California Statewide Freight Forecast Model Development

Institute of Transportation Studies
University of California, Irvine, for
California Department of Transportation

Project Team from UC Irvine

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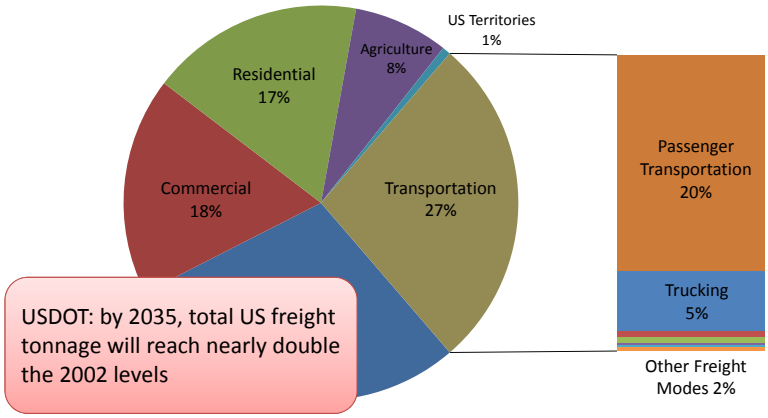
Motivation (1)

- Freight transportation CO_2 emissions accounted for 7.4% of total US emissions in 2009.



Source: Inventory of US GHG Emissions and Sink 1990-2009, EPA, 2011

Motivation (2)

- Existing tools
  - California Statewide Travel Demand Model (CSTDM)
  - MPO Freight Models (e.g. SCAG Heavy Duty Truck Model)
- Need for a statewide, commodity-based, policy-sensitive and freight infrastructure-based model

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Purpose of the Model

- Policy-sensitive model to forecast commodity flows and commercial vehicle flows within California addressing:
  - Socioeconomic conditions
  - Land use policies related to freight
  - Environmental policies
  - Multimodal infrastructure investments

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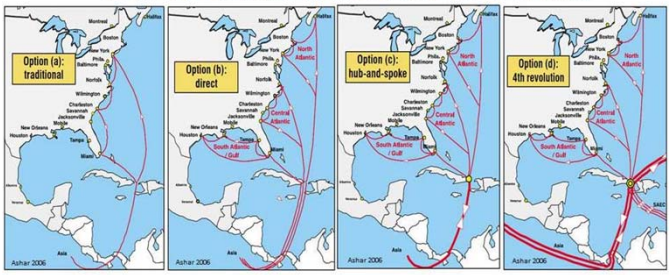
Example Scenario: Panama Canal

- "What happens to average daily GHG emissions on I-5 corridor in Fresno when Panama Canal is widened in 2014?" – Doug MacIvor, Caltrans

THE IMPACT OF PANAMA CANAL EXPANSION ON THE ALL-WATER SERVICE PATTERN



From Dr. Asaf Ashar of National Ports and Waterways Initiative, University of New Orleans, http://www.asafashar.com/images.html

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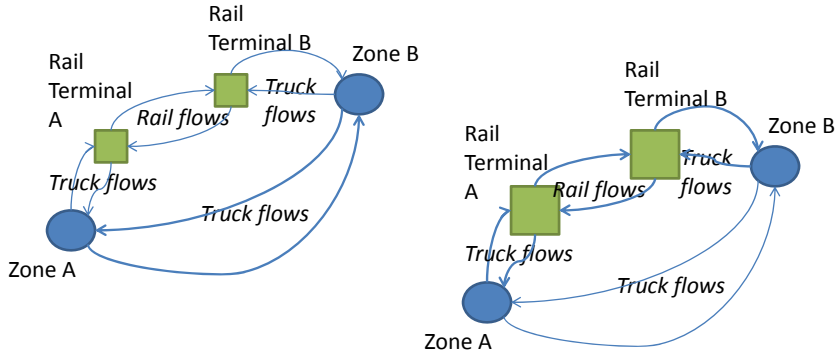
Example Scenario: Infrastructure Investment

- What happens if a rail terminal's capacity increased by 10%?



