Go Big AND Go Home: Modeling short and long distance travel in a common framework

presented to

Transport Chicago

presented by

Jeffrey Newman

COLORADO
Department of Transportation

June 9, 2017

Think Forward

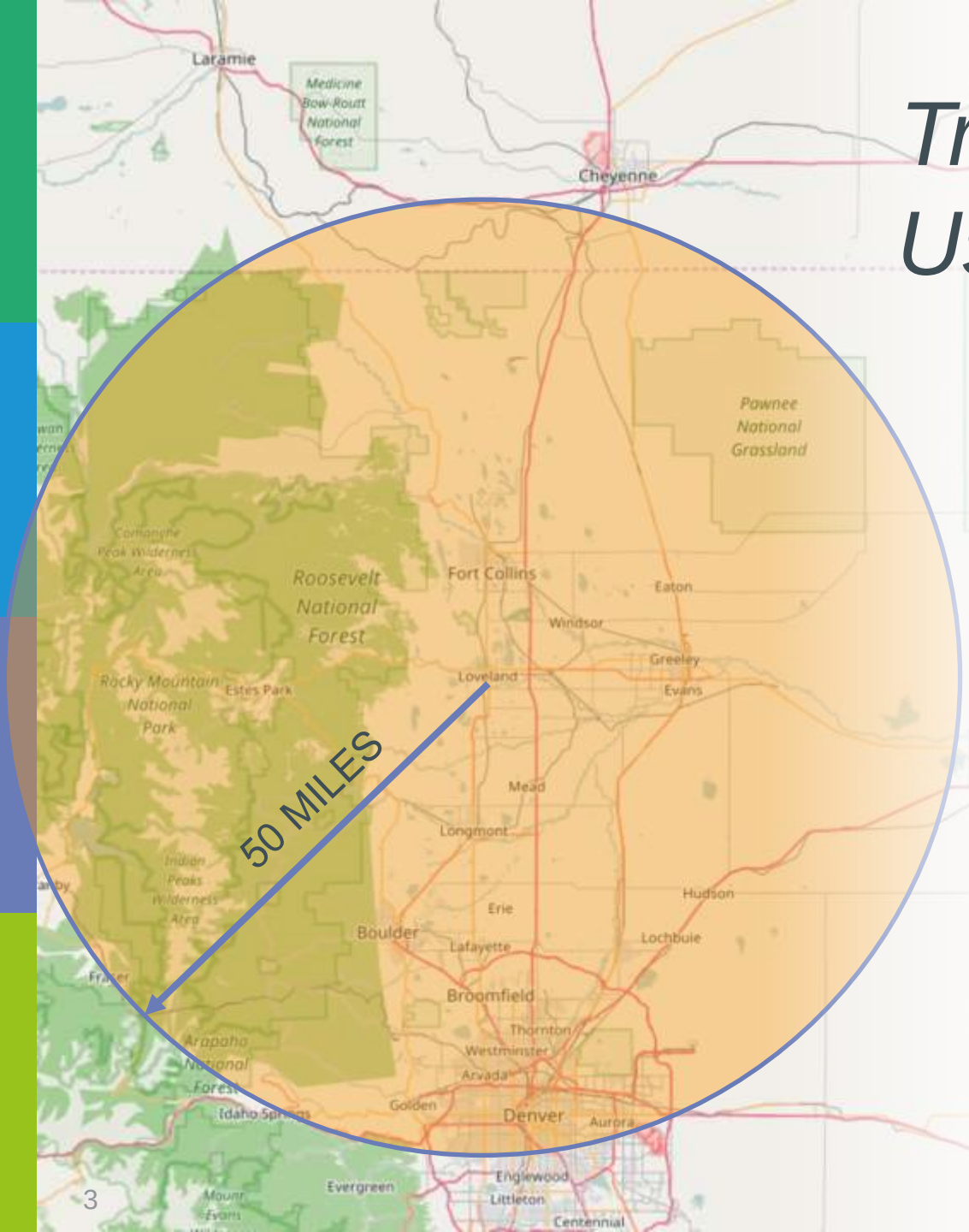
The Long and Short of It

Common practice for statewide travel modeling is to use two travel model components:

- a “typical” daily travel model that includes **short**(er) and more frequent trips, and
- an "atypical" travel model that includes **long** distance trips that are undertaken infrequently

Why not just have one model for all travel?

