COMMODITY SPECIFIC DISAGGREGATION
OF THE 2002 FAF$^2$ DATA TO THE COUNTY LEVEL
FOR NEW JERSEY

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ABSTRACT

The second generation of the Freight Analysis Framework, known as FAF², is a continuation of the original Freight Analysis Framework developed by the U.S. Department of Transportation, Federal Highway Administration. FAF² provides trip interchanges for commodity flows between 114 domestic zones, 17 additional international gateways at which imports enter and exports depart the U.S., and 7 international regions. This paper presents methods for disaggregating the FAF² data to the county level by developing different disaggregation factors for different commodity types. These new methods are also compared to the other disaggregation methods that were previously presented. The objective is to enable state and local governmental agencies to utilize FAF² commodity origin-destination data for a quick desktop analysis and to devise further strategies in collecting and acquiring local commodity data. The focus area of this study is the State of New Jersey.

The study developed and applied different methods to disaggregate FAF² commodity data down to the New Jersey county level. The results of the disaggregation were then compared to Global Insight’s Transearch Database and other disaggregation methods previously developed and presented as part of this study. Findings indicate that no one disaggregation method produces the best results for trip productions and attractions. Disaggregating each commodity using commodity specific industry employment data yielded the best results in matching the Transearch database for flow origins. However, simple non-commodity specific factors, such as truck vehicle miles traveled, total employment, or adjusted population data generally yielded better results in disaggregating flow attractions.
INTRODUCTION

The second generation of the Freight Analysis Framework (FAF), known as FAF\textsuperscript{2}, is a continuation of the original Freight Analysis Framework developed by the U.S. Department of Transportation, Federal Highway Administration. Unlike the original FAF, which provided the public with generalized freight movement and highway congestion maps without disclosing the underlying data, FAF\textsuperscript{2} provides two separate products. The first product is the commodity flow origin-destination (O-D) data. The O-D data covers both the base year (2002) and future years between 2010 and 2035 with a 5-year interval. The second product is the freight movement data on all highway links within the FAF\textsuperscript{2} highway network.

FAF is designed to enable the Federal Highway Administration (FHWA) to conduct investment/policy analysis and to support legislative activities. Since its inception, the application of FAF has permeated to all Administrations within the U.S. Department of Transportation. While FAF\textsuperscript{2} is currently undergoing further development, the FHWA has been collaborating with State Departments of Transportation, Metropolitan Planning Organizations, universities/colleges, and other institutions to develop methods and procedures to enable state and local government agencies to incorporate FAF\textsuperscript{2} data into their data analysis processes.

The objective of this study is to support FAF\textsuperscript{2} by developing methods to disaggregate the large commodity origin-destination data covered in FAF\textsuperscript{2} into small geographic areas (county level) that will enable state and local governmental agencies to utilize FAF\textsuperscript{2} commodity origin-destination data for freight flow trend and directional analysis and to devise further strategies for collecting and acquiring local commodity data. The focus area of this study is the State of New Jersey. The objective was to propose disaggregation methods that rely on readily available data and are reasonably easy to follow. This paper will present the work completed during the second year of this three year initiative and includes a discussion of the new commodity-based methods to estimate flows at the New Jersey county level, an improved treatment for overseas commodity flows by water, an overview of the disaggregation methods, and the potential future direction for the subsequent year of this study. Results are compared with the findings from the first year of this study (I).

BACKGROUND

FAF\textsuperscript{2} Data Overview

The study discussed in this paper developed methods to disaggregate base year 2002 data from FAF Version 2.2 as outlined in detail in the FAF Version 2.2 User Guide (I).

FAF\textsuperscript{2} Data

FAF Version 2.2 contains six data tables that are available in either comma delimited format (.csv) or as a Microsoft Access file (.mdb). Although there are six tables in total, they are essentially two sets of three tables. Three of the six tables present commodity flows in thousands of short tons (KT) and the other three present those same movements in terms of millions of dollars (MDOL). Each three table set contains the following tables:

- DOM: commodity flows between domestic origins and destinations.
- BRD: commodity flows by land from Canada and Mexico to domestic destinations via ports of entry on the U.S. border and from domestic origins to Canada and Mexico via ports of exit on the U.S. border.
- **SEA**: commodity flows by water from overseas origins via U.S. ports of entry to domestic destinations and from domestic origins via U.S. ports of exit to overseas destinations.

