Objective

The purpose of this course is to introduce students to develop empirical models to develop freight travel demand models. The theoretical concepts and practical considerations will be discussed in the class on how freight modeling is being carried out at the national, state and metropolitan levels. The course introduces students to key freight industry terms, concepts and issues, and provides a freight big picture based on performance of the major freight transportation modes. Building on this factual knowledge the course provides worked examples of the mathematical and statistical models and solution procedures used to estimate and forecast freight movements by mode and commodity. Common applications of these planning model outputs are presented and discussed for freight demand modeling at various level of geographies.

Course Description:

The course will discuss available approaches to model freight transportation demand. Concise description of the state-of-the-art mathematical models of freight transportation system, focusing primarily on areas where it deviates from passenger transport models. Such mathematical models can support freight demand model development and facilitate policy design in different ways including: explanation of drivers of freight transport; modeling and forecasting of freight flows; performance assessment of freight systems; and design of freight operations. During the course students will have opportunity to use softwares such as TransCAD.

Class Project (90% of grade): The class project is to develop a freight demand model for state of TN. Students can choose to work on part of the overall class project. Students (in groups of 3 to 5) will present their part of the class project on September 19, and provide description of the proposal in one page. Comments on the proposal will be made available to the students on September 26 via email. Guidelines for the project proposal, report, and presentation format will be provided in class.

Class presentation and participation (10% of the grade): Students are expected to attend classes and discuss project details with the instructors. Also the students are expected to present adequate findings in class presentations.

Text Books and References


Notes: Additional materials will be provided in the class

Weekly Contents

Week-1: Introduction to Freight Transportation Demand Modeling (Mishra)

- Three layer structure of freight
  - Global
  - Regional
  - Local
- Overview of basic four steps of modeling freight
- Difference between passenger and freight demand models

Source

- NCHRP Report 606: [Full Text]
- T1, Chapter-1: Recent Developments in Freight Transportation Modeling
- T3, Chapter-14: Modeling Freight Flows

Week-2: Freight Trip Generation and Land Use (Golias)

- Freight Generation and Freight Trip Generation
- Trend and time series models
- System dynamics models
- Zonal trip rate models
- Input-output and related models

Source

- NCFRP Report 19: [Full Text]
- De Jong et al. National and international freight transport models (2004), Transport Reviews, 24(1), 103-124, [Full Text]

Week-3: Freight Trip Distribution (Golias)

- Distribution of freight flows
- Production/Consumption to origin/destination

Source

- T2, Chapter-2: Modelling Inter-Regional Freight Demand with Input–Output, Gravity and SCGE Methodologies
- Production/Consumption to origin/destination (PCOD) models. [Full Text]

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1 Schedule is tentative and may be altered at any time
Week-4: Mode Choice (Mishra)

- Competing modes for specific commodity choice
- Behavioral methodology
- Associated factors

Source

- T1, Chapter-10: Endogenous Shipment size in Freight Mode Choice Models
- T2, Chapter-6: Mode choice models.

Week-5: Assignment Models (Mishra)

- Assignment Algorithms for freight
- Typical algorithms used
- Data needs

Source

- FAF, Assignment Algorithm [Full Text]
- NCFRP-8: Freight demand models for public sector decision making [Full Text]

Week-6: Combining all four steps into one for freight demand model (Aggregate-Disaggregate-Aggregate (A-D-A) Freight Model System, and A-D-D concept) (Golias)

T1, Chapter-4: Endogenous Shipment size in Freight Mode Choice Models

Week-7: Data Availability and Model Forms (Mishra)

- Sources of data availability: Proprietary, Semi-public and Public
- Data granularity
- Connecting various data sources to steps of freight demand models

Sources

- TxDOT. State-of-the-practice in freight data: a review of available freight data in the US. [Full Text]
- Tavasszy and De Jong, Modeling Freight Transport, Chapter-10: Data Availability and Model Forms
- SHRP2, Freight Demand Modeling and Data Improvement, Chapter-1, page 15-17 [Full Text]
- NCHRP 606, Forecasting Statewide Freight Toolkit. Chapter 5 [Full Text]

Week-8: Review of Freight Models in the US (Golias)

- Examples of freight models in the US
• Typical steps
• Freight models in practice and decision making

Source
• Oregon Statewide Freight Model, SWIM2 [Full Text, ppt]
• Ohio Statewide Freight Model [Full Text]
• Florida Statewide Freight Model [Full Text, ppt]
• Maryland Statewide Freight Model [Full Text]
• Chicago Regional Freight Model [Full Text]

Week-9: Tour Based Models (Mishra)
• Modeling local freight (typically urban areas)
• Use of truck GPS data
• Stop duration, sequence, destination choice, and time of day choice models
• Urban freight last mile delivery

Sources
• T2. Chapter-8: Urban Freight Models.
• Tour Based Freight Models [Full Text, ppt]
• Tour Based Freight Models using entropy maximization [Full Text]
• Tour Based and Supply Chain Freight Modeling [Full Text, ppt]

Week-10: International Practices (Golias)
• International freight modeling experience
• Data availability and model disaggregation

Sources
• De Jong et al. 2010. Swedish National Freight Model. [Full Length]
• RAND Europe, Solving and INRO (2004). The specification of logistics in the Norwegian and
• Swedish national freight model systems, Model scope, structure and implementation plan. Report
  for the NTP and Samgods group.TR-225-SIKA, RAND Europe, Leiden. [Full Text]
• Lóránt A. Tavasszy. Freight Modelling– An overview of international experiences [Full Text]

Week: 11-16
Class project to develop a statewide freight demand model for Tennessee
Student presentations every week on project progress