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Example Scenario: Carbon Pricing

- "How would truck/rail mode share change if a carbon tax of $20/ton was levied on transportation fuels?"

Project Scope

- $1.4M Budget
- 2 Year Timeline: Complete by June 2013
- Compatibility with California Statewide Travel Demand Model (CSTDM)
- SB 391 →
  - Section 65071: update the California Transportation Plan by December 31, 2015
  - Section 65072.1: shall consider all subject areas for movement of people **and freight**

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Users of the Model

- California Department of Transportation
  - Division of Transportation System Information
  - Division of Transportation Planning
  - Division of Rail
  - Districts 1 – 12
- California Air Resources Board
- Metropolitan Planning Organizations
- Port and Freight Facilities
- California Energy Commission
- Others

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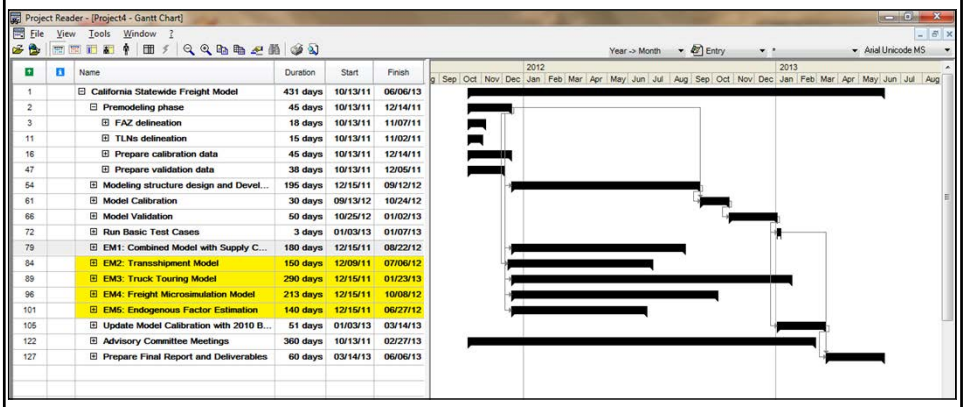
Project Timeline



	Name	Duration	Start	Finish
1	California Statewide Freight Model	431 days	10/13/11	06/06/13
2	Premodeling phase	45 days	10/13/11	12/14/11
3	FAZ delineation	18 days	10/13/11	11/07/11
11	TLNs delineation	15 days	10/13/11	11/02/11
16	Prepare calibration data	45 days	10/13/11	12/14/11
47	Prepare validation data	38 days	10/13/11	12/05/11
54	Modeling structure design and Devel...	195 days	12/15/11	09/12/12
61	Model Calibration	30 days	09/13/12	10/24/12
66	Model Validation	50 days	10/25/12	01/02/13
72	Run Basic Test Cases	3 days	01/03/13	01/07/13
79	EM1: Combined Model with Supply C...	180 days	12/15/11	08/22/12
84	EM2: Transshipment Model	150 days	12/09/11	07/06/12
89	EM3: Truck Touring Model	290 days	12/15/11	01/23/13
96	EM4: Freight Microsimulation Model	213 days	12/15/11	10/08/12
101	EM5: Endogenous Factor Estimation	140 days	12/15/11	06/27/12
105	Update Model Calibration with 2010 B...	51 days	01/03/13	03/14/13
122	Advisory Committee Meetings	360 days	10/13/11	02/27/13
127	Prepare Final Report and Deliverables	60 days	03/14/13	06/06/13

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MODEL DETAILS

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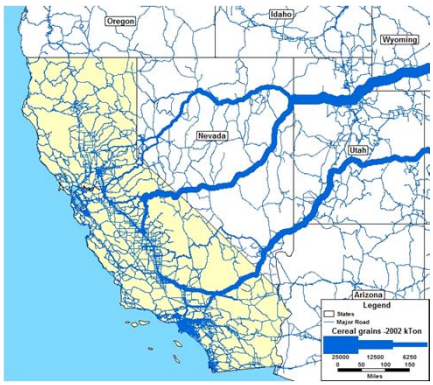
Proposed FAZ Scheme