Each record in all of the tables includes an origin zone, origin state, destination zone, destination state, mode of transport, commodity, and amount of goods (either thousands of short tons or millions of dollars). Additionally, the BRD and SEA tables include the port of entry/exit indicating where the commodity came into or left the U.S. In addition to base year 2002 commodity flows, FAF Version 2.2 contains forecasts through 2035 (2010 to 2035 with a five year interval).

### FAF$^2$ Zone Structure

FAF Version 2.2 contains 114 domestic regions (same as the 2002 Commodity Flow Survey), 17 additional international gateways at which imports enter and exports depart the U.S., and 7 international regions. While New Jersey is geographically divided into three FAF$^2$ zones, commodity flows to and from New Jersey are reported in four different FAF$^2$ zones:

- Zone 62: NJ part of the New York-Newark-Bridgeport, NY-NJ-CT-PA region,
- Zone 63: NJ part of the Philadelphia-Camden-Vineland, PA-NJ-DE-MD region,
- Zone 64: Remainder of NJ, and portions of
- Zone 68: NY part of the New York-Newark-Bridgeport, NY-NJ-CT-PA region

Figure 1 illustrates how New Jersey’s 21 counties are covered by the FAF$^2$ zone structure. While the majority of New Jersey flows are recorded through the three zones covering the state (zones 62 through 64), oceangoing overseas flows with a point of entry or exit of the Port of New York and New Jersey (PONYNJ) are recorded in the FAF$^2$ databases as zone 68. Since the majority of the activities at PONYNJ facilities are actually in New Jersey, a significant portion of the oceangoing overseas commodity flow database (SEA) for zone 68 actually represent activity in northern New Jersey. This is consistent with the way import and export activities are reported in the Journal of Commerce PIERS databases, a data source used in developing the FAF$^2$ database.

### FAF$^2$ Modes of Transport

The mode of transport refers to the domestic portion of the commodity movement. There are seven modes: truck, rail, water, air (including truck-air), truck-rail, other intermodal, and pipeline/unknown.

### FAF$^2$ Commodity Code Classification

FAF Version 2.2 contains 43 commodity categories defined by the Standard Classification of Transported Goods (SCTG) coding system, to the 2-digit accuracy level.
FIGURE 1  New Jersey FAF² Zones and Counties
Disaggregation Method Review

Disaggregating commodity flows is a task that freight planners have been dealing with for well over 20 years, but while the methods have varied through the years, they have most frequently used some form of employment and population as the primary factors for the disaggregation of commodity flows (3,4,5). Memmott (3), focusing on manufacturing plants, outlines a methodology that uses county employment by Standard Industrial Classification (SIC) to disaggregate statewide commodity flows down to the county level. He also suggests other disaggregation factors such as population for consumer oriented industries and county farm income for agricultural industries. While employment and population are the most common disaggregation factors they are often complemented by other indicators such as farm acreage used to disaggregate farm machinery attraction (5).

Battelle (6) outlines a Truck Vehicle Miles Traveled (TVMT) approach to disaggregating commodity flow data. The method uses the proportion of zone TVMT present within a county in that zone to disaggregate the FAF² zone based commodity flows down to the county level. The disaggregation is done in the software package TransCAD, using the matrix-disaggregate procedure. The disaggregated commodity flows at the county level are then distributed using TransCAD’s Tri-Proportional Trip Distribution Gravity Model. Finally, Battelle assigns the resulting matrix over the FAF² network for the purpose of calibrating the approach.

During the first year of this study (1), seven different disaggregation approaches were developed. The feedback received on the work completed in the study’s first year was overwhelmingly positive. The approaches developed provided new ways for planners to deal with the oftentimes difficult task of disaggregating data and allowed some of them to consider FAF² as a potential alternative to other sources of commodity flow data.