Trouble with the Usual Approach



- Consider Colorado, where drawing a line between long and short is not easy or desirable
- CODOT is building a statewide model and does not want an artificial boundary
- Solution: just one model to describe both long and short travel

CAMBRIDGE SYSTEMATICS

Benefits of the Seamless Approach

- Simplicity of application
- No artificial breakpoint causing “cliff effects”
- Models regular intra-regional tours of 50+ miles
- Allows regular travel between MPOs to increase

CAMBRIDGE SYSTEMATICS

Challenges of Seamless Approach

- Survey data **does** have artificial break points:
  - » Daily diary contains all trips in a particular day, truncated at 3 am
  - » Long distance travel log includes only long (50+ miles) trips over 14 days
- Overnight travel cannot just be discarded or artificially truncated but it doesn't fit neatly
- Taking an long overnight trip can impinge on other activity the same day
  - » But there still may be some such activity

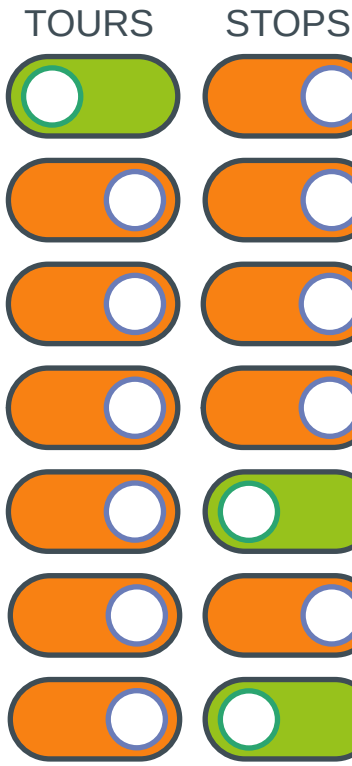
Selected Key Model Changes

- Auto Availability
- Daily Activity Pattern
- Exact Number of Tours
- Work Tour Dest Type
- Subtour Generation
- Tour Destination
- Tour Main Mode
- Tour Time of Day
- Interim Stop Generation

- Non-closed tours explicitly accommodated
- Nontraditional (overnight) closed tours
- Non-closed tours have a different distance profile
- Need a more detailed destination model with multiple distance segments for reasonable calibration
- Must accommodate tour legs that occur before the beginning of the day or after the end

