

Integrating Transportation and Emissions Modeling:

Applications and Data Needs for Asia

by

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Outline of Presentation

- Discuss Issues Related to People/Goods Movement in Large Urban Areas
- Present a Case for the Need for More Quantitative Emission/Transportation Models
- Brief Review of CE-CERT's Research in this Area
- Data Requirements for These Models

Quantitative Transportation Planning

- Population and Economic Growth
- Land Use Options/ Quality of Life
- Options Available for People Movement
 - Personal Vehicles (2,3,4 Wheels)
 - Public Transportation
- Options Available for Goods Movement
 - Include Full Inter-modal System
- Fuel Infrastructure
- Roadway Network

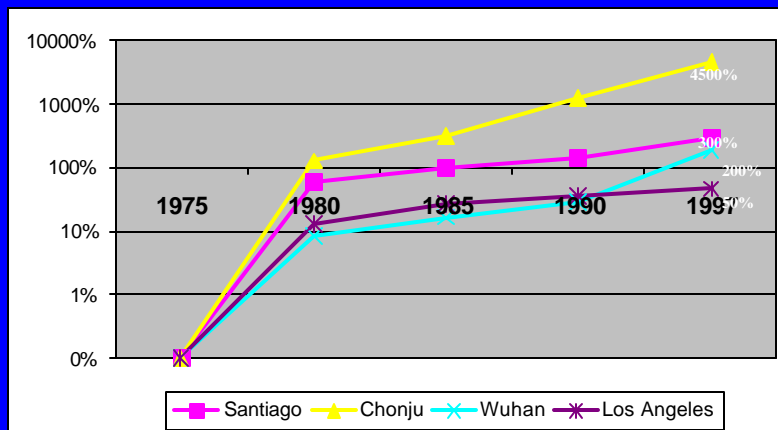
Environmental and Energy Impact

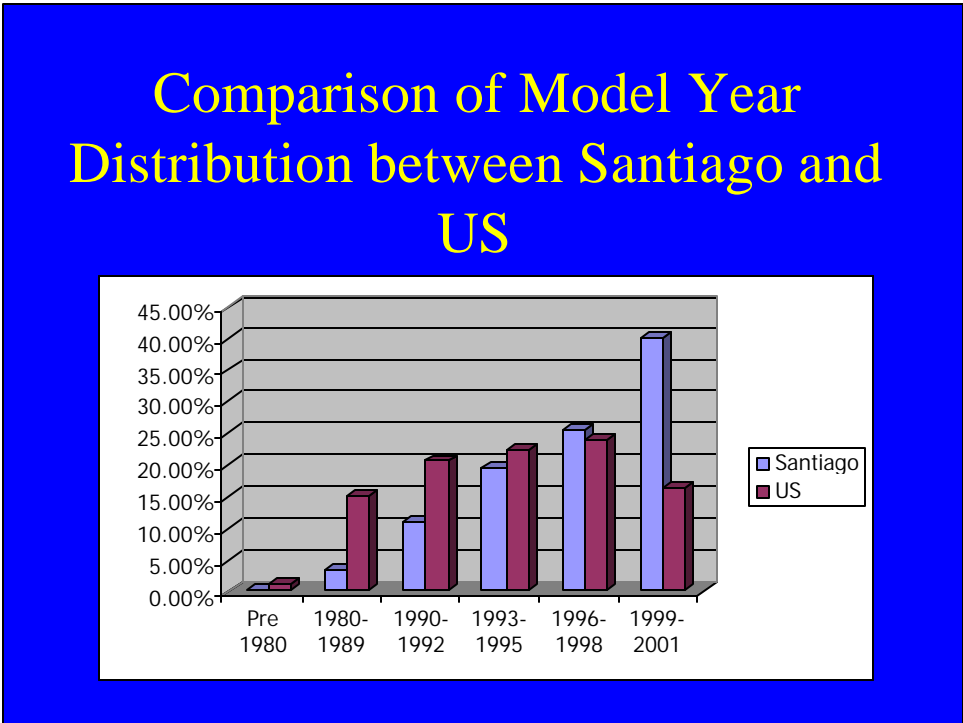
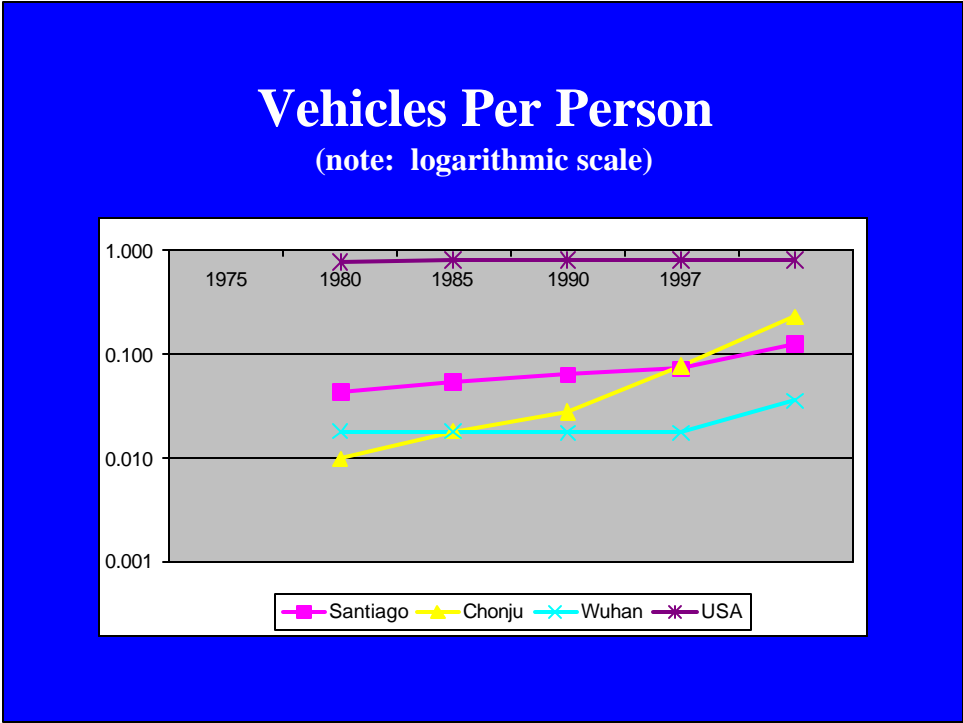
- Emissions and Fuel Use
 - Vehicle Mix
 - Emission Control Technology
 - On/Off Road Duty Cycles
 - Driving Behavior
 - Traffic Dynamics
 - Emission and Energy Characterization of Fleet