In response to comments received in response to the findings of the first year study, the second year study attempts to maximize the use of universal data sources and to minimize the use of data that may not be commonly available, such as truck flows and Truck Vehicle Miles Travelled (TVMT) extracted from the New Jersey Statewide Truck Model (NJSTM) (7). The approaches that utilize the NJSTM are limited to implementation in those states that have a working truck model. Currently, there are still a handful of states that do not have a working truck model or are still developing such a tool. As a result, in the second year of this study, the authors propose alternative disaggregation approaches that use more universally available data sources. The study’s first year methods were also revised to better reflect the true location of activities for import and export locations (as captured in the BRD and SEA table) within the FAF² zones.

METHODOLOGY

Disaggregation Procedure

As with the first year study, a proportional approach to disaggregate the FAF² zones down to the county level was utilized. First, the data was extracted from the original six tables in the FAF Version 2.2 database for all New Jersey flows. This includes all commodity flows that have an origin, a destination, or a port of entry/exit in New Jersey. Origin and destinations were remapped for international flows (BRD and SEA tables) to represent just the domestic leg of the trip. New zone codes based on the FAF² zone numbers were developed for these remapped import and export points to allow for special treatment for
disaggregation of port or border crossing activities. For all commodity flows, the mode of transportation (of the domestic leg of the movement) and the SCTG commodity code is retained.

The database of commodity movements by tonnage was then disaggregated from the \( \text{FAF}^2 \) zones using disaggregation factors as proportional weights to the individual county level. Separate disaggregation factors are used for flow origins (productions) and for destinations (attractions). As the goal was to disaggregate to the county level in New Jersey, only disaggregation factors for New Jersey were developed. All non-New Jersey ends of all commodity flows were retained in full detail, but were left at the \( \text{FAF}^2 \) zone level. All disaggregation methods are discussed in detail in the following sections of this paper.

The proportional weighting disaggregation methods were executed using customized programs written in the Visual FoxPro database programming language. Customized programs were written instead of using commercially available transportation software packages to allow for maximum flexibility in applying different disaggregation methods. Quality checks were conducted to ensure that the custom programs replicated the results of the matrix disaggregation routine within TransCAD, a common commercial transportation modeling software. The disaggregation program requires three main inputs: the New Jersey flows extracted from the \( \text{FAF}^2 \) origin-destination database, and two databases of disaggregation factors for each combination of 2-digit SCTG commodity code and New Jersey county (one database for origins or productions and another for destinations or attractions).

**International Disaggregation Factors**

While several disaggregation methods are presented in this study, a constant throughout all of the different methods is an improved treatment for disaggregating international import and export traffic reported in the SEA and BRD tables within \( \text{FAF}^2 \). Since international import and export cargo enters or exits the country at seaport facilities or border crossing locations, it was decided that disaggregation of these flows should be treated differently than domestic flows. The international disaggregation factors described in this section were always used to disaggregate flows for the port side of the domestic leg (entry port for imports and exit point for exports) of international flows. The true domestic origin (for exports) and destination (for imports) for these international flows is disaggregated using the normal domestic disaggregation factors discussed in the next section.

While the \( \text{FAF}^2 \) zone structures cover large areas, oceangoing cargo exits and enters the country via seaports that are limited in number and at known locations. Rather than attempt to use population, employment, or other estimators of freight activity as proportional weights to disaggregate commodity flows at ports, actual estimates of the tonnage handled (or other attributes of the seaport facilities) should be available and can be used. The Journal of Commerce’s PIERS database is the dominant source of estimates of import and export tonnage on oceangoing vessels. While the PIERS database is an expensive commercial product that may not be readily accessible for some states, similar estimates of annual tonnage movements are often published by terminal operators and/or port authorities. By locating the county in which seaports are located, the tonnage in and out of New Jersey via seaports reported in PIERS was used as the basis for disaggregating port tonnage to the county level. However, PIERS records all imports and exports at major port facilities in several counties in northern New Jersey and the New York region as simply the Port of New York and New Jersey (PONYNJ). This is not useful in developing disaggregation factors to the county level, since PONYNJ facilities are located in several counties in both New York and New Jersey. Since estimates of tonnage by specific
PONYNJ terminal (and therefore county) were not able to be obtained from the Port Authority of New York and New Jersey (PANYNJ), a specific attribute about the seaport terminals needed to be used in order to proportion flows to New Jersey and New York counties. The parameter used to make that determination was total land area occupied by each port terminal in the PANYNJ district. Land area was selected because acreage is deemed to be a reasonable estimate of port terminal capacity. Thus it would provide enough accuracy for disaggregating flows and equally important the acreage data by terminal is publicly available information.