FAZs in CA

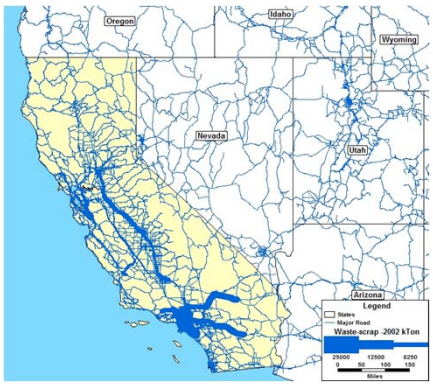
Total zones in CA: 93
Neighboring states: 7 zones
Other states: 46 zones
International: 8 zones
Total zone centroids: 154
Transshipment Nodes: 99
Total OD Nodes: 253

Commodity Flows

Cereal Grain



Waste/Scrap



2-Digit SCTG Commodity Groups
14 Aggregate Groupings Considered

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Changes to CSTDM Network

- NODES:
- Add Transshipment Nodes
- Add New Network Gateways
- Add New Zone Centroids

- LINKS:
- Update Truck Tolls
- Add Truck Routes
- Add Truck Restrictions
- Add WIM Locations
- Add Freight Rail Lines
- Add Hazardous Material Routes
- Explode Transshipment Nodes to Links
- Add New Connectors

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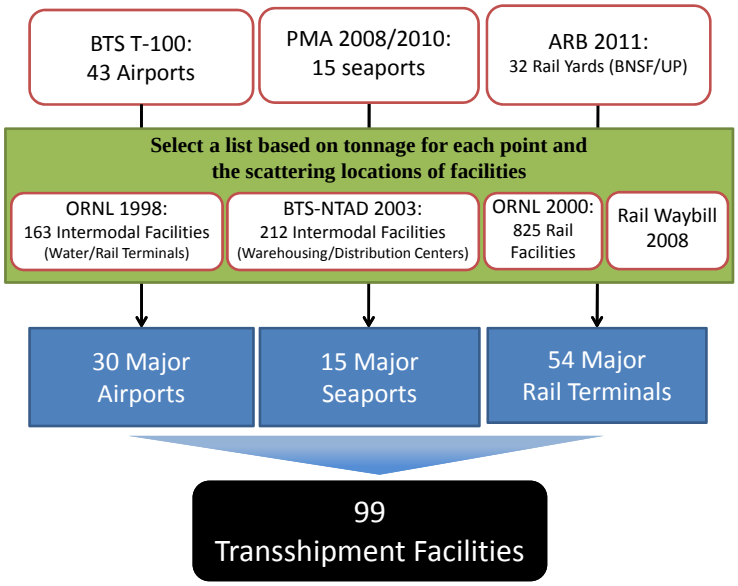
Transshipment Nodes Selection



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Airport Selection (30 Airports)

ID	Name	Freight/Mail(2008),K LB.
1	Arcata/Eureka	488
2	Bishop	338
3	Burbank Bob Hope	74,000
4	Chico Municipal	984
5	Fresno Air Terminal	20,000
6	Imperial County	2,282
7	Inyokern-Kern County	762
8	Jack Mcnamara Field	338
9	John Wayne Orange County	46,000
10	La/Ontario International	1,003,000
11	Long Beach Daugherty Field	88,000
12	Los Angeles International	1,459,000
13	March ARB	52,088
14	Mather Air Force Base	158,000
15	Meadows Field	2,254
16	Oakland International	1,194,000
17	Murray Field	1,352
18	Palm Springs International	53
19	Peninsula	701
20	Redding Municipal	1,677
21	Sacramento International	133,000
22	San Diego International	273,000
23	San Francisco International	407,000
24	San Jose International	169,000
25	San Luis Obispo/Paso Robles	1,531
26	Santa Barbara Municipal	7,183
27	Santa Maria Public	1,777
28	Sonoma County	979
29	Ukiah Municipal	758
30	Visalia Municipal	1,677

