

Quick Response Freight Manual II

presented to

FHWA “Talking Freight” Seminar Series

presented by

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Transportation leadership you can trust.

Overview

- **1996 QRFM 1996**
 - Purpose
 - Contents
 - Usage
- **2007 QRFM II**
 - Purpose
 - Contents
- **Lessons Learned**

Quick Response Freight Manual (1996)

- Purpose
- Contents
- Major usage

Quick Response Freight Manual (1996)

Purpose

- To provide background information to new freight planners
- To help planners locate freight-related data
- To provide simple techniques and transferable parameters for the conventional four-step planning process
- To provide techniques and transferable parameters for site planning

Quick Response Freight Manual (1996)

Contents

- Factors affecting freight demand
- Simple growth factor methods
- Incorporating commercial vehicles into urban models
- Site analysis
- Data collection
- Principles of application
- Statewide freight forecasting
- Urban case studies

Quick Response Freight Manual (1996) Usage

Figure 4.1 Simplified Quick Response Freight Forecasting Procedure

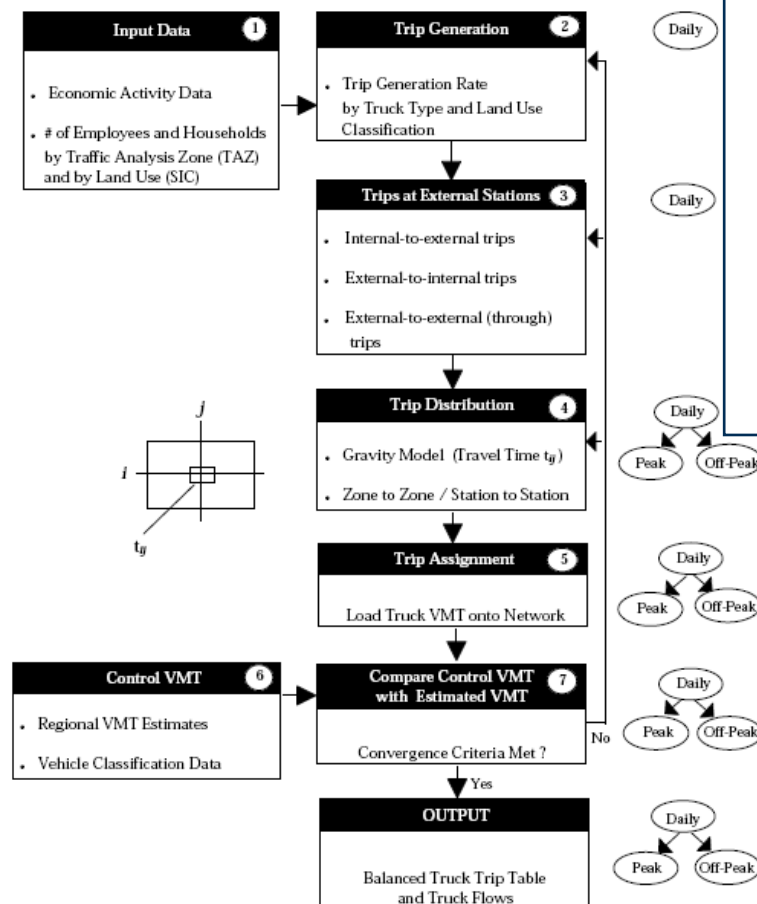


Table 4.1 Trip Generation Rates

Generator	Commercial Vehicle Trip Destinations (or Origins) per Unit per Day			
	Four-Tire Vehicles	Single Unit Trucks (6+ Tires)	Combinations	TOTAL
Employment: *				
• Agriculture, Mining and Construction	1.110	0.289	0.174	1.573
• Manufacturing, Transportation, Communications, Utilities and Wholesale Trade	0.938	0.242	0.104	1.284
• Retail Trade	0.888	0.253	0.065	1.206
• Office and Services	0.437	0.068	0.009	0.514
Households	0.251	0.099	0.038	0.388

