesa East Investment Grade Traffic & Revenue Study

• Binational Traffic & Revenue Model → Investment Grade
• Schedule → Draft Revenue Numbers by July 30
• Data Update
  – Wait times northbound and southbound
  – Traffic counts in Tijuana and SD border region
  – Surveys
    • Passenger vehicle in-person survey – Pre-COVID
    • Passenger vehicle stated preference online survey
    • Commercial vehicle surveys – industry and companies
  – Travel times/speeds
    • INRIX
    • Sin Tráfico
## Binational Traffic & Revenue Model Update

<table>
<thead>
<tr>
<th>Model</th>
<th>Tijuana &amp; US</th>
<th>Cross-Border Demand</th>
</tr>
</thead>
</table>
| • Level II T&R Model still in use  
• Methodology changes for opening/closing lanes | • Networks  
• Internal trips | • Future growth  
o Commercial vehicles  
o Passenger vehicles | • Origin-Destination  
• Value of Time |
ABM2+ Subarea Enhancement

• **Scope and schedule**
  - Project Management
  - Employment Density Update
  - Existing Processes and Model Enhancement Plan
  - Model Enhancements
  - Application Tests
  - Trip Table Data Report and Threshold Definitions
  - Final Report and Workshop
  - As Needed Support

  **We are here**

  **Expecting to start in September**

  **ABM2+ production work begins after Board adoption of the 2021 Regional Plan (November)**
ABM2+ Subarea Enhancement

• **Employment density update**
  – Refresh of existing "Employees per Square Foot" of non-residential space
    • SANDAG Data Solutions & Economic and Demographic Analysis and Modeling
    • California Economic Development Department (EDD)
    • Costar
    • Buildings
    • ITE
  – School employment
    • Calculated using existing enrollment-to-employment ratios
  – New unit types
    • Beds: Update Group Quarters population and scale employment
    • Acres: Calculate employment for non-residential uses that do not include building space
ABM2+ Subarea Enhancement

• Model enhancements for customized subarea ABM scenarios
  – Convert all scripts to Python
  – Procedures to override residential and non-residential land use assumptions
  – Procedures to update the synthetic population
    • Household sampling
  – Use of a flexible TAZ system to accommodate study areas
    • MGRA is still the atomic geographic unit
    • Build vs No Build
  – The 4D's
  – Automated QA/QC input checking and output reporting
ABM2+ Subarea Enhancement

• Project challenges
  – Sample rates
  – Shadow pricing
  – Work location choice
  – Commercial vehicle model

  – Model run times

JOBS AHEAD

Alt 1

Alt 2
ABM2+ Subarea Enhancement

• Trip Table Data Report
  – Expected trips per unit by land use code
  –Parsed by Major Statistical Area (MSA) & Area Type

  – Base year model data -- not observed data!

• Subarea Thresholds
  – Define the required amount of Population and Employment in a project study area to render VMT and Mode Choice reports as statistically significant
Model Development Plan for 2025RP

• Priorities-the 4M
  – Activity-Based Model (Core Resident Model-ABM3, aka the BEAST per mca)
  – Rapid Strategic Model (RSM)
  – Commercial vehicle model (CVM)
  – Crossborder Model (CBM)

*Features and priorities to be finalized via a series of discussions with stakeholders*
Model Development Plan for 2025RP

• Timeline
  – CBM
    • Beta working version: 12/31/2021; Final version: 3/31/2022
  – RSM:
    • 12/31/2022
  – CVM
    • 12/31/2023
  – ABM3
    • Beta working version: **12/31/2023**; Peer reviewed: **3/31/2024**
Model Development Plan for 2025RP

• What about the other Ms?
  – Airport Models (2)
  – Visitor Model
  – External Trip Models
  – Heavy Truck Model
  – TCOV Upgrade?

• Refresh vs Reconstruct
  – Data & Marginal Controls
  – Software
  – Model Structure (aka math, sequence, & algorithms)
Software for 2025RP Modeling

• From CT-RAMP to ActivitySim
• From Java (mostly) to Python
• What is ActivitySim?
  – AMPO led consortium to create and maintain advanced and open-source ABM software based on best software development practices
  – SANDAG is one of the founding member agencies
  – A suite of light, fast, easy to maintain, and cost-effective models built on top of ActivitySim for 2025RP
Model Development Plan for 2025RP

• Risks & Challenges
  – Data, data, & data
    • CVM survey
    • Household travel behavior survey that represents ‘new normal’
    • Parking inventory & behavior survey
  – COVID impact on base year
    • Seems like we will have to change base year in the middle of the project
  – Software is heavy lifting
  – Futuristic modes & technologies
Forum Agenda Recap

• Welcome and Introductions
• Travel Model Visualizations
• What Feeds the Beast
• Project Updates

Next
Transportation
Model Forum:

December 8, 2021
TRANSPORTATION MODEL FORUM

June 9, 2021