Transportation Modeling and the Traffic Impact Analysis Process

AMPO National Conference
Clark County, NV October 2015
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Why A Peer Review?

To improve the role of the FMPO Regional Travel Model in the Transportation Impact Analysis Process

To eliminate the strife

To give bikes, peds, & transit equal treatment
Why this is important

• Add value for member agencies
• Magnitude of private investment in transportation system
• Legal and financial implications for proportional share
• Getting the details right for non-motorized modes
Major Take-Aways

• Regional Model > Site Plan
  – Two sets of often independent lessons
• Good models can help:
  – Trip distribution
  – Trip assignment / Proportional share
  – Multimodal evaluations
• Tracking TIA processes can inform updates to regional model inputs
• One size doesn’t fit all
The FMPO Region

- 2 hours north of Phoenix
- Study area size: 525 sq. miles
- Total population: 90,301
- Transit awards
  - Walk-Friendly
  - Bike-Friendly
TRANSPORTATION IMPACT ANALYSIS

PURPOSE

• Ensure Safe and Efficient Transportation

• Primary Beneficiary – Business and Customers

• Secondary Beneficiary – Travelers and Public Agency

FOCUS NOW: APPROVAL
TYPICAL PRELIMINARY MEETING

• Existing and Proposed Land Uses
• Preliminary Site Plan
• Analysis Scope
  – Small – Trip Generation Comparison Only
  – Medium – Close Intersection(s) and Opening Year
  – Large – Numerous Intersections and Years
• Trip Generation and Trip Distribution
  – Some Agencies Second Meeting
Primary Decision Points

Analysis Periods
- Weekday / Morning / Evening Peak Hour
- Saturday Peak Hour

Trip Generation (& Reduction)
- Land Use and Independent Variable
- Rate versus Equation versus Plotted Points

Trip Distribution & Assignment
- Population or Employment or Traffic Volumes or Model
SITE PLAN
Need & Model Practice

- Access, circulation
- Traffic Analysis Zone (zones) structure
- Centroid connectors / Network
ANALYSIS PERIOD
Need, Model Practice & Recommendation

• **Peak Hours:** AM/PM/maybe Saturday

• **24-hour model**
  – With a “weaker” PM Peak Hour

• **AM, PM & Off-peak**
  – Strengthen calibration

• **Not “Dynamic Traffic Assignment”**
TRIP GENERATION
Shopping Center – Land Use Code 820
Average Vehicle Trip Ends vs. 1,000 square feet Gross Leasable Area
on a WEEKDAY AM Peak Hour of Adjacent Street

Fitted Curve Equation: \( \ln(T) = 0.61 \ln(X) + 2.24 \)

\( R^2 = 0.56 \)

The Danger of Averages
Shopping Center – Land Use Code 820
Weekday AM Peak Hour of Adjacent Street

WEIGHTED AVERAGE RATE: 0.96

AVERAGE OF RATES 2.06

WEIGHTED AVERAGE RATE IS 118% LESS THAN AVERAGE OF RATES
Need, Practice & Recommendation

• **ITE Trip Rates**
  – 60 uses & 5 trip purposes
  – Ability to change to more effective uses

• **Population & Employment (SE) Data**
  – Introduce cross-classification
  – Introduce K-12 trip purpose
Why Land Use & Not SE

• Current Land Use
  – 60 land uses with associated ITE trip rates
  – Derived from Assessor Data
  – Aggregated to TAZ’s

• Build Out & Horizon Years
  – Twenty place-types with population density and job intensity assumptions
  – Place-types converted to Land Use Model codes
  – A Build Out year based on state growth rates.
  – Regional districts assigned low to high low growth rates
  – Interpolations for years 2020, 2030 and 2040
Build Out Land Use in FMPO
Transportation Districts
TRIP GENERATION
TRIP REDUCTION
TRIP REDUCTION (or credit)

JUSTIFY EACH DEDUCTION SEPARATELY

TRANSIT – Sufficient frequency and seats

BICYCLES – Adequate bicycle parking and incentives

PEDESTRIANS – Adequate sidewalks and destinations

INTERNAL CAPTURE – Corresponding land uses

URBAN IN-FILL – High current traffic

PASS-BY – Independent of urban in-fill
Land Use Goals

• Prioritize Infill Over Sprawl

• Several master-planned mixed use “Urban Villages”

• All well-connected with
  ✓ High-frequency (15 min) transit
  ✓ ADA Pedestrian Sidewalks
  ✓ Marked Arterial Bike Lanes
  ✓ Multi-use “Greenways” Trails
  ✓ Multimodal Arterial Streets
Concurrency Service Areas (CSA)

