

Tri-Center Meeting on Transportation Networks

MCEER Studies on Network Analysis

Sungbin Cho  ImageCat

October 13, 2005

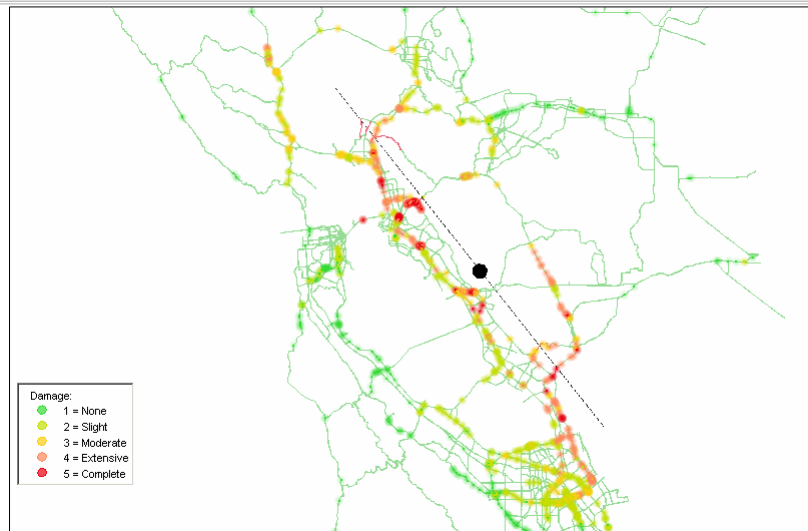
Transportation Network Analysis in MCEER

- Analysis of Earthquake-Damaged Network
 - Implement congestion-sensitive travel demand via the Variable Demand User Equilibrium Model
 - Compensate longer running time of VDUE by applying the Dual-Simplex Shortest Path Algorithm
- Easy Data Creation for SRA
 - Development of Import Wizard to create network database for Seismic Risk Analysis

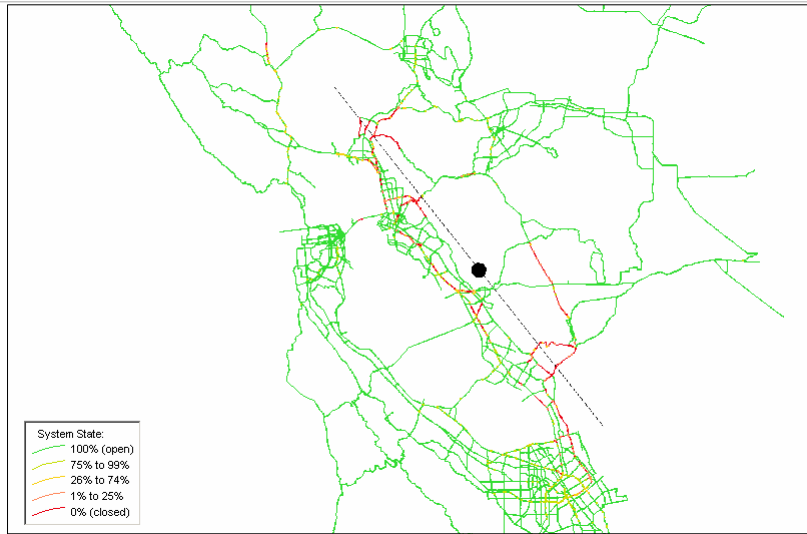
Variable Demand Model (1/6)

- Experience with Fixed Demand User Equilibrium Model
 - Demand for transportation system in pre and post earthquake stays same.
 - Extremely overestimated travel time
- Variable Demand Model
 - Travel demand and network capacity are in equilibrium through travel time (cost)
 - Hold Wardrop's principals

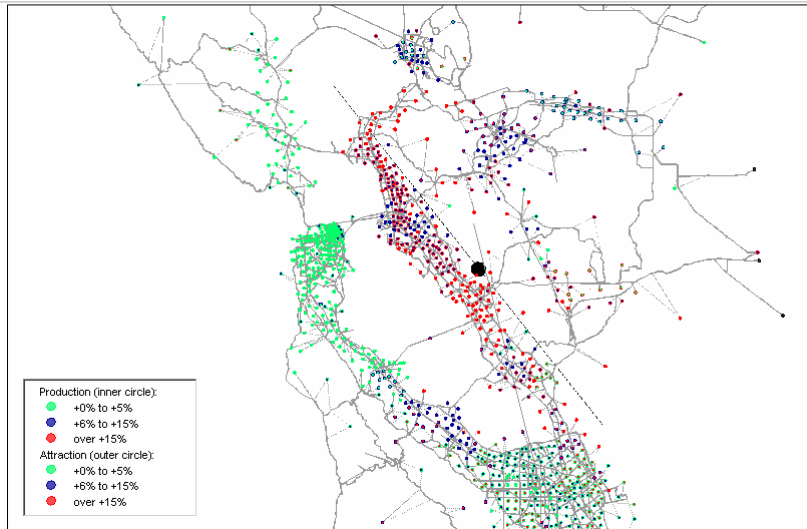
Variable Demand Model – Bridge Damage (2/6)



