I-494 Corridor Freight Study

DRAFT

Minnesota Department of Transportation

Prepared by:

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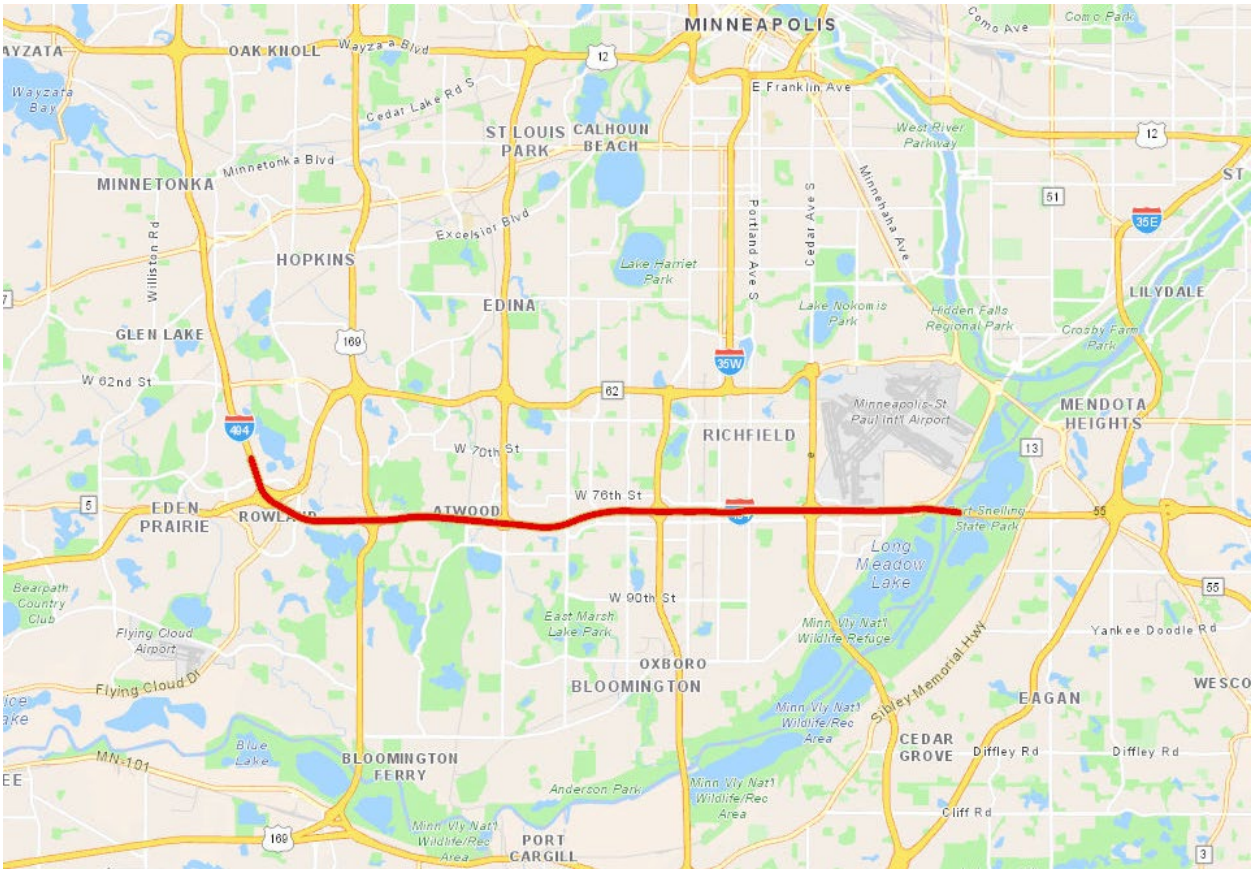
Introduction

Since 2016, MnDOT has been working with neighborhoods, community groups, district councils, local governments and others interested in the future of I-494 between United States Highway 212 in Eden Prairie and Minnesota Highway 5 and the Minnesota River in Bloomington in an effort to plan for transportation changes on and along the freeway.

The I-494 segments included in the study are shown in Figure 1.

Figure 1. I-494 Corridor Freight Study Area Map



I-494 Freight Assessment

One key stakeholder group that relies heavily on I-494 are the shippers, carriers, receivers, and other businesses involved in the freight transportation system. I-494 plays a critical role in connecting area businesses to the regional and national markets. Having a better understanding of the locations and types of major freight activity in the corridor will help project planners address needs specific to the movement of freight goods. Goals of the I-494 Corridor Freight Study are to:

- Gain better understanding of overall freight activity in the corridor
- Identify the locations of freight businesses throughout the corridor
- Identify the key freight industries represented in the corridor
- Estimate truck volumes on I-494 and the surrounding roadway network
- Identify the critical routes used to connect freight businesses to I-494
- Conduct high-level environmental justice analysis of impacts of freight on minority and low-income populations within the corridor.

This report describes the approach and methodology used to combine multiple sources of data to generate estimates of daily truck counts and truck travel patterns along the I-494 corridor and throughout the Twin Cities Seven-County Metropolitan area. The data sources used in this analysis include INRIX GPS data, InfoUSA business data, zip-code level Census Business Pattern Data, and MnDOT's Heavy Commercial Annualized Average Daily Traffic Data (HCAADT). The combination of this data was used to estimate daily truck trip counts, origin-destination, travel patterns, and distribution of truck size for multiple "freight districts" located within the study corridor. The results of this analysis will help project planners and engineers gain a thorough understanding of the freight system in and around the I-494 corridor and will function as an outreach tool to educate other stakeholders about the existing conditions and future needs of the I-494 freight transportation system.

Data Sources

The analysis of freight activity on roadway networks is often hampered by the limited availability of freight data. This assessment used a combination of four data sources to help illustrate the locations of key freight generators in the area, approximate the intensity of freight truck trips accessing the various freight networks, and estimate truck counts and travel patterns along the I-494 corridor.

The following section describes each of the four freight data sources and discusses the relative advantages and disadvantages of each. While each data source individually provides only a portion of the freight activity picture, the goal of this analysis is to combine the sources in such a way that their unique characteristics balance their inherent limitations to result in a more comprehensive picture of freight activity in the corridor.

HCAADT Count Locations

HCAADT data is routinely collected by MnDOT and distinguishes heavy commercial vehicles (e.g., semi trailers, large delivery trucks) from passenger vehicles, motorcycles and other non-freight-related vehicle types. A major advantage of this data is that it is up-to-date. It is an accurate, objective measure of the number of trucks using a specific segment of roadway. However, it is only available on a limited number of roadways. An example of this data on the I-494 corridor is shown in Figure 2. This figure highlights the HCAADT count locations near the intersection of I-494 with I-35W. The most current counts for Highways 100 and 77 are shown at multiple locations along their routes. The HCAADT on local roadways is unknown, or can only be guessed at based on the change in HCAADT values on the major roads.

For the purposes of this analysis, the HCAADT data functions partially as a validity check for our truck volume estimates. If our estimates for truck volumes are accurate on roadways where HCAADT is known, it can be assumed that the estimates on other roadways are also reasonably accurate.

Figure 2. HCAADT Count Locations

InfoUSA Business Data

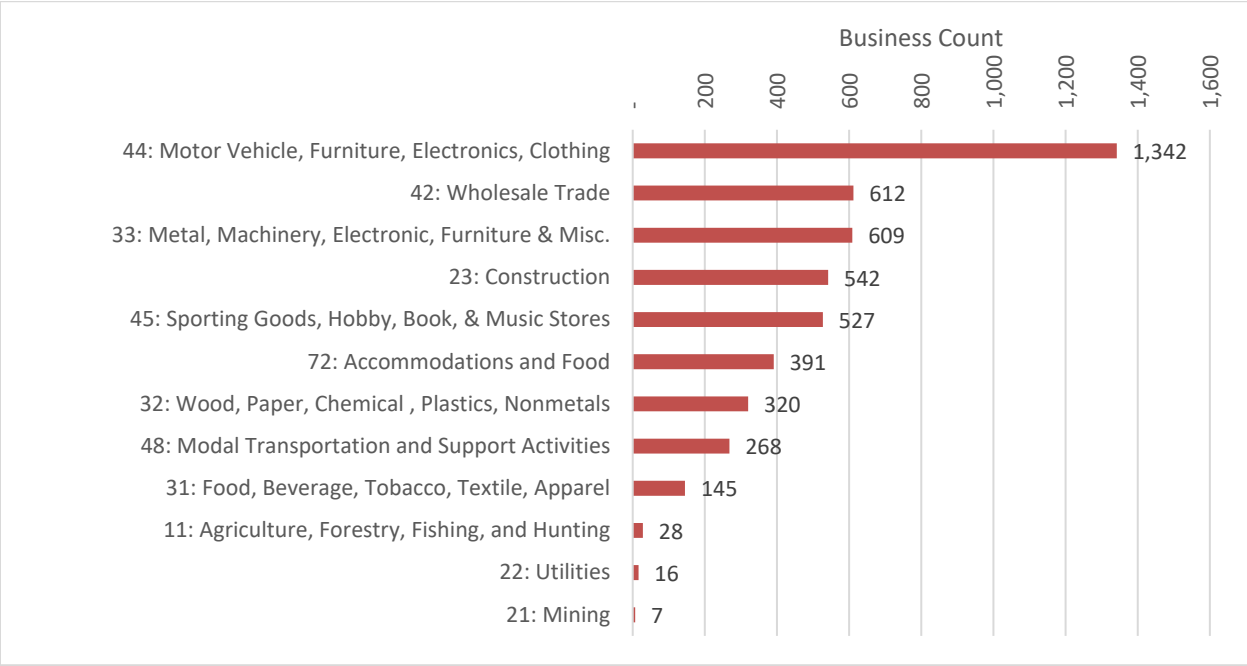
The InfoUSA freight business dataset is a product used primarily for targeted business marketing efforts. The information is updated routinely and includes information such as business location, NAICS[1] code, estimated number of employees, estimated sales volume, and many other related data points. A set of this data was collected by the Minnesota Department of Transportation (MnDOT) in 2014 for use in the update to the statewide freight plan and has been repurposed for this analysis. One key limitation of this data is that to lower the costs of collection at the statewide level, MnDOT collected it only for businesses with employee counts of 20 or more. Because of this, the data should be considered a sample rather than a complete dataset.

Despite excluding smaller freight businesses, the InfoUSA data still helps to highlight the distribution of key freight trip generators in the Twin Cities and in the I-494 Corridor and provides a snapshot of the main industry categories active in these regions. The InfoUSA data includes 4,807 freight-related businesses in the Twin Cities Metropolitan Area. The distribution of these businesses

[1] North American Industry Classification System

based on their two-digit NAICS codes is shown in Figure 3. Approximately one in four freight-related businesses are categorized under NAICS code 44: Motor Vehicle, Furniture, Electronics, Clothing, which can be more generally categorized as part of the retail industry.

Figure 3. Twin Cities Freight-Related NAICS Codes Included in InfoUSA Data



For illustrative purposes, the freight-related NAICS codes were grouped into three distinct categories:

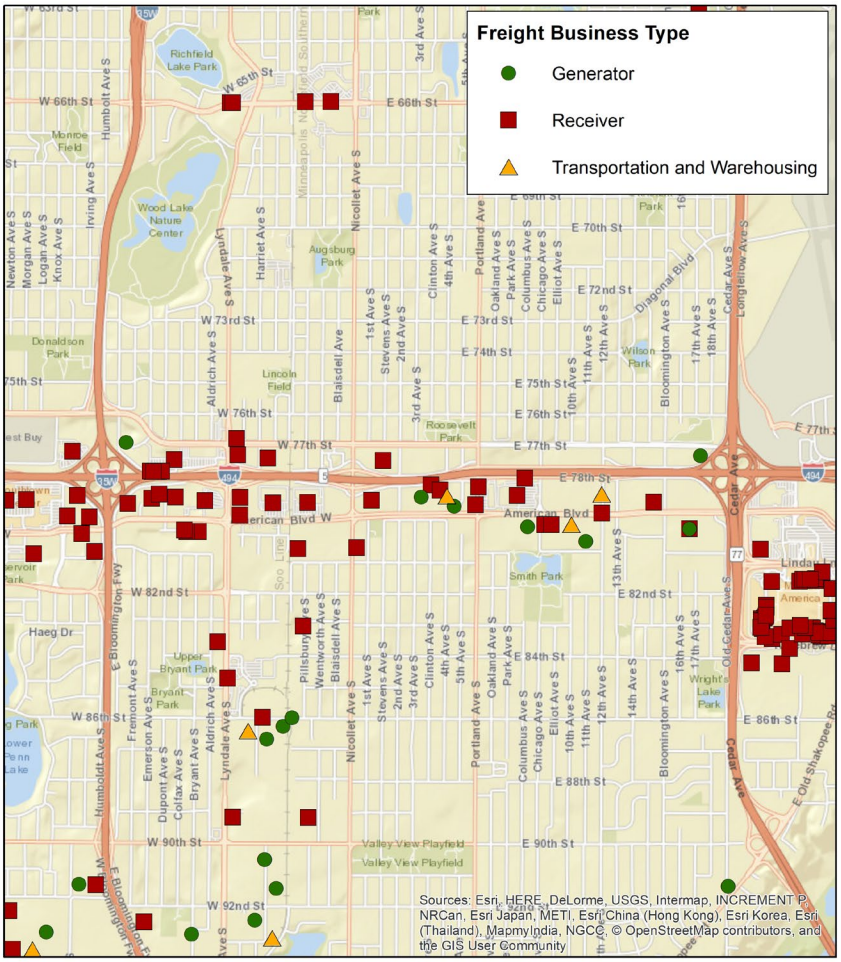
- **Freight Receivers** are those businesses that primarily receive freight. Industries in this category include retail stores, restaurants, and hotels. These businesses tend to cluster in more commercial areas such as downtowns and shopping malls.
- **Freight Generators** are more likely to generate truck shipments to other locations. They also typically receive freight shipments, but not to the extent of the Freight Receivers.
- **Transportation and Warehousing** are businesses that are involved in the movement or storage of freight goods.

A list of the freight-related NAICS codes is provided in Table 1 along with a classification of freight generation type. An example of the locations of the InfoUSA freight-related businesses is shown in Figure 3. The figure highlights the extent to which freight-related businesses tend to cluster around other freight-related businesses.

Table 1. Freight-Related NAICS Sectors and Freight Generation Classification

Freight Intensive NAICS Sector	Freight Generation Classification
11: Agriculture, Forestry, Fishing, and Hunting	Generator
21: Mining, Quarrying, and Oil and Gas Extraction	Generator
22: Utilities	Receiver
23: Construction	Receiver
31-33: Manufacturing	Generator
42: Wholesale Trade	Generator
44-45: Retail Trade	Receiver
48-49: Transportation and Warehousing	Transportation and Warehousing
72: Accommodation and Food Services	Receiver

Figure 4. InfoUSA Business Locations Sample



INRIX Travel Patterns

INRIX provides trip-level GPS collected by users of INRIX navigation programs. Data for each individual trip is provided with timestamped waypoints (latitude and longitude) collected approximately every 30 seconds during a trip. The INRIX data can be used to analyze information such as common travel patterns, average trip lengths and speed, and trip-level origin-destination. The data used for this study was collected for the seven-county Twin Cities metropolitan area from September 2015 to November 2015. Approximately six million individual trip records are included in this dataset.

Additional data processing was required to convert the INRIX data into a usable format for this analysis. The ArcGIS NEAR function was applied to the INRIX dataset to convert the individual trip waypoints to a path format. To match paths generated using the ArcGIS NEAR function, CUBE travel demand modelling software was used to generate multiple paths for each origin-destination pair within the roadway network. The CUBE path generation process was repeated for over nine million zone pairs, and the route matching process was repeated for six million trips.

The INRIX data provides excellent insight into the travel patterns of individual trips. The data is categorized into three distinct vehicle categories based on vehicle weight. The vehicle weight categories and the associated vehicle classification used for this study are summarized in Table 2.

Table 2. INRIX Vehicle Classification

INRIX Vehicle Weight Category	Vehicle Classification
< 14,000 lbs.	Passenger Vehicle
14,000 – 26,000 lbs.	Medium Truck
> 26,000 lbs.	Heavy Truck

Care should be taken when using the INRIX data to consider its potential limitations and biases. The INRIX navigation programs are used by only a small portion of drivers, and thus constitute a sample rather than a complete set. As a result, these data overrepresent the travel patterns of INRIX users and does not include travel patterns of non-INRIX users. This is a particularly important issue when considering the travel patterns of trucks to specific locations, as they may not be represented in the data. However, by summarizing the data at a higher level of aggregation (e.g., looking at all trips into and out of a TAZ), the INRIX data should be able to provide a relatively complete picture of the potential freight movements in a general area.

Zip Code Freight Activity Estimates

A new approach for estimating freight activity at both the zip code and business establishment levels was recently published in *NCFRP Research Report 37: Using Commodity Flow Survey Microdata and Other Establishment Data to Estimate the Generation of Freight, Freight Trips, and Service Trips*. The research team reviewed several detailed data sources to develop a freight trip estimation model based on the NAICS code and the number of employees at each establishment. The resulting trip generation formulas can be applied to specific establishments if the NAICS code and employment counts are known.

The NCFRP research team also developed an online tool[2] that applies the trip generation formulas to zip-code level Census Business Pattern data. The NCRFP research team found that these estimates are more reliably accurate than other commonly used models based on land use classification. The team also found the results to be geographically transferable between cities, but noted that more research is needed to confirm this finding.

The freight trip attraction (FTA) and freight trip production (FTP) models used for this analysis are summarized in Tables 3 and 4. Included in each table are the factors to be applied to the employee count variable under each NAICS industry. The tables also include the number of observed establishments used by the NCFRP Report 37 research team to generate the models and the minimum, maximum, and mean values of employee count in each NAICS category. The estimate of the total freight activity is taken as the sum of the FTA and the FTP estimates.

[2] https://coe-sufs.org/wordpress/software/

Table 3. Freight Trip Attraction Models

FTA = a * [Emp.]^b

Freight Trip Attraction (FTA) Non-Linear Models
New York City and Capital Region (Deliveries/day)

NAICS	Description	a	b	Obs.	Employment		
					Min	Mean	Max
23	Construction	1.565	0.275	66	3	28	201
31-33	Manufacturing	0.858	0.499	202	1	41	350
31	Food, beverage, Tobacco, Textile, Apparel	1.169	0.298	54	2	39	200
32	Wood, paper, Chemical, Plastics, Nonmetals	0.517	0.603	65	2	38	300
33	Metal, Machinery, Electronic, Furniture & Misc.	0.803	0.54	83	1	44	350
42	Wholesale Trade	1.142	0.539	227	1	20	200
44-45	Retail Trade	1.58	0.427	259	1	17	173
44	Motor Vehicle, Furniture, Electronics, Clothing	1.571	0.465	180	1	18	173
45	Sporting Goods, hobby, Book, & Music Stores	1.541	0.316	79	1	15	98
48	Modal Transportation and Support Activities	2.463	0.47	14	3	36	151
72	Accommodations and Food	0.918	0.477	102	3	27	180
All	**All Freight Intensive Sectors (FIS)**	**1.389**	**0.428**	**872**	**1**	**26**	**350**

Table 4. Freight Trip Production Models

FTP = a * [Emp.]^b

Freight Trip Production (FTP) Linear Models
New York City and Capital Region (Deliveries/day)

NAICS	Description	a	b	Obs.	Employment		
					Min	Mean	Max
23	Construction	0.276	0.896	20	6	39	201
31-33	Manufacturing	2.111	0.445	96	1	51	350
31	Food, Beverage, Tobacco, Textile, Apparel	1.581	0.369	18	2	43	150
32	Wood, Paper, Chemical, Plastics, Nonmetals	2.201	0.572	36	2	45	300
33	Metal, Machinery, Electronic, Furniture & Misc.	2.133	0.385	42	1	59	350
42	Wholesale Trade	6.804	0	68	2	22	200
44-45	Retail Trade	0.966	0.737	63	1	15	94
44	Motor Vehicle, Furniture, Electronics, Clothing	0.806	0.762	42	1	15	77
45	Sporting Goods, hobby, Book, & Music Stores	1.689	0.603	21	2	15	94
48	Modal Transportation and Support Activities	9.714	0	8	9	53	151
72	Accommodations and Food	0.508	0.706	12	5	35	159
All	**All Freight Intensive Sectors (FIS)**	**1.348**	**0.544**	**268**	**1**	**33**	**350**

Freight Analysis Methodology

As discussed in the previous section, each of the four data sources provides important information about specific aspects of the freight transportation system, but do not provide the complete picture that is the goal of this study. To develop truck trip volume estimates on roadways throughout the I-494 corridor study area, the team completed a four-step analysis process consisting of the following steps:

1. Generate zip-code-level freight activity estimates

2. Allocate the zip-code-level estimates to Traffic Analysis Zones (TAZs) using the InfoUSA data as a weighting measure.

3. Scale the INRIX trip data based on the TAZ-level freight trip estimates

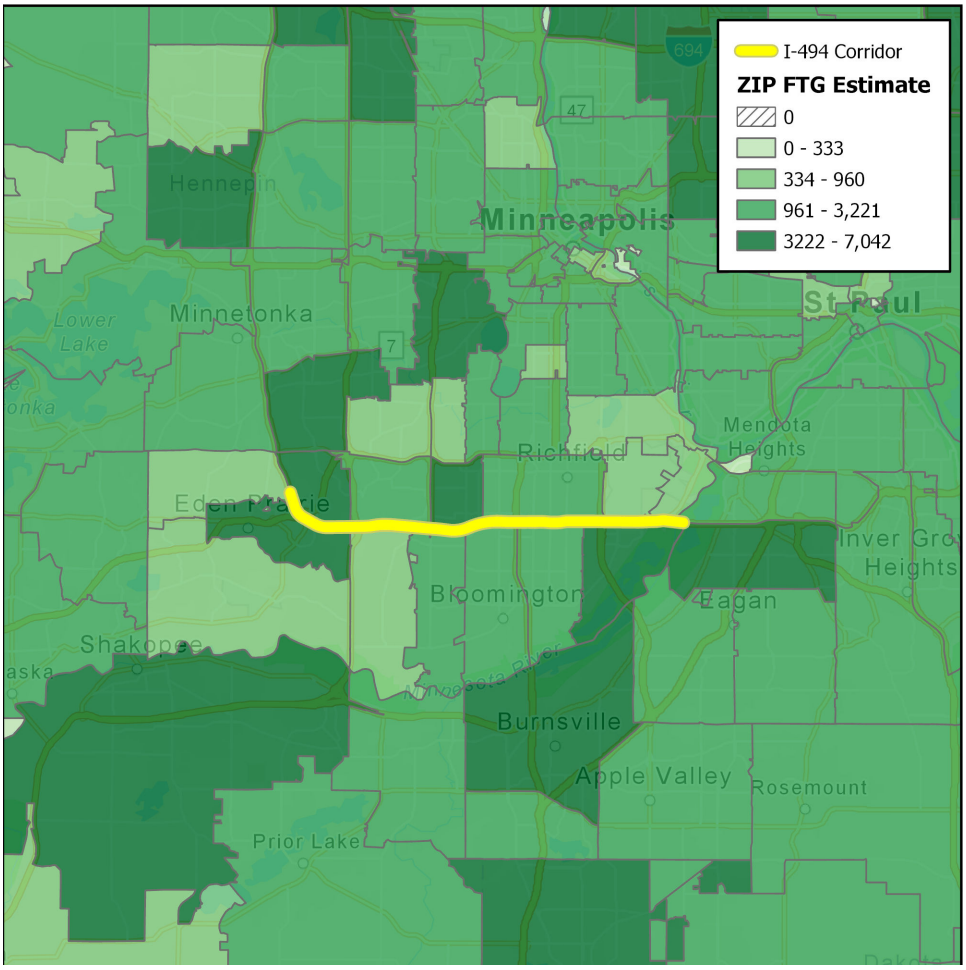
4. Check the initial results against existing HCAADT data and make minor adjustments to match HCAADT values on I-494.

Step 1: Zip Code Estimates

The starting point of this freight analysis was generating zip-code-level freight activity estimates using the online tool developed by the authors of NCFRP Report 37. This tool applies the freight trip generation models to the Census Business Pattern data, which includes a count of the number of businesses in each two-digit NAICS category as well as an approximation of the number of employees at each location. The online tool used 2015 Census data to generate freight activity estimates for each of the 560 zip codes in Minnesota. The freight trip estimates ranged from 10 to 7,595 trips per zip code with an average of 865 trips per zip code.

The results of this analysis are shown in Figure 5. Note that in this context, the term "Freight Trip Generation" includes both ingoing and outgoing truck trips. Multiple pockets of freight activity are located near or immediately adjacent to the I-494 Study Area.

