Non-Motorized Model Development
General Information and DCHC MPO Project

presented to

North Carolina Model Users Group
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presented by

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Presentation Outline

- *General*
- DCHC-MPO
- End Notes

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Non-Motorized Model Enhancement
Objectives

- Improve ability to capture impacts of land use and infrastructure enhancements on non-motorized travel
- Demonstrate air quality and congestion mitigation impacts of investments that expand bike trails, improve pedestrian and bicycle safety, and provide or improve sidewalks

DCHC MPO's Metropolitan Transportation Improvement Program (MTIP) Regional Priority List for fiscal years 2007-2013 lists more than 75 potential projects in which bike/pedestrian infrastructure improvements are a primary or prominent feature of the improvement project

- Benefit in developing Transportation Improvement Programs (TIP), air quality conformity analysis, and other studies and programs

Non-Motorized Model Enhancement
Application Areas

- Mode Choice
- Analysis of TDM and Other Measures to Reduce Auto Travel
- Analysis of Effects of Alternative Land Use Patterns
- Transit Access

Non-Motorized Model Enhancement
Example Projects

- **Central Artery Project (Boston, MA)**
  - Pedestrian trip generation uses three trip types: walk only trips; transit access/egress trips; and parking access/egress
  - Pedestrian origin-destination flows and link volumes are estimated through a process of walk trip generation; trip distribution; and assignment
- **LUTRAQ (Portland, OR)**
  - Incorporated pedestrian environment variable in existing models.
  - Showed that pedestrian environment and density variables can be statistically significant variables in models of auto ownership and mode choice
- **DVRPC (Philadelphia, PA)**
  - Incorporated PEV into trip generation model
  - Mode choice model was developed to separate motorized from non-motorized trips

Pedestrian Environment Variables

- **Typical**
  - Sidewalk availability
  - Ease of street crossing
  - Street connectivity
  - Availability of bicycle infrastructure
  - Building setbacks
  - Terrain

- **DVRPC Example**
  - PEV = 0.25* (Sidewalk Availability) + 0.30* (Ease of Street Crossing) + 0.45* (Building Setbacks)
  - Range for variable is 1-3

Variables Affecting Non-Motorized Travel

Variable Type	Descriptions
Land Use	Density, mixed use/pedestrian-oriented development
Roadway	Speeds, lanes, street density, connectivity, grade
Intersection	Signals, crosswalks, medians
Non-motorized facilities	Sidewalks, bike lanes/paths, pavement markings
Demographics	Age, student status
Accessibility	Proximity of persons to activities
Impedance	Time or distance from origin to destination

General Modeling Challenges

- The need for *objective* measures for variables affecting non-motorized travel behavior
- Identifying the effects on other modes
  - Transit trips
  - Auto trips
- Zonal attributes

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DCHC MPO Project Objectives

- Develop and implement enhancements to Triangle Regional Model (TRM) to:
  - better capture travel demand impacts of non-motorized travel (walking and bicycling) due to land use and facility/infrastructure changes
  - generate trip tables indicating zone-to-zone and intrazonal non-motorized travel
- Enhancements intended to help DCHC MPO:
  - forecast future bicycle and pedestrian demand
  - assess future bicycle and pedestrian travel needs
  - plan for adequate non-motorized facilities/infrastructure
  - prioritize bicycle and pedestrian improvement projects
  - gauge the effects of non-motorized trip-making on other travel modes

Triangle Region Household Survey
Non-Motorized Travel by Trip Purpose

Trip Purpose	1995 Survey	2006 Survey (Weighted)
Home-Based Work	2.79 %	3.82 %
Home-Based Shopping	4.68 %	3.99 %
Home-Based School	7.74 %	3.64 %
Non-Home Based	13.12 %	8.50 %
Home-Based Other	9.09 %	5.57 %

DCHC MPO Project
Phase 1

Objective: Improve the existing model to be more sensitive to factors affecting non-motorized travel in a short timeframe