“Mobility-Sheds” based on land use context

3 Urban Village (Type 1) Green
Higher density mixed use urban

2 Urban Institutional (Type 1A)
Western Washington University
Whatcom Community College

5 Transition (Type 2) Yellow
Moderate density neighborhoods

7 Suburban (Type 3) Red
Lower density neighborhoods
Auto-centric commercial (north)
Non-Motorized Plans

**Pedestrian Master Plan**
- 266-mile pedestrian network
- ~ 170 miles (64%) complete
- Identifies pedestrian needs
- Prioritizes improvements

**Bicycle Master Plan**
- 170-mile bicycle network
- ~ 68 miles (40%) complete
- Identifies bicycle needs
- Prioritizes improvements

**Multiuse Greenways Trails**
- Extensive citywide trail system
- 65 existing trail miles

**Mode Share & Goals**

<table>
<thead>
<tr>
<th>Mode</th>
<th>2008-2012</th>
<th>2015</th>
<th>2022</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pedestrian</td>
<td>8.2%</td>
<td>11%</td>
<td>13%</td>
</tr>
<tr>
<td>Bicycle</td>
<td>4.1%</td>
<td>6%</td>
<td>6%</td>
</tr>
<tr>
<td>Transit Bus</td>
<td>5.8%</td>
<td>4%</td>
<td>6%</td>
</tr>
<tr>
<td>Automobile</td>
<td>75.9%</td>
<td>80%</td>
<td>75%</td>
</tr>
<tr>
<td>Work at Home</td>
<td>5.0%</td>
<td>~</td>
<td>~</td>
</tr>
</tbody>
</table>

Notes:
1. 2008-2012 American Community Survey (U.S. Census) data
2. Bellingham Comprehensive Plan Transportation Element
Creating Multimodal Concurrency Measurements

- 2008 – consultants help City study 15 alternative methods, develop preferred alternative, & implement Jan 1, 2009
- “Plan-based” - Concurrency Service Areas (CSA) [“Mobility Sheds”]
  Variable typology & weighting factors based on land use context
- Pedestrian = % completeness of network in Pedestrian Master Plan
- Bicycle = % completeness of network in Bicycle Master Plan
- Multiuse Trails = % completeness relative to Ped & Bike networks
- Transit = WTA seated 2-way capacity, frequency, & ridership counts
- Vehicles = pm peak 2-way arterial volume-to-capacity (v/c) – HCM LOS

5 measurements instead of traditional auto-only v/c LOS
## “Policy Dials”

### Mode Weight Factors

Based on Land Use Typology

<table>
<thead>
<tr>
<th>Mode</th>
<th>Transportation Concurrency Service Areas</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Type 1¹</td>
</tr>
<tr>
<td><strong>Motorized</strong></td>
<td></td>
</tr>
<tr>
<td>Auto</td>
<td></td>
</tr>
<tr>
<td>Mode weight factor⁴</td>
<td>0.70</td>
</tr>
<tr>
<td>Transit</td>
<td></td>
</tr>
<tr>
<td>Mode weight factor⁵</td>
<td>1.00</td>
</tr>
<tr>
<td><strong>Non-Motorized</strong></td>
<td></td>
</tr>
<tr>
<td>Pedestrian</td>
<td></td>
</tr>
<tr>
<td>Percent threshold for minimum system complete⁶</td>
<td>50%</td>
</tr>
<tr>
<td>Person trip credit for 1% greater than minimum threshold⁷</td>
<td>20</td>
</tr>
<tr>
<td>Mode weight factor⁸</td>
<td>1.00</td>
</tr>
<tr>
<td>Bicycle</td>
<td></td>
</tr>
<tr>
<td>Percent threshold for minimum system complete</td>
<td>50%</td>
</tr>
<tr>
<td>Person trip credit for 1% greater than threshold</td>
<td>20</td>
</tr>
<tr>
<td>Mode weight factor⁹</td>
<td>1.00</td>
</tr>
<tr>
<td>Multi-Use Trails¹⁰</td>
<td></td>
</tr>
<tr>
<td>Person trip credit for 1% greater than threshold¹¹</td>
<td>10</td>
</tr>
<tr>
<td>Mode weight factor¹²</td>
<td>1.00</td>
</tr>
</tbody>
</table>
What’s Next? Connectivity Metrics

ViaCity

Route Directness Index (RDI)

CSA #9 Composite Scores
### BMC 19.06 Urban Village Vehicle Trip Reduction Credits

#### TABLE 2 – URBAN VILLAGE VEHICLE TRIP REDUCTION CREDITS

<table>
<thead>
<tr>
<th>Menu of Location Factors and Performance Measures to Reduce Vehicle Trips</th>
</tr>
</thead>
<tbody>
<tr>
<td>Note: Reductions below are additive and may not exceed a total of 50%</td>
</tr>
</tbody>
</table>

1.) MIXED USE URBAN VILLAGE LOCATION  
(Based on ITE Internal Trip Capture - Mixed Use Urban Environment)  