Figure 5. Zip-Code-Level Freight Trip Generation Estimates

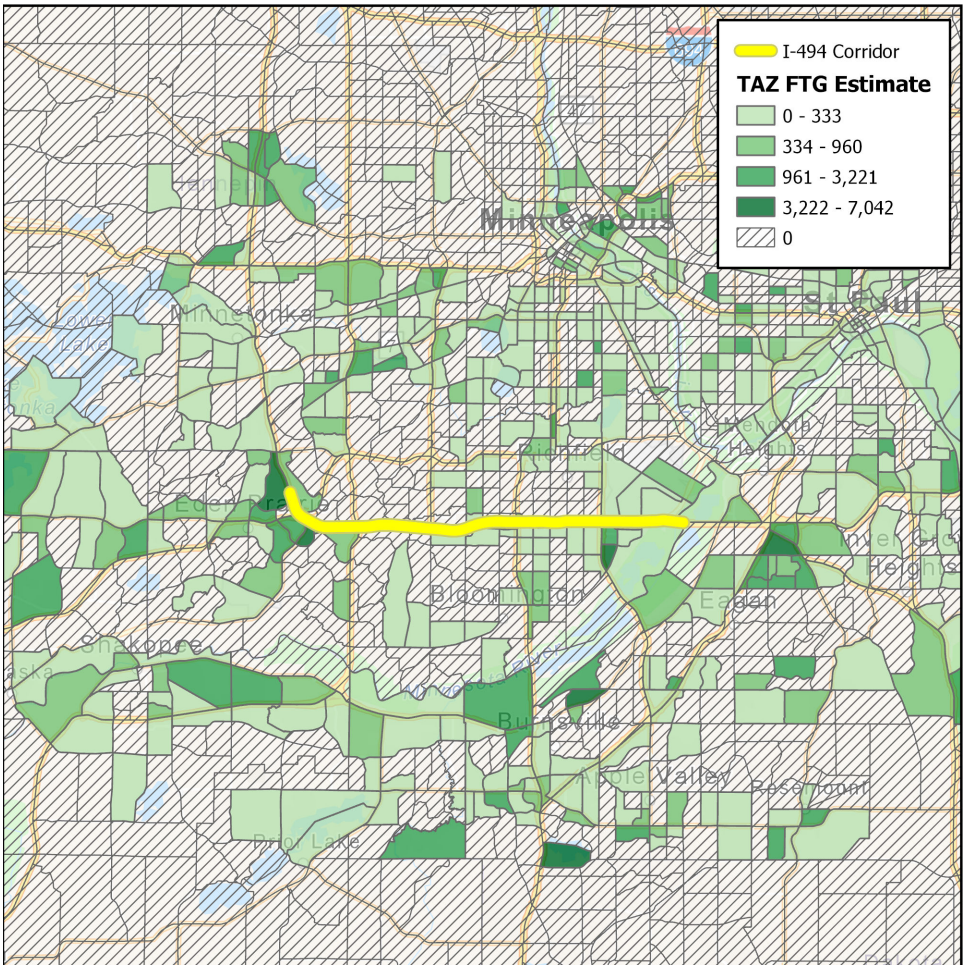


Step 2: Allocate Trips to TAZ Level

The previous step provides a reasonable approximation of freight activity in the area, but at too large of a scale to provide any useful insight on specific corridors. To allow for further analysis, the zip code estimates were allocated to their constituent TAZs using the InfoUSA establishment-level data as a weighting factor.

Establishment-level freight trips were estimated using the same freight trip generation models discussed above. These establishment-level trips were then used to calculate the proportion of the zip-code-level trips in each TAZ. For example, if 40 percent of the establishment-level trips in a given zip code were located in a single TAZ, then that TAZ would be assumed to account for 40 percent of the zip-code-level freight trip estimates from Step 1. This approach was applied to all the TAZs in the metropolitan area, resulting in the TAZ estimates shown in Figure 6.

Figure 6. TAZ-Level Freight Trip Generation Estimates



Step 3: Scale INRIX Trips

In this step, the TAZ-level freight trip estimates were allocated proportionately to the INRIX trips based on the origin and destination of each trip. For example, if 100 trips per day were estimated to occur at one TAZ, and the INRIX dataset showed that 500 trips originated from that same TAZ, then each would be counted as the equivalent of 0.2 trips (100 estimated daily trips / 500 INRIX trip records = 0.2). This scaling process is an attempt to counteract the potential disproportionate representation of the INRIX data at specific locations.

Note that many of the TAZs shown in Figure 6 do not have any InfoUSA businesses within their boundaries. In this situation, even if the INRIX data showed freight trips starting or ending at a TAZ with zero estimated trips, the scaling process would negate those trips. To counteract this result, TAZs with no InfoUSA business locations were assigned a nominal value of 0.1. In this way, the INRIX trips starting or ending at these TAZs would still be represented in the final data but would be scaled down to reflect the potentially limited number of freight businesses in the TAZ.

Roadway segment-level freight trip estimates were then calculated by taking the sum of the scaled INRIX trip patterns on each segment.

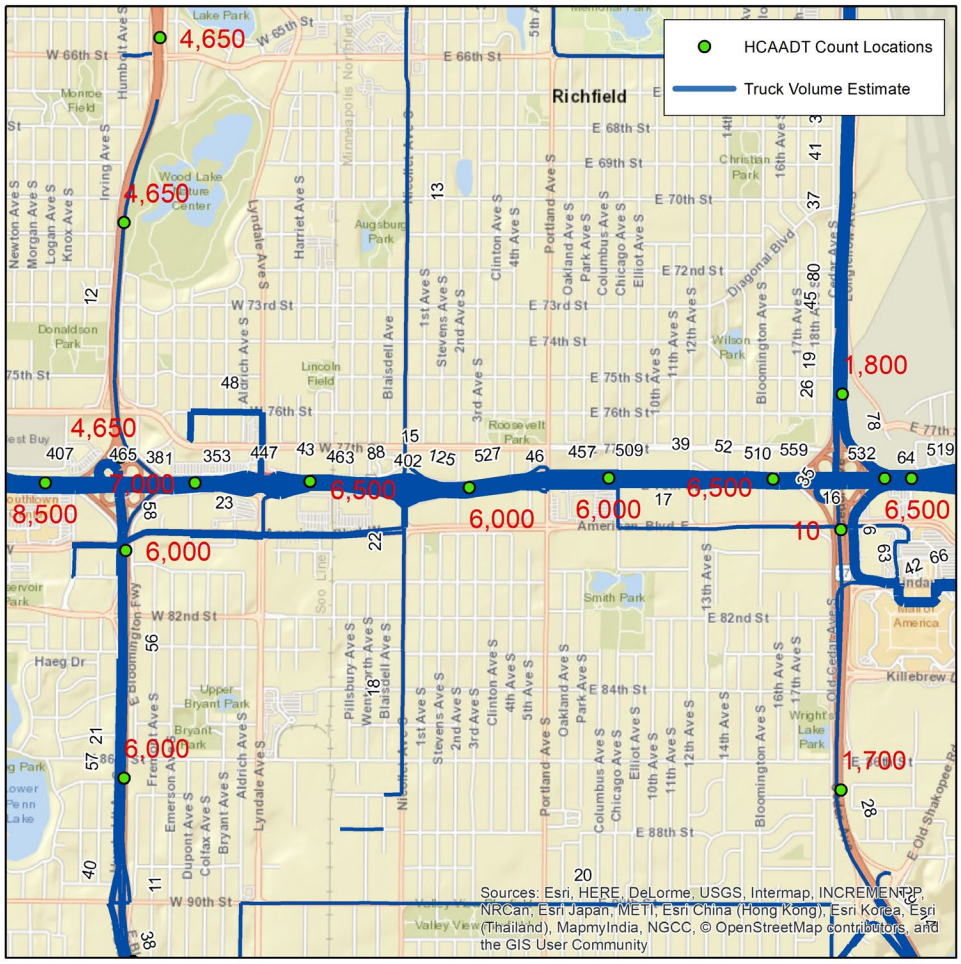
Step 4: Compare to HCAADT Data

As a final step in the process, the resulting roadway segment-level freight trip estimates were compared to known HCAADT values on major roadways to validate their accuracy. Since I-494 is the focus of the study, care was taken to compare the freight trip estimates to the HCAADT value along that corridor. A secondary scaling process was undertaken to manually adjust groupings of the scaled INRIX data to better match the HCAADT values on I-494. An example of this comparison is shown in Figure 7.

A final spot check of the estimated values to known HCAADT values on multiple other roadways showed that the estimates were within approximately 20 percent of the actual values at most locations. This level of accuracy is sufficient for reviewing overall truck trip patterns but should not be relied on for accurate heavy commercial trip counts. Some known gaps in the data exist. For example, the estimated values on I-494 are less than half of what the known values area. However, this latter case can potentially be explained by the fact that the road was closed during part of the INRIX data collection period.

Despite the existence of some gaps in the data, the results of the analysis appear to provide reliable planning-level estimates of freight activity on specific roadway segments. The data will prove useful for assessing multiple freight-related measures throughout the corridor, as shown in the following sections.

Figure 7. Comparing Freight Trip Generation Estimates to Known HCAADT Counts



Freight Analysis Results

The results of the freight analysis discussed in the previous section, in combination with other data from the InfoUSA and INRIX datasets, were used to conduct a detailed assessment of freight in the I-494 corridor. A first step in this process was identifying specific areas in which to conduct a deeper analysis.

Identifying Freight Districts

The locations of the freight-related InfoUSA businesses along the I-494 corridor are shown in Figure 8. Also shown on this figure is the calculated freight business density in terms of businesses per square mile. The figure helps illustrated how freight businesses in the corridor are often clustered together geographically. Through discussions with MnDOT staff, multiple "freight districts" were identified based on a combination of the evident business clusters and their proximity and relation to key roadway infrastructure. In total, 22 freight districts were identified for further study, as shown in Figure 9. The boundaries of each district were established by selecting the TAZs that most closely matched the extents of the freight business clusters.

Freight District Summaries

Summary sheets for each freight district are included in Attachment 1. For each freight district, multiple factors were reviewed and compared to the other districts. These include truck travel patterns, truck activity by time of day, proportion of trips traveling inter-regionally, frequency of truck type, and the predominant freight industries in each district. A summary of the findings of this comparison is highlighted below in Table 5. Additional discussion of these results is included on the following pages.

This information will equip the I-494 project team with greater insight into freight activity in the corridor and allow for more informed discussions with freight stakeholder regarding their specific needs and issues.

Figure 8. InfoUSA Freight-Related Business Density

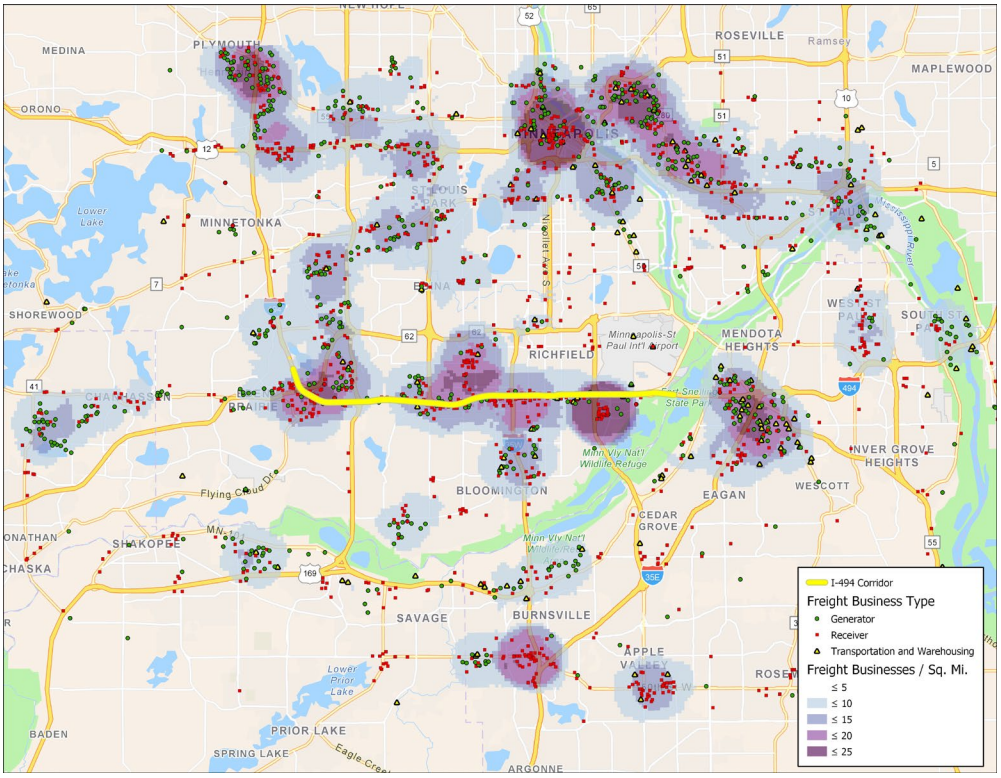


Figure 9. Identified Freight Districts

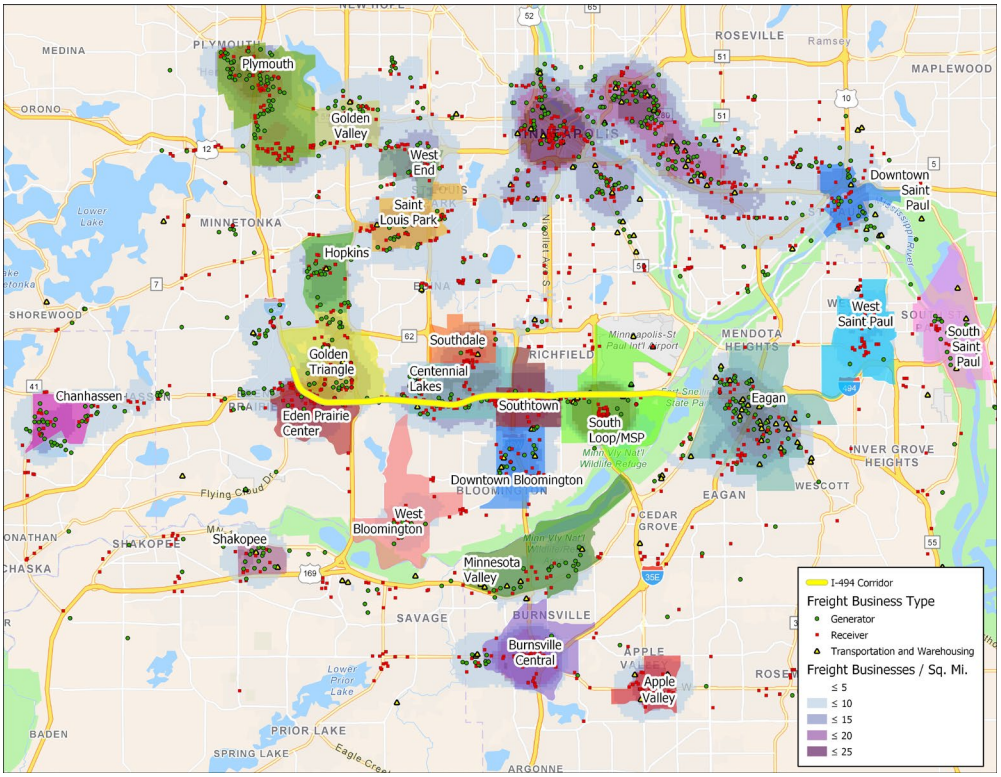


Table 5. Freight District Summaries

Freight District	Primary I-494 Access Points	Peak Hour for Arriving Trips	Peak Hour for Departing Trips	Percent Inter-Regional Trips	Percent Heavy Trucks	Top Three Freight Industries	Other (Non Top 10) Industry Percent
Apple Valley	- I-494 EB at 494/MN-77 - Majority of trips use I-35E and MN-77	10:00 AM	10:00 AM, 2:00 PM	29%	42%	Retail Trade (69%) Accommodation and Food Services (17%) Construction (8%)	6%
Burnsville Central	- I-494 EB at 494/I-35W - I-494 EB at 494/I-35E - Majority of trips use I-35W and I-35E	9:00 AM	10:00 AM	27%	34%	Retail Trade (80%) Accommodation and Food Services (7%) Manufacturing (6%)	7%
Centennial Lakes	- I-494 EB/WB at 494/MN-100 interchange - I-494 EB/WB at 494/I-35W interchange - I-494 EB/WB at France Ave and Bush Lake Rd Exits	11:00 AM	11:00 AM	27%	27%	Retail Trade (43%) Wholesale Trade (17%) Accommodation and Food Services (14%)	26%
Chanhassen	- I-494 EB at 494/US-212 interchange - Large portion of trips use US-212 and MN-5	7:00 AM	9:00 AM	30%	48%	Manufacturing (57%) Wholesale Trade (18%) Construction (14%)	11%
Downtown Bloomington	- I-494 EB/WB at 494/I-35W interchange - Majority of trips use I-35W	11:00 AM	10:00 AM	29%	42%	Retail Trade (33%) Manufacturing (24%) Construction (17%)	26%
Downtown Saint Paul	- I-494 EB at 494/I-35E interchange - I-494 EB at 494/MN-5 -I-494 - Majority of trips use I-94, MN-5, and I-35E	9:00 AM	11:00 AM, 2:00 PM	31%	25%	Manufacturing (35%) Construction (24%) Retail Trade (15%)	26%
Eagan	- I-494 EB/WB at 494/I-35E interchange - I-494 EB at MN-62 interchange - Large portion of trips use I-35E and MN-62	1:00 PM	10:00 AM	52%	63%	Manufacturing (25%) Retail Trade (23%) Transportation and Warehousing (18%)	34%
Eden Prairie Center	- I-494 WB at 494/US-212 interchange	11:00 AM	1:00 PM	35%	47%	Retail Trade (71%) Accommodation and Food Services (15%) Wholesale Trade (10%)	4%
Golden Triangle	- I-494 EB/WB at 494/US-212 interchange - I-494 WB at 494/US-169 interchange	10:00 AM	8:00 AM, 12:00 PM 2:00 PM	22%	25%	Manufacturing (31%) Retail Trade (28%) Wholesale Trade (18%)	23%
Golden Valley	- I-494 WB at 494/US-169 interchange -Majority of trips use US-169 and I-94	8:00 AM	7:00 AM	23%	30%	Retail Trade (25%) Manufacturing (21%) Wholesale Trade (18%)	36%
Hopkins	- I-494 WB at 494/US-169 interchange - I-494 EB at 494/MN-7 interchange - Majority of trips use US-169, I-94, and MN-62	6:00 AM	11:00 AM	41%	65%	Retail Trade (32%) Manufacturing (26%) Wholesale Trade (13%)	29%
Minnesota Valley	- I-494 WB at 494/I-35W interchange - Majority of trips use I-35W and MN-13	10:00 AM	11:00 AM	52%	58%	Wholesale Trade (28%) Retail Trade (23%) Construction (21%)	28%
Plymouth	- I-494 EB/WB at 494/MN-55 interchange - I-494 WB at 494/US-212 interchange - I-494 EB/WB at 494/94	11:00 AM	12:00 PM	31%	36%	Retail Trade (34%) Manufacturing (31%) Wholesale Trade (15%)	20%

Saint Louis Park	- I-494 EB at 494/US-12 interchange - I-494 EB at 494/MN-7 interchange - Majority of trips use US-169 and I-35W	7:00 AM, 12:00 PM	8:00 AM	23%	30%	Retail Trade (33%) Wholesale Trade (21%) Manufacturing (17%)	29%
Shakopee	- I-494 WB at 494/US-169 interchange - Majority of trips use MN-13/MN-101	11:00 AM	10:00 AM	51%	63%	Manufacturing (38%) Retail Trade (24%) Wholesale Trade (24%)	14%
South Loop/MSP	- I-494 EB/WB at 494/MN-77 interchange	9:00 AM	12:00 PM	33%	29%	Retail Trade (65%) Accommodation and Food Services (10%) Manufacturing (9%)	16%
South Saint Paul	- I-494 EB at Concord St Exit - I-494 WB at 494/US-10 interchange	2:00 PM	7:00 AM	48%	22%	Manufacturing (28%) Wholesale Trade (21%) Construction (17%)	34%
Southdale	- I-494 EB/WB at 494/I-35W interchange - Majority of trips use I-35W and MN-62	9:00 AM	12:00 PM	19%	35%	Retail Trade (86%) Manufacturing (6%) Accommodation and Food Services (3%)	5%
Southtown	- I-494 EB/WB at 494/I-35W interchange - Large portion of trips use I-35W - Sizeable portions of trips use US-169, MN-100, and MN-77	2:00 PM	9:00 AM	33%	30%	Retail Trade (65%) Construction (14%) Accommodation and Food Services (12%)	9%
West Bloomington	- I-494 EB/WB at 494/US-169 interchange - I-494 EB/WB at 494/MN-100 interchange - I-494 WB at 494/I-35W interchange - Large portion of trips use US-169, MN-100, and MN-1 (Old Shakopee Road)	7:00 AM	11:00 AM	44%	48%	Retail Trade (36%) Wholesale Trade (32%) Construction (16%)	16%
West End	- I-494 WB at 494/MN-100 interchange - I-494 EB at 494/394 interchange - Majority of trips use MN-100, I-94, and I-394	8:00 AM, 5:00 PM	8:00 AM, 2:00 PM	24%	20%	Retail Trade (55%) Accommodation and Food Services (23%) Manufacturing (14%)	8%
West Saint Paul	- I-494 WB at 494/I-35E interchange - I-494 EB/WB at 494/US-52 interchange - I-494 EB/WB at MN-3 (S. Robert Trail) Exit	9:00 AM	10:00 AM	27%	38%	Retail Trade (64%) Accommodation and Food Services (15%) Manufacturing (9%)	12%

Travel Patterns

The freight trip travel patterns into and out of each district were reviewed to identify the key routes used to access I-494 and other major highways in the area. This information could aid in discussions related to rethinking major interchanges I-494 in a way that would benefit the movement of freight.

The freight trips from all freight districts use I-494 to some extent, but some rely on I-494 more heavily than others. The districts with the highest usage of I-494 are the Centennial Lakes, Downtown Bloomington, Eagan, South Loop/MSP, and West Saint Paul Districts. The Burnsville, Hopkins, Plymouth, Saint Louis Park, Southdale, and West Bloomington Freight Districts are also reliant on I-494, but a greater proportion of their truck trips use I-35W, I-35E, US-169, MN-100, MN-77, and other roads. The districts with the least reliance on I-494 are the fringe districts of Apple Valley and Shakopee, as well as the Downtown Saint Paul District. Truck trips from these districts primarily use alternative roadways, such as I-35E, MN-77, and MN-13/101, and local roads and may only pass through I-494 briefly or for a small percentage of overall trips.

Time of Day

The INRIX data allows an assessment of the time of day of each trip. This data was evaluated independently for trip arrivals and departures to identify peak periods of freight activity.

A large portion of the freight districts tend towards a unimodal midday peak distribution with truck trip arrivals and departures peaking between the hours of 7:00 A.M. and 1:00 P.M. Some of the freight districts—particularly those with higher concentrations of retail activity—tend towards a more bimodal distribution with a peak of freight trip arrivals between the hours of 6:00 A.M. and 10:00 A.M. and a peak of freight trip departures between the hours of 2:00 P.M. and 4:00 P.M.

Notable exceptions to these generalizations include districts that have arrival times later in the afternoon, between the hours of 12:00 PM and 5:00 PM, and departure times earlier in the morning, between the hours of 7:00 AM and 10:00 AM. Districts with this "reversed" distribution include the Saint Louis Park, South Saint Paul, Southtown, and West End Freight District which shows a clear bimodal distribution, but with a peak of freight departures in the morning and a peak of freight arrivals in the afternoon.

Inter-/Intra-Regional Trips

The start and stop points of each trip were reviewed to calculate the percentage of freight trips with an origin or destination outside of the 7-county metro, within the metro, or even within the same freight district.

On average, 33 percent of all freight trips start or end at a point outside of the metro, but this varies substantially from district to district. The districts with the highest proportion of inter-regional trips include Minnesota Valley (52 percent), Eagan (52 percent), Shakopee (51 percent), South Saint Paul (48 percent), West Bloomington (44 percent), and Hopkins (41 percent). The proportion of inter-

regional trips at the remaining districts ranges from nineteen percent at Southdale to 35 percent at Eden Prairie Center.

Also of note are districts with a relatively high proportion of inter-district trips. In the Plymouth district, 10 percent of all freight trips start and end within the district. Other districts with a higher proportion of inter-district trips include Downtown Saint Paul (8 percent), Golden Triangle (8 percent), Saint Louis Park (6 percent), and Centennial Lakes (6 percent).

Truck Type

The INRIX data distinguishes between medium and heavy trucks. This information helps provide insight into the type of truck that is predominant in each district.

The data show a very strong correlation between the proportion of inter-regional trips and the proportion of heavy trucks. This result is expected as it is generally most cost-effective to use heavier vehicles such as semi-trailers for long-haul trips. The Hopkins has the highest proportion of heavy truck trips at 63 percent. Districts with high concentrations of retail activity such as Downtown Saint Paul and the West End District show a very low proportion of heavy trucks.

One notable exception to this finding is the South Saint Paul District. Despite having the fourth-highest proportion of inter-regional trips, the South Saint Paul District has a heavy truck proportion of only 22 percent.