- Coordination with DCHC-MPO
- Determine candidate variables
- Reestimate models with new variables
- Develop program to implement new models
- Revalidate models
- Documentation
- Phase 2 work plan

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DCHC MPO Project
Phase 2

Objective: Developed revised model to accurately integrated non-motorized travel into the region's model

- **Make any necessary revisions to trip generation**
- **Revise/revalidate trip distribution**
- **Develop new mode choice model including non-motorized modes**
- **Develop program to implement new models**
- **Documentation**

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DCHC MPO Project
Potential Variable Categories

- **Three potential areas for new variables to be incorporated into the model:**
  - **land use mix and density**
  - **zonal network characteristics**
  - **person and household characteristics**

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DCHC MPO Project
Initial Variables (from Existing Models)

Table 1. Initial Variables Used in the Nonmotorized Model

Variable	Description
Str1dum	No Car Indicator, 1 if Car = 0
Str2dum	Low Income Indicator, 1 if Inc<=19,999
Str3dum	Med. Inc and Less Cars Indicator, 1 if 20,000<=Inc<=99,999 and Cars<Workers
Str4dum	Med. Inc and More Cars Indicator, 1 if 50,000<=Inc<=99,999 and Cars >=Workers
Str5dum	High Income Indicator, 1 if Inc>=100,000
EmpDis	Employment Distance Accessibility Measure
PopDis	Population Distance Accessibility Measure
EPDis	Emp + Pop Distance Accessibility Measure
Urban	High Density Indicator, 1 if Area Type = 1
Suburban	Medium Density Indicator, 1 if Area Type = 2
Rural	Low Density Indicator, 1 if Area Type = 3

DCHC MPO Project
Enhanced Variable List

Table 2. Additional Variables Used in the Phase 1 Nonmotorized Model

Variable	Description
Inc2	Low-Medium Income Indicator, 25,000<=Inc<=49,999
Inc3	Medium-High Income Indicator, 50,000<=Inc<=99,999
Inc4	High Income Indicator, Inc=>100,000
Inc234	Not Low Income Indicator, Inc=>25,000
LessVeh	Less vehicles than workers in the household, with at least one vehicle, Cars<Workers
MoreVeh	At least or more vehicles than workers in the household, Cars >=Workers
PChild	Presence of children in the household
Suburb	Medium Density Indicator
LUMix	Land Use Mix = ((2*(People+Jobs)-abs(People-Jobs))/acre
AveBlock	Average Street Block Perimeter in Zone

DCHC MPO Project
Preliminary Models – Significant Variables

HBW

Parameter
Intercept
Inc4
LessVeh
MoreVeh
Urban
EmpDis
PopDis
AveBlock

HBSh

Parameter
Intercept
Inc2
Inc3
Inc4
MoreVeh
AveBlock

HBO

Parameter
Intercept
Inc2
Inc3
Inc4
LessVeh
MoreVeh
PChild
Urban
AveBlock

HBSc

Parameter
Intercept
MoreVeh
Urban
LUMix
EmpDis
PopDis

NHB

Parameter
Intercept
Inc234
MoreVeh
PChild
Urban
LUMix
EmpDis
PopDis
AveBlock

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End Notes
Potential Resources

- Traveler Response Handbook (TCRP Report 95)
  - Chapter 16 – Pedestrian and Bicycle Facilities (Forthcoming)
- Guidebook on the Methods to Estimate Non-Motorized Travel (1999) Federal Highway Administration *(available on the web)*
- Rossi, T. (2000) "Modeling Non-Motorized Travel," Preprint 00-0492, TRB Annual Meeting

End Notes
DCHC-MPO Project

- **Team Members**
  - Cambridge Systematics, Inc.
  - Kimley-Horn and Associates, Inc.

- **Key Staff**
  - Felix Nwoko, Client Project Manager

  - Tom Rossi, Project Manager
  - Jay Evans, Deputy Project Manager
  - Laura McWethy
  - Tim Padgett
  - Chris Porter
  - Tara Rima
  - Kevin Tierney

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End Notes
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