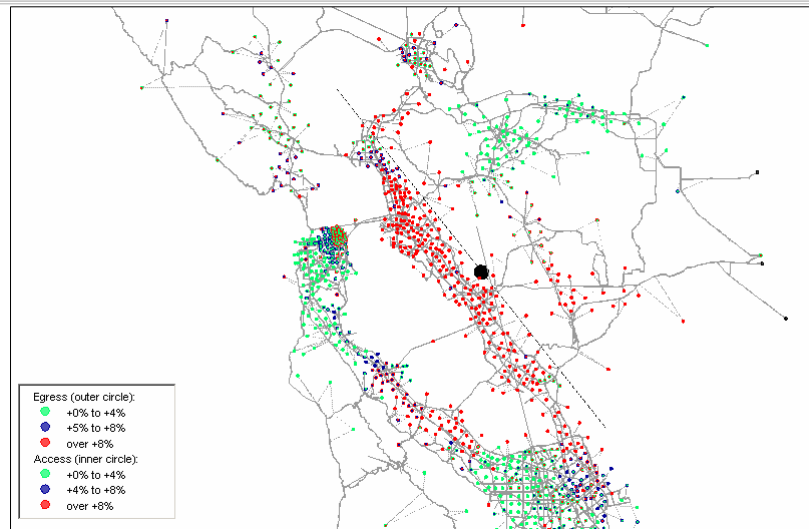
Variable Demand Model – Network Capacity (3/6)



Variable Demand Model – Demand Reduction (4/6)



Variable Demand Model – Travel Time Increase (5/6)

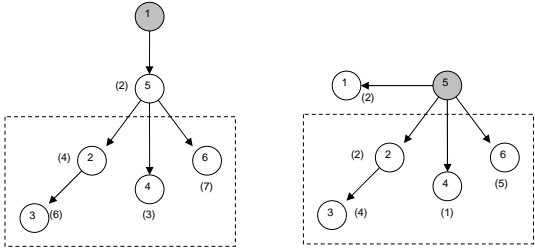


Variable Demand Model – Forgone Trip Value (6/6)

- with PEER and USC
 - Reduced travel demand in post-earthquake system may cause less system cost, i.e. travel time cost spent by all drivers
 - Based on changes in consumers surplus, value of forgone trips is calculate

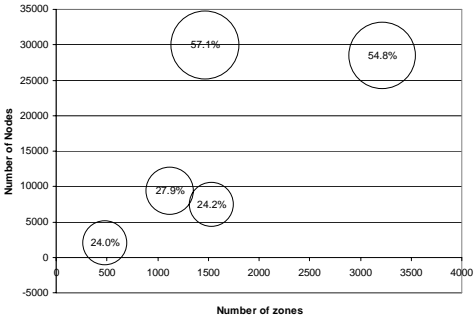
Minimum Path Algorithm (1/2)

- Due to Florian et al
 - Minimum paths from two adjacent origins may have common links on their paths.
 - Recycle the information to reduce running time



Minimum Path Algorithm (2/2)

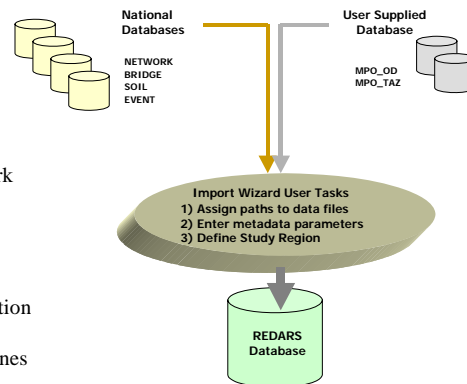
- Running time reduction ranges from 20% - 55% depending on size of network (redundancy)