Predominant Freight Industries

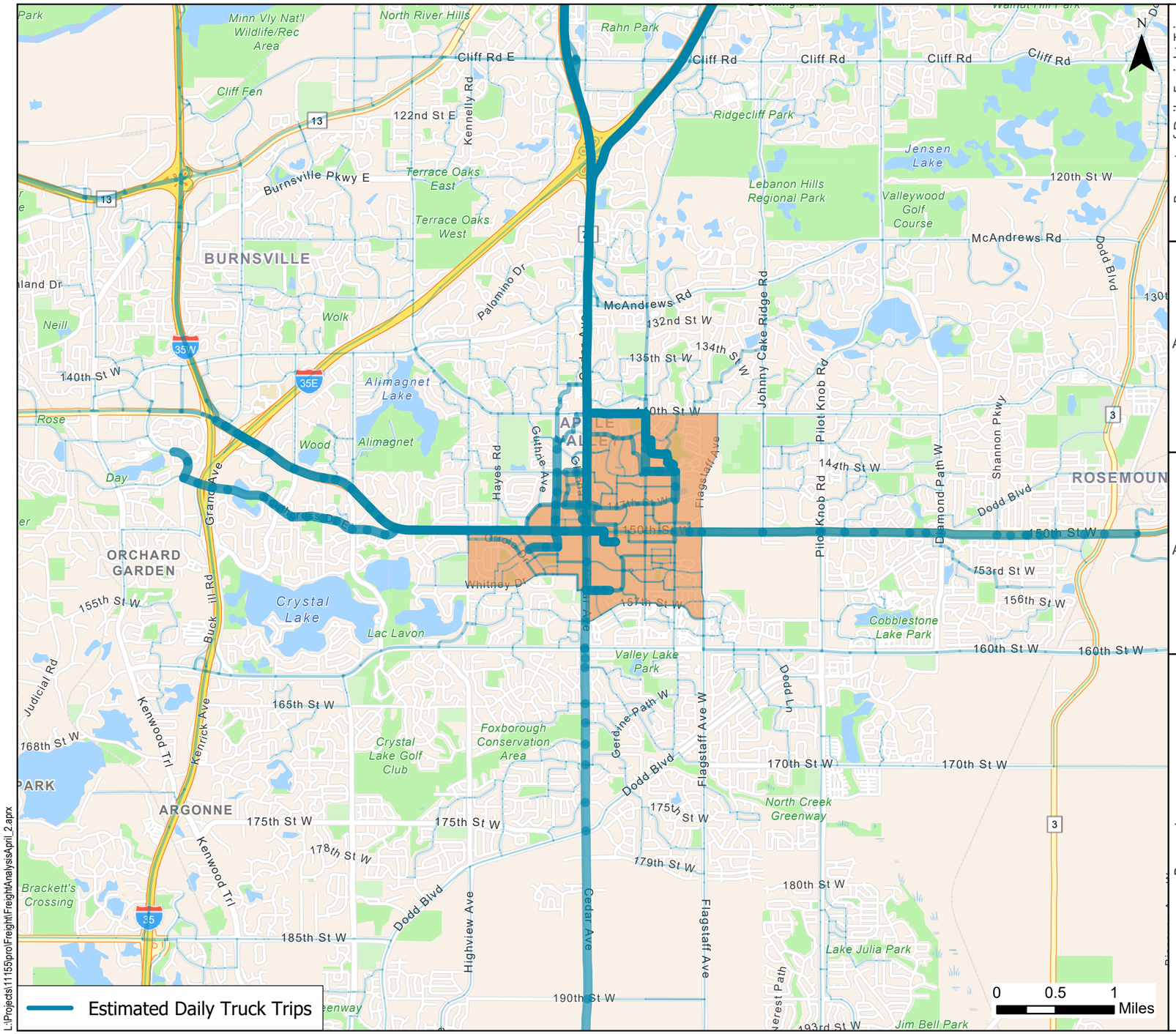
The InfoUSA sample was reviewed to identify the NAICS industries that are predominant in each district. Table 5 highlights the top three industries in each district along with the proportion of estimated freight trips associated with each. Similar information for the top ten industries in each district is shown on the figures in Attachment 1.

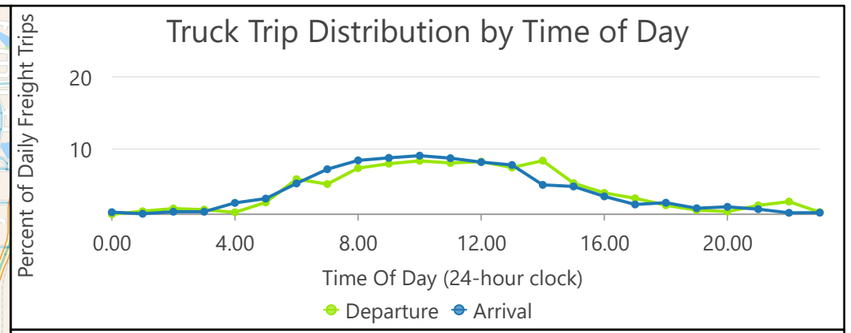
This can be used to identify the industries that are predominant in each district, but can also be used to assess the level of specialization in each freight district (i.e., the extent to which freight trips are concentrated in only a handful of industries). This was completed by comparing the percent of total estimated truck trips included in the top ten industries.

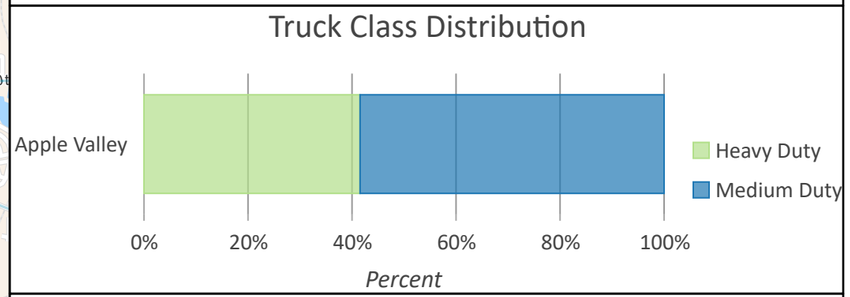
The majority of districts contain a high degree of specialization including Apple Valley, Chanhassen, Eden Prairie Center, and Southdale. In these districts, between 88 and 96 percent of all estimated trips are included in the top three industry categories.

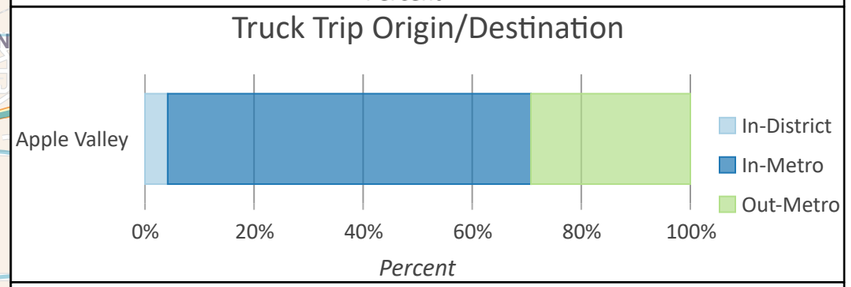
Conversely, districts with a low level of specialization include Downtown Saint Paul, Golden Valley, and Eagan. In these districts, between 64 and 74 percent of all estimated trips are included in the top three industry categories.

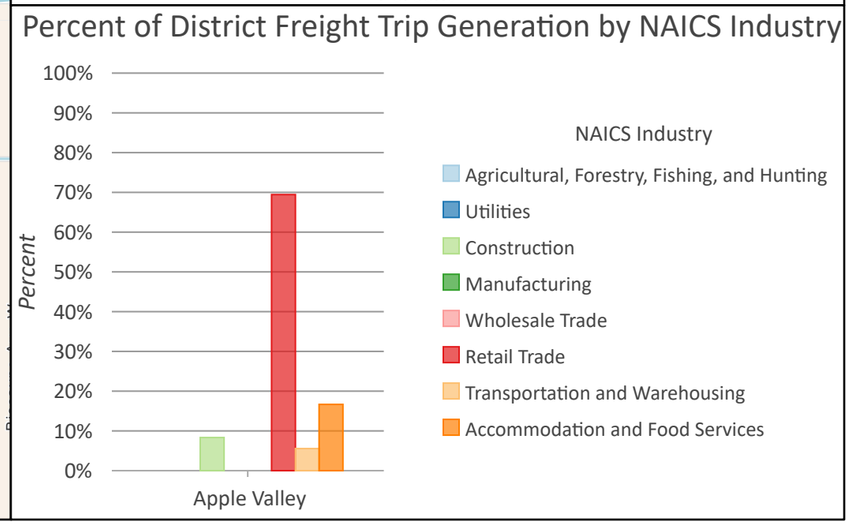
Attachment 1: Freight District Summary Sheets











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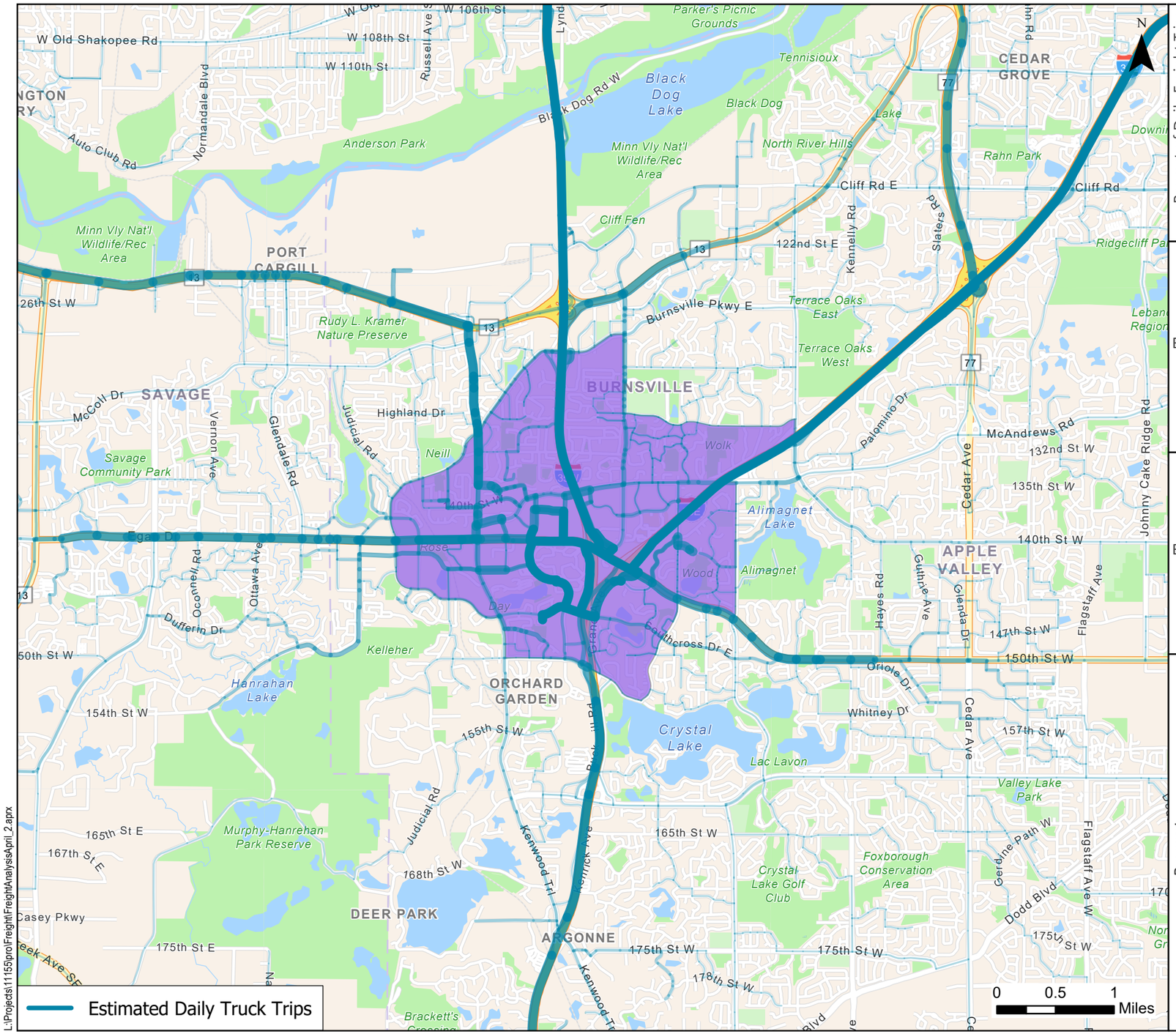
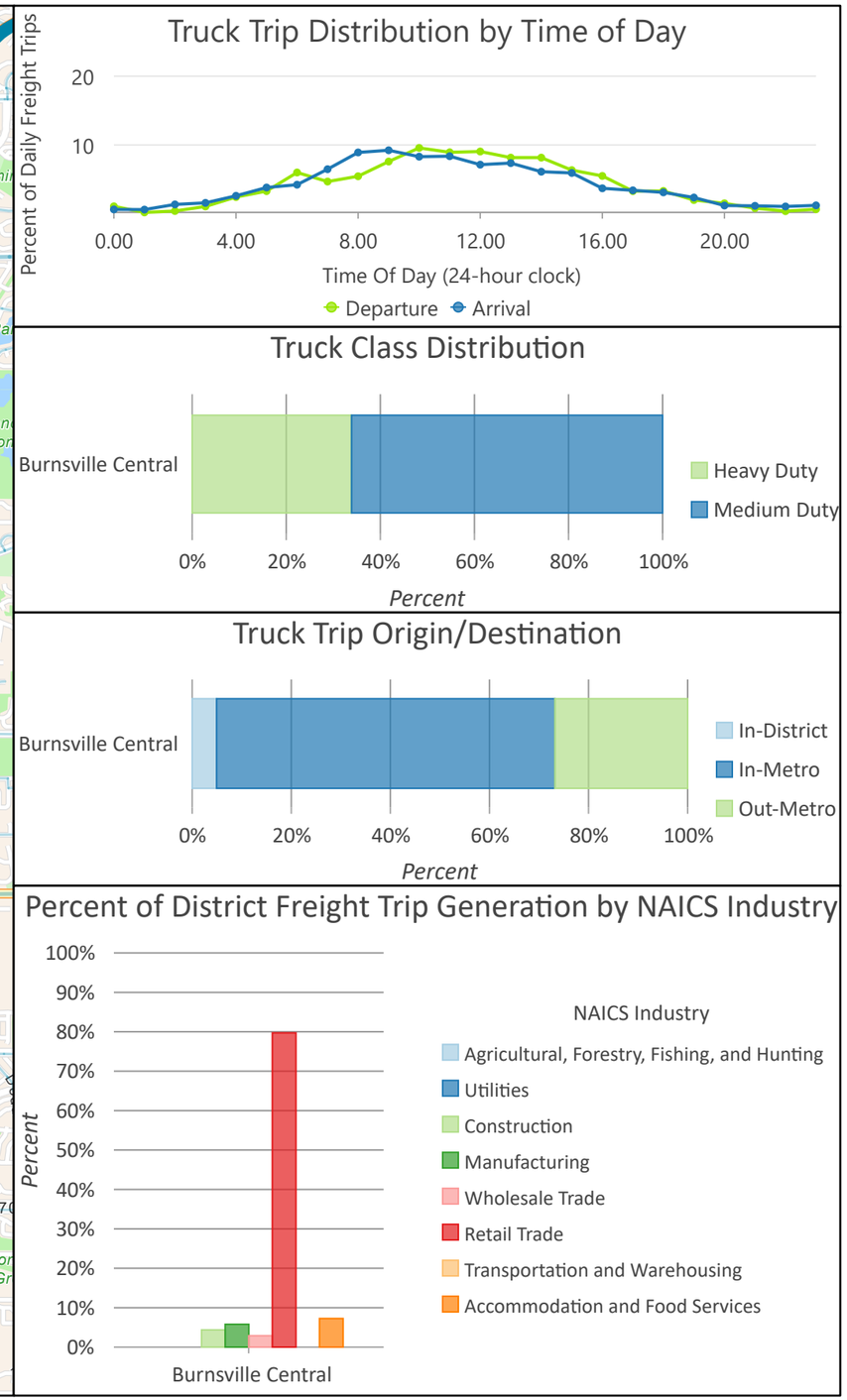
Estimated Truck Trips Originating from or Terminating at Apple Valley Freight District

I-494 Corridor Freight Study

Minnesota Department of Transportation

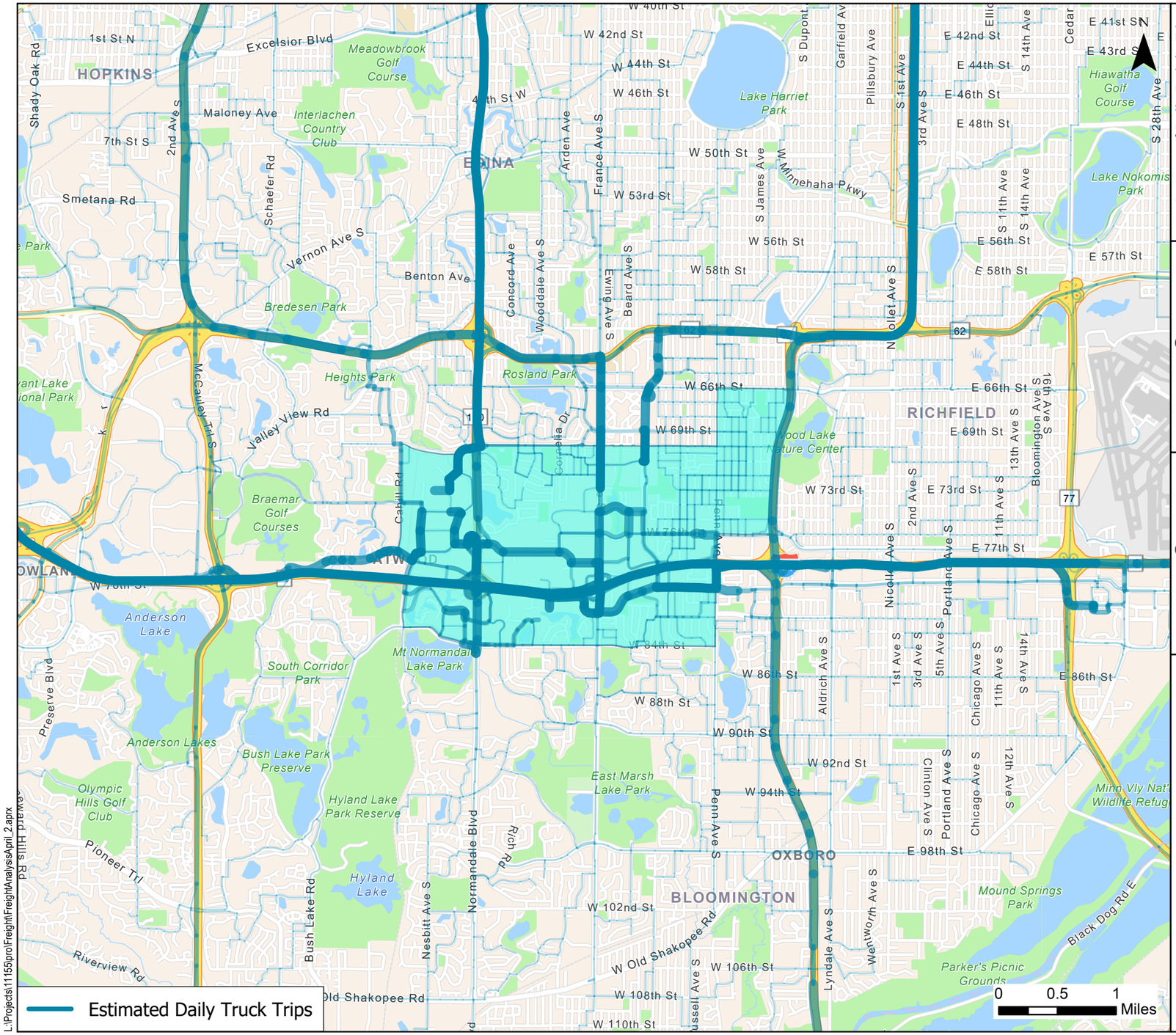


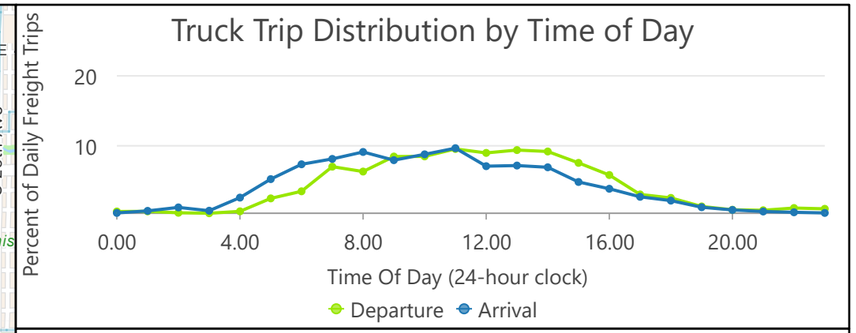


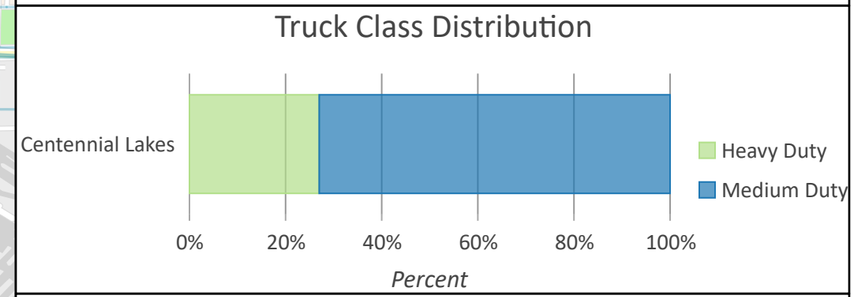
Estimated Truck Trips Originating from or Terminating at Burnsville Central Freight District