Data: BTS-T100

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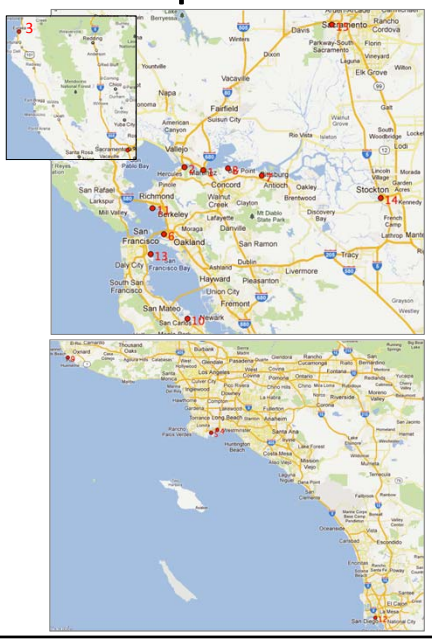
Seaport Selection (15 Seaports)



ID	Name	2008, Tons
1	Benicia	2,349,774
2	Crockett	760,055
3	Eureka	165,868
4	Long Beach	94,909,076
5	Los Angeles	106,534,781
6	Oakland	28,411,011
7	Pittsburg	226,868
8	Port Chicago	29,488
9	Port Hueneme	3,571,199
10	Redwood City	942,485
11	Richmond	1,247,246
12	San Diego	5,560,852
13	San Francisco	811,205
14	Stockton	1,276,809
15	West Sacramento	552,112

Data: Pacific Maritime Association(PMA)

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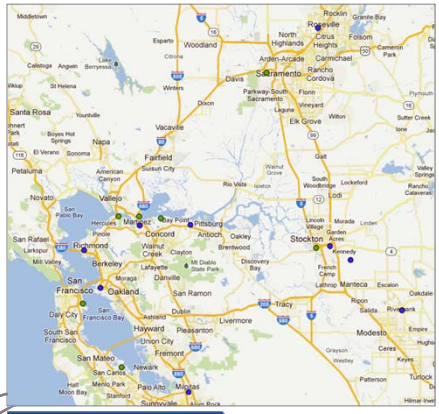
Rail Selection (54 Rail Terminals)



Class I Terminals

BNSF	UP
Richmond	Oakland
Stockton	Roseville
Bakersfield	Stockton
Fresno (Calwa)	Fresno
Pittsburg	Martinez
Riverbank	Milpitas
	Portola

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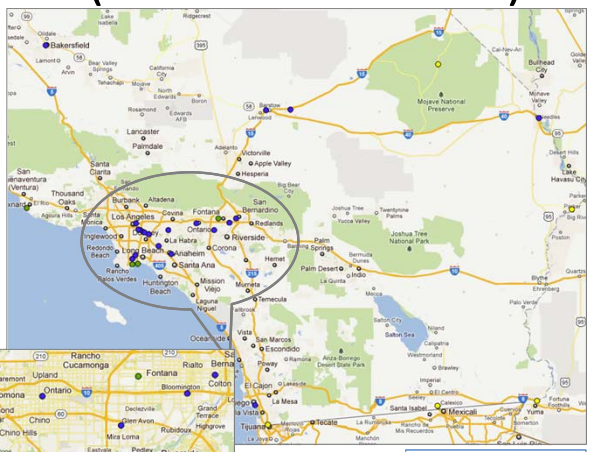
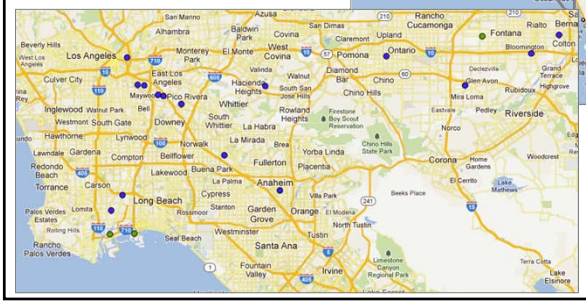
Rail Selection (54 Rail Terminals)