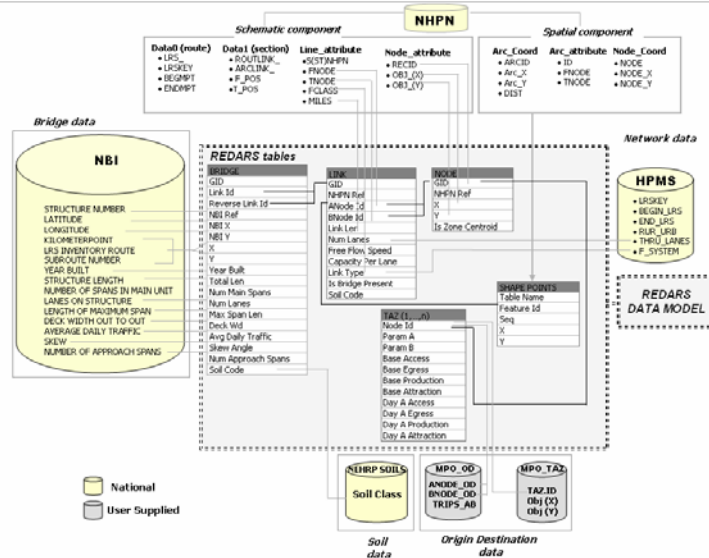
Import Wizard – Role (1/6)

- Minimizing data collection and reformatting tasks for SRA on transportation systems

- Data
 - National Highway Planning Network (NHPN)
 - Highway Performance Monitoring System (HPMS)
 - National Bridge Inventory (NBI)
 - National Earthquake Hazard Reduction Program (NEHRP) Soil
 - Metropolitan Origin-Destination zones

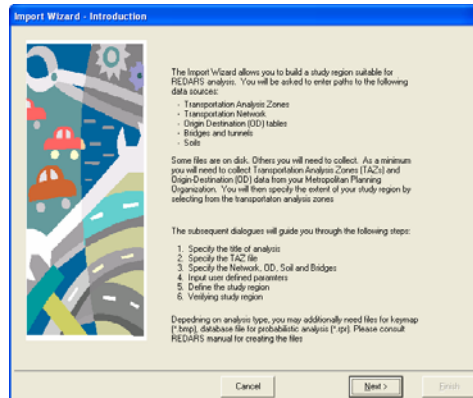


Import Wizard – Data Model (2/6)



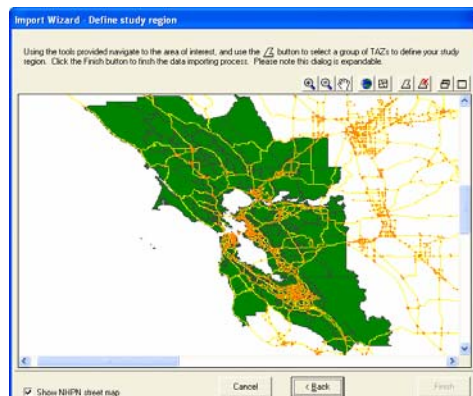
Import Wizard – GUI 1 (3/6)

- Wizard-style GUI with 8 pages of simple questions on files names and global parameters



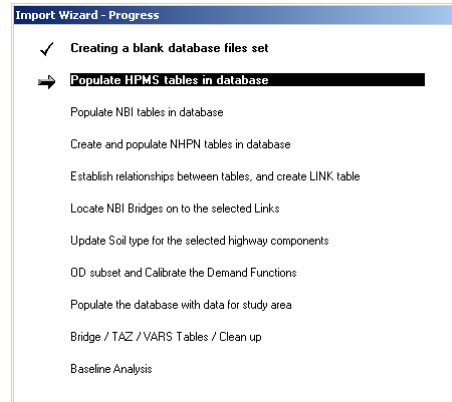
Import Wizard – GUI 2 (4/6)

- Study region selection by using built-in GIS component



Import Wizard – Internal Steps (5/6)

- Read in the public data into pre-defined database
- Subset TAZ and Network based on User's selection (topological process)
- Check network connectivity
- Update network attributes
- Update attributes for highway components (bridges / tunnels)
- Baseline run



Import Wizard – Performance (6/6)

- Reduce data provision tasks from 6 months to 45 minutes for Los Angeles data
- Inconsistency between data sources affects data quality
 - Linear Referencing System in NBI does not match to NHPN
 - Link topology in NHPN is not corresponding to Link attribute from HPMS

Future Work

- Leap from deterministic modeling framework
- An algorithm to turn the planning network model (macro) into a model for reduced capacity
- Multi-tier application
 - Wider area with brief analysis
 - Small area with detail analysis

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