NCHRP Report 716
Travel Demand Forecasting

Parameters and Techniques

presented to

North Carolina Model Users Group Meeting

presented by

Cambridge Systematics, Inc.

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April 29, 2015

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Presentation Outline

- Project Overview
- Analysis of NHTS Data
- Data from Existing MPO Models
- What's in the Guidebook?
- Potential Applications
- Acknowledgments

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Project Overview

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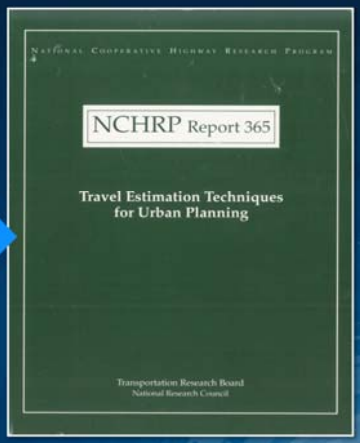
Project Overview
Background

- 1978 – NCHRP Report 187
  - » Quick Response Urban Travel Estimation Techniques and Transferable Parameters
- 1998 – NCHRP Report 365
  - » Travel Estimation Techniques for Urban Planning
- 2012 – NCHRP Report 716
  - » Travel Demand Forecasting: Parameters and Techniques



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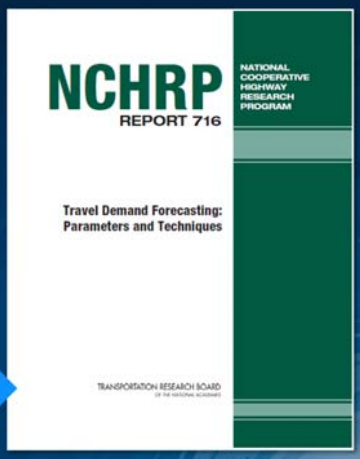
Project Overview
Background (continued)

- 1978 – NCHRP Report 187
  - » Quick Response Urban Travel Estimation Techniques and Transferable Parameters
- 1998 – NCHRP Report 365
  - » Travel Estimation Techniques for Urban Planning
- 2012 – NCHRP Report 716
  - » Travel Demand Forecasting: Parameters and Techniques



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Project Overview
Project Panel, Staff, and Research Agency Team

NCHRP Staff for Project 8-61

Nanda Srinivasan, Sr. Pgm. Officer

Project 8-61 Panel

Thomas Kane (Chair)
Michael Bruff
Ed Christopher
Nathan Erlbaum
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Bruce Griesenbeck
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Richard Pratt
Bijan Sartipi
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Kim Fisher (TRB Liaison)
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Research Agency Team

Cambridge Systematics, Inc.
in association with
Vanasse Hangen Brustlin, Inc.
Martin/Alexiou/Bryson, PLLC
Gallop Corporation
Dr. Chandra R. Bhat
Shapiro Transportation Consulting, LLC

Principal Investigator

Thomas Rossi

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Project Overview
Objectives

- Revise and Update NCHRP Report 365
  - » Current travel characteristics
  - » Guidance on forecasting
    - Procedures
    - Applications
- Develop User-Friendly Guidebook
  - » Range of approaches
    - Application of straightforward techniques
    - Optional use of default (transferable) parameters
  - » References to more sophisticated techniques
  - » Broad range of transportation planning issues

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Analysis of NHTS Data

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Analysis of NHTS Data
Process

- Information developed for four variables of interest
  - » Person trip production rates
    - Per household by trip purpose
  - » Reported average trip durations
    - By mode and trip purpose
  - » Time of day of travel distributions
    - By trip purpose
  - » Vehicle occupancy
    - By trip purpose
- Variables selected based on potential for transferability

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Analysis of NHTS Data
Classifications

- Trip purposes used for data summaries
  - » Home-based work
  - » Home-based school
  - » Home-based other
  - » Nonhome based

Home-based nonwork

- Urban area population classifications

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Analysis of NHTS Data
Sample Tabulations

Table C.5 – Example Trip Production Tabulation
Home-Based Work Trip Rates

	Workers				
Autos	0	1	2	3+	Average
0	0.0	1.0	2.4	5.1	0.5
1	0.0	1.0	2.6	5.1	0.8
2	0.0	1.3	2.6	5.1	1.6
3+	0.0	1.3	2.6	5.1	2.3
Average	0.0	1.2	2.6	5.1	1.4