An exception to using international disaggregation factors was needed for zone 64 (remainder of New Jersey). Despite having no major seaport facilities located within the three counties in the zone, a significant tonnage of freight is reported in the SEA table as entering the country via a port in this FAF² zone. While this is likely an error in the FAF² data, the base FAF² data was not changed. Without any seaport facilities to use as the basis for a proportional split between counties, no seaport factors were developed and the flows were proportioned between the coastal counties of Atlantic and Cape May using normal (domestic) disaggregation weights. However, as no vessel of any significant size can travel far enough up the Delaware River to reach Warren County’s only water access points, no SEA traffic is ever assigned to Warren County.

Similar methods could have been developed for imports and exports via land crossings (the BRD table). However, since New Jersey has no international border crossings, a specific data source for disaggregating border crossings was not identified. The limited amount of commodity flows listed in the BRD table as entering or exiting the country via New Jersey was assumed to be either listed in error or the result of limitations of the transborder datasets used to create the FAF² databases, and normal disaggregation rates were used to proportion these flows to the county level.

**Domestic Disaggregation Factors**

The D1 through D7 disaggregation methods were developed during the first year of the study and are listed here as a reference. Details of the development of and reasoning for these methods are available in the report summarizing the first year study (1). Methods D8 through D13 were developed under this second year study and attempt to improve disaggregation by using industry specific employment to disaggregate each commodity type differently. All disaggregation methods are summarized in Table 1.

**TABLE 1 Disaggregation Method Descriptions**

<table>
<thead>
<tr>
<th>Disaggregation Method</th>
<th>Domestic Origin (Production) Factors</th>
<th>Domestic Destination (Attraction) Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>D1</td>
<td>Total Employment</td>
<td>Population</td>
</tr>
<tr>
<td>D2</td>
<td>Total Employment</td>
<td>Population of 25 to 54 year olds</td>
</tr>
<tr>
<td>D3</td>
<td>Total Employment</td>
<td>Income adjusted population of 25 to 54 year olds</td>
</tr>
<tr>
<td>D4</td>
<td>Truck Vehicle Miles Traveled (TVMT).</td>
<td>Truck Vehicle Miles Traveled (TVMT)</td>
</tr>
<tr>
<td>D5</td>
<td>Employment and TVMT combined</td>
<td>Income adjusted population of 25 to 54 year olds and TVMT</td>
</tr>
</tbody>
</table>
The D1 approach disaggregates origins by total county employment and destinations by total county population. The D2 approach disaggregates origins by total county employment and destinations by the county population of 25 to 54 year old persons. The D3 approach disaggregates origins by total county employment and destinations by the county population of 25 to 54 year old persons that is adjusted by the ratio of the county’s average per capita income to that of the state’s average per capita income. The D4 approach disaggregates both origins and destinations by Truck Vehicle Miles Traveled (TVMT) as estimated by the New Jersey Statewide Truck Model (NJSTM). The D5 approach is a combination of methods D3 and D4 and disaggregates origins and destinations by both TVMT and total county employment and destinations by the income adjusted county population of 25 to 54 year old persons. The D6 approach disaggregates origins and destinations, respectively, by the estimates from the NJSTM of truck flows exiting and entering the county boundary. The D7 approach disaggregates origins and destinations, respectively, by the estimates from the NJSTM of TVMT produced by trucks exiting and entering the county boundary.

