LACMTA Bike Model – Update to MTF

Review of Bicycle Model Development Progress

presented to

SCAG Modeling Task Force

presented by

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Metro

Overview

- Bike Model Status Report
  - » Big Picture and Progress to Date
    - Policy Sensitivity
    - Multiple Geographic Scales
    - 3-Step Developmental Approach
- Bike Data Collection Plan
  - » Why Collect Bike Data?
  - » What Kind of Data?

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Bike Model Status Report

Big Picture: Multiple Geographic Scales

- Highway, Transit, Mode Choice level
  - » TAZ {Census Tracts}
  - » "Traditional" network
- Bike Skims/Paths
  - » Census Blocks
  - » TeleAtlas Network
    - Very fine level
    - Includes all Collectors

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Big Picture: 3-Step Development Approach

- Prototype Case and Sensitivity Tests {Done}
  - » Model Specifications/Assertions
  - » Spreadsheet implementation – The "Math"
- Small Area Test Case {In Progress}
  - » Santa Monica Implementation
    - All "Rows and Columns" to/from Santa Monica
  - » Software Validation
- Full Model Application
  - » Full Implementation
    - All TAZs in all Counties
  - » Model Validation

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Refined Geographic Scale – Existing Bike Network

Ability to Answer Policy Questions

Policy Issue	Capable of Addressing Issue					
	Case 1		Case 2		LA	
	Mode Choice	Route Choice	Mode Choice	Route Choice	Mode Choice	Route Choice
Intra, Inter-zonal	Yes	Yes	Yes	No intra-zonal	Yes	Yes
Bicycle to transit	No	No	No	No	Yes	Yes
Bike sharing	No	No	No	No	Yes	Yes
Bicycle parking	No	N/A	No	N/A	Yes	Yes
Recreational	No	No	No	No	Yes	Yes

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Modeling Element Overview

Trip Purposes	Utilitarian						Recreation
	Auto	Transit			Non-Motorized		Biking
	Auto	Walk Access	Bike Access	PnR, KnR	Walk	Bike	@ destination
Home-Based Work							
Home-Based Univ							
Home-Based Recreation-Biking @ Destination							
Home-Based Other							
Non-Home-Based							

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Path Choice /Mode Choice Integration

- Five path themes are used to generate distinct and representative paths, including:
  - » Minimum distance (MD)
  - » Minimum turns (MT)
  - » Minimum stress (MS)
  - » Preferred facilities (PF)
  - » Preferred trails (PT)
- Path building parameters include weights on 10 variables:
  - » 2 for Roadway Types (major vs. minor)
  - » 5 for Treatment of Bicycle Facilities (no treatment, bike route, bike lane, cycle track and bike trail)
  - » 1 for Slope Effect
  - » 2 for Turn Penalty.

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Recreational Bicycle Model

- Quantity of Recreational Bicycling
  - » Refinement of Phase 1 Model: Two-stage, discrete choice and regression model on Synthetic Population
    - Propensity Logit Model
    - Frequency (regression) Model
    - Mileage (BMT) Calculation
- Allocation of Recreational Bicycling BMT
  - » Network element's potential for recreational bicycling
    - F (urban form, roadway facility characteristics, and more)
  - » Total Recreational BMT on bicycle network

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Recreational Modeling Process

- **Binary Logit Model –** predicts whether any recreational trip is made

Output #1: Individuals making recreational bike trips

Output #2: Amount of recreational bicycling per individual

- **Linear Regression Model –** predicts amount of recreational bicycling (BMT)

- **Allocation -** Allocation of recreational bicycling BMT to network

Output #3: Recreational bicycling (BMT) by facility

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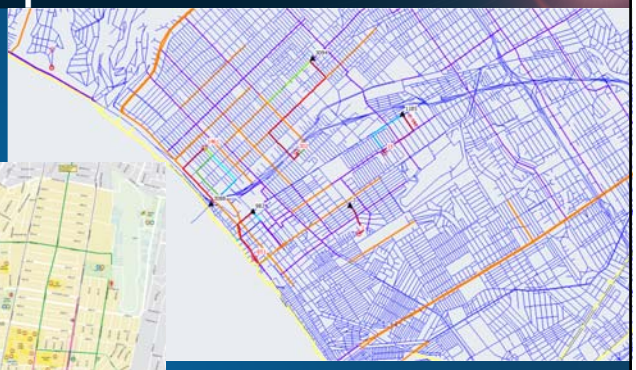
Santa Monica Implementation