<table>
<thead>
<tr>
<th>CREDIT</th>
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<tbody>
<tr>
<td>15%</td>
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2.) WTA TRANSIT PROXIMITY (Only one transit proximity reduction below may be used)  
Development fronts on a high-frequency WTA GO Line  
Development within 1/4-mile of WTA GO Line  
Development fronts on standard WTA Route (30 - 60 min)  
Development within 1/4-mile of standard WTA Route (30 - 60 min)  

<table>
<thead>
<tr>
<th>CREDIT</th>
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</thead>
<tbody>
<tr>
<td>10%</td>
</tr>
<tr>
<td>7%</td>
</tr>
<tr>
<td>5%</td>
</tr>
<tr>
<td>2%</td>
</tr>
</tbody>
</table>

3.) EMPLOYER MANDATORY COMMITMENT TO COMMUTE TRIP REDUCTION (CTR)  
CTR/TDM commitment combining economic incentives with transportation services  

<table>
<thead>
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<th>CREDIT</th>
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<tbody>
<tr>
<td>10%</td>
</tr>
</tbody>
</table>

4.) VOLUNTARY ANNUAL WTA TRANSIT PASS PROVISION (Non-CTR)  
2-year transit pass provided for residential units = 1% per unit pass  
2-year transit pass provided for employees = 1% per employee pass  

<table>
<thead>
<tr>
<th>CREDIT</th>
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<tbody>
<tr>
<td>1%</td>
</tr>
</tbody>
</table>

5.) VOLUNTARY CAR SHARE PARTICIPATION OR PROVISION (Non-CTR)  
Car Share Vehicle(s) Parked On Residential or Employment Site = 2% per vehicle  
Car Share membership fee provided for residential units = 2% per unit  
Car Share membership fee provided for employees = 2% per employee  

<table>
<thead>
<tr>
<th>CREDIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>2%</td>
</tr>
</tbody>
</table>
“3D”: Density, Diversity & Design

DESIGN

• The model includes design through the inclusion of separate pedestrian, bicycle and transit level-of-service variables.

• LOS scores, to date, are subjective or “empiridotal”
Modal LOS: Ped, Bike & Transit

Ped LOS Variables:
- Missing sidewalks, street or intersection density, crossing or cross-walk density weighted by type

Bike LOS Variables:
- BCI, Crossings, Street or intersection density, missing links

Transit LOS Variables:
- Proximity to bus stops (1/4 and 3/8 mile); Frequency of service. Influenced heavily by walk share
Bike Assignment by BCI

- Traffic speed
- Volume
- Bike lanes
- Lane Widths
- Paved Trail
- Unpaved Trail
- Width, etc.
Need, Practice & Recommendations

• **Quantitative, Defensible**
• **Qualitative, Defendable**
• Consider implementing a logit-based mode choice model within the overall model stream
  – Asserted parameters based FTA guidance make this a straightforward process
  – Route system, and non-motorized network coding would be required. The Bicycle Comfort Index (BCI) can fit into a logit model.
  – Jump into transit assignment
• Calibration data
TRIP DISTRIBUTION & ASSIGNMENT
Network by Facility Type

Centerline Miles by Facility Type
- Interstate: 82
- Mjr. Arterial: 40
- Mr. Arterial: 64
- Mjr. Collector: 33
- Mr. Collector: 57
- Local (model): 63
- Off model: 413
FMPO Trip Distribution Example

Readily mapped.

Use select link and select zone functions
Need, Practice & Recommendations

• Circulation patterns
• Gravity Model

• Improve accuracy/assumptions:
  – Calibrate/Validate:
    • HH Survey: Flow between sub-areas
    • HBW vs. CTPP Journey-to-work flow
  – Speed feedback loop
  – Gravity Model transition to Destination Choice Model
  – Link Volume delay to Intersection delay
Outstanding Questions

• Future Background Traffic
  – What does the TIA process gain from asking/answering this question?
  – What are the “right” and “logical” inputs to the model?

• Proportional share
Growth factors

- Growth factors by facility type based on a comparison of present and future growth are provided to developers.
- Used when future conditions forecasts are not robust.
- Useful to recognize different growth rates across the region.
Background Level of Service

- Future LOS without the project (background traffic only) can help identify relevant capacity issues
How can we improve these illustrations?
Comprehensive guidance and direction

Truck Trip Generation

Person-trips versus Vehicle-trips

Urban in-fill development

Pass-by Trips

Different Trip Generation calculation techniques

Disaggregate versus Aggregate considerations

Mixed-use development

Transit-friendly development
Recap

- Add value for member agencies
- Magnitude of private investment in transportation system
- Legal and financial implications for proportional share
- Getting the details right for non-motorized modes
Thank You!

The final report will be out soon.

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