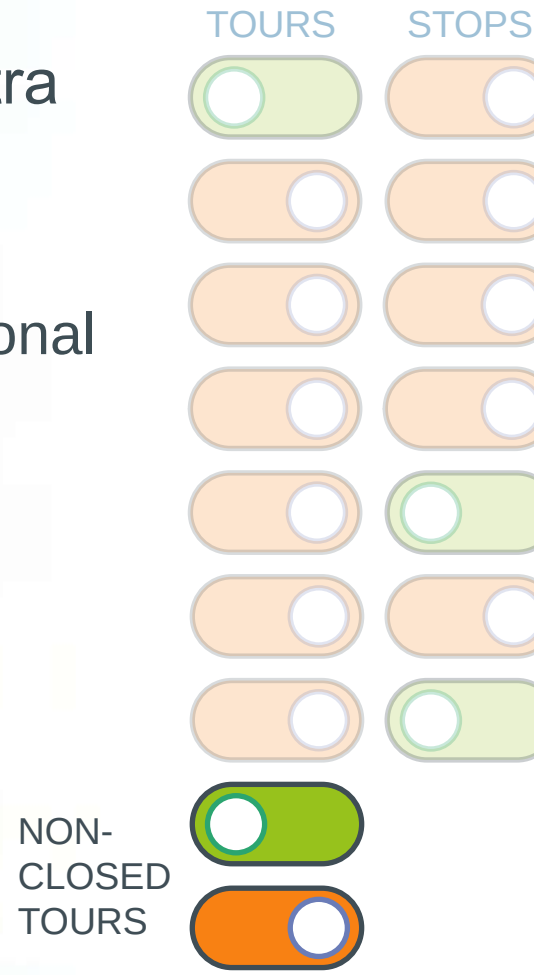
Daily Activity Patterns

- DAP's in Focus are modeled as 14 joint binary choices
  - » Yes or No on having 1+ tours for each of 7 purposes
  - » Same for intermediate stops by purpose
- Unrestricted this gives 2^{14} = 16,384 alternatives, but most are infeasible or disallowed
- Only 2,080 alternatives that are considered valid, which are modeled by MNL



New Daily Activity Patterns

- DAP's for the statewide model add two extra binary choices for non-closed tours:
  - work, and
  - other purposes (social/recreation and personal business; we exclude overnight tours for school, escort, meals and shopping)
- Again we disallow a bunch of rare or infeasible combination, so we get down to 2,146 alternatives
  - Just 66 more than before



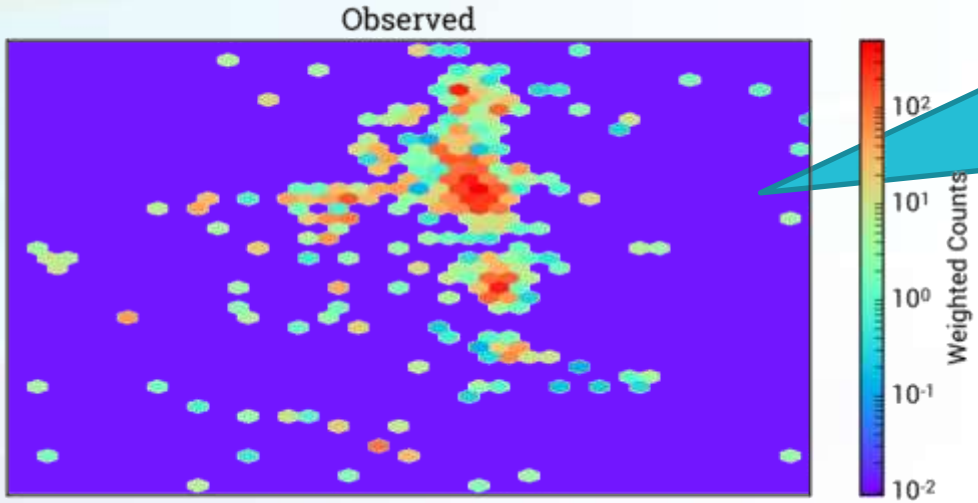
CAMBRIDGE SYSTEMATICS

Data for Destination Choice

Tour Purpose	Tour Distance	
	Less than 50 mi	More than 50 mi
Work/Daily Commute (same day closed tour)	Diary Only	Diary Only
Work/Other Business	Diary Only	Log Only
Other Purposes	Diary Only	Log Only

- The **Daily Diary** and the **Two Week Travel Log** contain overlapping data (in theory), only one or the other should be used for any particular category
- The **Diary** was seen to capture daily commuting patterns better regardless of distance
- The **Log** has a better picture of non-regular destinations that are within its domain
- Non-weekday travel is removed from the **Log** and weights adjusted to be compatible