- Bike Facilities



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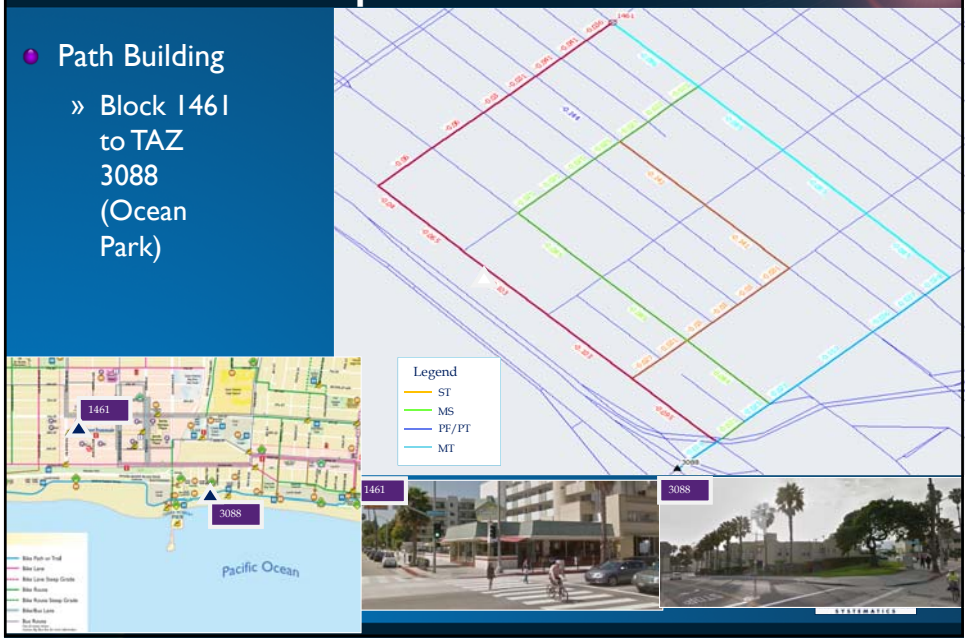
- Path Building
  - » Block 1461 to TAZ 3088 (Ocean Park)



Santa Monica 20 Year Plan Bike Model Test

- Network Coding
  - » Added 38 new links
  - » Updated about 1300 links with modified bike facility class
  - » Recalculated utility cost
  - » Conversion from ArcGIS to CUBE
- Base Year and Future Year Model Run
  - » Built about 16 million bike paths
  - » Aggregated block to block utility to intra-zonal utility (from 8 million interchanges to 2268)
  - » Aggregated block to zone utility to short inter-zonal utility (from 3 million interchanges to 26455)

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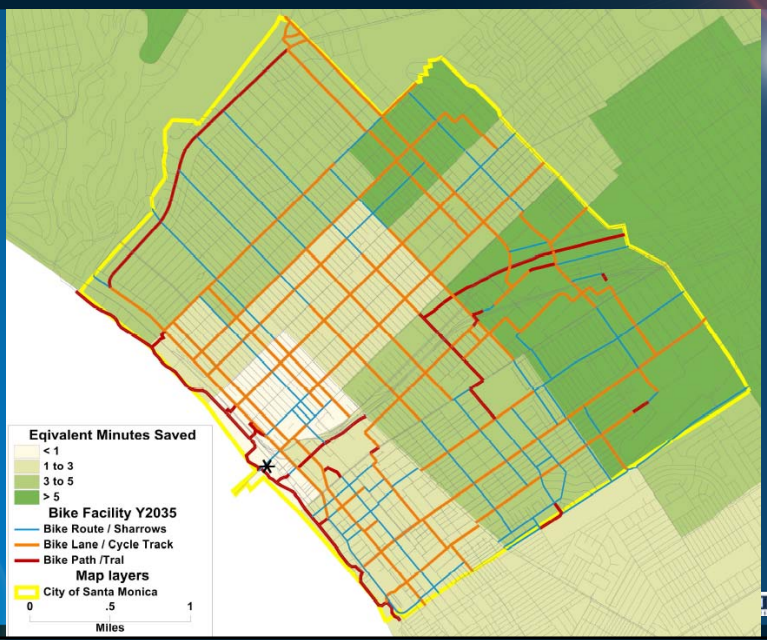
To Santa Monica Pier, Bicycle Travel Time Saved, Year 2035 vs. Year 2015



Data Collection

Why Collect Bike Data?
(Modeling and Other Purposes)

- Model Development/Validation/Application
- Planning Projects
- Safety Issues (Collision Data)
- Before and After Studies
- Trend Analysis
- Maintenance
- Other Needs