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Analysis of NHTS Data
Sample Tabulations

Table C.10 – Example Trip Length Tabulation
Home-Based Work – Average Travel Time in Minutes

Urban Area Population	Auto	Transit	Nonmotorized	All Modes
Greater than 1 million with rail	29	55	16	32
Greater than 1 million without rail	25	55	16	26
Between 500,000 and 1 million	22	55	16	22
Less than 500,000	20	55	16	21
Not in urban area	24	55	16	24
All trips	24	55	16	25

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Data from Existing MPO Models

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Data from Existing MPO Models
Process

- Information from over 70 MPOs
  - » Small, medium, large
  - » Direct contact or publicly available reports
  - » Information collected
    - Model parameters
      - ♦ Trip attraction rates
      - ♦ Friction factor parameters
      - ♦ Mode choice parameters
      - ♦ Volume-delay function parameters
      - ♦ …
    - Model methods used

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Data from Existing MPO Models
Sample Tabulation

Sample Gamma Function Gravity Model Parameters (Home-Based Work)

	"b"	"c"
Large MPO 1	-0.503	-0.078
Large MPO 2	-1.650	-0.040
Large MPO 3	-0.156	-0.045
Medium MPO 1	-0.812	-0.037
Medium MPO 2	-0.388	-0.117
Medium MPO 3	-0.020	-0.123
Small MPO 1	-0.265	-0.040

Source: Table 4.5

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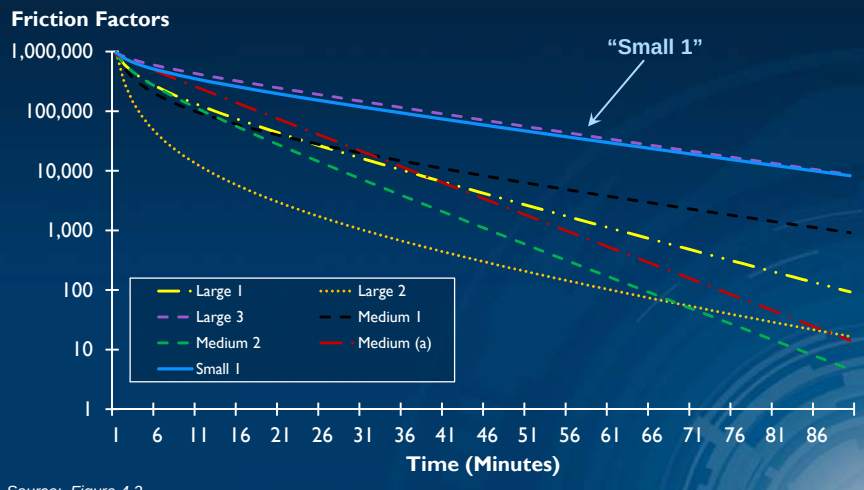
Data from Existing MPO Models
Sample Gamma Function Comparison (Home-Based Work)



Source: Figure 4.2

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What is in the Guidebook?

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What's in NCHRP Report 716?

- Chapter 1. Introduction
  - » Purpose, objectives, and roadmap
  - » Summary of modeling process
  - » How parameters used
- Chapter 2. Planning Applications Context
  - » Planning context affect on model
  - » Examples from urban areas

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What's in NCHRP Report 716? *(continued)*

- Chapter 3. Development of Data
  - » Purposes
    - Model development
    - Model validation
    - Model application
  - » Considerations
    - Limitations of typical data
    - Primary and secondary data sources
    - Conversion of data from secondary sources
    - Network coding procedures

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What's in NCHRP Report 716? *(continued)*

- Chapter 4. Model Components
  - » Discusses each model component
  - » Logit model summary
  - » Each subsection presents
    - A brief description of best practice(s)
    - Basis for development of the parameters
    - Parameters classified by urban area category
    - Explanations of use in model
      - ♦ Estimation
      - ♦ Validation
    - Parameter transfer

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What's in NCHRP Report 716? (continued)

- Chapter 4 subsections
  - » Vehicle Availability
  - » Trip Generation
  - » Trip Distribution
  - » External Travel
  - » Mode Choice
  - » Automobile Occupancy
  - » Time-of-Day Characteristics
  - » Truck/Freight Modeling
  - » Highway Assignment
  - » Transit Assignment

Tables of transferable parameters are presented in Chapter 4. Longer tables are found in Appendix C and referred to in the text of Chapter 4 by table number (e.g., Table C.1).