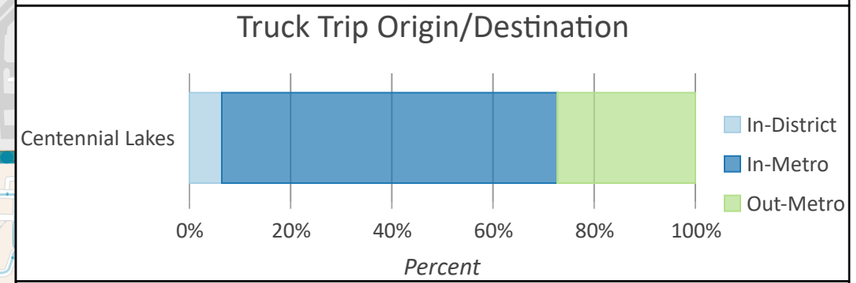
I-494 Corridor Freight Study

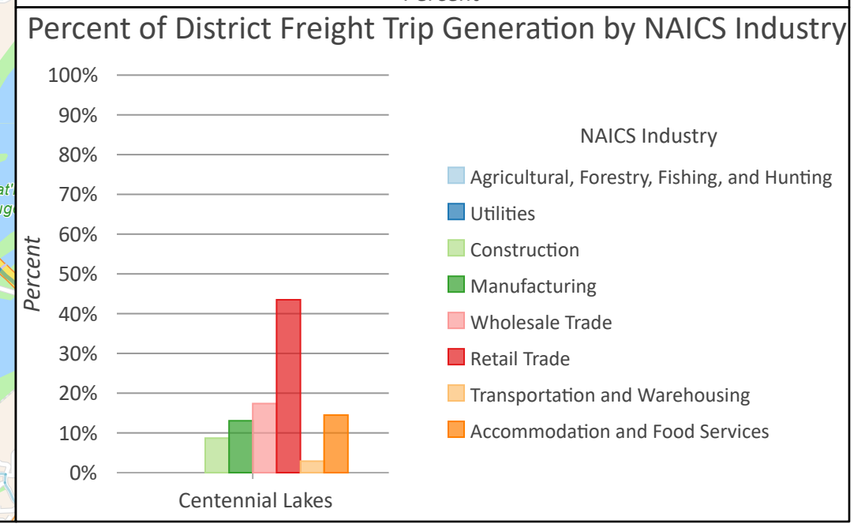
Minnesota Department of Transportation











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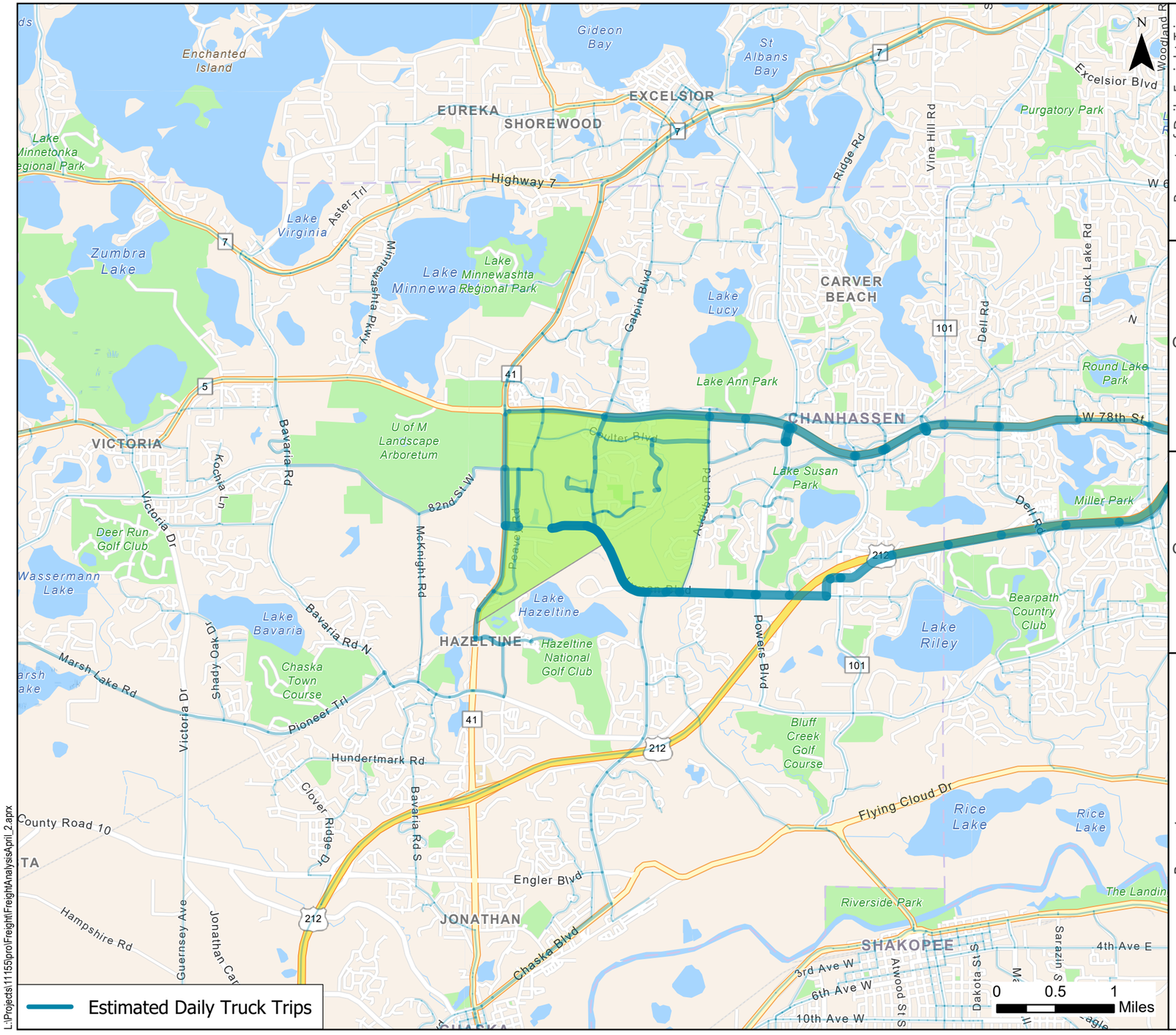
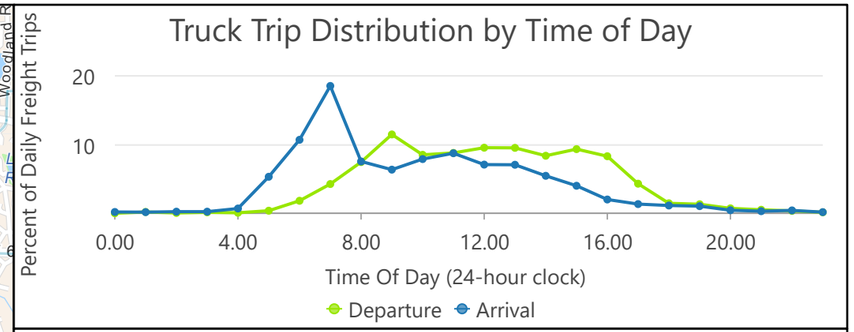
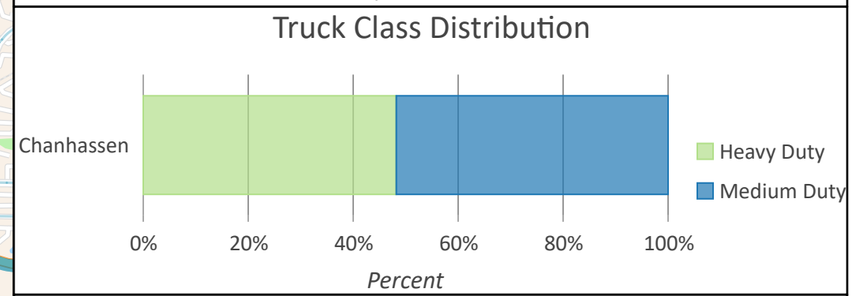
Estimated Truck Trips Originating from or Terminating at Centennial Lakes Freight District

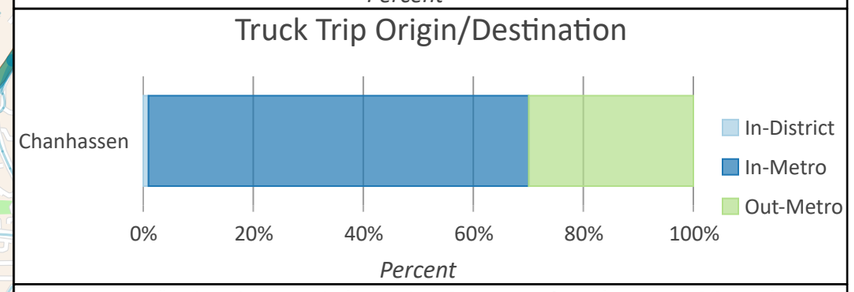
I-494 Corridor Freight Study

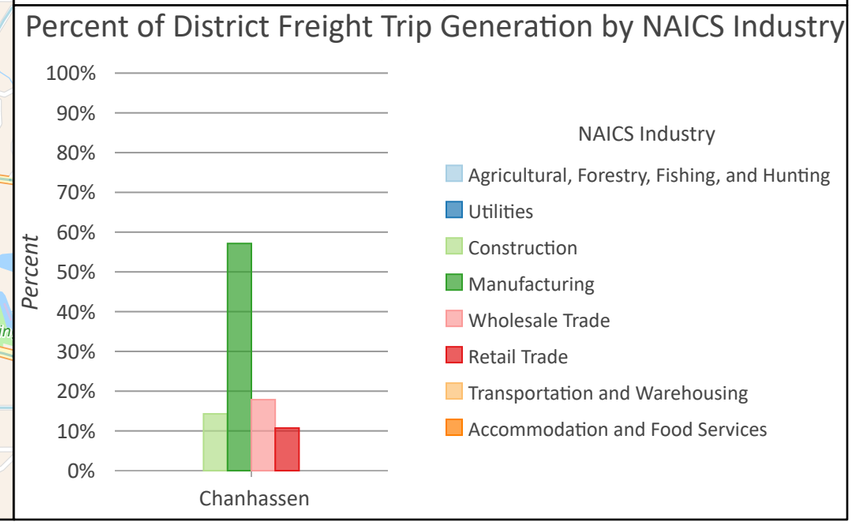
Minnesota Department of Transportation







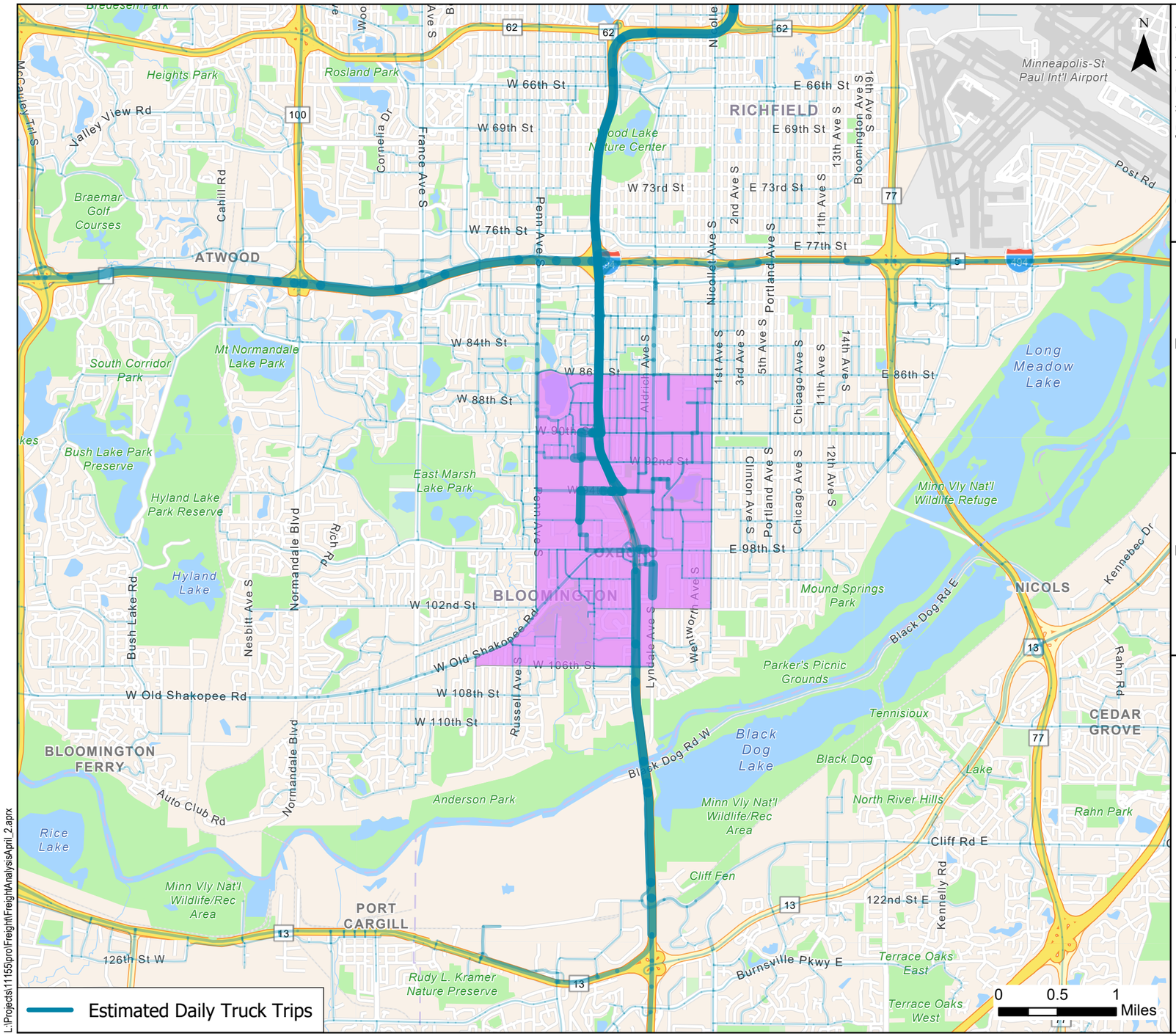


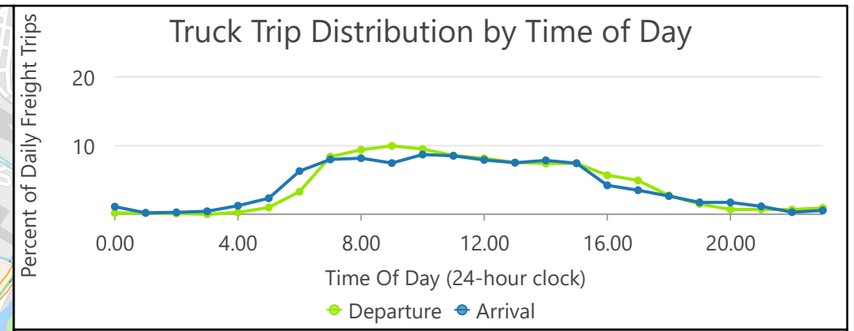


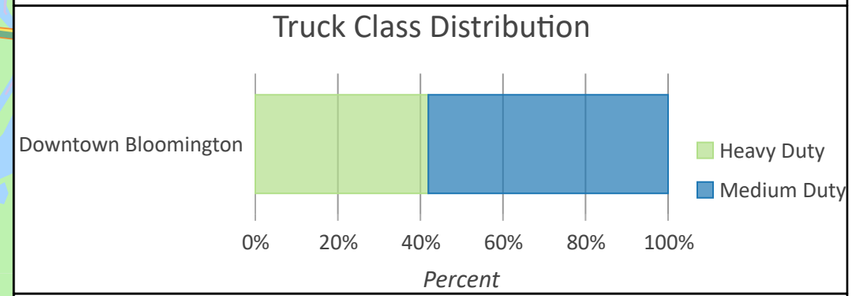
Estimated Truck Trips Originating from or Terminating at Chanhassen Freight District

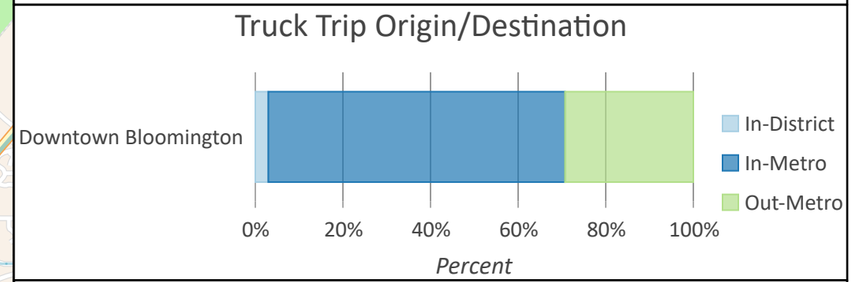
I-494 Corridor Freight Study

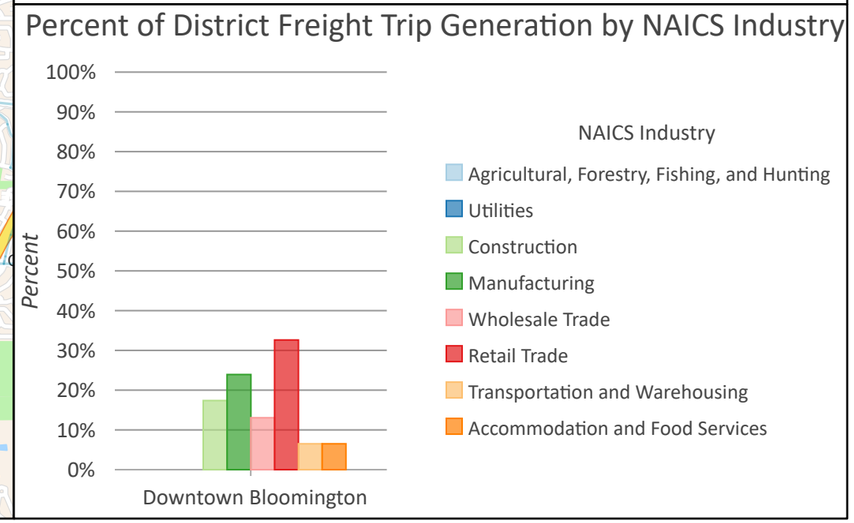
Minnesota Department of Transportation











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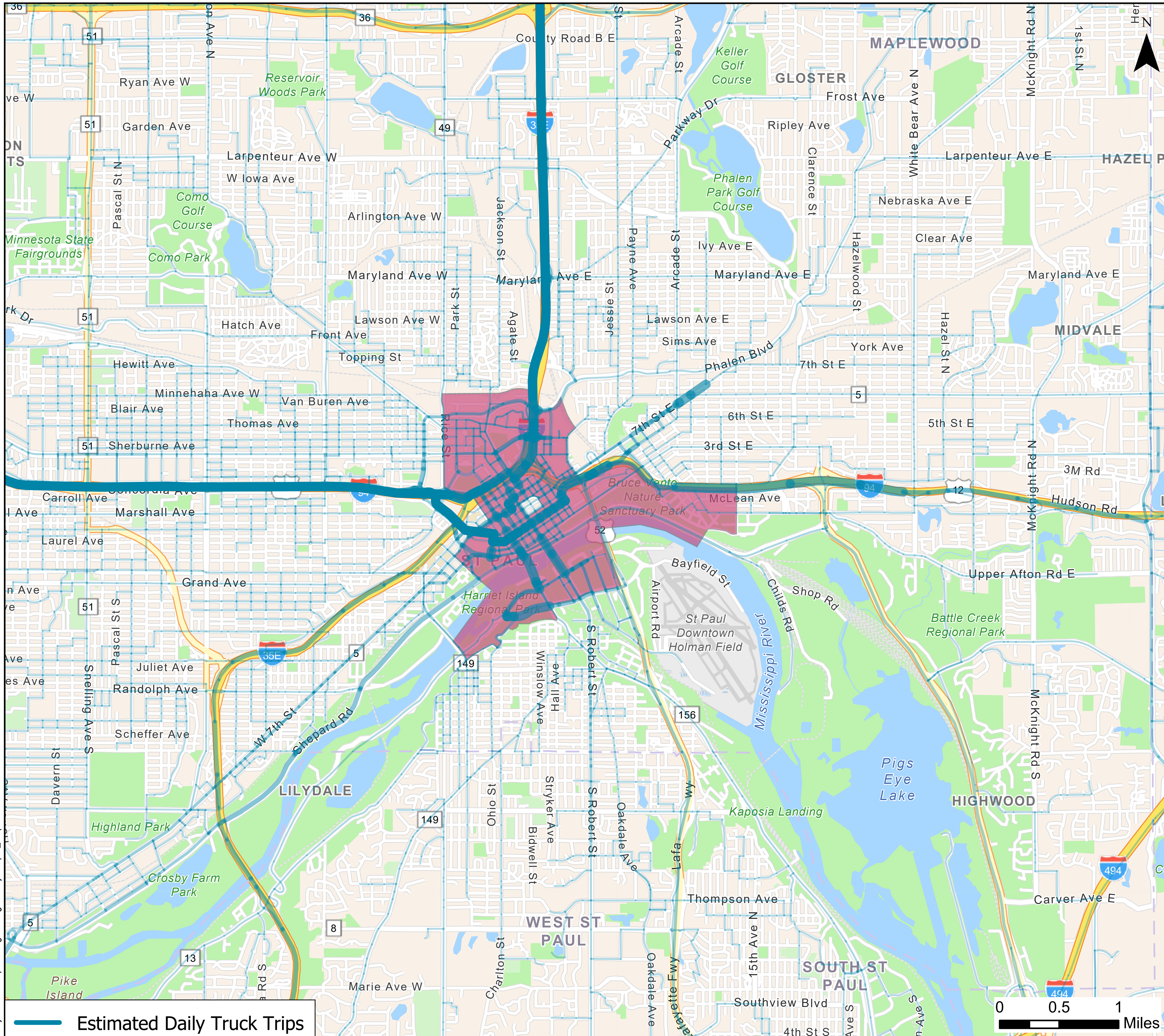
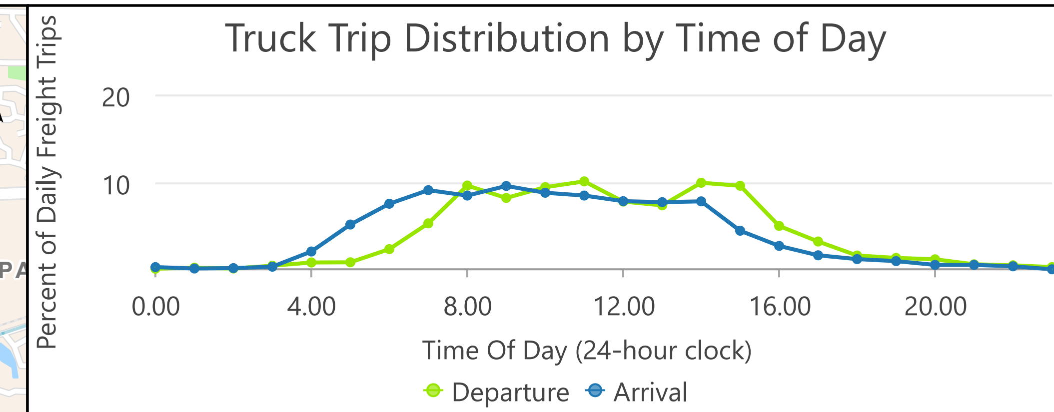
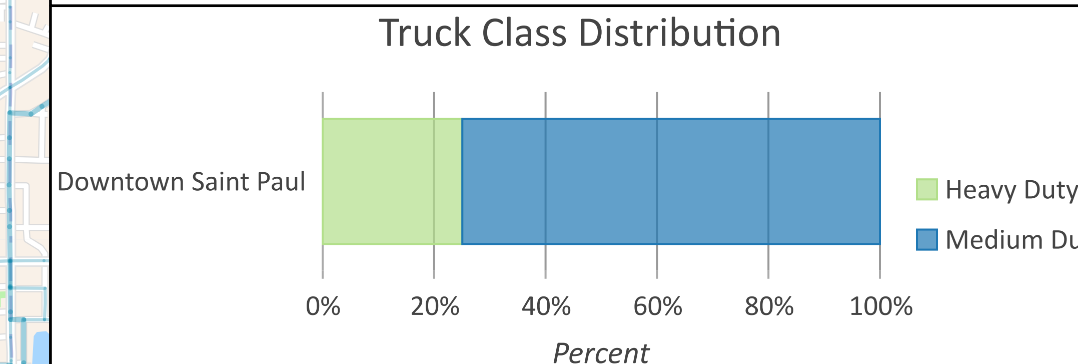
Estimated Truck Trips Originating from or Terminating at Downtown Bloomington Freight District