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Why Collect Bike Data?
(Modeling and Other Purposes)

- Data Collected in Other Cities Uses a Wide Variety of Technologies, Similar to Those Planned for LA County
- While Bike Data in LA County Is Insufficient, Its No Worse than in Most Large Cities
- Similar Problems and Concerns
  - » Most existing data is site specific, not subject to extrapolation to a larger geographic area
  - » All count technologies are subject to error, and the use of short term counts extrapolated over time is especially prone to error
  - » Until recently, there has been little guidance regarding best practices
- Even Cities Known for Their High Bike Usage – Such as Portland, Oregon – Are Struggling to Identify the Best Data Collection Practices

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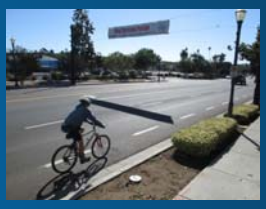
What Kind of Bike Data?

- Bike Travel Demand
  - » Bike Counts on Bike Network
  - » Bike User Surveys
  - » GPS Tracking
- Bike Travel Supply
  - » The Current Database is Ready for Current Model Development Tasks
  - » Bike Infrastructure (Network Attributes)
  - » Bike Programs



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Overview

- Long Term Plan Goal
  - » Implement a Permanent and **On-going** System of Bike Data Collection
  - » Use Automated Counters to Allow **Continuous** Data Collection and Reporting
  - » Expand Data Collection Plan to Include Pedestrian Data
- Short Term Plan Objectives
  - » Focus on Data Necessary for Model Calibration and Model Validation
  - » Begin Purchase and Implementation of Automated Counters
  - » Supplement with Video Bike Counts and Emerging Technologies to Increase Coverage
  - » Include Behavioral Surveys for Model Calibration
  - » Some Pedestrian Data Will Be Collected as a Byproduct of Bike Plan

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Behavioral Data Collection Methods

- Survey: Web-based
  - » Respondents use personal computer
  - » Intercept bicyclists use tablet
- Route choice: Smartphone with GPS device supplement
  - » Streetlight Data – customize CycleTracks, clean data
  - » Distribute GPS devices (~200 to 300 respondents)

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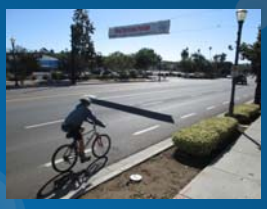
Data Collection Methods

- Counting Technology
  - » In-street inductive loop counting, a combined infrared/inductive loop technology for counting on bike paths, and an infrared pedestrian counter



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Short Term Plan: Evaluation Criteria

- Count Locations Will Be Chosen to Satisfy a Wide Range of Evaluation Criteria
  - » Urban Fabric: A Combination of Socioeconomic and Land Use Density Measures
  - » Transit Usage: Access to a Mix of Transit Modes, Including Local Bus, Rapid Bus and Rail
  - » Highway Facility Type: Arterial, Collector and Local
  - » Bike Treatment Type: Trail, Lane, Route or Untreated
  - » Dominant Bike Usage: Utilitarian or Recreational
  - » Safety/Collision Data: Focus on Locations with Clusters of Bike Collisions
  - » Supplement Existing Data Sources: Focus on Locations that Lack Existing Data
  - » Model Concerns: Use Initial Application of Bike Model to Identify Anomalous Results

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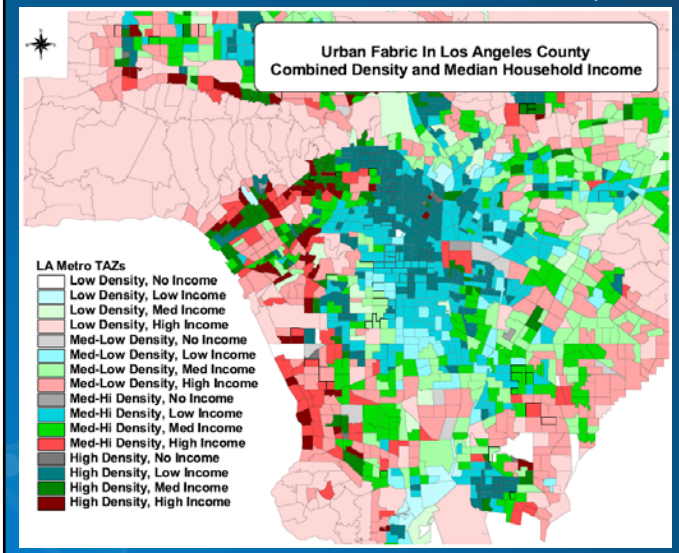
Short Term Plan: Evaluation Criteria