Four-tire commercial vehicles:

$$F_{ij} = e^{-0.08 * t_{ij}}$$

Single unit trucks (6+tires):

$$F_{ij} = e^{-0.1 * t_{ij}}$$

Combinations:

$$F_{ij} = e^{-0.03 * t_{ij}}$$

Quick Response Freight Manual Update (2007)

Purpose

- To update the 1996 manual
- To provide freight methods appropriate for different geographic and temporal scales
- To provide alternative analysis methods, data sources, and data collection methods to improve the accuracy of freight forecasts

Quick Response Freight Manual Update (2007)

Contents

- **Part A – Introduction**
- **Part B – Methods**
- **Part C – Data Sources**
- **Part D – Practical Applications**

Part A – Introduction

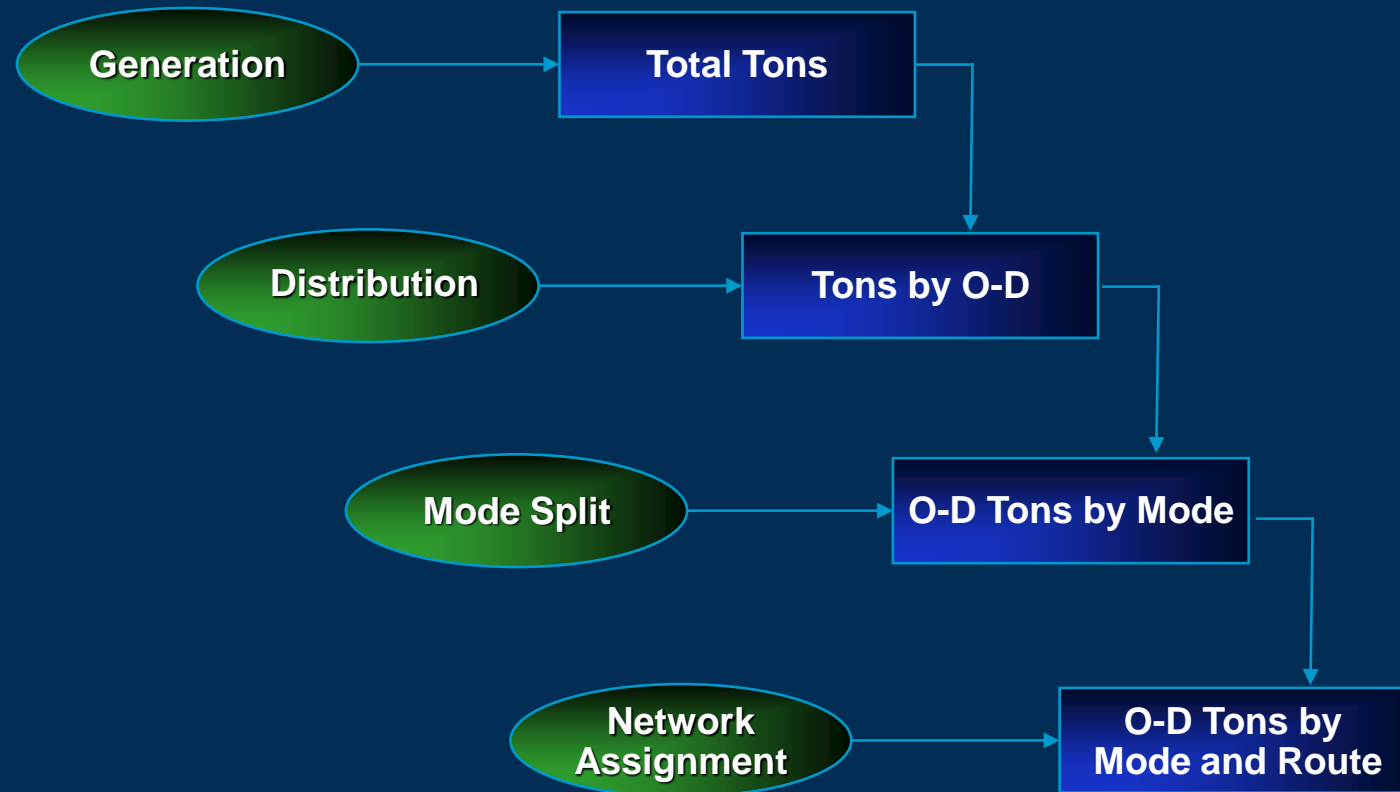
- **Freight and Commercial Vehicles Demand – Controlling Factors**
 - ***Why*** freight moves – economic/industrial factors
 - ***Who*** moves freight – shipper, receiver, and carrier factors
 - ***What*** moves freight – truck, rail, water, and air
 - ***Where*** freight moves – vehicles on the modal networks
 - ***How*** freight moves – public policy rules and regulations

