Methods and Tools for Freight Flow Disaggregation

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Background

TN DOT Ongoing Study (Began April 2019)

Objective

- Review freight disaggregation methods
- Develop in-house GIS tools

Team members:

- TNDOT: D. Pallme, A. Kosanovic
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Methods

How do we create disaggregate freight OD?

Approach 1: Productions/Attractions => OD Matrix

Approach 2: OD Disaggregation

Both consider relationship between:

- Commodity producing/consuming industries
- Socio-economic variables
- Some impedance function
Used Data Sources and Crosswalk Tables

Data Sources:
- Transearch
- InfoUSA
- Bureau of Economic Analysis (BEA) Input-Output (IO) Accounts Supply and Use tables
- Network Data (Zones, Links, Facilities)

Crosswalk Tables:
- BEA IO Account code to NAICS code crosswalk
- SCTG 2-digit to NAICS 3-digit crosswalk (see Anderson et al., 2013)

GIS Toolbox

Preprocessing tools:
1. Transearch: SCTG3=>SCTG2 (County level in TN)
2. IO Accounts Supply and Use: Industry shares (producing and using) by IOCode, NAICS
3. Spatial and economic data (InfoUSA): Aggregate and disaggregate values/shares for sq. ft., value of sales, employment

Disaggregation tools:
1. Trip productions/attractions disaggregation=> Create OD
2. Direct OD Disaggregation
Preprocessing Tools
Transearch Preprocessing Tool

- From SCTG 3 to SCTG 2 digit code BY:
  i. Equipment type
  ii. Trade type
  iii. Mode
- Average length (miles between ODs)
- Estimate Productions and Attractions (Aggregate Level)
Spatial and Economic Data Preprocessing Tool

- Economic indicator shares and values at disaggregate level
- Centroid of disaggregate and Transearch zones (estimate travel times or length)
IO Accounts Supply and Use Table Conversion Tool

• Supply and Use Shares (any level of aggregation available)
OD Estimation/Disaggregation
Proportional Weight OD Disaggregation

Transearch Preprocessed OD

- Disaggregate Zone to Aggregate Zone Industry Shares by Economic Indicator
- IO Accounts Commodity-Producing and Using Industry Shares
- SCTG 2-digit to NAICS 3-digit Producing Industry Crosswalk

Disaggregate Zone Freight Flow by Commodity
Proportional Weight OD Disaggregation Example Output
Regression Disaggregation Method Tool

IO Accounts and Regression Disaggregation Method Tool Inputs and Outputs

- Transsearch Preprocessed Freight Flow Data
- Study Area County Geographic File
- SCTG 2-digit to NAICS 3-digit Code Crosswalk Table
- IO Accounts Commodity-Producing Industry Share Table
- IO Accounts Commodity-Using Industry Share Table
- Aggregate Zone Economic Indicator Value Tables
- Disaggregate Zone Economic Indicator Value Tables

Distribution Using: Gravity Model (optional)
Distribution Using: Proportional Weighting (optional)
Distribution Using: Iterative Proportional Fitting (optional)
Gravity and/or Iterative Proportional Fitting Tolerance (%) (optional)

Freight Flow Tonnage Lower Bound (optional)

IO Accounts Commodity-Producing and Using Industry Shares
Aggregate and Disaggregate Zone Economic Indicator Values
SCTG 2-digit to NAICS 3-digit Producing Industry Crosswalk

Disaggregate Zone Freight Flow by Commodity Using Gravity Model
Disaggregate Zone Freight Flow by Commodity Using Proportional Weighting
Disaggregate Zone Freight Flow by Commodity Using Iterative Proportional Fitting

Disaggregate and Transsearch Zone Centroid Latitude and Longitude
Average Commodity II, IE, and EI Flow Lengths
Regression
Method Tool
Example
Output
Next Steps

• Finalize GIS Tool Test
  • Tonnage to Truck Trip Conversion
  • Fix Bugs (if any)

• Validation/ Comparison of the two methods

• Finalize report by August 2020
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