In an effort to improve upon the disaggregation methods D1 through D7, additional methods were developed that utilized the flows of different commodity types contained within the FAF2 databases. This was done by using the inherent relationships between specific industries and specific commodity types. The bridge or crosswalk that defines the relationship between industry employment in North American Industry Classification System (NAICS) codes and SCTG commodity codes, which was established as part of the development of FAF2 forecasts (8), was used to establish the disaggregation factors specific to each commodity type. Using this NAICS to SCTG bridge, a matrix of dependencies between NAICS employment and SCTG commodities was created. Since no information was available as to the relative importance of each industry to each commodity type, uniform weighting was applied to industry employment when multiple industries contributed to one commodity type. The amount of employment influencing each commodity type can be determined by multiplying the vector matrix of employment by NAICS code and the NAICS to SCTG relationship matrix. County level employment estimates for the detailed NAICS codes (up to 6 digits) for the year 2002 were obtained from the Quarterly Census of Employment and Wages (CEW) (9) to correspond with the 2002 FAF2 databases.
This procedure was completed using the full detail of NAICS codes (up to 6-digit) for all counties in New Jersey. These results provided the basis for commodity specific disaggregation factors to the county level. While varying by county, this procedure translated 4% of the total statewide employment into SCTG codes. Although 4% is a small value, New Jersey is not a major goods producing state. The CEW reports that only 14% of total employment in New Jersey is in goods manufacturing industries. As some industries are not prevalent in New Jersey, some SCTG codes returned no employment at all for some of the FAF² zones in New Jersey. For these SCTG codes and FAF² zone combinations, NAICS codes in the bridge matrix were truncated to the 3-digit level and combined with 3-digit industry employment in an attempt to obtain as many SCTG specific disaggregation factors as possible. Even at the 3-digit level, some SCTG and FAF² zones still had no industry specific information. For these combinations still without any industry employment data, along with SCTG commodity types 42 (Mixed Freight) and 43 (Unknown) which were not included in the NAICS to SCTG bridge, total county employment was used in place of industry specific data. Collectively referred to as the NAICS 6-digit commodity specific industry employment numbers, these were applied in the D8 method to disaggregation both origins and destinations to yield county to county level flows.

Method D9 is an adaptation of method D8. As the NAICS to SCTG relationships typically relate to goods production and not to goods consumption, method D9 uses the NAICS 6-digit commodity specific industry employment to disaggregate origins (or production points) and uses total employment in the county to disaggregate destinations (or consumption points). This change attempts to better reflect the demand for goods consumption. Method D10 is a further adaptation of method D8, and uses the NAICS 6-digit commodity specific industry employment to disaggregate origins and uses total population in the county to disaggregate destinations. Again, this is an attempt to better reflect commodity consumption demands in New Jersey.

While the relationship between NAICS industry employment and SCTG commodity codes is strongest with higher detail levels (more digits), some data loss occurs at the more detailed level of reporting of employment by 6-digit NAICS codes. Analysis of the data losses due to disclosure issues at the county level showed that the 6-digit NAICS employment in the CEW retained and reported 78% of the statewide employment. Conversely, 91% of total statewide employment is retained and reported at the 3-digit NAICS codes. In an attempt to minimize the effects of data loss due to disclosure issues in the CEW and to maximize the employment data used to disaggregate each SCTG code, a set of NAICS 3-digit commodity specific industry employment numbers was developed. All NAICS codes in the NAICS to SCTG bridge matrix were truncated to 3-digits and combined with 3-digit NAICS employment statistics to yield the NAICS 3-digit commodity specific industry employment numbers. This increased the percentage of industry specific employment from 4% in the 6-digit analysis to over 10%.

Similar to D9 and D10, methods D12 and D13 modify method D11. In methods D12 and D13, origins are disaggregated by the NAICS 3-digit commodity specific industry employment numbers, while destinations are disaggregated by total county employment and population, respectively.

VALIDATION OF DISAGGREGATION METHODS

After compiling and calculating all of the disaggregation factors for each of the disaggregation methods for New Jersey counties, each method was applied to yield a different
set of commodity flows by mode and SCTG commodity code to and from all 21 counties in New Jersey and the rest of the nation. The domestic disaggregation factors were varied as described above for all domestic ends of commodity flows, and the international disaggregation factors were used for all import and export ends of the domestic leg of an international commodity flow.