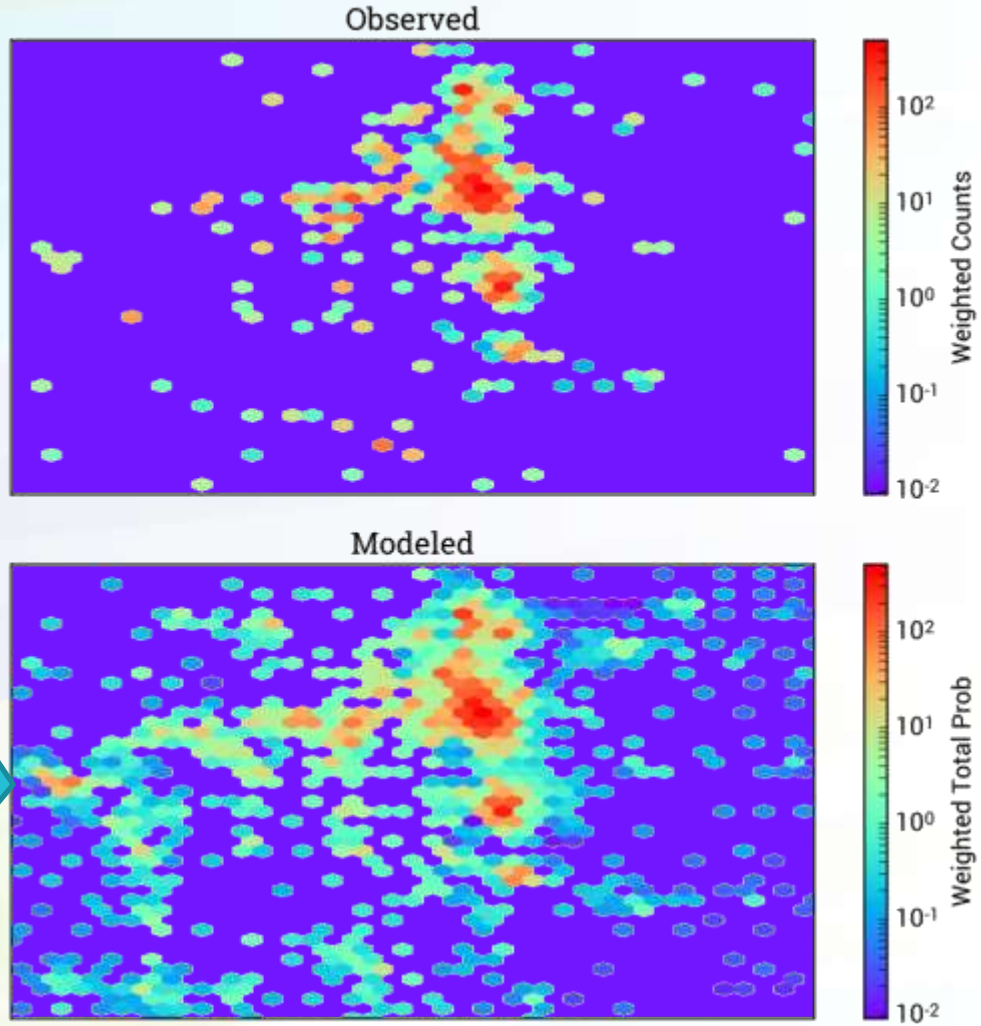
Social/Recreational Destinations



Almost no trips to the plains for recreation trips

CAMBRIDGE SYSTEMATICS

Social/Recreational Destinations

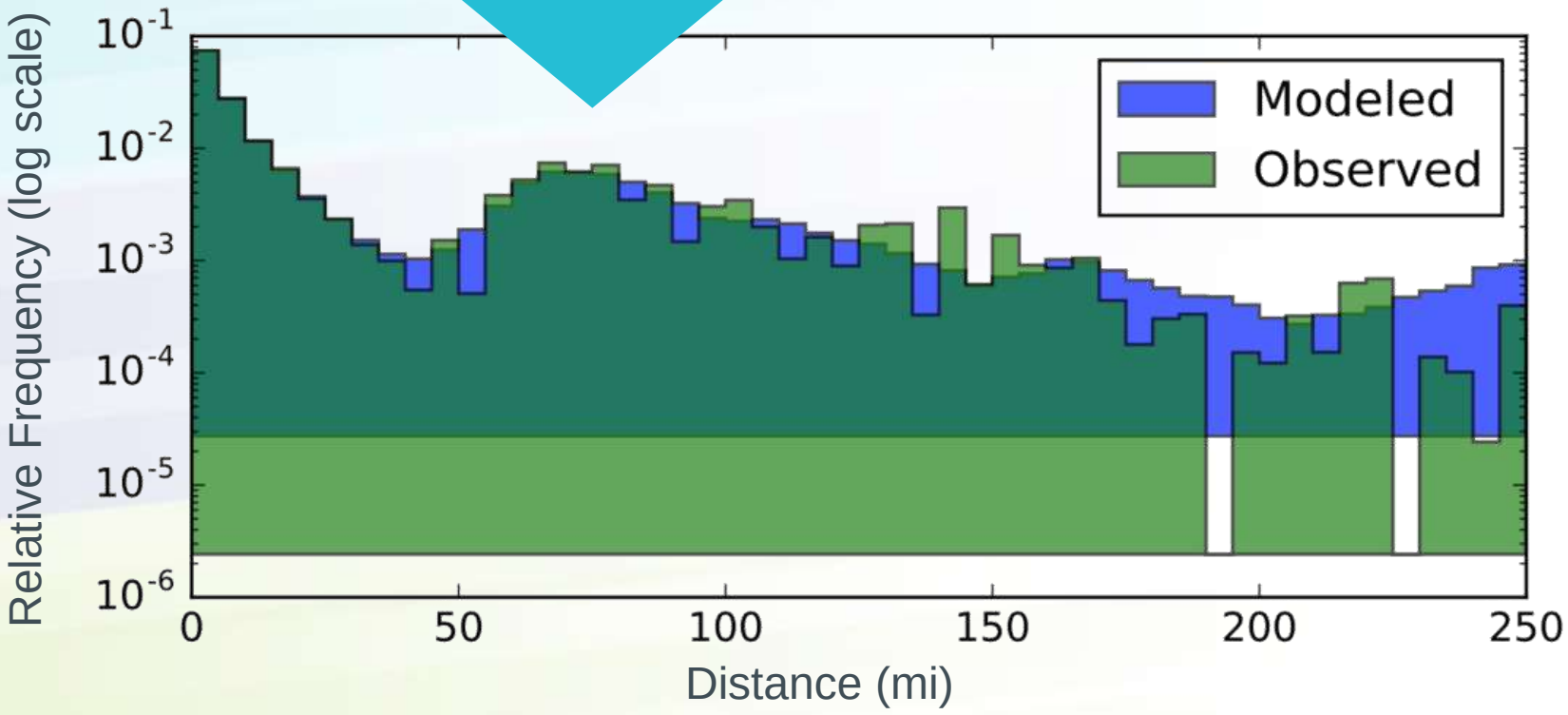