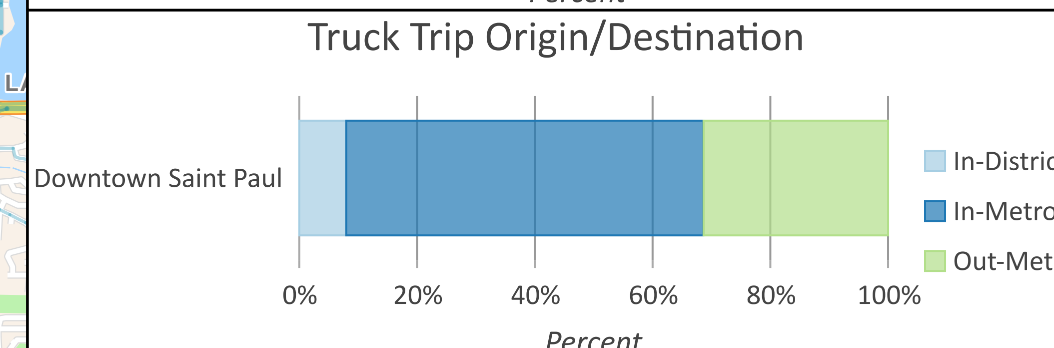
I-494 Corridor Freight Study

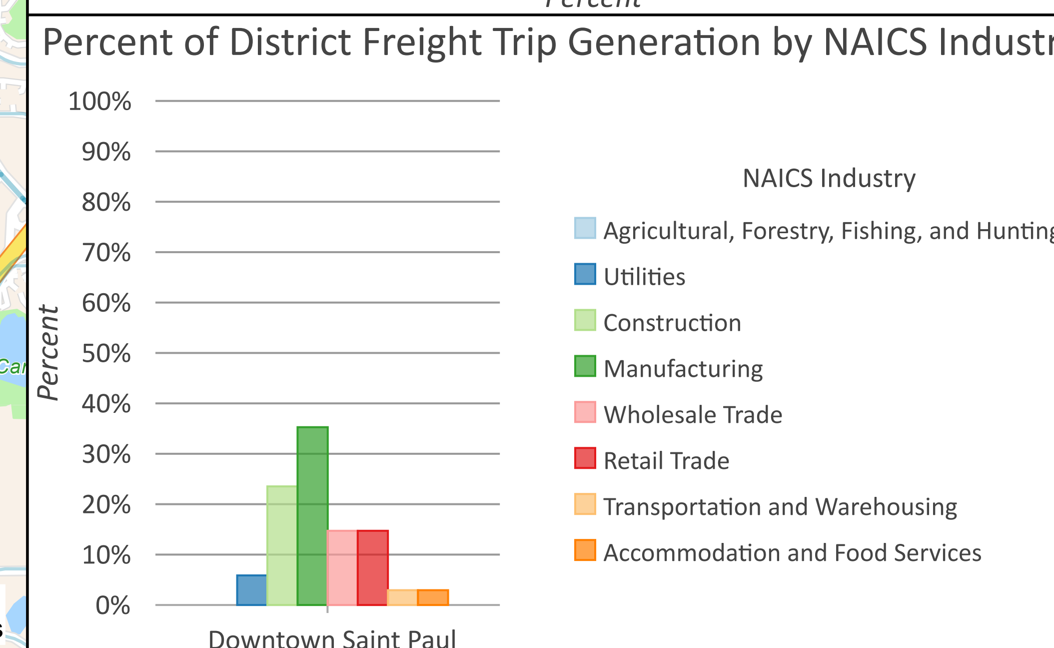
Minnesota Department of Transportation











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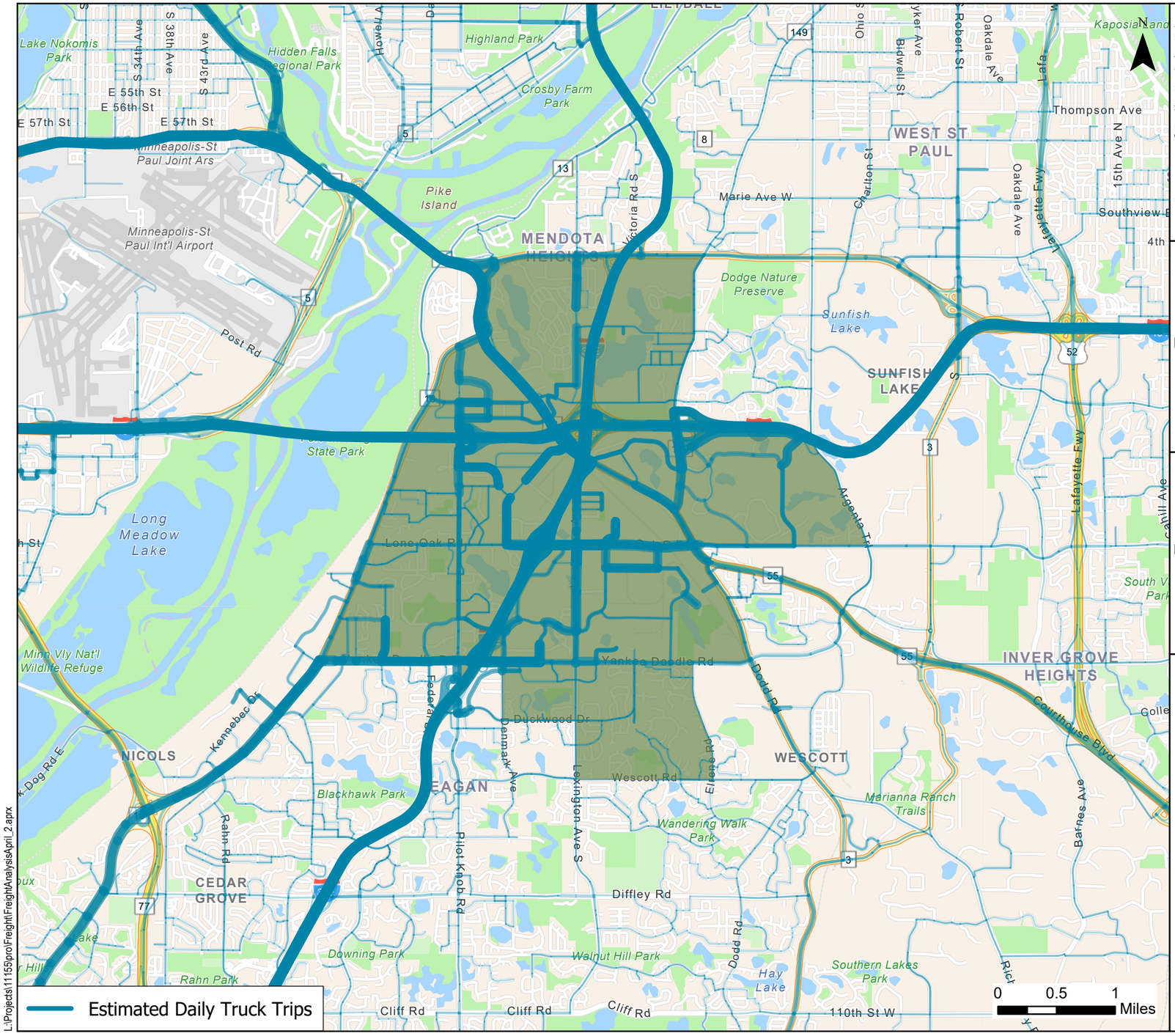
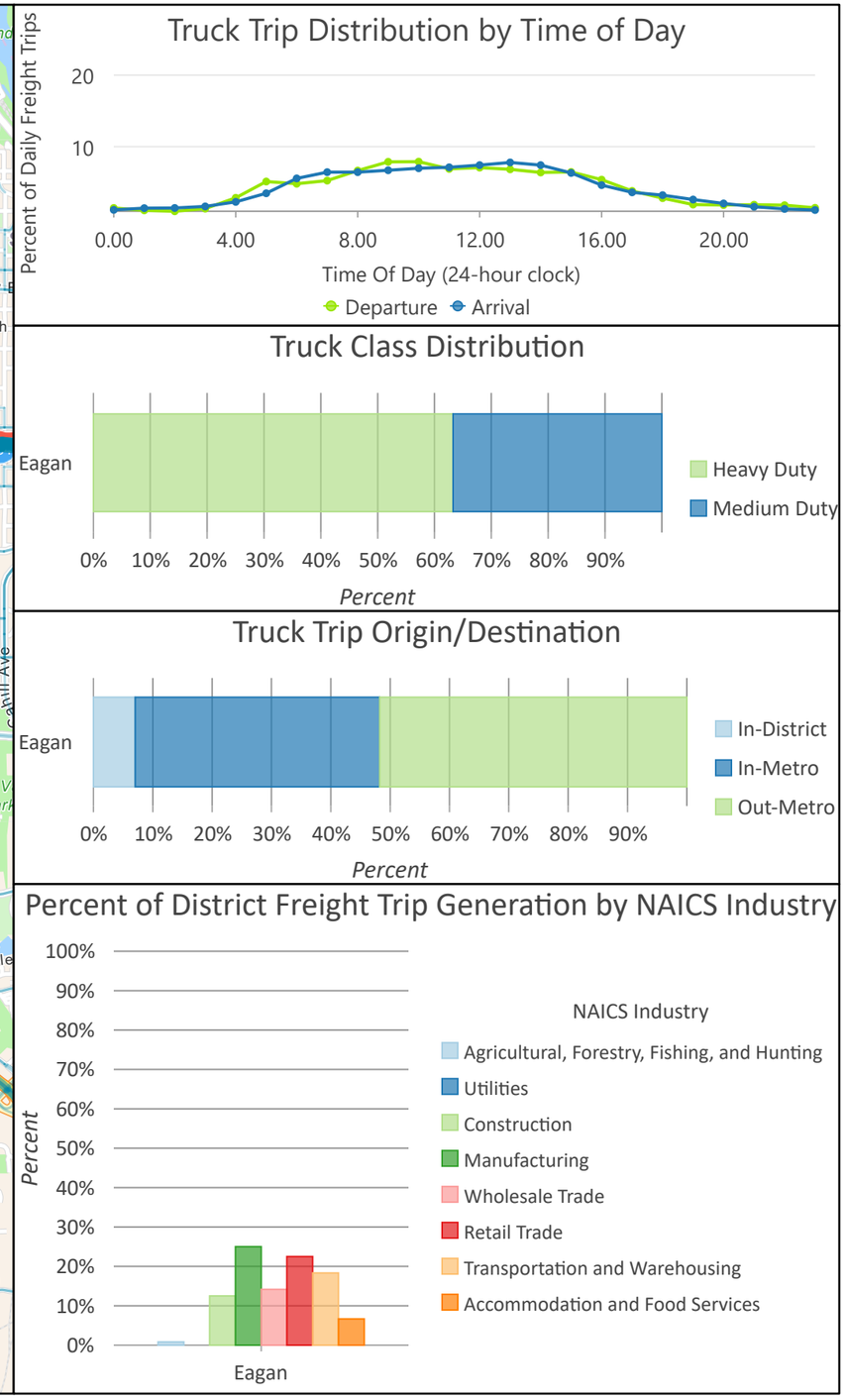
Estimated Truck Trips Originating from or Terminating at Downtown Saint Paul Freight District

I-494 Corridor Freight Study

Minnesota Department of Transportation





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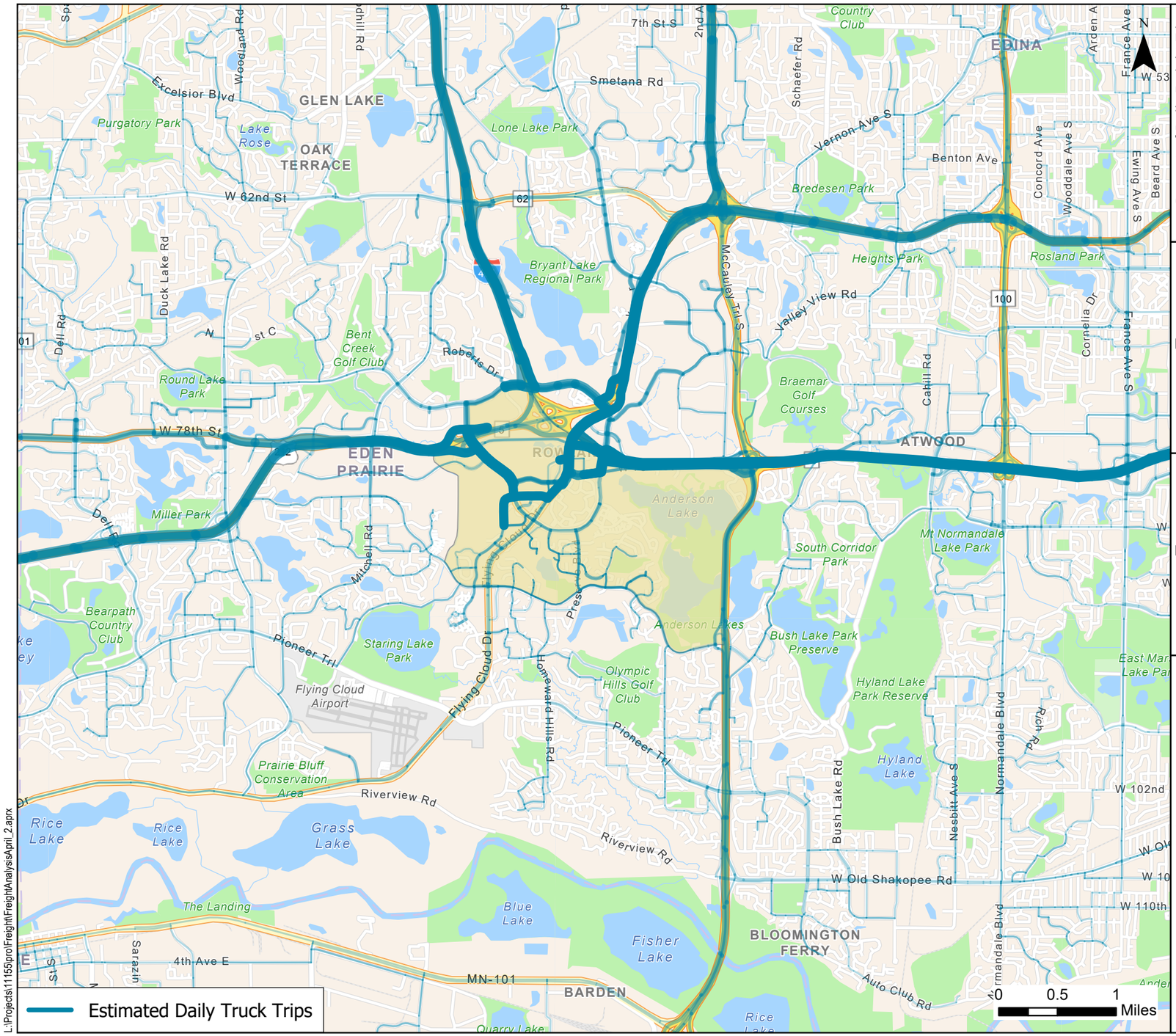
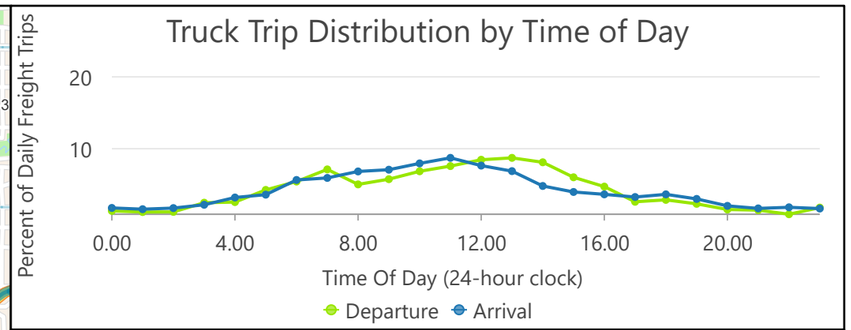
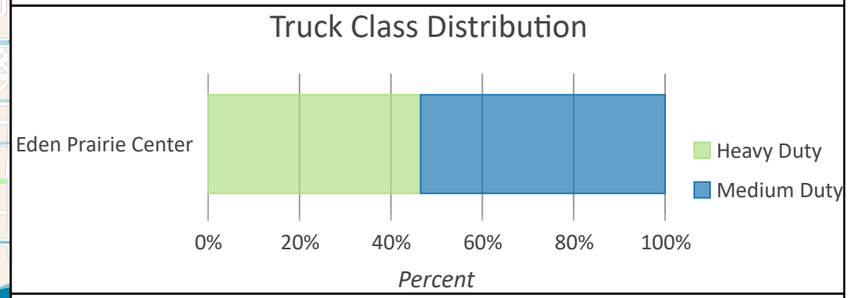
Estimated Truck Trips Originating from or Terminating at Eagan Freight District

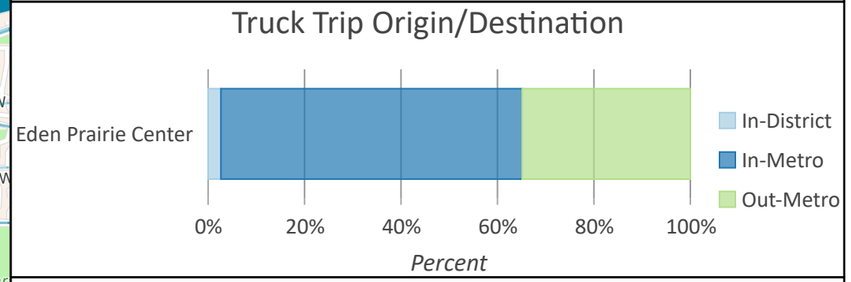
I-494 Corridor Freight Study

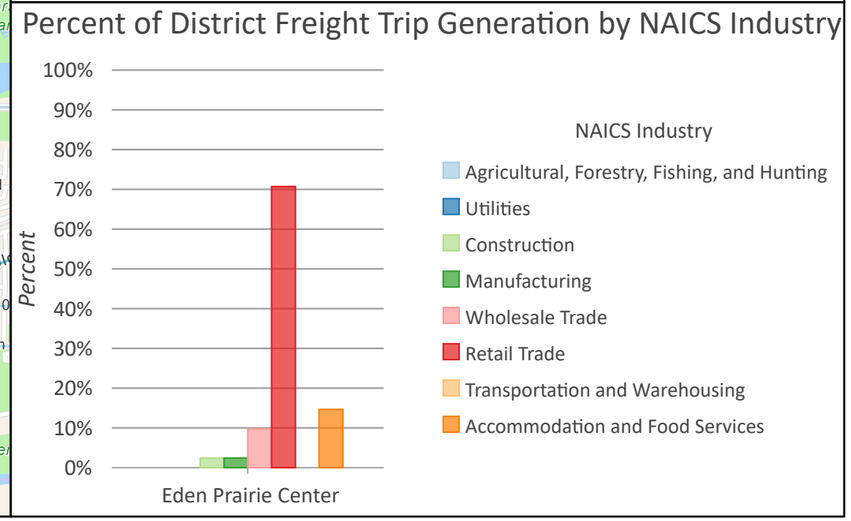
Minnesota Department of Transportation







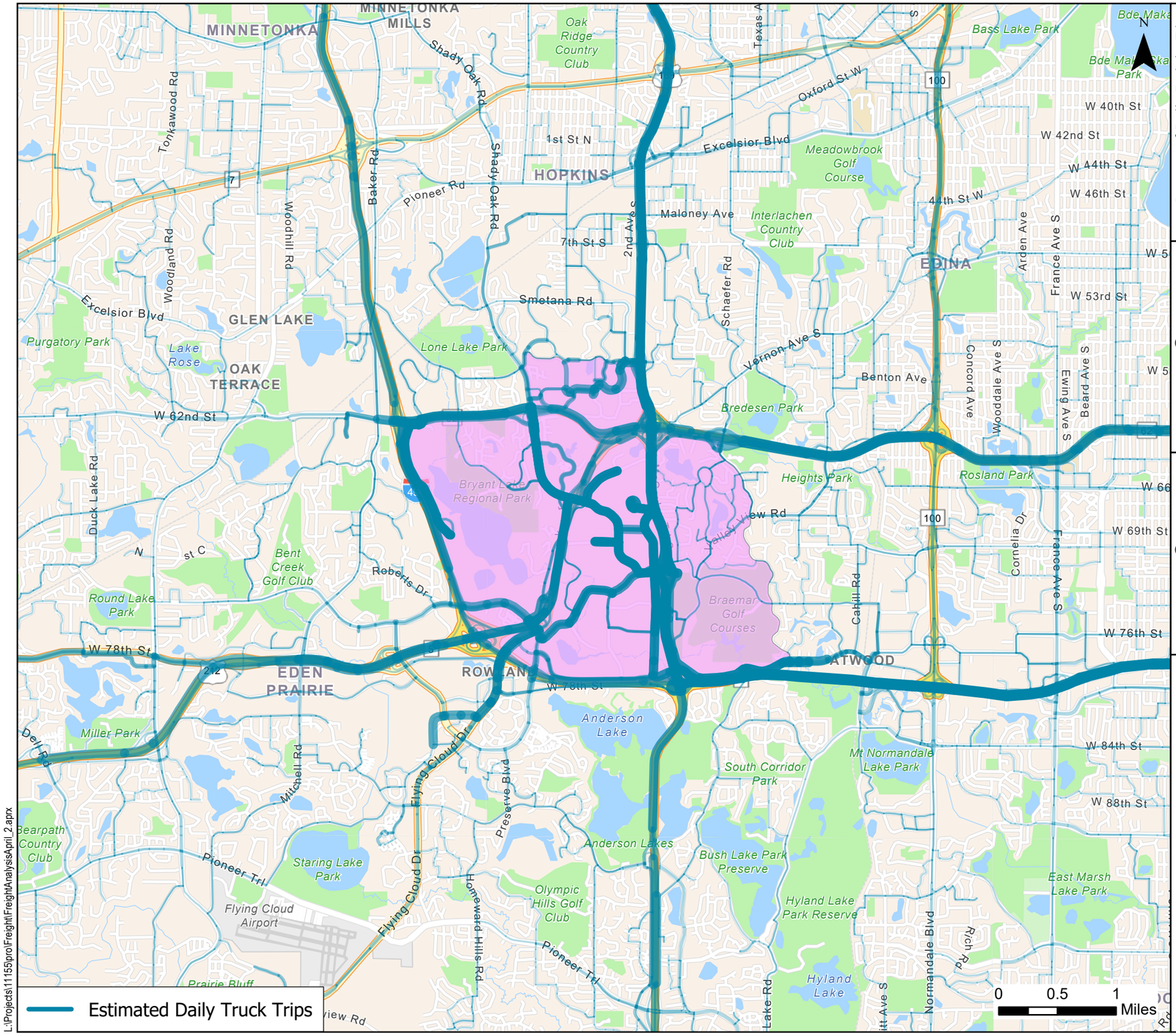




Estimated Truck Trips Originating from or Terminating at Eden Prairie Center Freight District

I-494 Corridor Freight Study

Minnesota Department of Transportation



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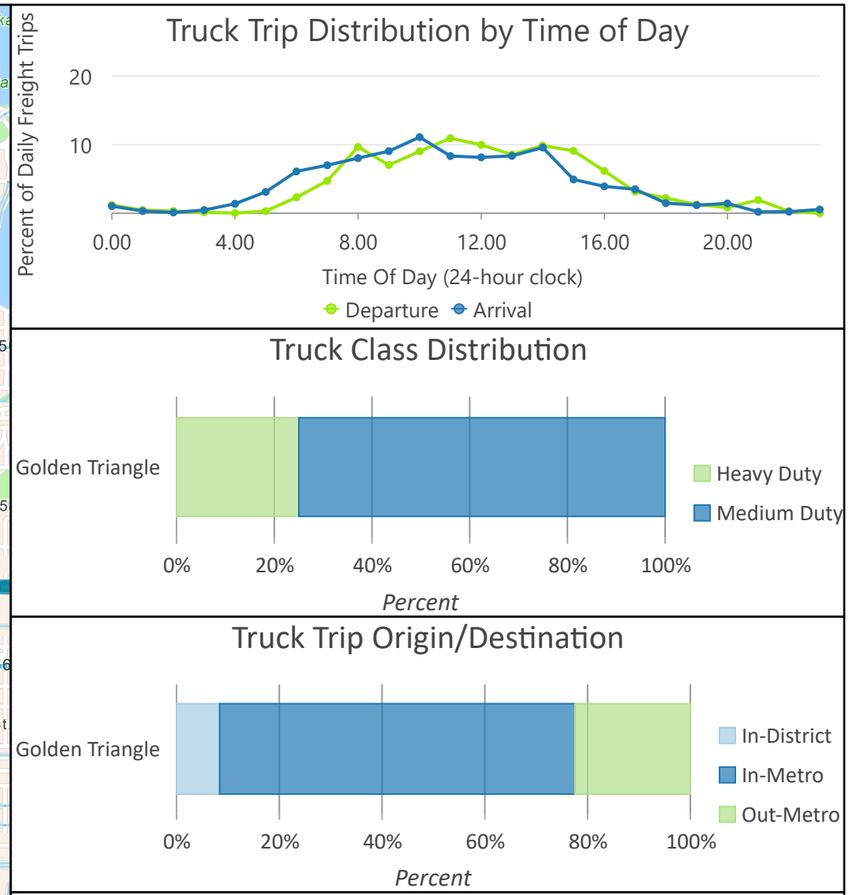
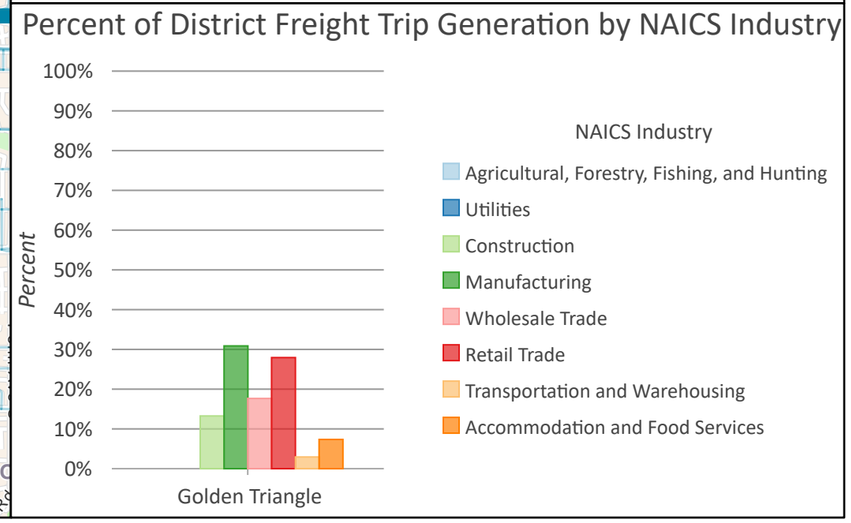
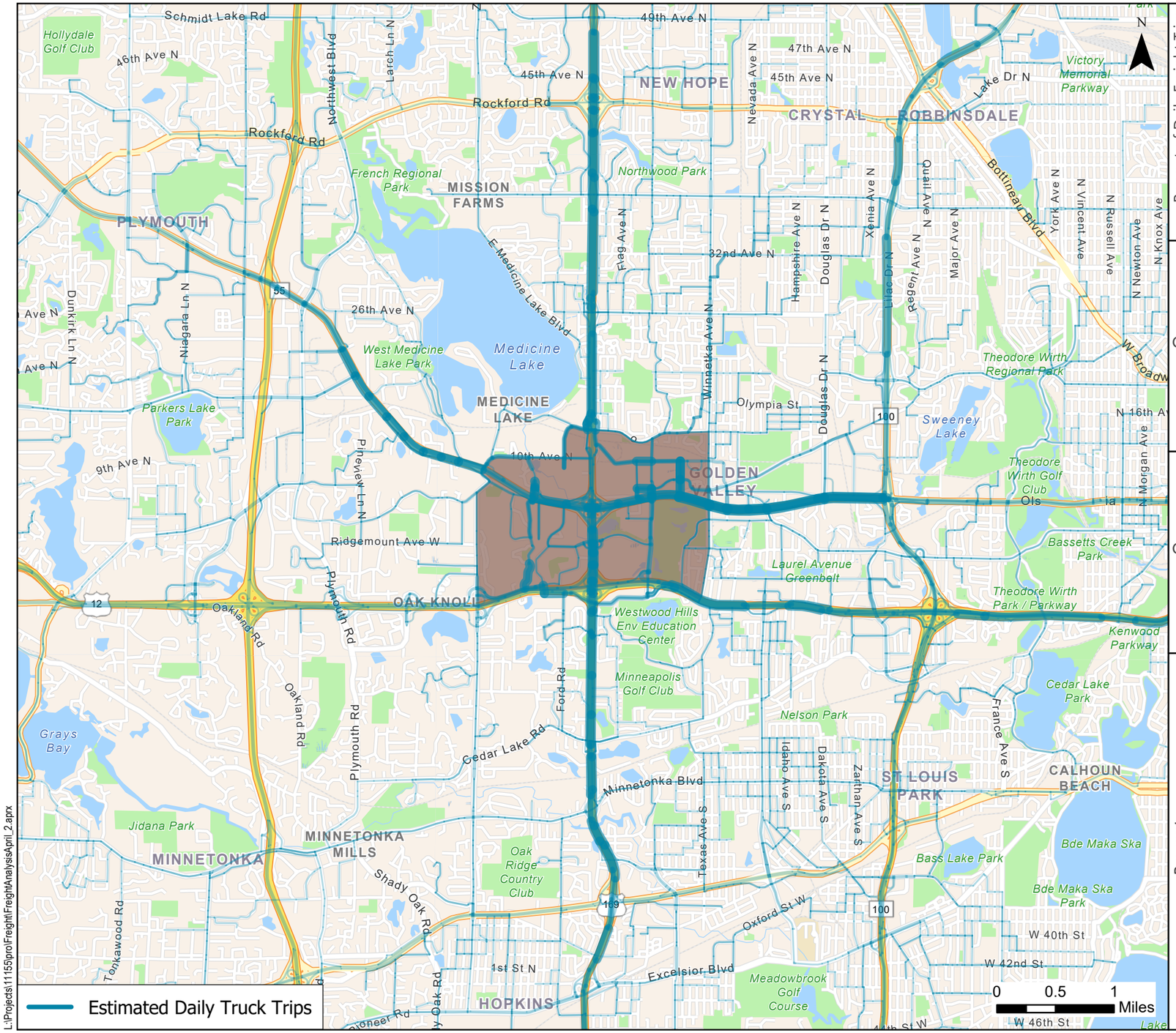