Part B – Methods

- Simple growth factor methods
- Incorporating Freight into “Four-Step” Travel Forecasting
 - Urban
 - State and multistate corridors
- Commodity modeling
- Hybrid approaches
- Economic models
- Model validation

“Four-Step” Models

“Four-Step” Process of Freight Forecasting



“Four-Step” Models

Trip Distribution – Puget Sound Example

- **Medium truck impedance function**
 - $\text{Exp}(4.75 - 0.05 * \text{medium truck time skim})$ for less than 27 miles
 - $\text{Exp}(4.2 - 0.003 * \text{medium truck time skim})$ for greater than or equal to 27 miles
- **Heavy truck impedance function**
 - 1.0 for less than 7.5 miles
 - $\text{Exp}(5.0 - 0.009 * \text{heavy truck time skim})$ for greater than or equal to 7.5 miles

Average Truck Trip Lengths	Medium Truck	Heavy Truck
Observed (Miles)	27.51	30.81
Modeled (Miles)	27.53	28.29

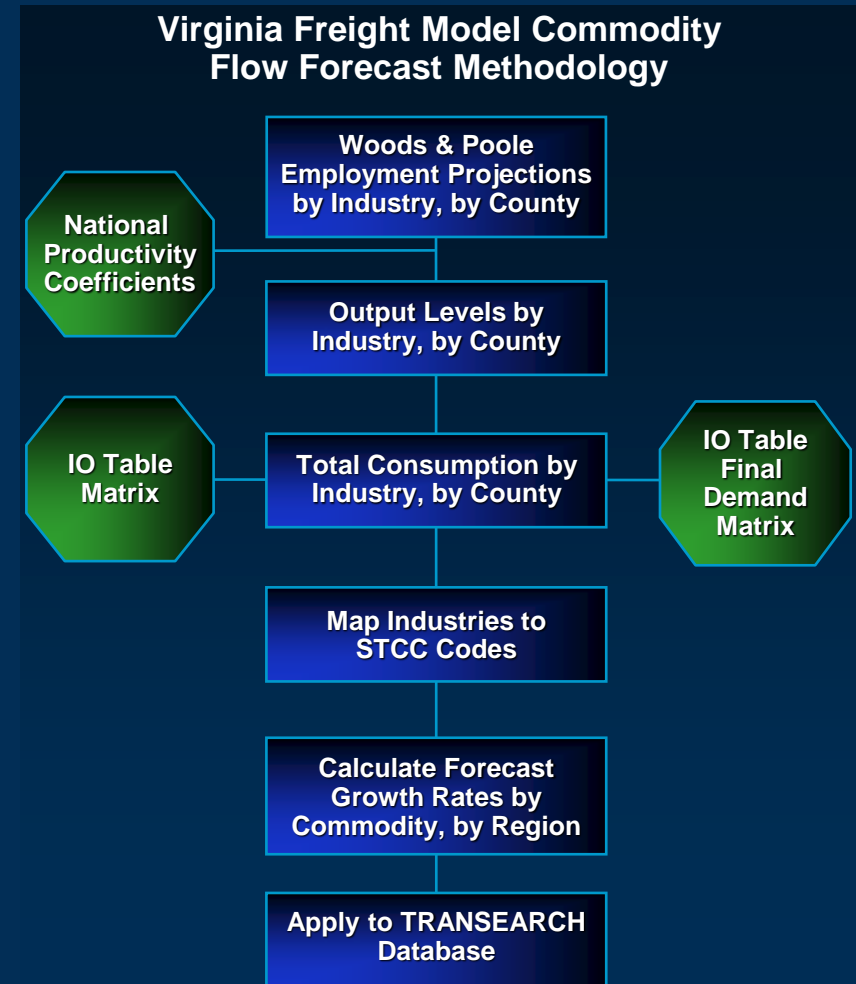
“Four-Step” Models

Trip Assignment

- **Preload assignment**
 - When trucks don't change routes in response to congestion
- **Multiclass or simultaneous assignment**
 - Passenger Car Equivalents (PCE)
 - Stochastic assignment
 - User-equilibrium assignment

Commodity Models

- Trip generation and trip distribution replaced by commodity flow database
 - Processed into trip table
 - Does not include all trucks
- Remaining steps as in “four-step” model
 - Mode choice
 - Modal assignment

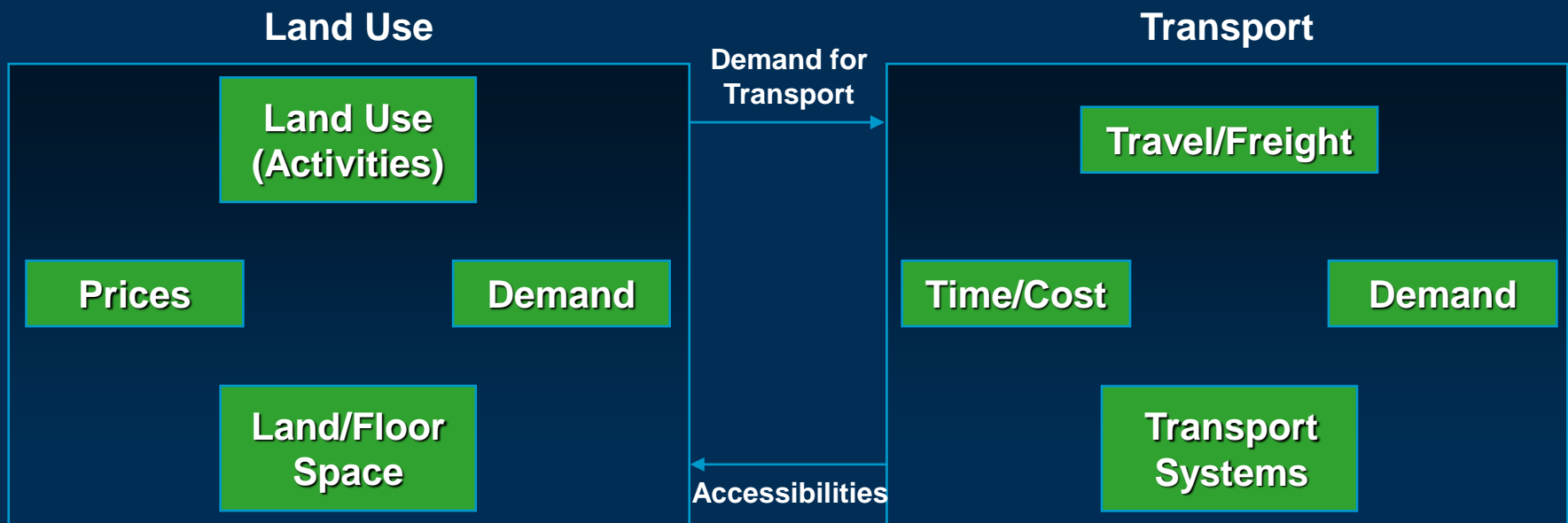


Hybrid Models

- **Commercial truck model for internal-internal truck trips**
- **Commodity model for external truck trips (E-E; E-I; I-E)**
- **Three-step freight truck models**
- **Four-step commodity flow models**
- **Case studies**
- **Issues with hybrid approaches**