Model slightly over-predicts travel to Grand Junction

CAMBRIDGE SYSTEMATICS

Social/Recreational Tour Distance

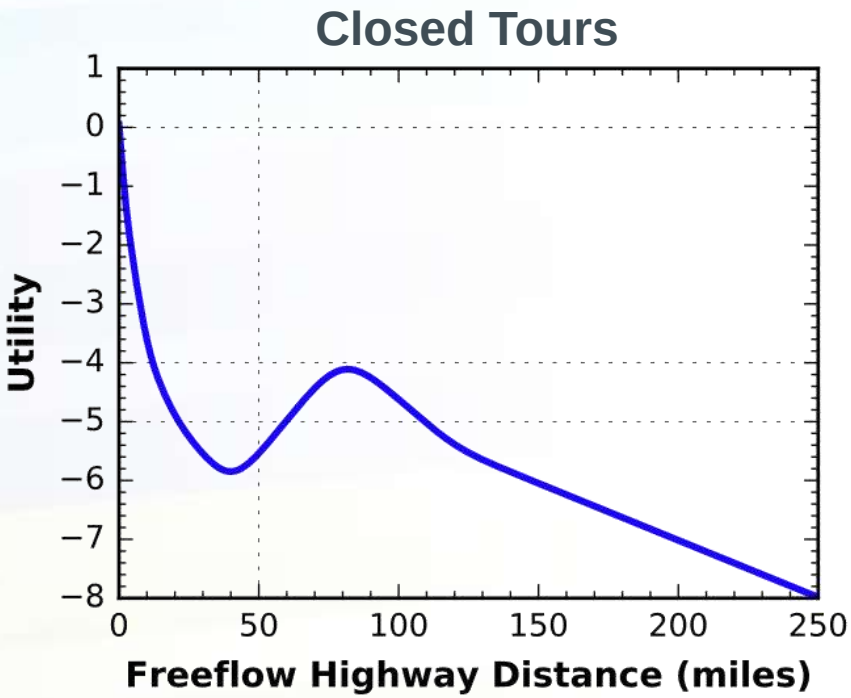
Hump about 70 miles is an artifact of Colorado geography



CAMBRIDGE SYSTEMATICS