- Urban Fabric: Combination of Land Use Density and Household Income



- Income Displayed Thematically by Color:
  - Blue = Low Income
  - Green = Medium
  - Red = High Income
- Density Displayed by Shading:
  - Lighter Shades Represent Lower Density
  - Darker Shades Represent Higher Density
- Identify Clusters of Similar Urban Fabric for Bike Counts

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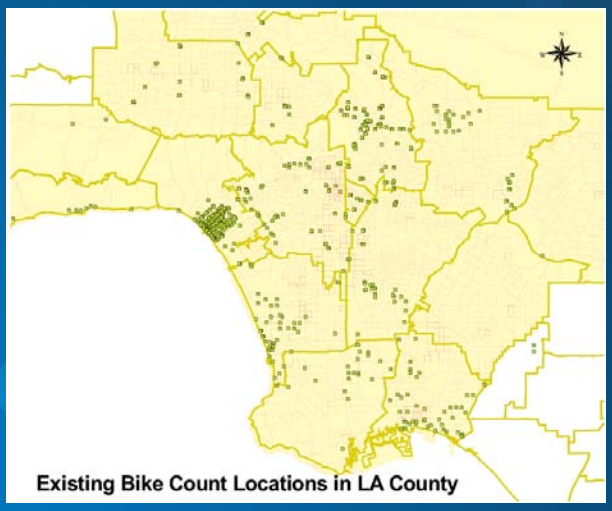
Current Status of Bike Data in LA County

- Very Few Existing Bike Counts in LA County (Except in Santa Monica)
- Most Existing Counts are Only for a Few Hours on a Single Day



Existing Bike Count Locations in LA County

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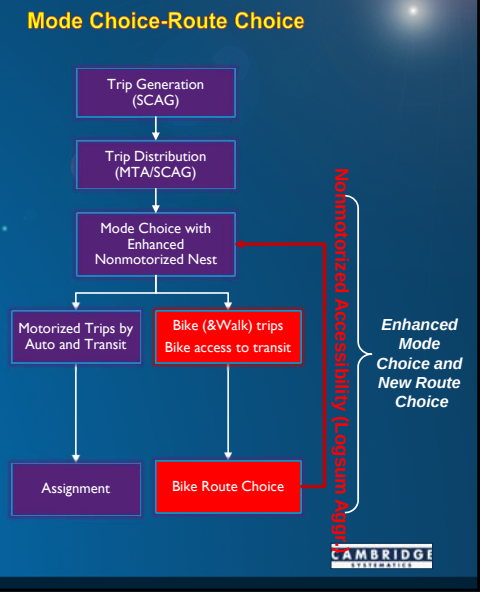
Questions and Comments

End

Modeling Framework for Utilitarian Trips

- Intrazonal trips
- Interzonal trips
- Bicycle access to transit trips



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Path Choice /Mode Choice Integration

- Logsum Aggregation/Disaggregation - TAZ to SB

$$T_{ij} = T_{IJ} \times \left[\frac{\exp(ls_{ij} + \ln[size_{ij}])}{\sum_{p,q} \exp(ls_{pq} + \ln[size_{pq}])} \right]$$

$$size_{ij} = 1.0 * POP_i + 1.0 * POP_j + 2.0 * EMP_i + 2.0 * EMP_j$$

  - » ls_{ij} should be "symmetrized" for Mode Choice
    - Intra-zonals cost averaged before logit averaging
    - Inter-zonals cost averaged $(S+S^T)/2$ after logit averaging

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Path Choice /Mode Choice Integration

- Modal Utility Function for bike modes
  - » Literature review – identified key variables in bike mode utility
    - Literature on bike access to transit is thin
    - Coefficient values
      - ♦ Based on odds ratios &/or equivalent minutes
  - » Key Variables
    - Route choice logsum
    - Densities
    - Bike parking (by parking type, as % with access to)
    - Bike share program – literature is thin
      - ♦ Extent of system (described by variable with min/max 0/1)
      - ♦ Access to system
    - Others - % 0-veh households, % education land area

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Path Choice /Mode Choice Integration

- Logsum Calculations
  - » Use MNL logsums, rather than CNL
    - Overlap across paths is not considered
    - Each of 5 paths is considered to be unique in logsum calculation
      - ♦ There are always 5 alternatives in the logsum, regardless of the degree of overlap across the alternatives
  - » Non-uniform utility functions
    - Each alternative uses its respective path-building weights in the utility function (rather than a unified utility function across paths)
    - Alternative constants
      - ♦ Due to unevenness in utility by path type, constants are calibrated for each path type alternative to ensure each impacts logsum appropriately (on average).