Economic Models

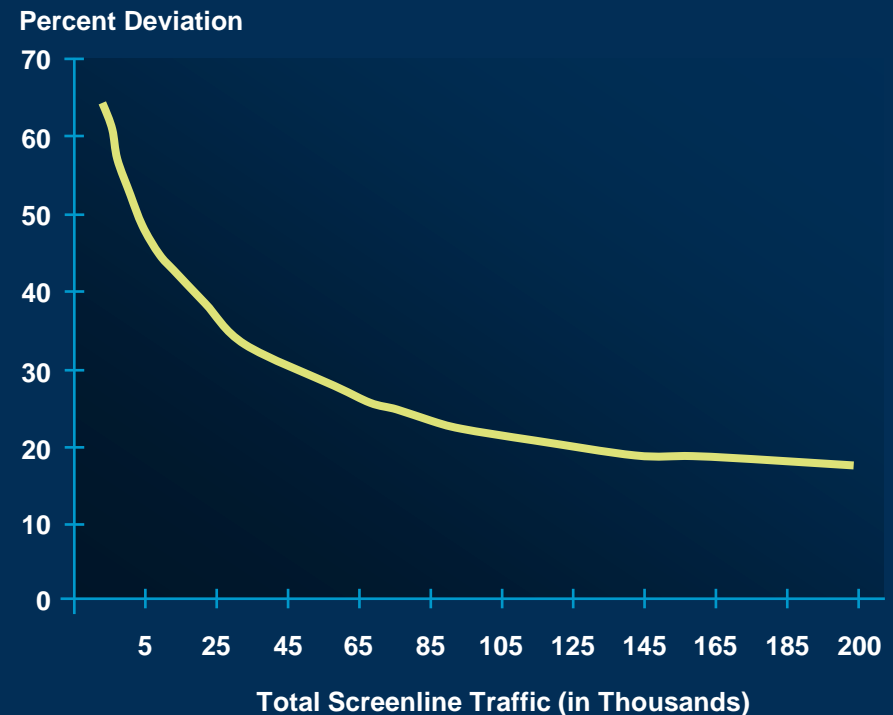
- Modeling framework
- Data requirements
- Oregon Statewide Passenger and Freight Forecasting Model
- Cross-Cascades Model



Validation

- Trip generation validation
- Trip distribution validation
- Mode split validation
- Assignment validation
- Model parameters