Social/Recreational
Utility Function by Distance

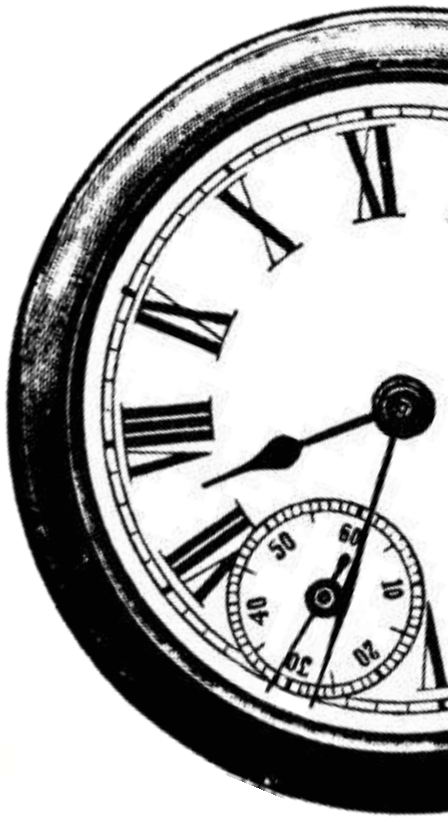
- Multi-point piecewise linear (smoothed) function for utility by distance
- Allows for better calibration over the very wide range of distances



