Taming the Modeling Monster

Starring:

• Ellen Greenberg
• Scott McCarey
• Jim Charlier
Audience Poll, part 1

✓ Elected Officials
✓ Board Members
✓ Public Staff
✓ Consultants
✓ Journalists
✓ Other
Audience Poll, part 2

✓ Modeling experts
✓ Know enough to be dangerous
✓ What’s a model?
What We Will Not Do Today:

- Get Technical
- Provide Answers
Session Outline

- Framing the issue (Charlier)
- Problems with monsters (Greenberg)
- Technical alternatives (McCarey)
- Alternative approaches (Greenberg)
- Group Q & A
- Audience examples
- Break out work sessions
Framing the Issue
Framing the Issue

- Transportation 101
- Things You May Have Wondered About
Transportation 101

- Balanced mobility
- Overemphasis on travel capacity
- Modern urban trends
“Mobility” (Balanced)
Anthropologists: one of the defining characteristics of the human species is a need to be mobile.

we are human = we need mobility
Mobility Elements

- **Travel** – Moving over distances
- **Circulation** – Moving within areas
- **Access** – Getting in the door
Built for…

Seattle

Redmond

…travel
Built for…

Denver

Boulder

...travel
Built for... circulation

Flagstaff

Redmond
Built for… Boulder…circulation
Built for...

Winter Park, Fl

...access

Minneapolis
Over-Emphasis on Capacity

1. Travel-biased programs
2. Facility-oriented planning
3. Congestion management
Travel-Biased Programs

...build only in support of travel and fail to provide for circulation and access
Facility-Oriented Planning

...is focused on facilities rather than networks
Congestion Management

...the fruitless attempt to reduce peak hour congestion or build our way past congested arterial corridors
“Induced Traffic”

Def.

The additional traffic that results directly and indirectly from transportation capacity or travel time improvements – traffic that would not otherwise have occurred at that location.
Types of Induced Traffic

Changes in travel route ...................... Immediate

Changes in mode of travel .................. < 6 months

Changes in time of travel ................... < 6 months

Changes in amount of travel ............... < 6 months

Changes in origins & destinations ......... < 10 years
% of new capacity consumed by induced traffic...

Long Term: five to 10 years

Short Term: less than five years
If you build it . . .

. . . they will come
If you build it . . .

. . . they will come
Road Size, Not Congestion is the Choice

Credit: Kulash
How did traffic flow, congestion relief and road capacity get to be more important than other community objectives?
Common Community Objectives

- Community character
- Green environment
- Family-oriented place
- Sustainability
- Pedestrian “friendly”
- Economic vitality
- Great streets
- Healthy neighborhoods
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Common Community Objectives

- Community character
- Green environment

Level of service objectives

- Traffic capacity
- Congestion relief

- Great streets
- Healthy neighborhoods
Things You May Have Wondered About

Traffic Models
Things You May Have Wondered About

- What is a traffic model?
- What is included and not included?
- How are they used?
- How accurate are they?
- How good are models at what they are designed to do?
What is a Traffic Model?

Things You May Have Wondered About
What is a Traffic Model?

Data In

Traffic Model

Trip Generation → Trip Distribution → Mode Choice → Route Assignment

Data Out
What is a Traffic Model?

Data In

“Black Box”

Data Out
What Is Included and Not Included?

Things You May Have Wondered About
Not All Streets are Included in Model Networks
No Local Streets or Internal Drive Aisles Are Modeled
No Collectors –
Only Arterials are Modeled
Multimodal Travel, Circulation and Access

- SOV: 39.0%
- MOV: 23.5%
- Transit: 4.6%
- Bike: 14.0%
- Ped: 18.6%
- Other: 0.3%

Boulder Residents Mode Share 2003
How Are Models Used?

Things You May Have Wondered About
Common Uses of Models

- Plan & prioritize street networks (TIPs, etc)
- Evaluate proposed rail projects (AA/EIS)
- Basis for traffic impact studies (TIRs, EIRs)
- Growth management systems
  - Impact fees
  - Concurrency management systems (LOS)
- Air quality management (mobile sources)
- Environmental impact analysis (EIS, etc.)
- Provide data for detailed intersection and corridor planning
Common Uses of Models
Plan & Prioritize Street Networks
Common Uses of Models

Evaluate Rail Projects (AA/EIS)
Common Uses of Models

Basis for Traffic Impact Studies
## Common Uses of Models

### Growth Management Systems

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2022 Criteria: 0.5 - 1.0

### Arterial Intersections Across Screenline

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2022 Criteria: 0.5 - 1.0

Report year actual
Common Uses of Models

Air Quality Management
Common Uses of Models

Environmental Impact Analysis
Common Uses of Models

Intersection & Corridor Studies
How Accurate are Models?