Maximum Desirable Deviation in Total Screenline Volumes



Part C Data Sources

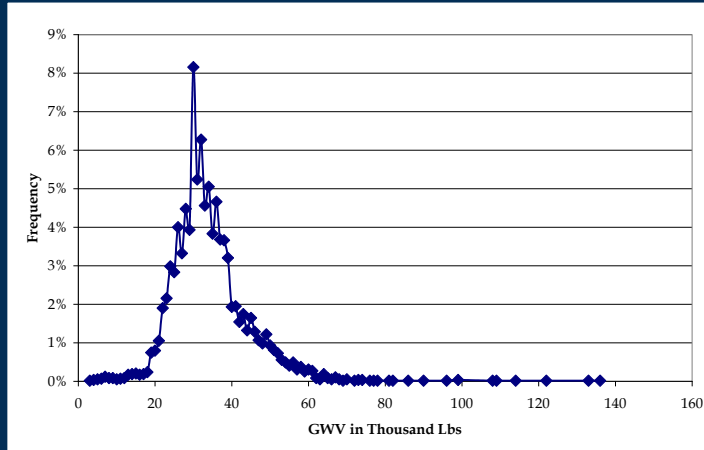
- Existing data
- Data collection

Existing Data

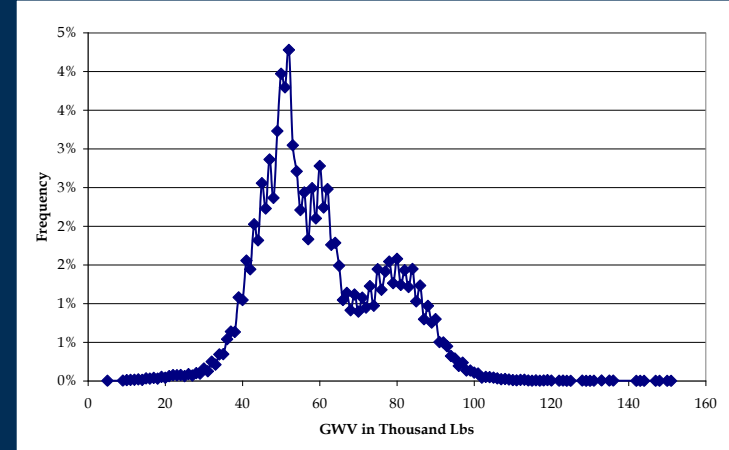
- **Commodity O-D tables**
- **Mode-specific freight data**
- **Employment/industry data**
- **Performance data**

Truck Specific Data VTRIS

GA Interstate Stations
Class 6 – Three Axle, SU Trucks



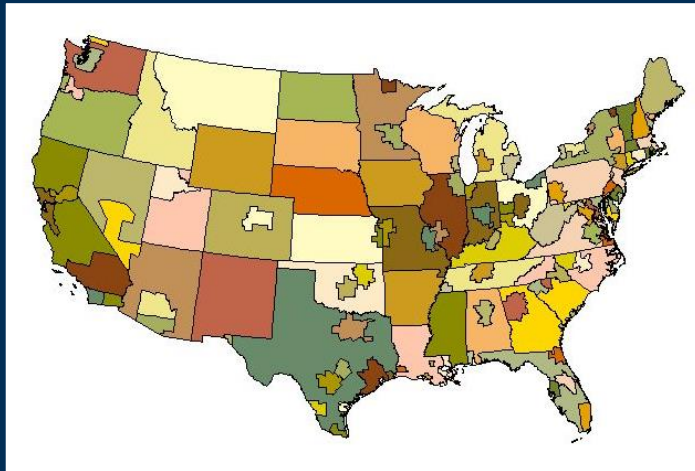
GA Interstate Stations
Class 9 – Five Axle, Trailer Trucks



- Vehicle Travel Information System (VTRIS) can provide WIM data
- WIM data is total weight of truck and load
 - Need estimate of empty truck weight to estimate payload
 - Does not give nature of load (percent loaded, commodity/contents)

Commodity O-D Data Freight Analysis Framework

FAF2 CONUS Regions



New York State Modal Flows
By Weight (Millions of Tons)

2002						
	Within State		From State		To State	
	Number	Percent	Number	Percent	Number	Percent
Total	256.5	100	152.2	100	215.8	100
Truck	223.2	87	96.9	64	120.2	56
Rail	1.7	<1	5.4	4	23.6	11
Water	0.4	<1	1.5	1	18.7	9
Air, air & truck	<0.1	<1	<0.1	<1	0.1	<1
Truck & rail	<0.1	<1	0.2	<1	0.6	<1
Other intermodal¹	0.3	<1	2.1	1	3.0	1
Pipeline & unknown²	31.0	12	46.0	30	49.5	23

- Does not include all trucks
- FAF2 includes international origins and destinations
- Use SCTG2 commodity classifications