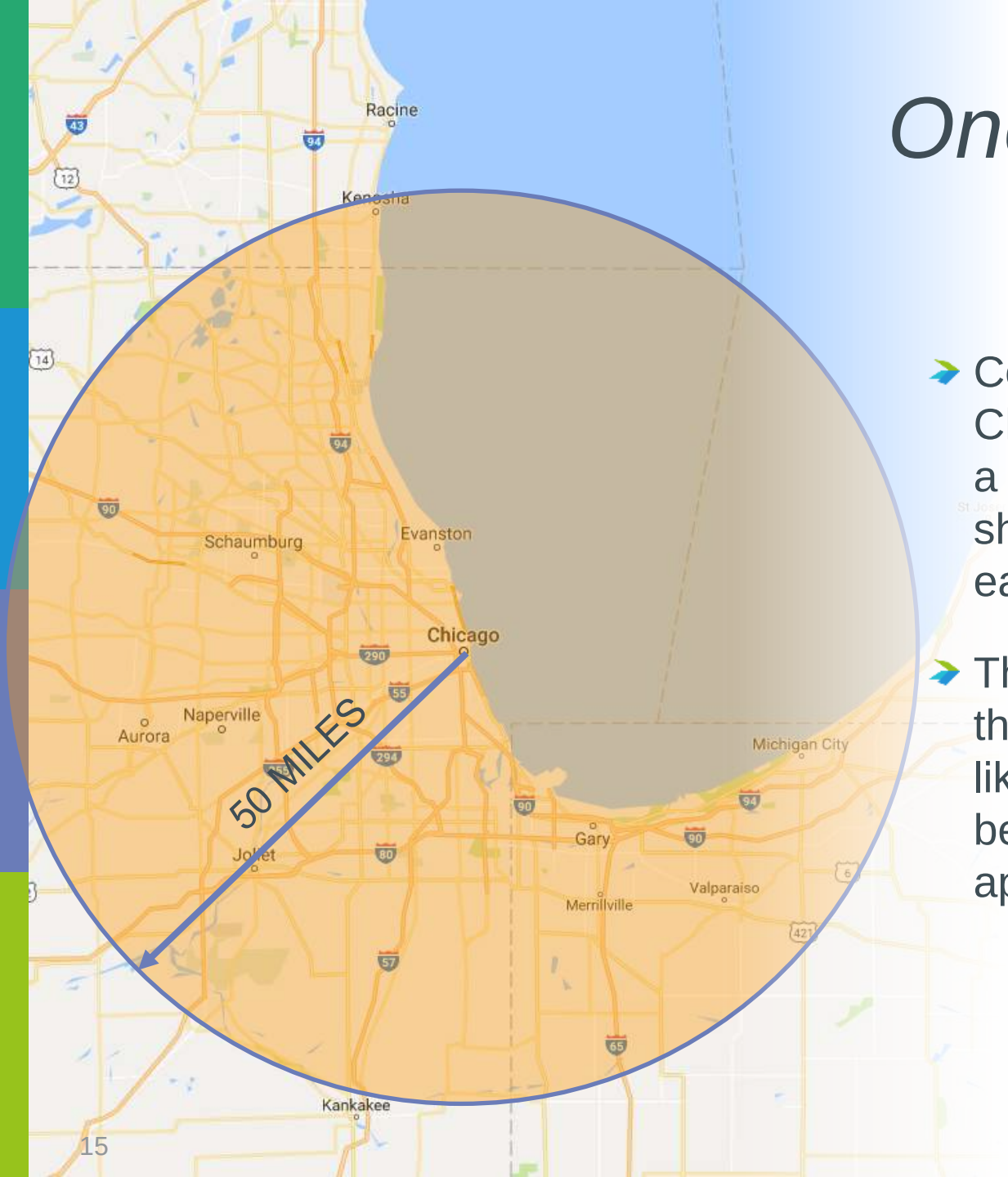
CAMBRIDGE SYSTEMATICS

Tour Time of Day

- Closed Tours, Same Day
  - Same as the DRCOG model: identify start and end hour for tours, as an MNL of all feasible alternatives
- Closed Tours, Span Overnight
  - Tours split in two, one starts “before” the travel day with a choice of end times, other starts “after” with a choice of start times.
- Non-Closed Tours
  - Tour must start “before” or end “after”, not both



One Size Does Not Fit All



- Contrast Colorado with Chicago, where drawing a line between long and short is actually fairly easy
- The modeling costs of this kind of approach likely don't justify the benefits in Midwest applications

CAMBRIDGE SYSTEMATICS

Summing Up

- Fusing long and short distance travel into a single model has a lot of knock on effects in model development
- The fused approach has some significant benefits in model application and interpretation
- Colorado is a good candidate for the fused approach because of its geography
- Chicago is likely better served by the traditional two-part approach

Jeffrey Newman jnewman@camsys.com
Cambridge Systematics

Erik Sabina
Colorado Department of Transportation

David Kurth
Jason Lemp
Tom Rossi
Cambridge Systematics