Class I Terminals

BNSF	UP
Barstow	City of Industry
Commerce Eastern	Colton
Sheila	Commerce
Hobart	Dolores (ICTF)
San Bernardino	LA (LATC)
San Diego	Mira Loma
Watson	Anaheim
La Mirada	Montclair
Needles	Yermo
Pico Riverra	





Class I
Port Area
Border Area

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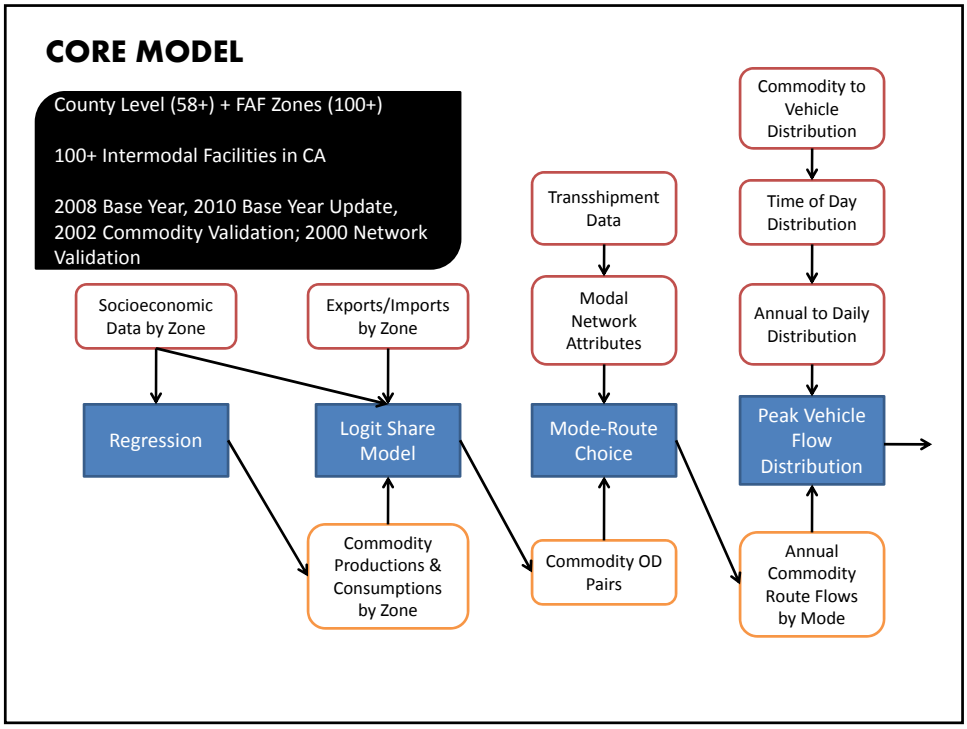
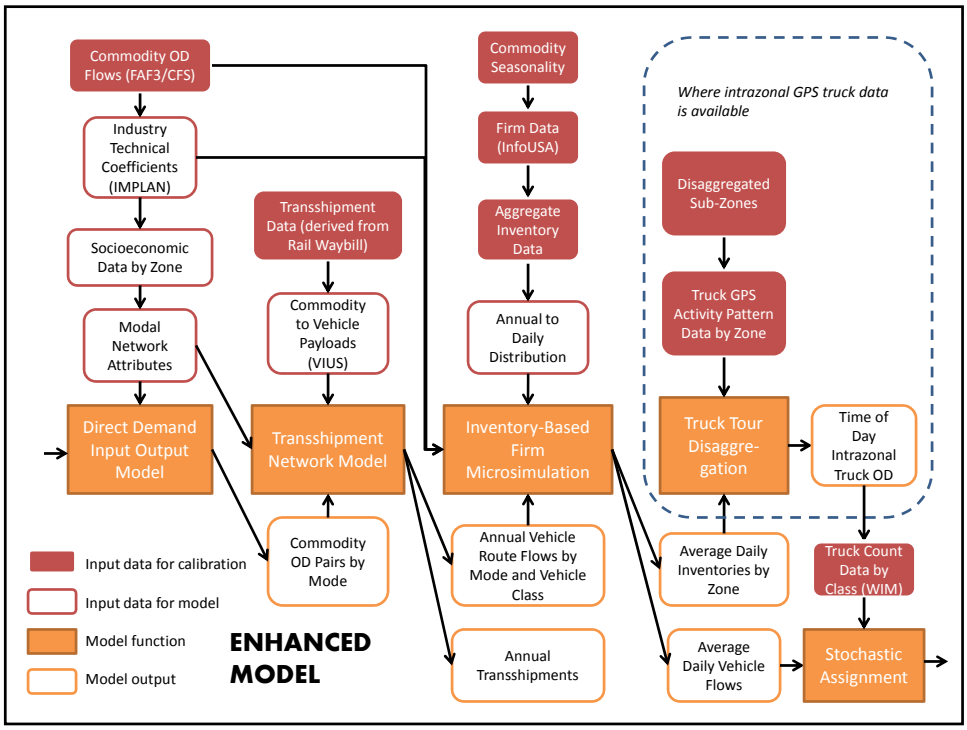