Employment Data

County Business Patterns

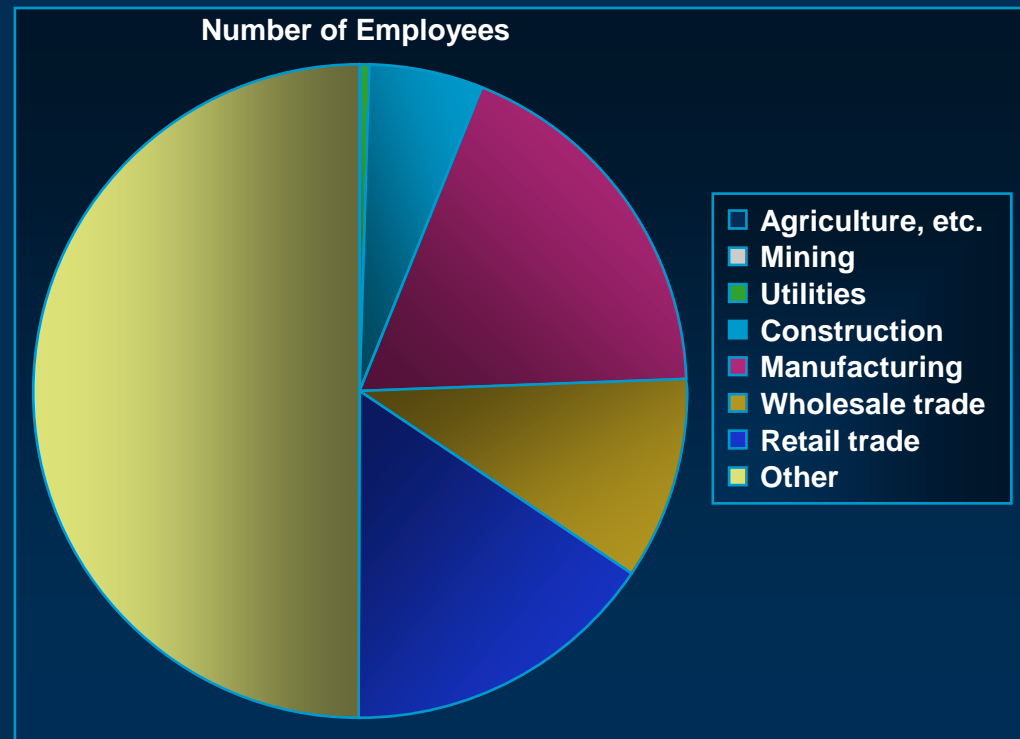
- **Maintained by U.S. Census**

- **Annual economic data by industry (NAICS)**

- **Geography**

- United States
- States
- Counties
- Metropolitan areas
- Zip code

Los Angeles County, California
2005 Employment by Industry



Marine Freight Data

USACE Waterborne Commerce

- Published annually by the U.S. Army Corps of Engineers
- Contains cargo summaries
 - Value and weight information
 - Type of service on U.S. waters
 - Imports and exports

**Stamford
Harbor, CT
Freight Traffic
2005
(Thousand
Short Tons)**

	Coastwise		
	Total	Receipts	Shipments
Total, all commodities	819	750	69
Total petroleum and petroleum products	184	184	—
Subtotal petroleum products	184	184	—
2330 distillate fuel oil	184	184	—
Total crude materials, inedible except fuels	634	565	69
Subtotal soil, sand, gravel, rock and stone	565	565	—
4331 sand & gravel	565	565	—
Subtotal iron ore and scrap	69	—	69
4420 iron & steel scrap	69	—	69

Data Collection

- Vehicle classification counts
- Roadside intercept surveys
- Establishment surveys
- Travel diary surveys

Part D Practical Applications

- Application issues
- Case studies
- Intermodal considerations, including drayage

Application Issues

- Growth factoring
- Four-step modeling
- Integration with passenger forecasts

Case Studies

- **Los Angeles Freight Forecasting Model**
- **Portland Metro Truck Model**
- **Florida State Freight Model**
- **Texas Statewide Analysis Model (SAM)**

Intermodal Considerations, Including Drayage

- **Types of intermodal freight transportation**
- **Characteristics of intermodal freight transportation**
- **Intermodal freight data sources**

Lessons Learned

- Freight > trucks
Trucks > freight
- Freight trips \cong passenger trips
- Many sources of freight data
- Many approaches to modeling freight