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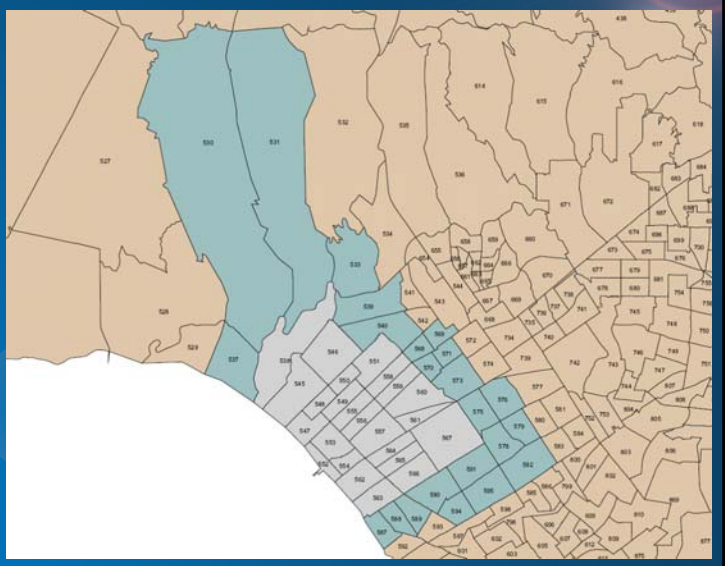
- Study Area



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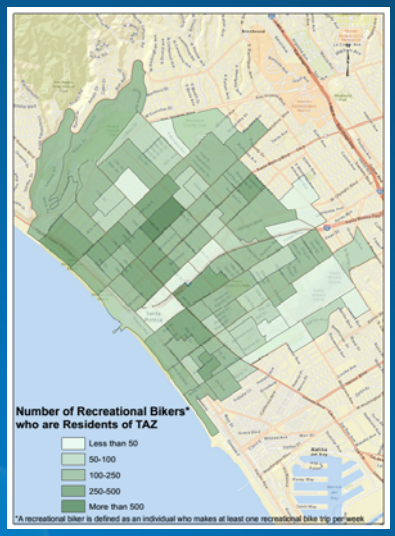
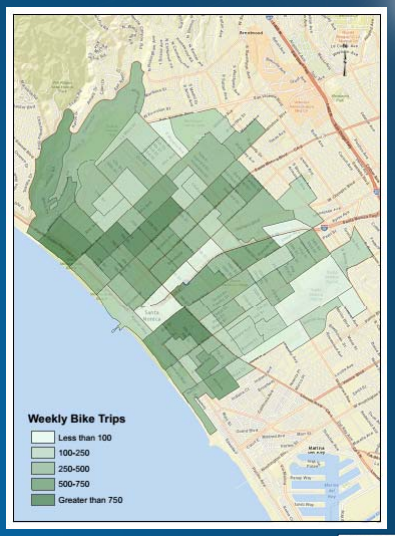
Santa Monica Implementation

- Recreational Bike Travel Demand





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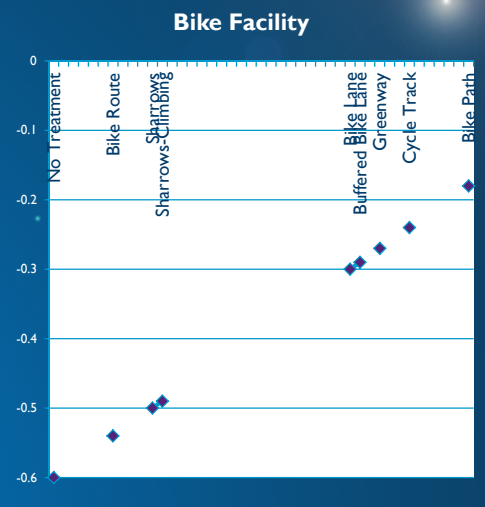
More Bike Facility Types

Bike Facility	Coefficient
No Treatment	-0.60
Bike Route	-0.54
Sharrows	-0.50
Sharrows-Climbing	-0.49
Bike Lane	-0.30
Buffered Bike Lane	-0.29
Greenway	-0.27
Cycle Track	-0.24
Bike Path	-0.18



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Intra-TAZ, Bicycle Travel Time Saved, Year 2035 vs. Year 2015