Motor Vehicle Emissions Problem Essentially Solved

- Emission Control Technology Improving and Costs Being Reduced For All Vehicle Classes (SELEV Project at CE-CERT)
- On-Board Diagnostics Will Substantially Improve Inspection/Maintenance
- Fuel Properties Key To Reduction of In-use Emissions
- Emissions from Diesel Engines Next Target
- Congestion Management Key Problem
- Long Term Transportation System Most Probably will be Hydrogen-Based

Increase in Vehicles in Developing Areas Compared to 1975 (note: logarithmic scale)





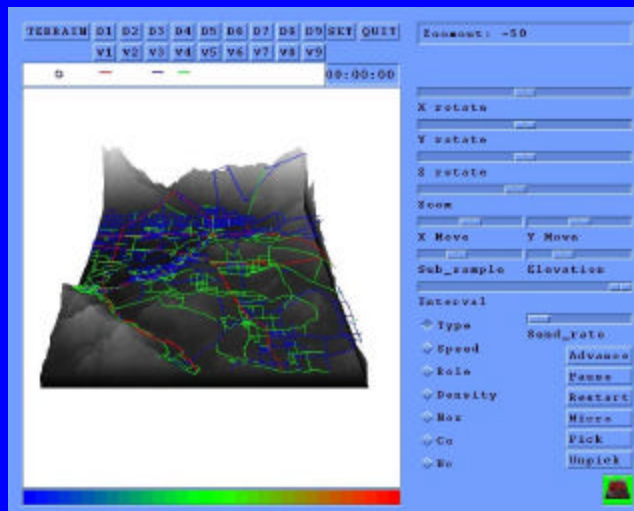
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Integrated Transportation/Emissions Modeling (ITEM) Framework

Unique Features:

- incorporates Modal Emission Data (i.e., emissions associated with vehicle operating mode)
- handles both regional (i.e., wide-area network) and local (e.g., corridor) emissions inventories
- discrete event-based simulation
- dynamic network path - re-route capability
- explicitly includes other transportation modalities

ITEM: Mesoscopic Wide-Area Model



- simulates individual vehicles
- discrete event-based simulation
- events: generate vehicle, link transition, arrive
- dynamic network path - re-route capability
- link-based emissions - emissions related to congestion level (v/c ratios, speed)

The Development of the Comprehensive Modal Emissions Model (CMEM)

Objective:

to develop and verify a modal emissions model that accurately reflects vehicle emissions produced as a function of the vehicle's operating mode.

- began as National Cooperative Highway Research Program Project: (1995 - 2000)
- currently being enhanced and improved (2000 – present) with EPA funding
- based on significant amount of emissions data from a wide range of vehicles
- over 100 other groups now using CMEM for specific analysis

Integrated Transportation/Emissions Modeling (ITEM) Framework

Data Requirements:

- roadway network:
 - links
 - nodes
 - topography (i.e., elevation)
- travel demand data:
 - by travel mode
 - hourly volumes (can relax to larger time periods)
- vehicle fleet data:
 - vehicle types
 - emission characteristics (e.g., CMEM category)

CE-CERT's Research in Asia

- REO Catalyst Retrofit Program in China
 - Emission Characteristics of Airborne Toxics
 - Importance of Engine Maintenance
- Developed an International Vehicle Emissions Model
 - Obtained Vehicle Data from Korea, China, Chile
 - In-use Fuel Characterization
- Evaluating E-Diesel Fuel for Thailand
- Beginning to Develop ITEM for India