To measure the accuracy and effectiveness of each of the disaggregation methods, observed county level commodity flows are needed. As there are no actual sources of observed data that contain county level commodity flows, the authors decided to compare the disaggregation results of all disaggregation methods described above with the Transearch database from Global Insight. Although it does not contain actual observed commodity flows, the Transearch database is commonly regarded in the freight planning industry as a good, albeit expensive, estimate of county level (and below) commodity flows. The study team had in house a copy of the 2001 Transearch database with county level zones in New Jersey that was used in previous freight planning studies for New Jersey. The Transearch database contains annual commodity flows by tonnage by mode and also by value for all modes of transport. The database accounts for each leg of a commodity trip including trips that enter and leave the U.S. via international gateways such as seaports.

Before comparisons of commodity flows at the county level for the resulting disaggregated FAF2 databases were compared to the Transearch database, a comparison of tonnage totals in New Jersey between the Transearch and the raw FAF2 databases (only modified to remap seaport tonnage coded to New York that actually occurs in the ports of northern New Jersey) was completed. The Transearch commodity flows were aggregated up from the county level to match the zonal definitions of the FAF2 database and compared. The relative measure of agreement between the two sets of tonnage is measured by the coefficient of determination ($R^2$). In this comparison, $R^2$ is defined as the proportion of variability in the 2002 tonnage flows in the FAF2 database that can be explained (accounted for) by the 2001 tonnage in the Transearch database. Table 2 lists the $R^2$ values comparing the total tonnage produced and consumed (total of flow origins and destinations) for all the three New Jersey FAF2 zones for each of the modes of truck, rail, water, air, and again for total tonnage (all modes).

**TABLE 2 $R^2$ Comparison of FAF2 and Transearch Tonnage at FAF2 Zones in New Jersey**

<table>
<thead>
<tr>
<th>Tonnage</th>
<th>By Mode</th>
<th>All Modes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Truck</td>
<td>Rail</td>
</tr>
<tr>
<td>Total Production Tonnage</td>
<td>0.879</td>
<td>0.508</td>
</tr>
<tr>
<td>(Origin Totals)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Attraction Tonnage</td>
<td>0.914</td>
<td>0.622</td>
</tr>
<tr>
<td>(Destination Totals)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

While the tonnage estimates between the two commodity flow databases are similar, certain modes have better $R^2$ values than others. Of particular interest are the small $R^2$ values for tonnage attraction totals in all modes other than truck, and for productions by rail. These values indicate where large disagreements exist between the two databases. These $R^2$ values measured at the FAF2 zone level can be used to set the benchmark for estimating a good $R^2$ when comparing the disaggregated FAF2 commodity flows and the Transearch databases at county level.
Table 3 and 4 show the $R^2$ values comparing the results of all thirteen disaggregation methods with respect to Transearch, comparing total production and attraction tonnage, respectively, in each of the 21 counties by mode and for all modes.

**TABLE 3 $R^2$ Comparison of Disaggregated FAF$^2$ and Transearch Production Tonnage (Origins) at County Level in New Jersey**

<table>
<thead>
<tr>
<th>Method(s)</th>
<th>Production (Origin) Disaggregation Factor</th>
<th>By Mode</th>
<th>All Modes</th>
</tr>
</thead>
<tbody>
<tr>
<td>D1 - D3</td>
<td>Total Employment</td>
<td>Truck</td>
<td>Rail</td>
</tr>
<tr>
<td>D4</td>
<td>Truck Vehicle Miles Traveled (TVMT)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D5</td>
<td>Employment and TVMT combined</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D6</td>
<td>Number of trucks exiting county</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D7</td>
<td>TVMT of trucks entering county</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D8 - D10</td>
<td>NAICS 6-digit commodity specific industry employment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D11 - D13</td>
<td>NAICS 3-digit commodity specific industry employment</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**TABLE 4 $R^2$ Comparison of Disaggregated FAF$^2$ and Transearch Attraction Tonnage (Destinations) at County Level in New Jersey**