Estimated Truck Trips Originating from or Terminating at Golden Triangle Freight District

I-494 Corridor Freight Study

Minnesota Department of Transportation



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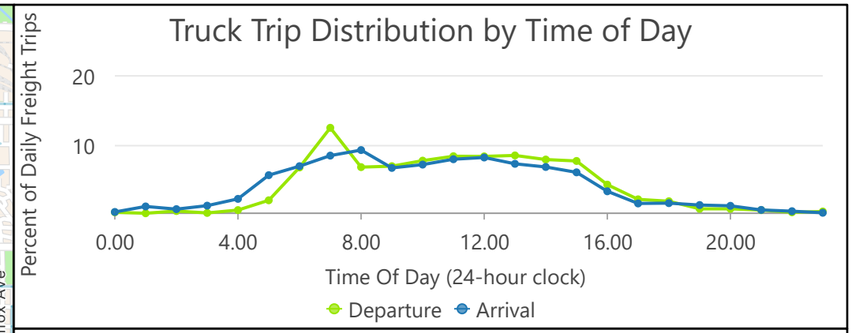
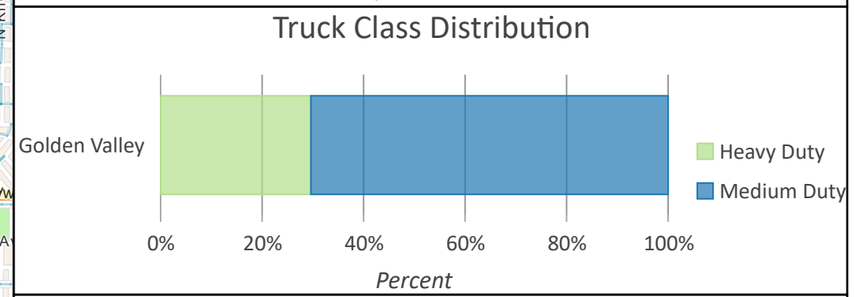
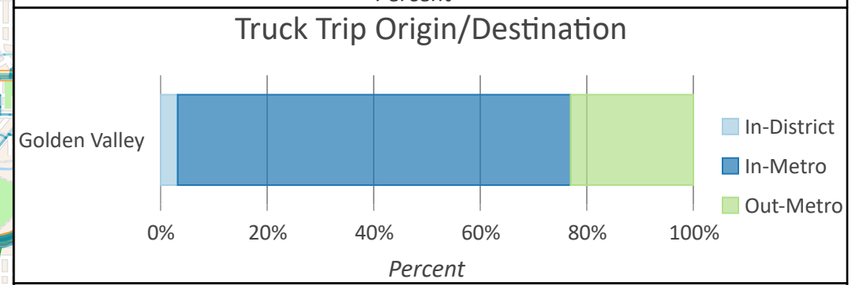
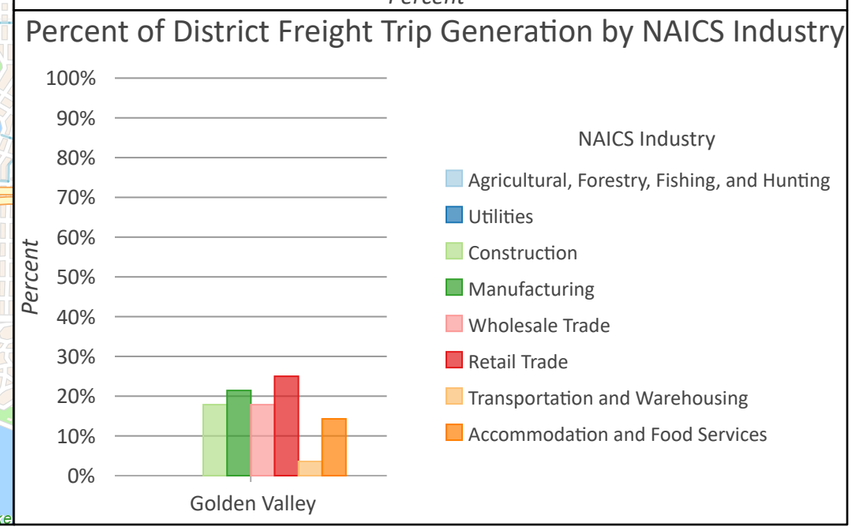




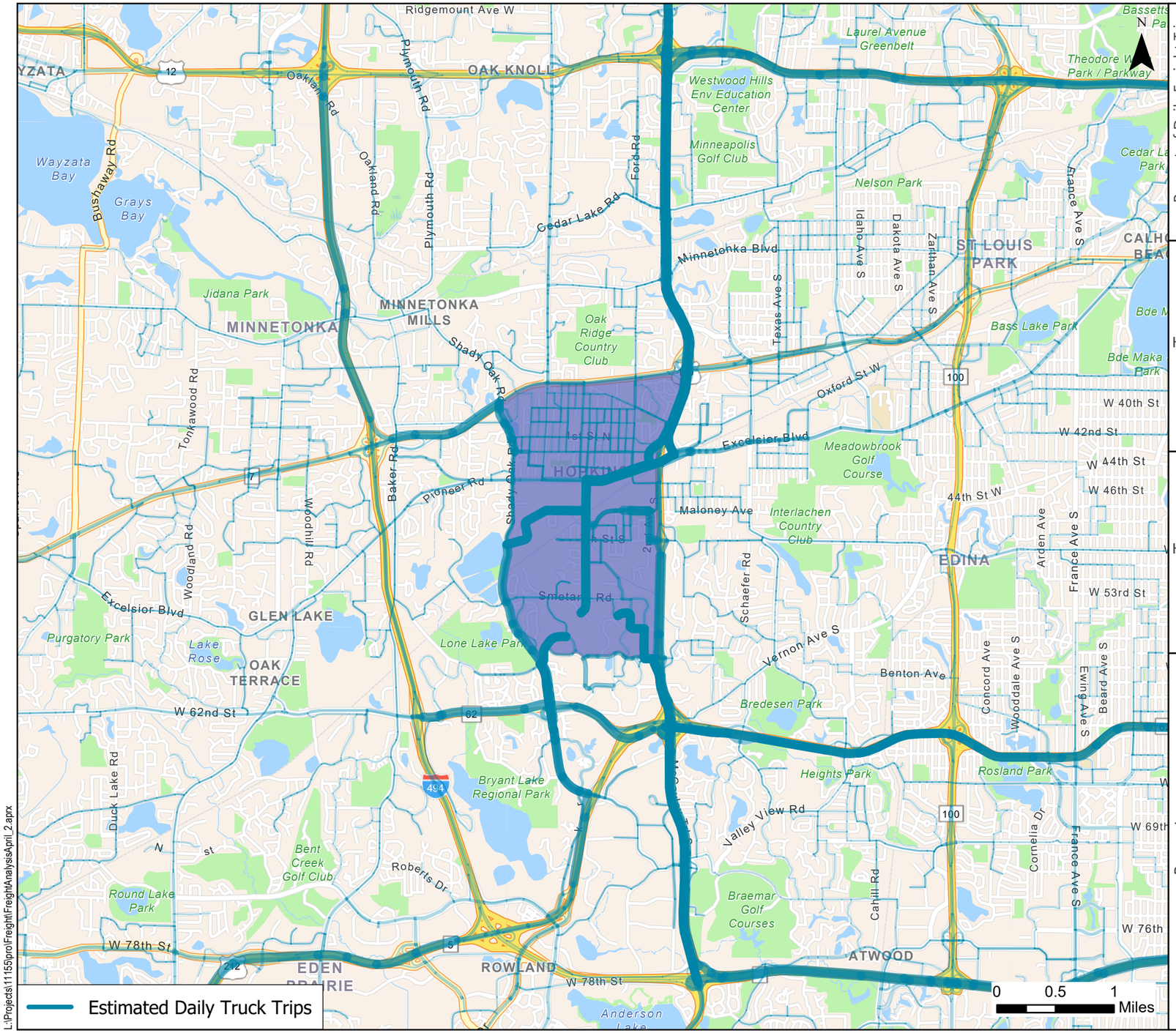


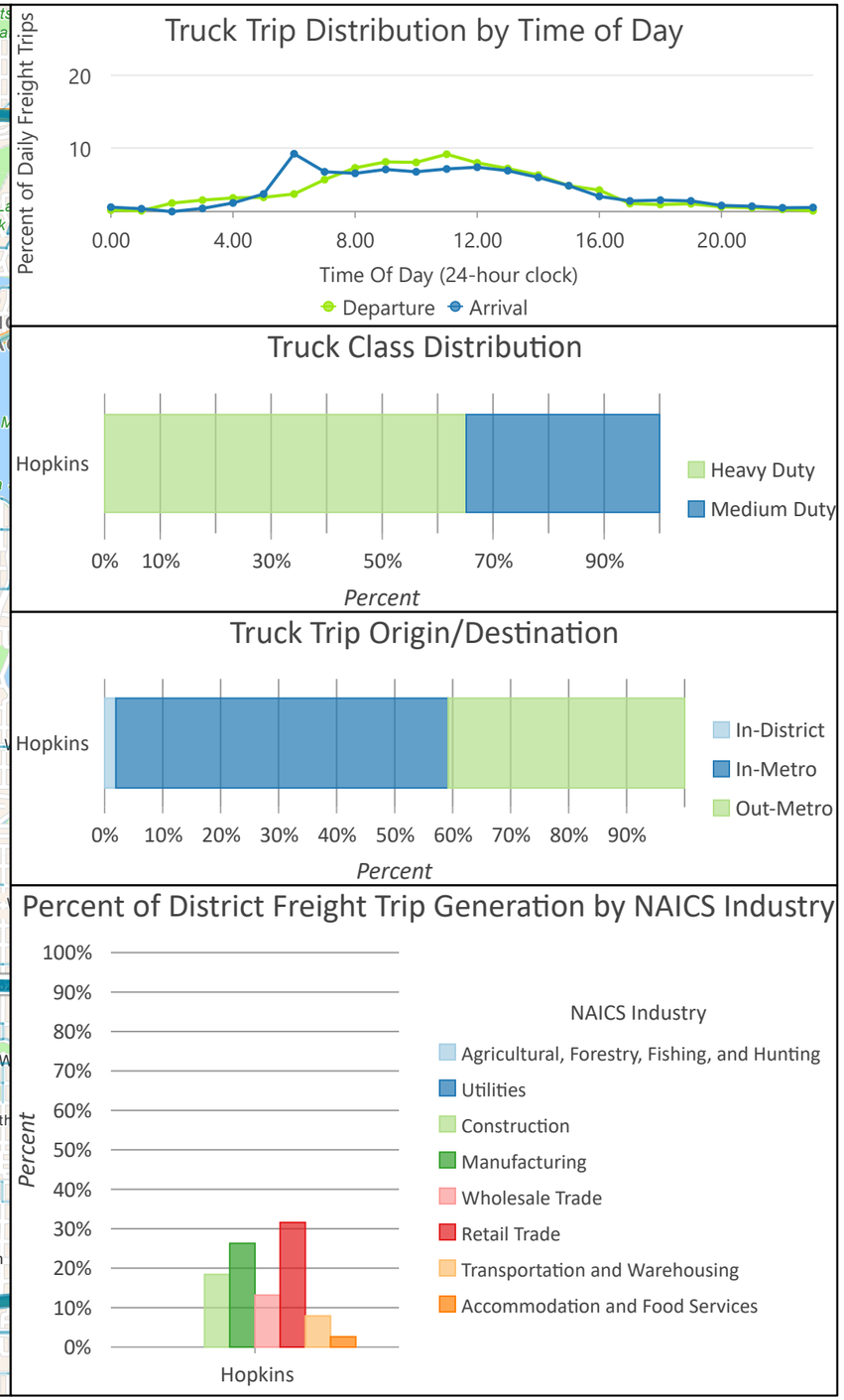


Estimated Truck Trips Originating from or Terminating at Golden Valley Freight District

I-494 Corridor Freight Study

Minnesota Department of Transportation





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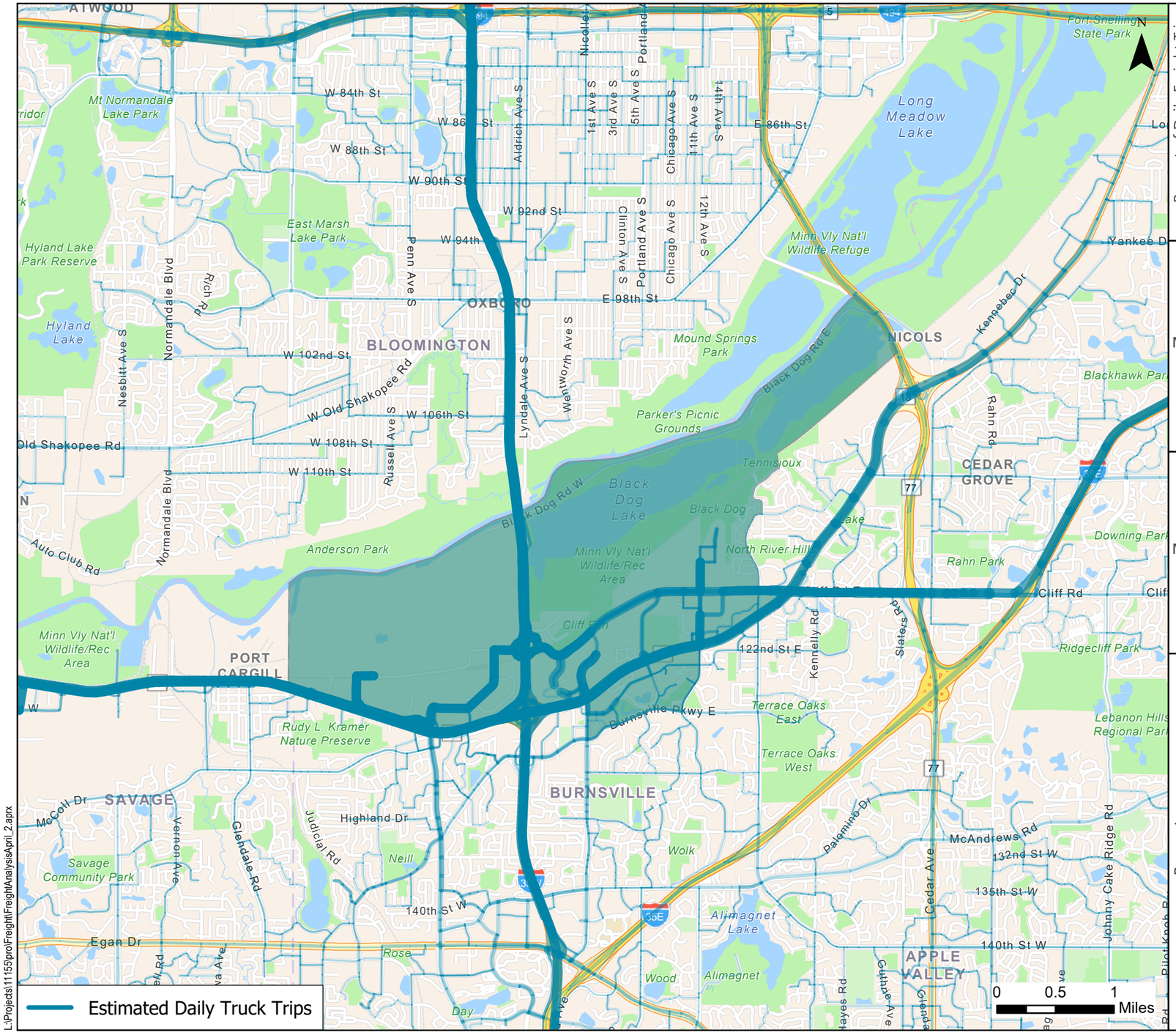
Estimated Truck Trips Originating from or Terminating at Hopkins Freight District

I-494 Corridor Freight Study

Minnesota Department of Transportation



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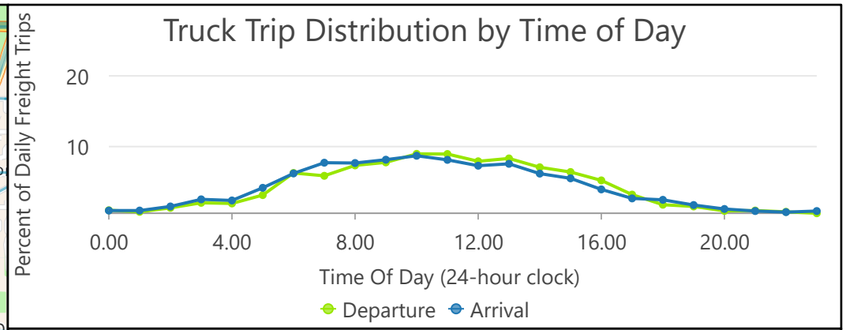
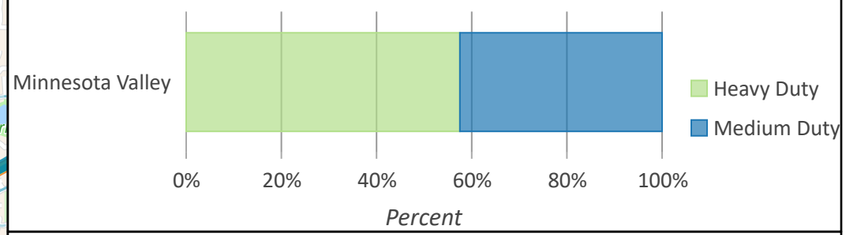
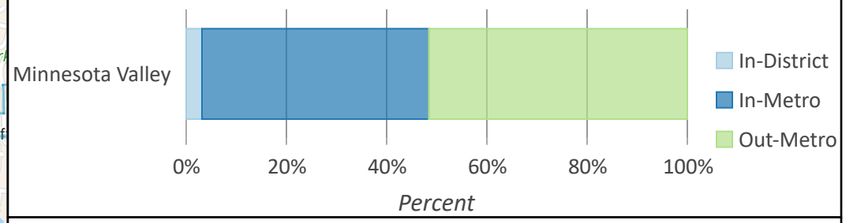
Truck Trip Distribution by Time of Day



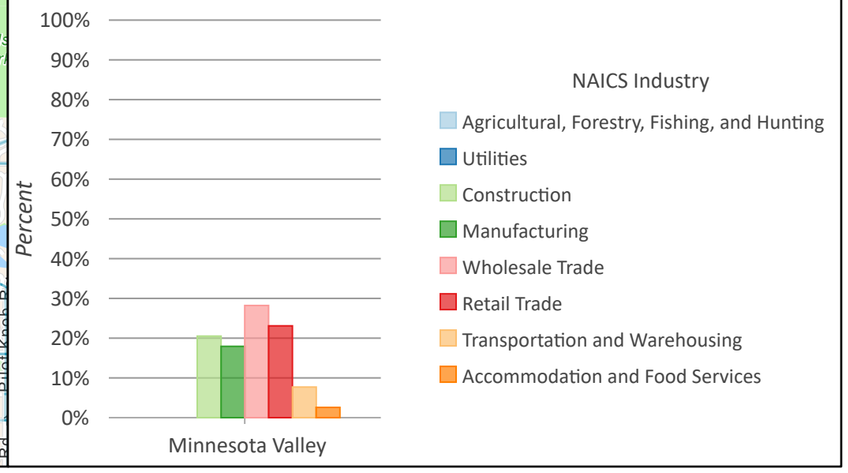
Truck Class Distribution



Truck Trip Origin/Destination



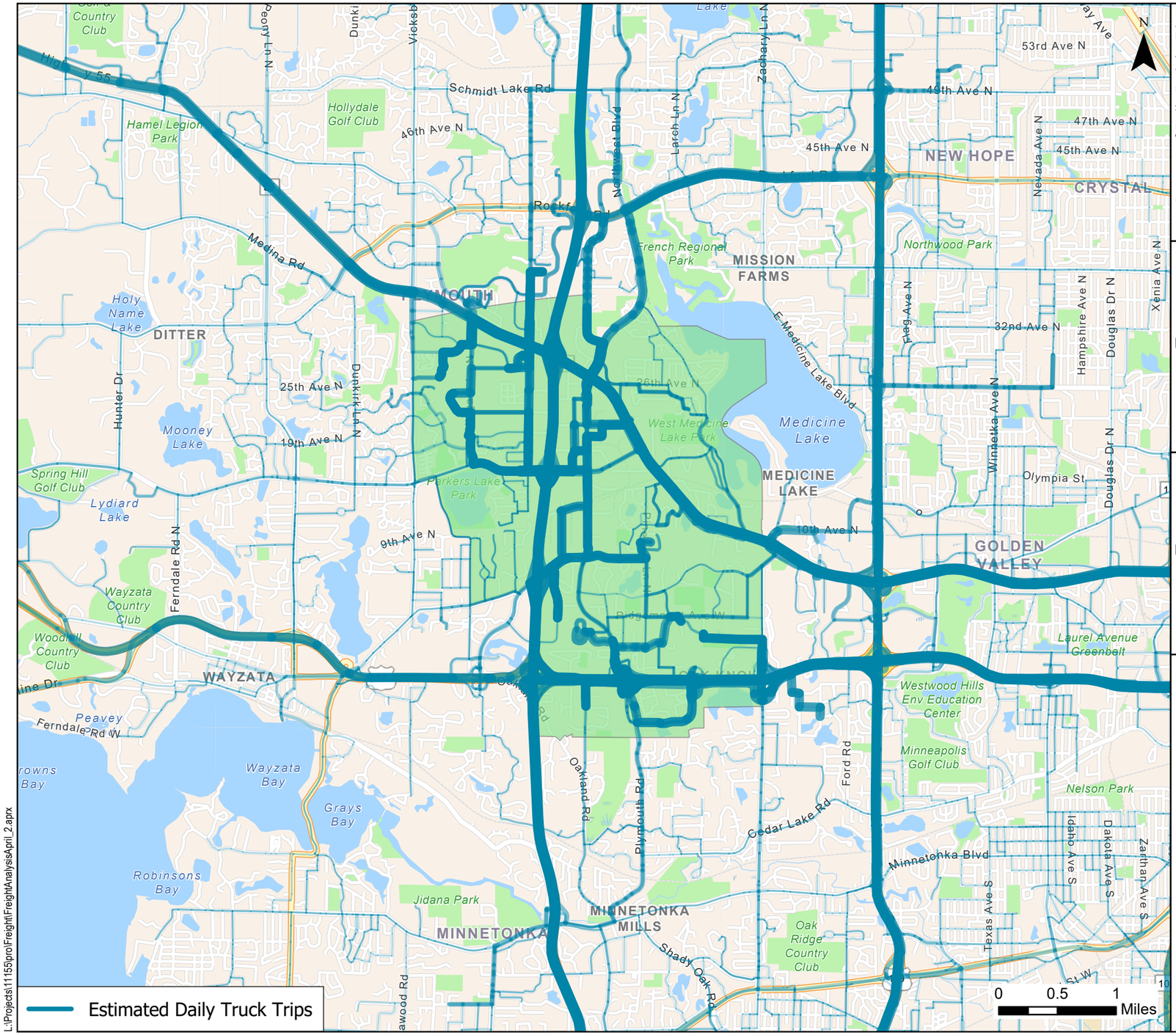
Percent of District Freight Trip Generation by NAICS Industry



Estimated Truck Trips Originating from or Terminating at Minnesota Valley Freight District