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What's in NCHRP Report 716? *(continued)*

- Chapter 5. Model Validation Process
  - » Validation overview
    - Consistent with other sources
    - Appropriate out-references
    - Not duplication of existing references
  - » Basic guidance
    - Focus on information in the guidebook

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What's in NCHRP Report 716? *(continued)*

- Chapter 6. Advanced Modeling Practices
  - » Overview
  - » Tour- and activity-based approaches
  - » Traffic microsimulation
- Chapter 7. Case Study Application(s)
  - » Two studies
    - Smaller urban area with little transit
    - Larger area with transit
  - » Illustrate use of the information from Chapters 4 and 5
  - » Draw on concepts presented guidebook
    - Similar to approach in NCHRP Report 365

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Potential Applications

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How do I use NCHRP Report 716?

- Describes key model components and approaches
- Provides reference options and examples
- Discusses best practices and implementation choices
- Helps with developing travel model components when no local data suitable for model estimation are available
- Supports checking the reasonableness of model components developed using local data

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How do I use NCHRP Report 716?

- **Use Case 1: GTown**
  - » Large MPO
  - » Household travel survey
  - » Recalibrated model using this data
  - » Information from NCHRP Report 716 used to verify reasonableness
- **Use Case 2: Schultzville**
  - » Small urban area
  - » Never had a model
  - » No area-specific travel survey
  - » Model structure from another small area
  - » NCHRP Report 716 used to inform

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Gtown Model Reasonableness Checks
Trip Generation

Trip production rates

- *Compares model rates to NHTS rates*
- *Considers reasons for differences*

Trip attraction rates

- *Compares model rates to MPO summary rates*
- *Considers implications of differences*

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Gtown Model Reasonableness Checks
Trip Distribution

Average trip length

- *Compares model output to NHTS findings*
- *Discusses use of CTPP in reviewing HBW trip purpose*

Gamma function and friction factors

- *Compares model parameters to summarized MPOs*
- *Discusses implications of differences*

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Gtown Model Reasonableness Checks

Mode Choice

Reviews coefficients by trip purpose and implied value of time for model versus other MPOs

Automobile Occupancy

Compares average daily vehicle occupancy by trip purpose for model versus NHTS

Time of Day

Compares time of day distribution of auto trips for model versus NHTS

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How do I use NCHRP Report 716?

- **Use Case 1: GTown**
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Schultzville Model Development

- Zone and Highway Network Development
  - » Highway network development
  - » Transportation analysis zone definition
- Socioeconomic Data
  - » Households
  - » Employment

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Schultzville Model Development *(continued)*

- Trip Generation
  - » Trip production rates based on NHTS tables (Table C.5)
  - » Trip attraction rates based on reference models (Table 4.4)
- Trip Distribution
  - » Travel time inputs developed
  - » Friction factors applied to achieve trip length distribution
- External Trips
  - » Example uses a statewide model-derived trip table

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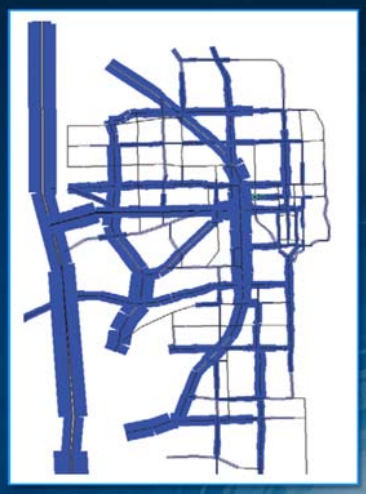
Schultzville Model Development *(continued)*

- Vehicle Occupancy
  - » Convert person trips to vehicle trips (Table 4.16)
  - » 1.10 for HBW; 1.72 for HBNW; 1.66 for NHB
- Highway Assignment
  - » Convert P-A to O-D
  - » Used BPR parameters from Table 4.26
  - » Equilibrium assignment
  - » Review RMSE results



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Acknowledgments

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Acknowledgments and Thanks

- Nanda Srinivasan, now with U.S. Department of Energy
- Tom Rossi, Cambridge Systematics, Inc.
- David Kurth, Cambridge Systematics, Inc.

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