<table>
<thead>
<tr>
<th>Method(s)</th>
<th>Attraction (Destination) Disaggregation Factor</th>
<th>By Mode</th>
<th>All Modes</th>
</tr>
</thead>
<tbody>
<tr>
<td>D1, D10, &amp; D13</td>
<td>Population</td>
<td>Truck</td>
<td>Rail</td>
</tr>
<tr>
<td>D2</td>
<td>Population of 25 to 54 year olds</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D3</td>
<td>Income adjusted population of 25 to 54 year olds</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D4</td>
<td>Truck Vehicle Miles Traveled (TVMT)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D5</td>
<td>Income adjusted population of 25 to 54 year olds and TVMT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D6</td>
<td>Number of trucks entering county</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D7</td>
<td>TVMT of trucks entering county</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D8</td>
<td>NAICS 6-digit commodity specific industry employment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D11</td>
<td>NAICS 3-digit commodity specific industry employment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D9 &amp; D12</td>
<td>Total Employment</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Clearly there is a great deal of variability between the disaggregated FAF\(^2\) commodity flows and the Transearch database. While some of this variability can be attributed to the differences in total modal tonnage between the two databases at the FAF\(^2\) zone level, none of the disaggregation methods tested in this study were able to sufficiently disaggregate flows to the county level when compared to the Transearch database. Much of the error in tonnage between the disaggregated flows and the Transearch database is related to only a few outlier counties. Further research is required to identify the potential reasons for those discrepancies and to determine additional explanatory factors that could be used in future disaggregation methods.

Despite the errors when compared to the Transearch data, there are still some definite patterns that emerge in reviewing the R\(^2\) values of the tested disaggregation methods. For disaggregating the productions or flow origins, the commodity specific industry employment factors yielded the closest match to the Transearch database, with the 6-digit level yielding better results for trucks, while the 3-digit level yielded better results for other modes. The favorable results for commodity specific industry employment factors do not hold true for disaggregation of flow attractions; other non-commodity specific factors such as truck vehicle miles traveled, total employment, or adjusted population generally yielded better results. The disaggregation factors also typically yielded better results for trucks than for other modes. This indicates that separate disaggregation factors should be considered for different modes of transport. Again, when evaluating the disaggregation methods in terms of R\(^2\), it is important to remember the discrepancies illustrated between the two databases at the FAF\(^2\) zone level as summarized previously in Table 2.

**CONCLUSIONS AND FUTURE RESEARCH**

This paper outlined the findings of a study that developed methods to disaggregate FAF\(^2\) commodity data down to the county level in New Jersey. The methods provide a good primer for disaggregating the FAF\(^2\) data to the county level. They are easy to follow by an MPO staff interested in this issue and are easily transferable. As an added exercise, the proposed methods were then applied to disaggregate the FAF\(^2\) commodity flow database in New Jersey and the resulting county level tonnages were compared to Global Insight’s Transearch database. The comparison showed clear discrepancies at the disaggregated county level. While comparisons were performed and outlined in this paper, the objective of the study was not to match or calibrate the disaggregation factors for the FAF\(^2\) data to the Transearch database. However, as the Transearch data is the most widely used nationwide source of commodity flows at the county level, and the only one available to the research study, it was viewed as of significant value to perform this comparison.

Areas of further research would include identifying potential reasons behind the discrepancy between the base FAF\(^2\) and Transearch databases. Additionally, further research can focus on incorporating impedances between the counties in future disaggregation methods to not just allow for better estimates of total county origin and destination tonnages, but also to provide better estimates of the individual flow characteristics between locations. This should also yield better results in estimating intrazonal commodity flows. Further research into developing a bridge between NAICS industries and SCTG consumption would be helpful in establishing better disaggregation results, as would the development of different disaggregation factors for different modes of transport. Finally, applying a method to further disaggregate the commodity flows below county levels, converting tonnage to vehicles (trucks, rail cars, etc.), and performing
route assignments of those vehicles would allow for a true validation of the disaggregation results against observable real world data such as truck and rail volumes by facility.

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