I-494 Corridor Freight Study

Minnesota Department of Transportation



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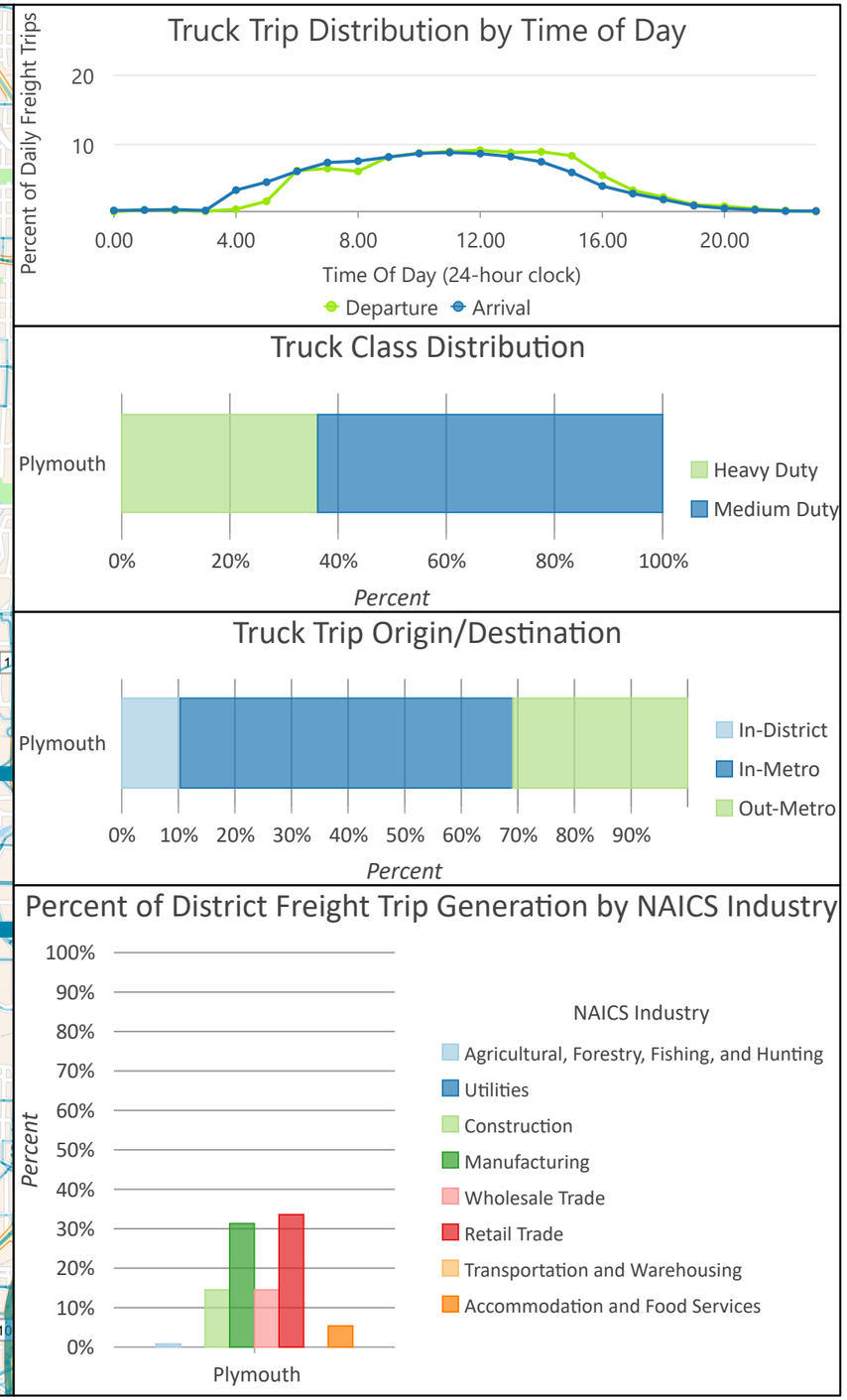
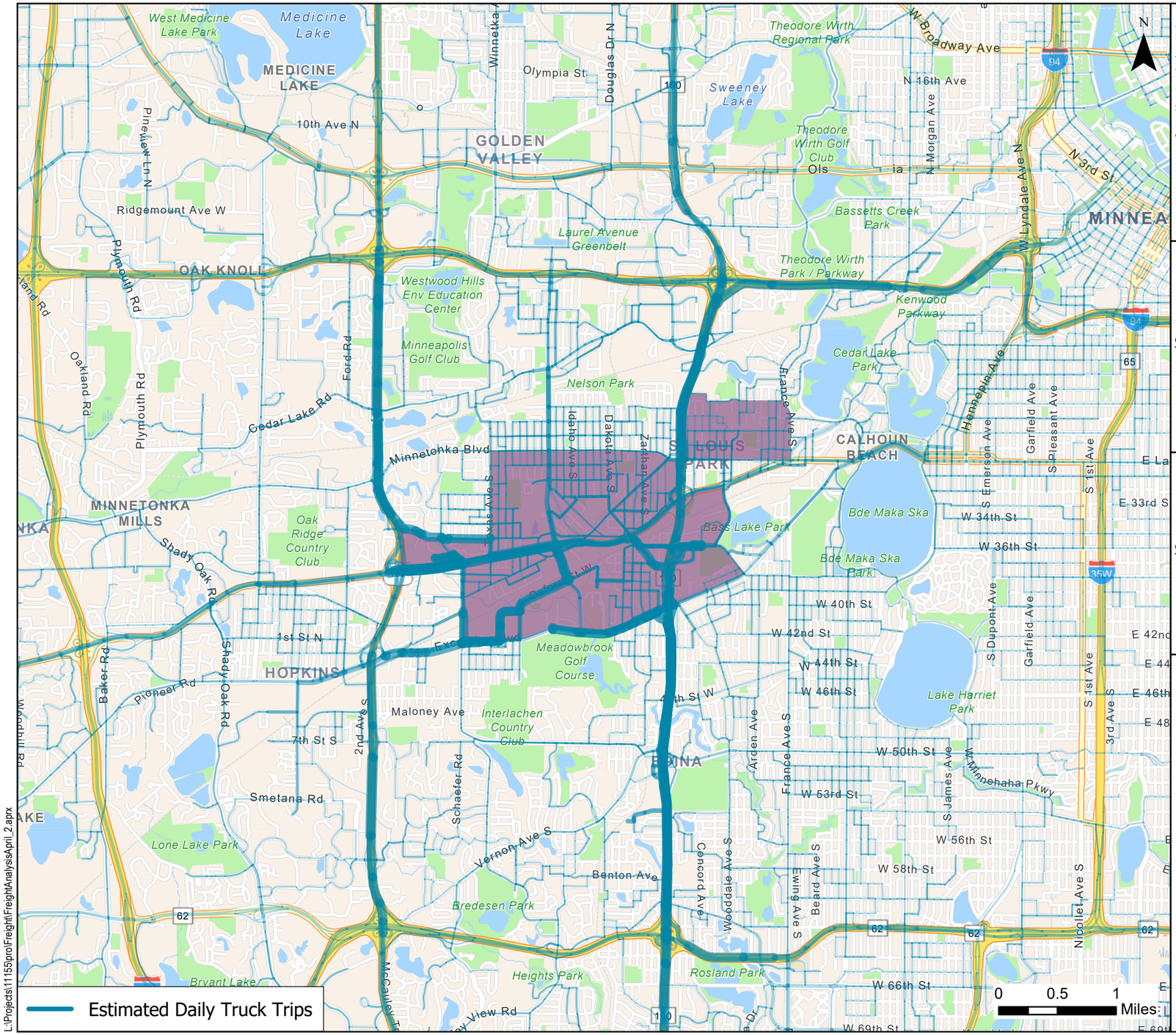
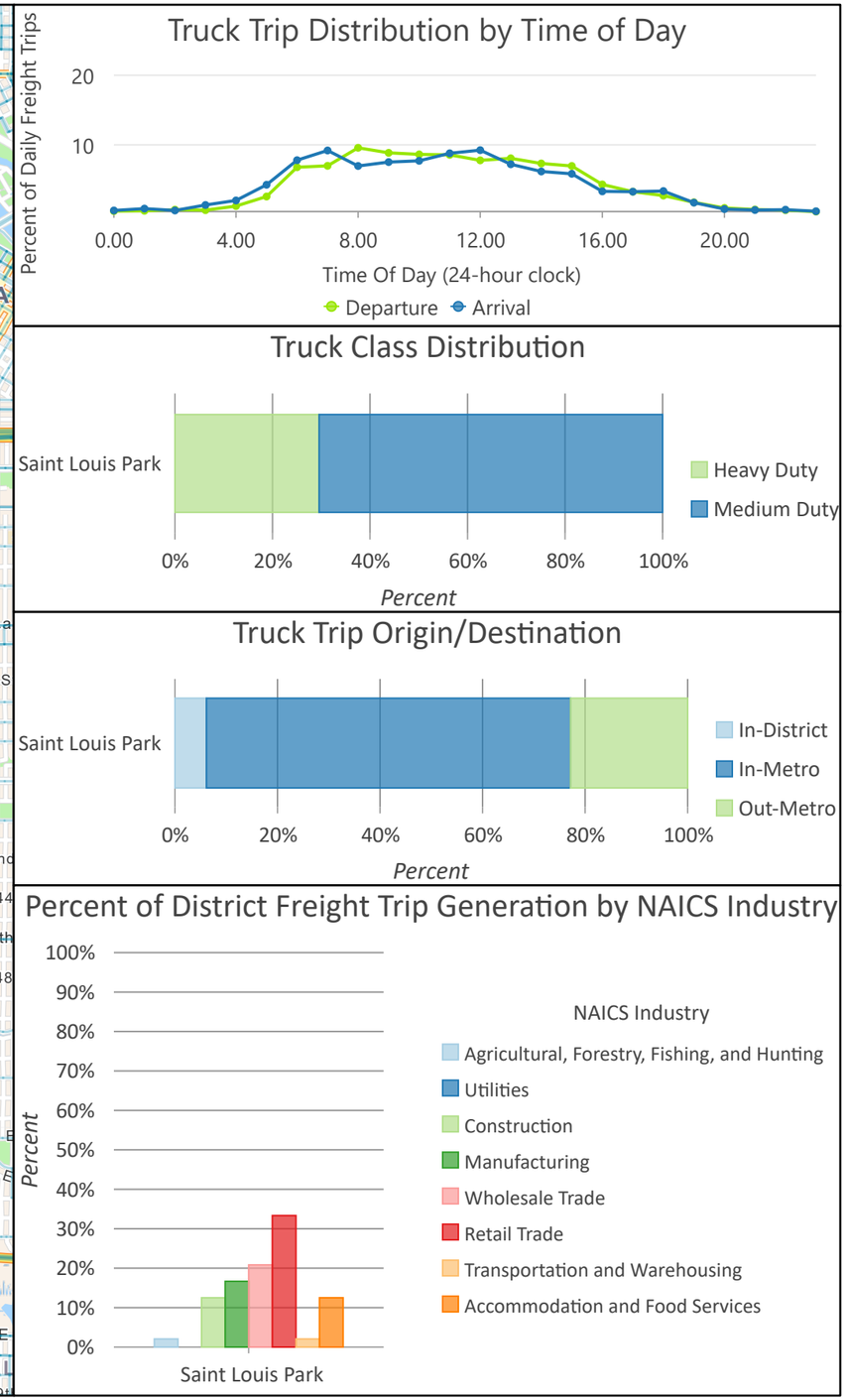


Estimated Truck Trips Originating from or Terminating at Plymouth Freight District

I-494 Corridor Freight Study

Minnesota Department of Transportation

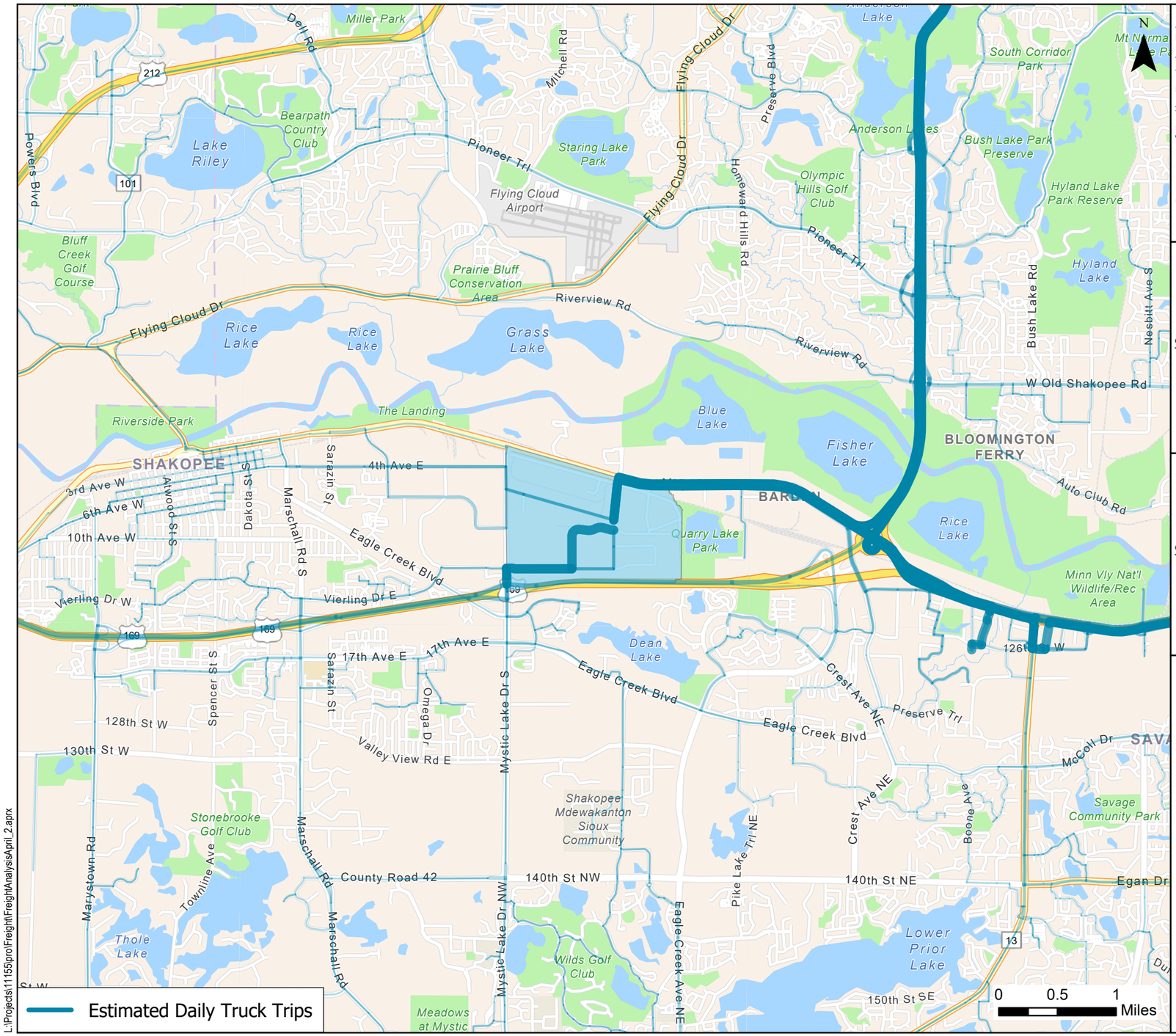




Estimated Truck Trips Originating from or Terminating at Saint Louis Park Freight District

I-494 Corridor Freight Study

Minnesota Department of Transportation



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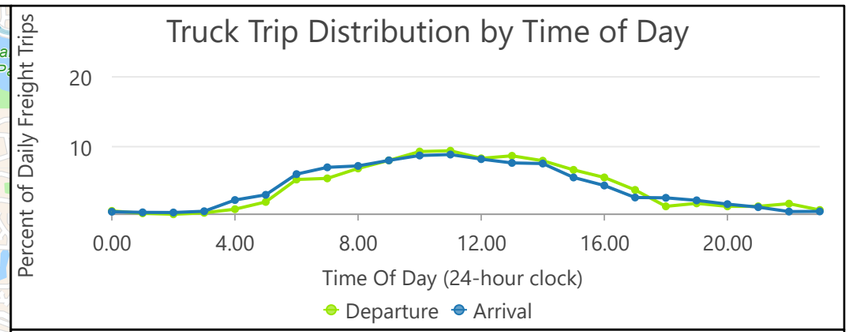
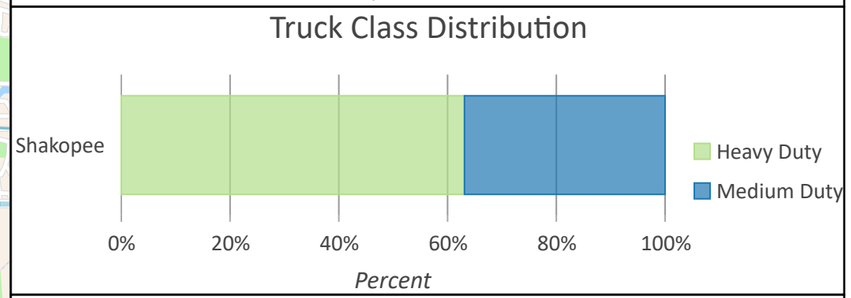
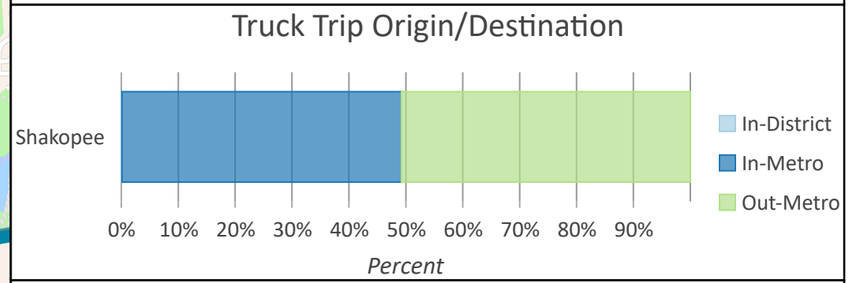
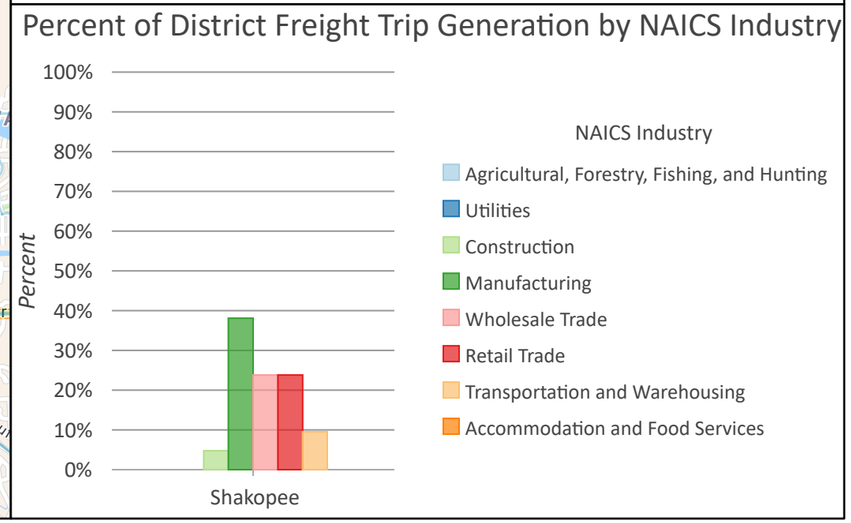




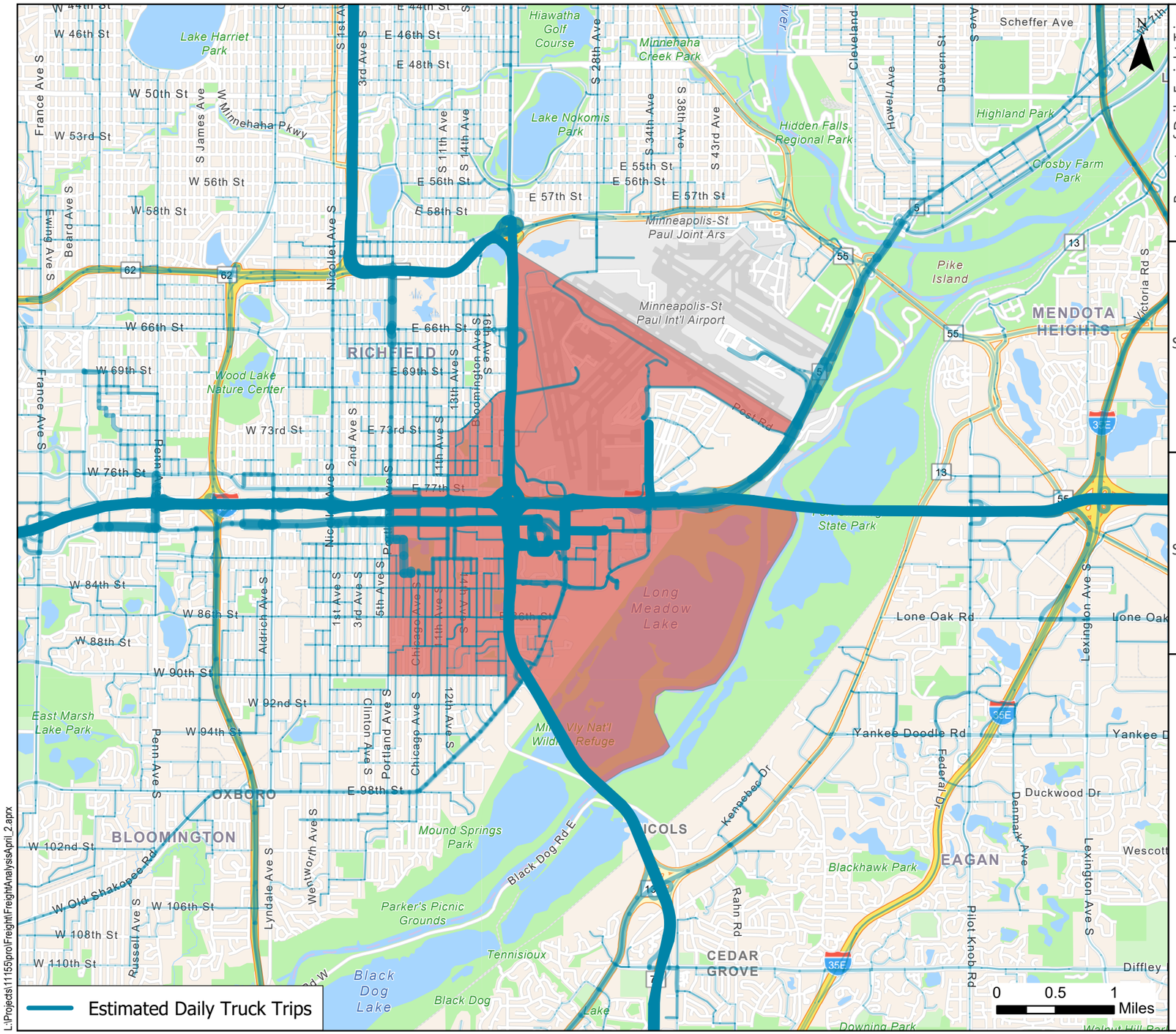


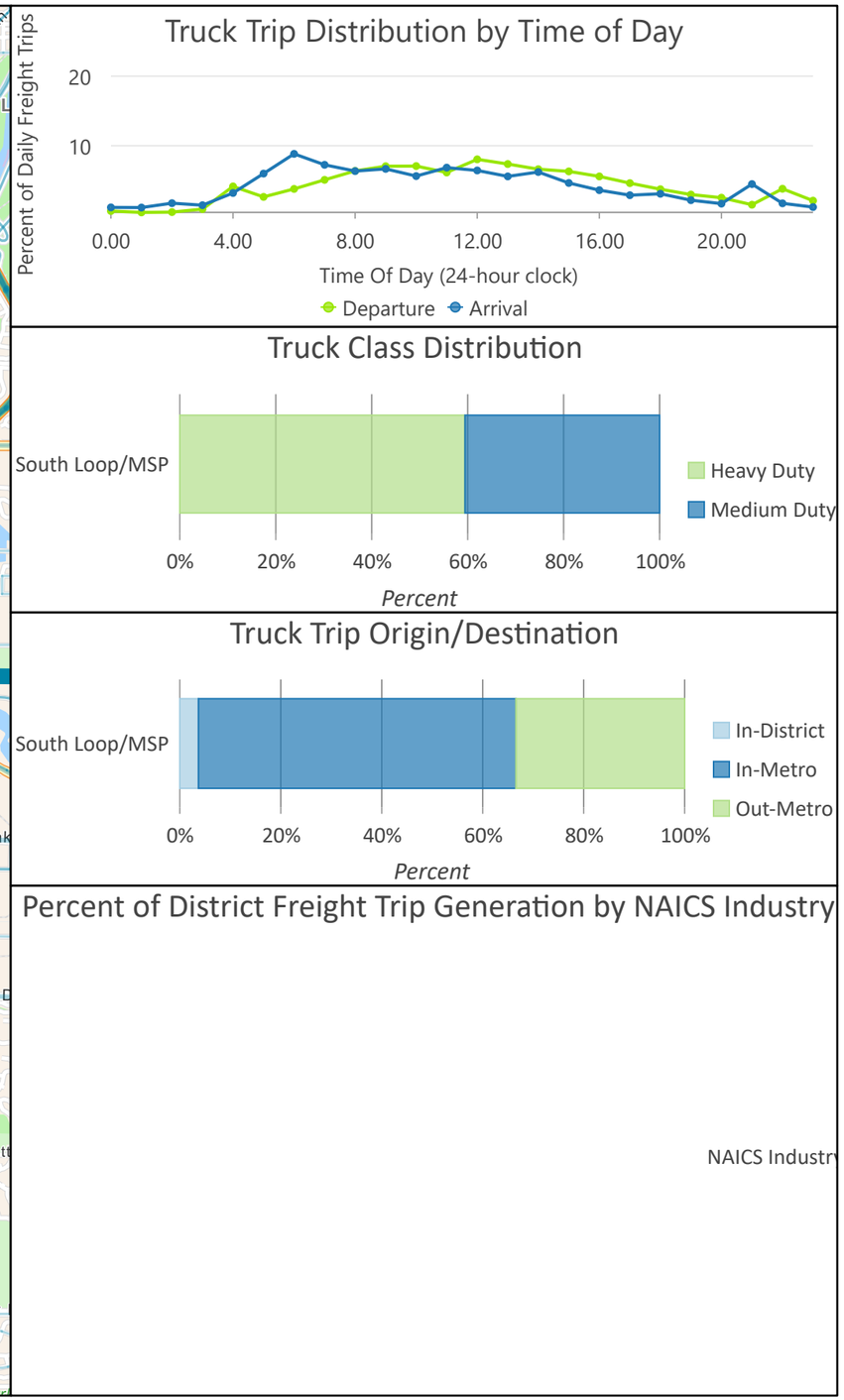


Estimated Truck Trips Originating from or Terminating at Shakopee Freight District