CORE MODEL
County Level (58+) + FAF Zones (100+)
100+ Intermodal Facilities in CA
2008 Base Year, 2010 Base Year Update, 2002 Commodity Validation; 2000 Network Validation
Socioeconomic Data by Zone
Exports/Imports by Zone
Regression
Logit Share Model
Commodity Productions & Consumptions by Zone
Transshipment Data
Modal Network Attributes
Mode-Route Choice
Commodity OD Pairs
Commodity to Vehicle Distribution
Time of Day Distribution
Annual to Daily Distribution
Peak Vehicle Flow Distribution
Annual Commodity Route Flows by Mode


Commodity OD Flows (FAF3/CFS)
Industry Technical Coefficients (IMPLAN)
Socioeconomic Data by Zone
Modal Network Attributes
Direct Demand Input Output Model
Transshipment Data (derived from Rail Waybill)
Commodity to Vehicle Payloads (VIUS)
Transshipment Network Model
Commodity OD Pairs by Mode
Commodity Seasonality
Firm Data (InfoUSA)
Aggregate Inventory Data
Annual to Daily Distribution
Inventory-Based Firm Microsimulation
Annual Vehicle Route Flows by Mode and Vehicle Class
Annual Transshipments
Where intrazonal GPS truck data is available
Disaggregated Sub-Zones
Truck GPS Activity Pattern Data by Zone
Truck Tour Disaggre-gation
Time of Day Intrazonal Truck OD
Average Daily Inventories by Zone
Truck Count Data by Class (WIM)
Average Daily Vehicle Flows
Stochastic Assignment
Input data for calibration
Input data for model
Model function
Model output
ENHANCED MODEL

User Training and Support

- Workshop
- User Manual
- Web-based Educational Module (6 basic courses)
  - Intro to Freight Transportation
  - Impacts on Freight Transportation
  - Data for Freight Transportation
  - Regional/Statewide Freight Planning
  - Local/Urban Freight Planning
  - Freight Operations

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Project Management and Oversight:

Redmine Issue Tracker

- Open source project management Tool
- Features highlight:
  - Dynamic management of sub-tasks, issues and assignments
  - Document and file repository
  - Wiki
    - Record of processes and decisions

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Technical Peer Advisory Committee

- Current Candidates:

J. Douglas Hunt	Professor, HBA Specto and University of Calgary
Anne Goodchild	Assistant Professor, University of Washington
Ram Pendyala	Professor, Arizona State University
Miguel Figliozzi	Associate Professor, Portland State University
William Rogers	Senior Program Officer, Transportation Research Board
Eric Shen	Director of Transportation Planning, Port of Long Beach
Scott Drumm	Manager, Port of Portland
Rolf Schmitt	Team Leader, Freight Analysis, Federal Highway Administration

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QUESTIONS OR COMMENTS?

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