Things You May Have Wondered About
Modeling Process

1. Build Model
2. Calibrate to Today’s Traffic
3. Forecast Future Traffic
“Acceptable” Error - Calibration

- Traditional: + or - one lane
- Common: 5% - 10% error in key corridors

Note: calibration measures how well the model output matches actual traffic levels today
Modeling Process - Accuracy

- Build Model
- Calibrate to Today’s Traffic: Within 5 – 10% in major corridors
- Forecast Future Traffic
How Good Are Models At What They Are Designed To Do?

Things You May Have Wondered About
How Good Are They?

- Iterative relationships between transportation investment & land use
- Understanding dense networks
- Leading causes of congestion
- Missing independent variables
Iterative Relationships

- Land development
- Transportation systems and projects
- Transportation demand
Iterative Relationships

Land development → Transportation demand

Transportation systems and projects
Models & Induced Travel

How well do models predict:

- Changes in travel route ........................................ well
- Changes in mode of travel................................. fairly well
- Changes in time of travel ....................................... no
- Changes in amount of travel ................................. no
- Changes in origins & destinations ....................... no
Understanding Dense Networks
Understanding Dense Networks
Leading Causes of Congestion

Peak Period Travel

Weather

Accidents/Incidents
Missing Independent Variables

- Fuel prices
- Development pattern – mixed use, etc.
- Perceptions – driver behavior
- Social factors, trends
Review

- Traffic models do some things well within the constraints of input data
- Traffic models do not give “accurate” forecasts of conditions in 25 years
- Traffic models ignore many important community objectives
Concluding Questions
Concluding Questions

- How did traffic congestion/capacity become pre-eminent anyway?
- What are some alternative criteria for planning transportation systems?
## Selective Focus –
The Doctrine of Apparent Precision

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Traffic Forecasting ≠ Planning
Predict Growth

Widen Streets

Forecast Traffic
1. What do we want?
2. How much traffic will result?
3. What should we do?
1. What do we want?

2. How much traffic will there be?

3. What should we do?
1. How much traffic will there be?

2. What should we do?

3. What do we get?
Technical Alternatives

Starring:

• Scott McCarey
Two Types of Improvements

- Modify existing 4-step modeling process
  - Include more variables
- Use GIS-based visualization software
URBEMIS Approach

- Uses traditional 4-step model as a baseline for traffic forecasts

- Adjusts traffic forecasts by incorporating additional variables:
  - Density, mix of uses, transit service, TDM programs

- Trip reductions can be as high as 90% residential and 35% non-residential
URBEMIS effectiveness

- Advised by *Trip Generation*:
  - “At specific sites, the user may wish to modify trip generation rates presented in this document to reflect the presence of public transportation, ridesharing or other TDM measures…or other special characteristics of the site or surrounding area.”

- However, adjusting a potentially seriously flawed baseline forecast
INDEX 5D Model

- Uses regional transportation demand models for baseline travel inputs

- Evaluates change in VT and VMT based on:
  - Density, Diversity, Design, Destinations and Distance (to rail transit)
INDEX limitations

- Forecasts are not absolute - relative to base case provided by regional model.
- Accuracy dependent upon the regional model’s baseline data.
- Analysis must be performed at the TAZ level.
Reference Class Forecasting

- Empirical inventory of hundreds of past projects

  - Each project recoded dozens of characteristics: density, proximity to transit, cost of parking, current congestion levels, mode shares

  - Reference projects with similar attributes to current study
Empirical Case Studies?

- Essentially what ITE Trip Generation does
  - with one variable

- Consider enough projects to be
  1. statistically meaningful, but
  2. similar to current project
GIS based software

Programs now provide the ability to visualize and evaluate development scenarios.
Input
Projected growth (Population, jobs)

Input
Existing conditions (Land use, roads)

Output
Where growth will occur

Output
Evaluation (VMT, mode split, LOS)
Input
Projected growth (Population, jobs)

Input
Existing conditions (Land use, roads)

Input
Directed growth

New Output
Evaluation (VMT, mode split, LOS)
2D Maps into Interactive 3D Scenes

Source: CommunityViz
Paint the Region

Source: Citerion Planners
SketchUp- Visual Modeling