I-494 Corridor Freight Study

Minnesota Department of Transportation





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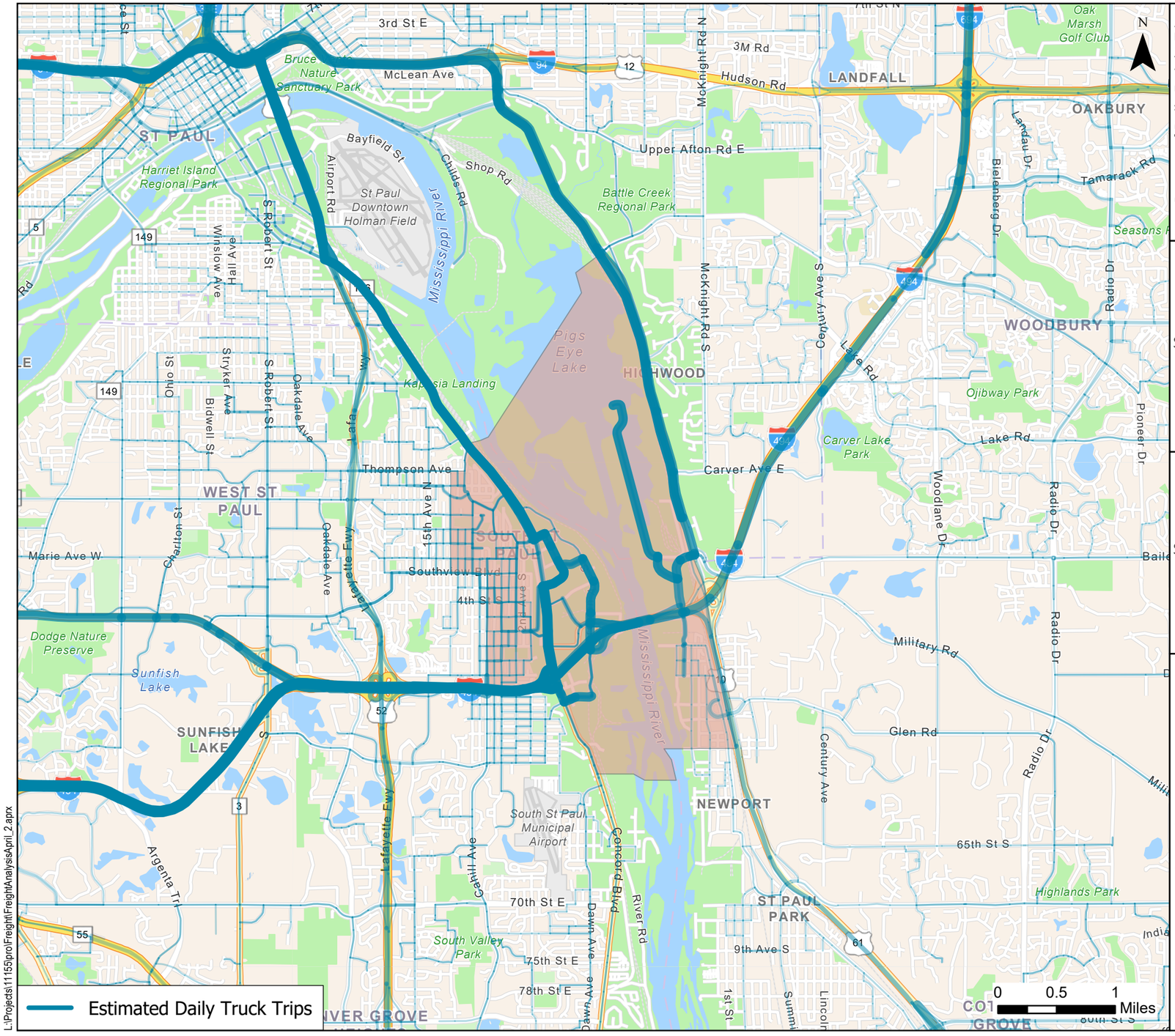
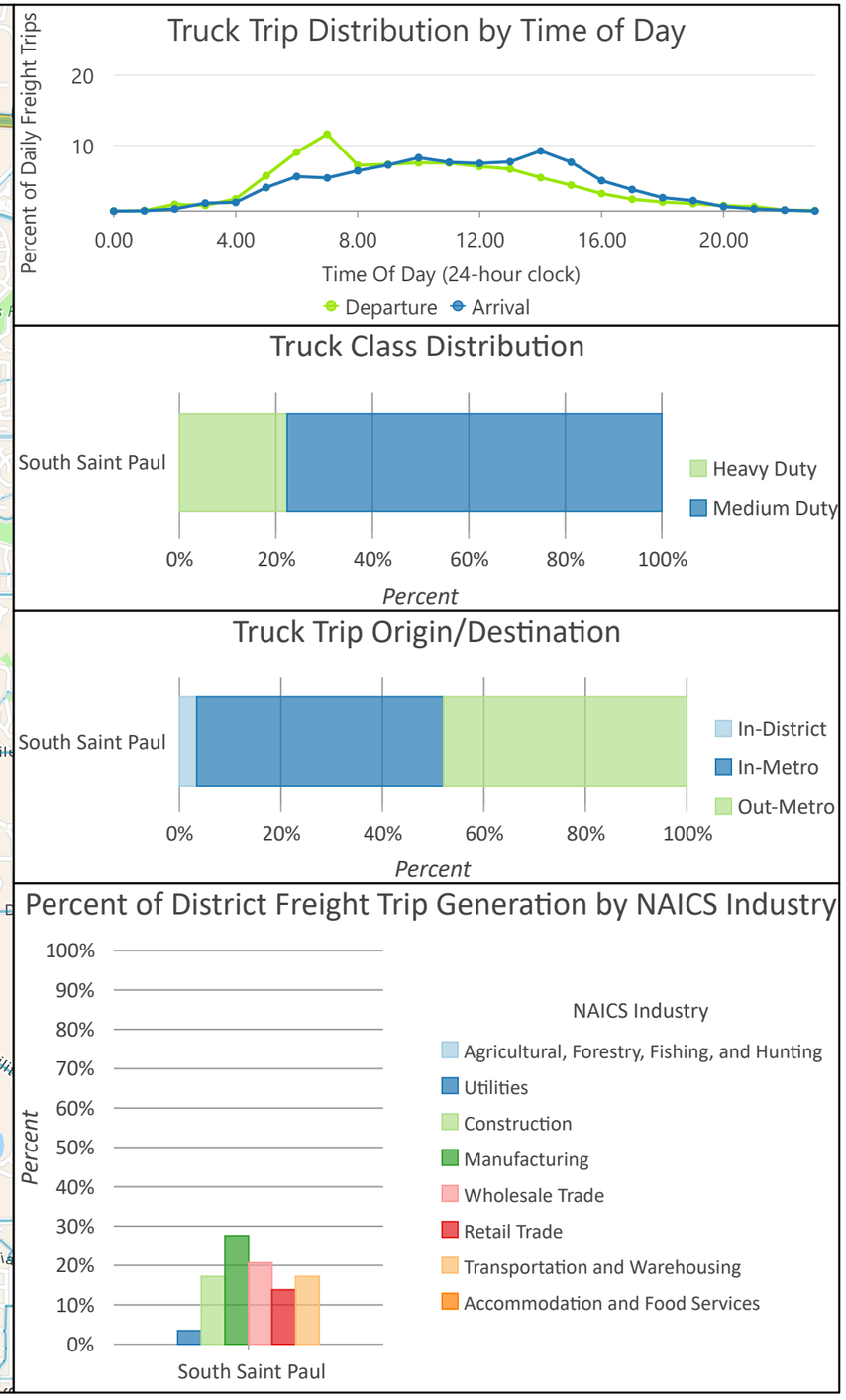
Estimated Truck Trips Originating from or Terminating at South Loop/MSP Freight District

I-494 Corridor Freight Study

Minnesota Department of Transportation





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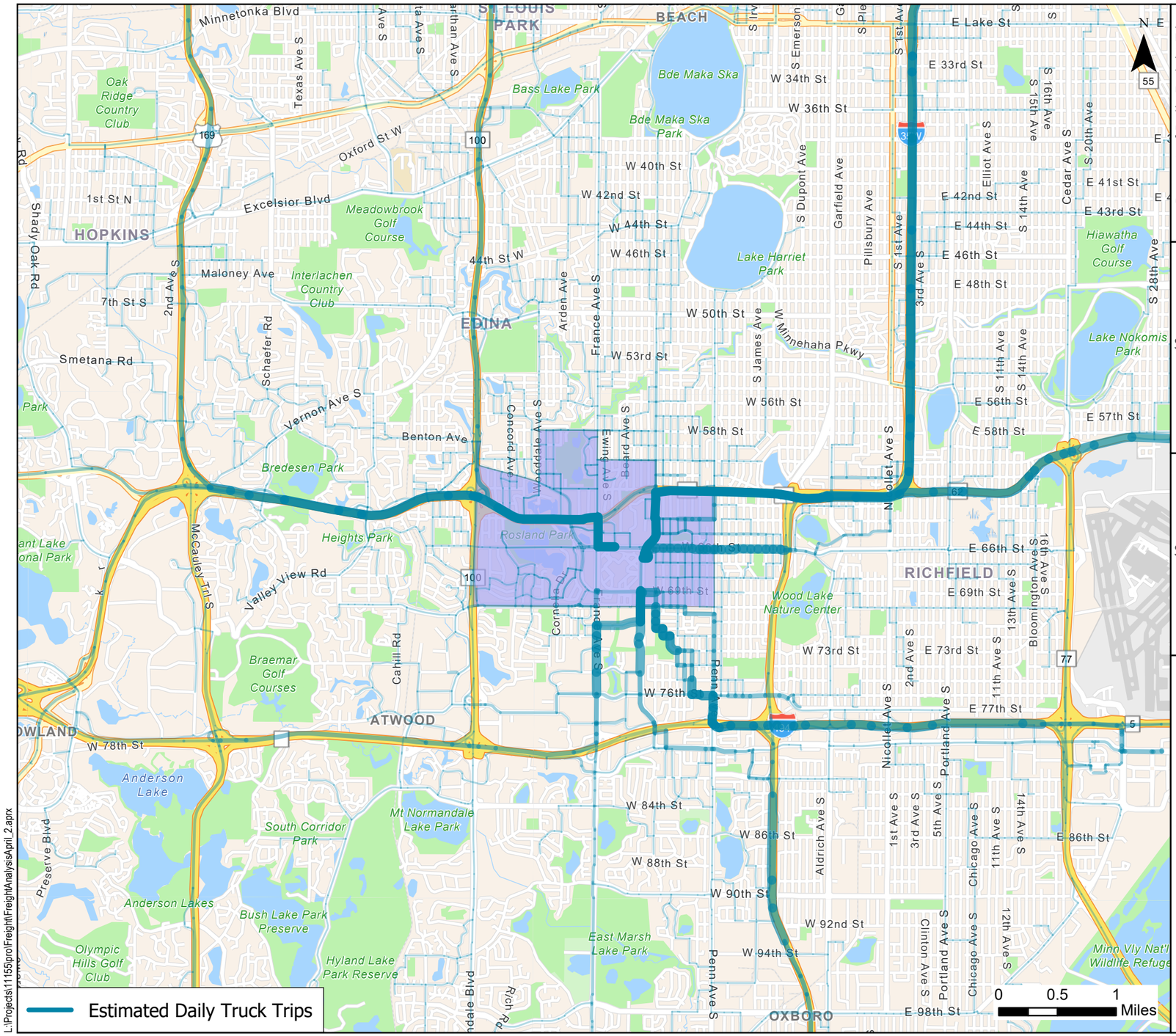
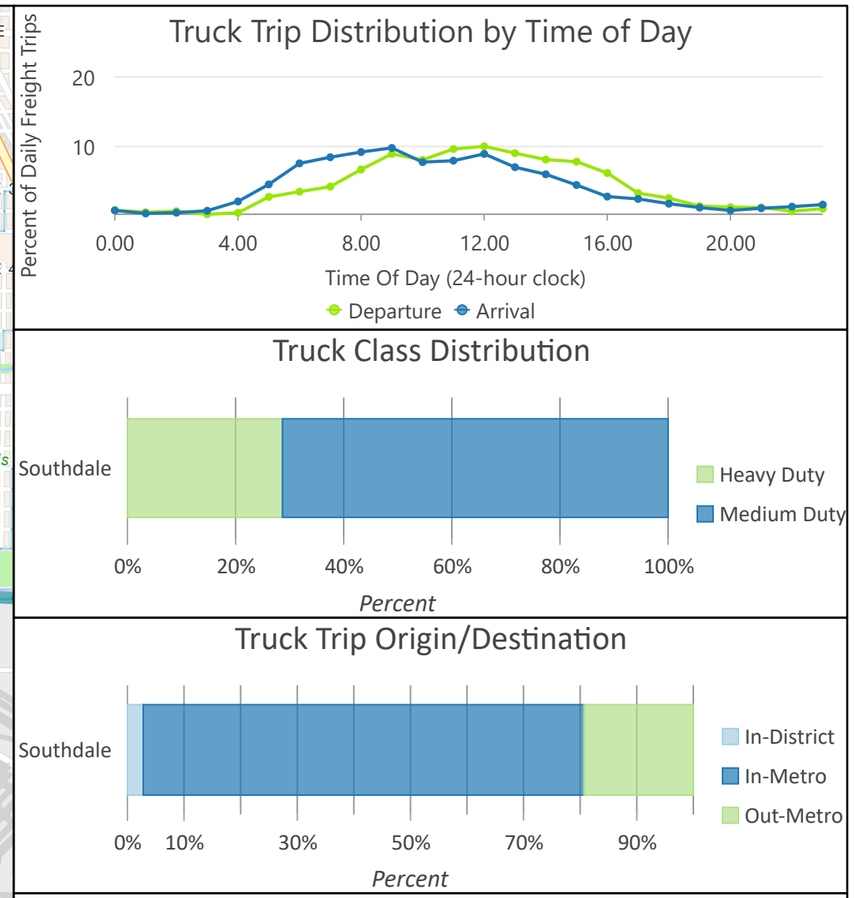
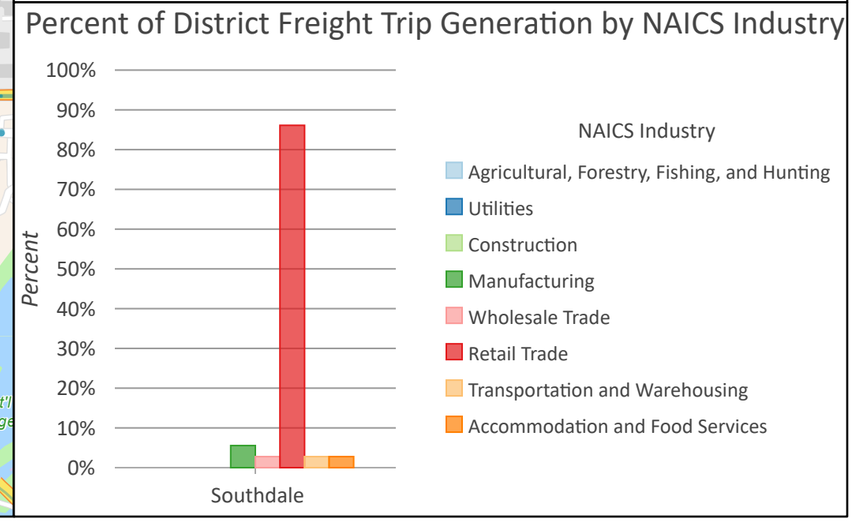
Estimated Truck Trips Originating from or Terminating at South Saint Paul Freight District

I-494 Corridor Freight Study

Minnesota Department of Transportation







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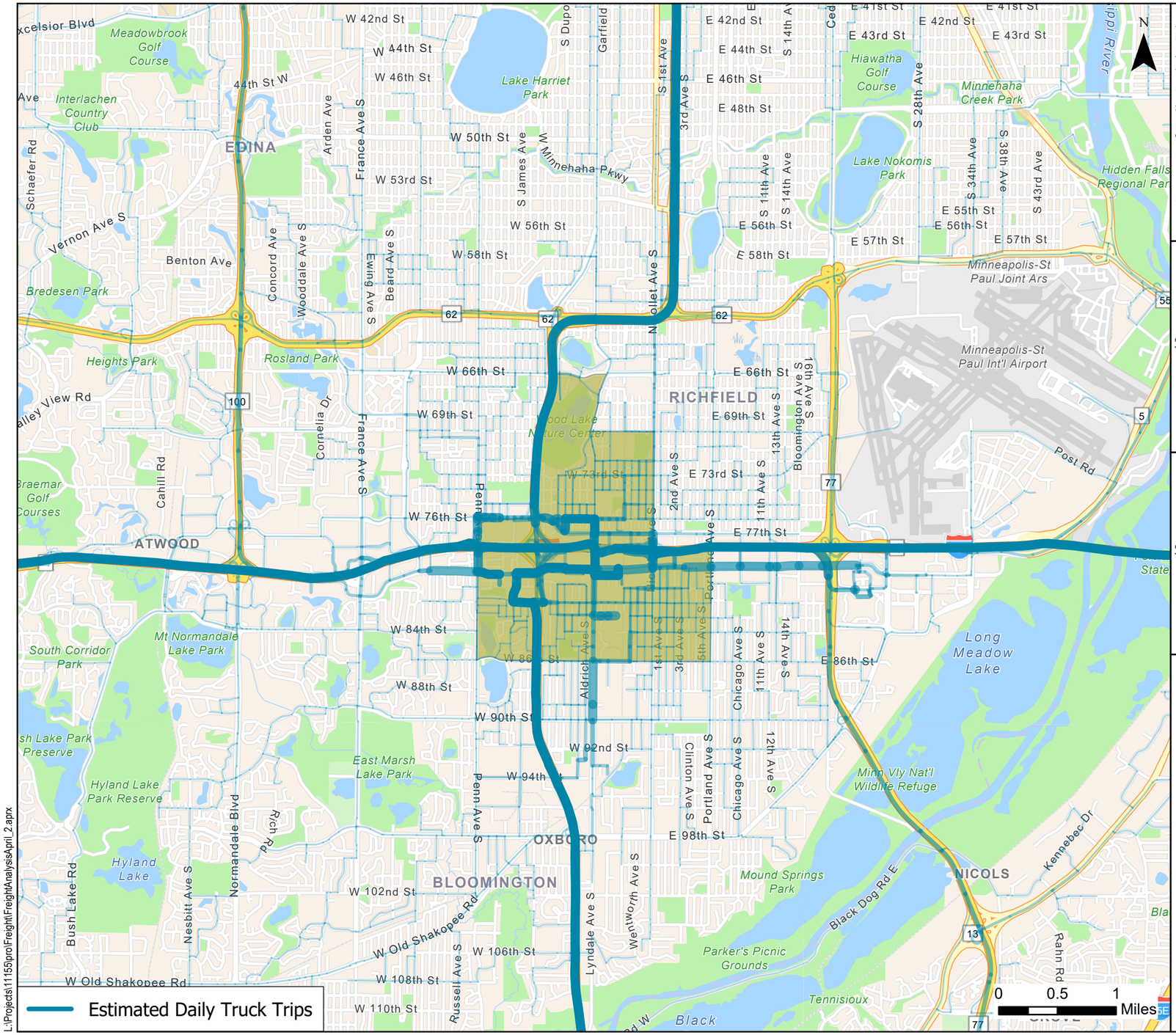
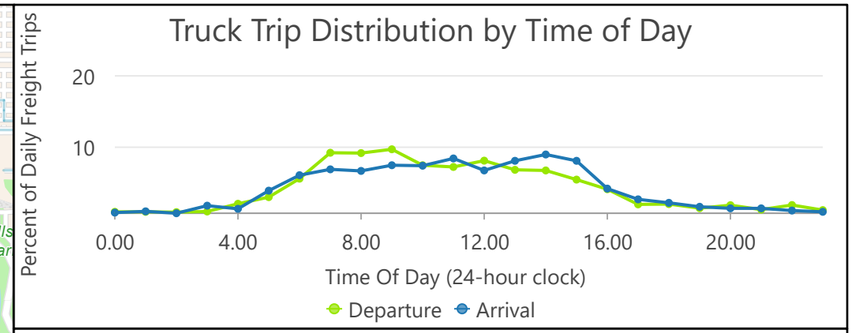
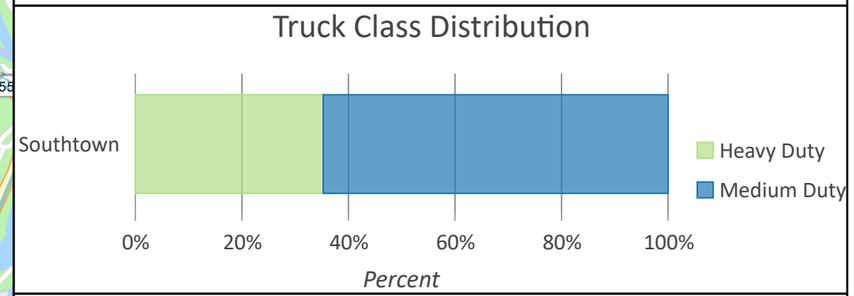
Estimated Truck Trips Originating from or Terminating at Southdale Freight District

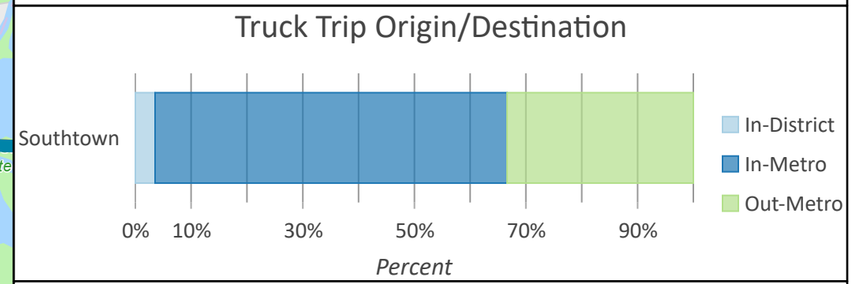
I-494 Corridor Freight Study

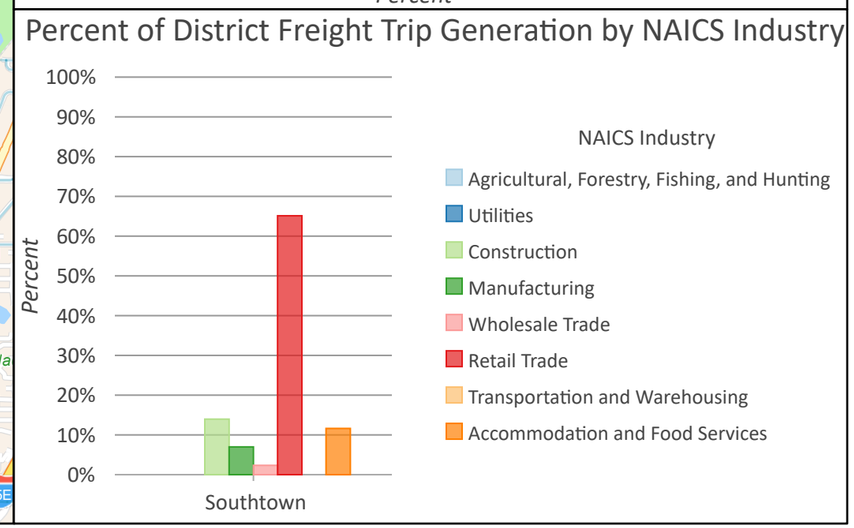
Minnesota Department of Transportation











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Estimated Truck Trips Originating from or Terminating at Southtown Freight District

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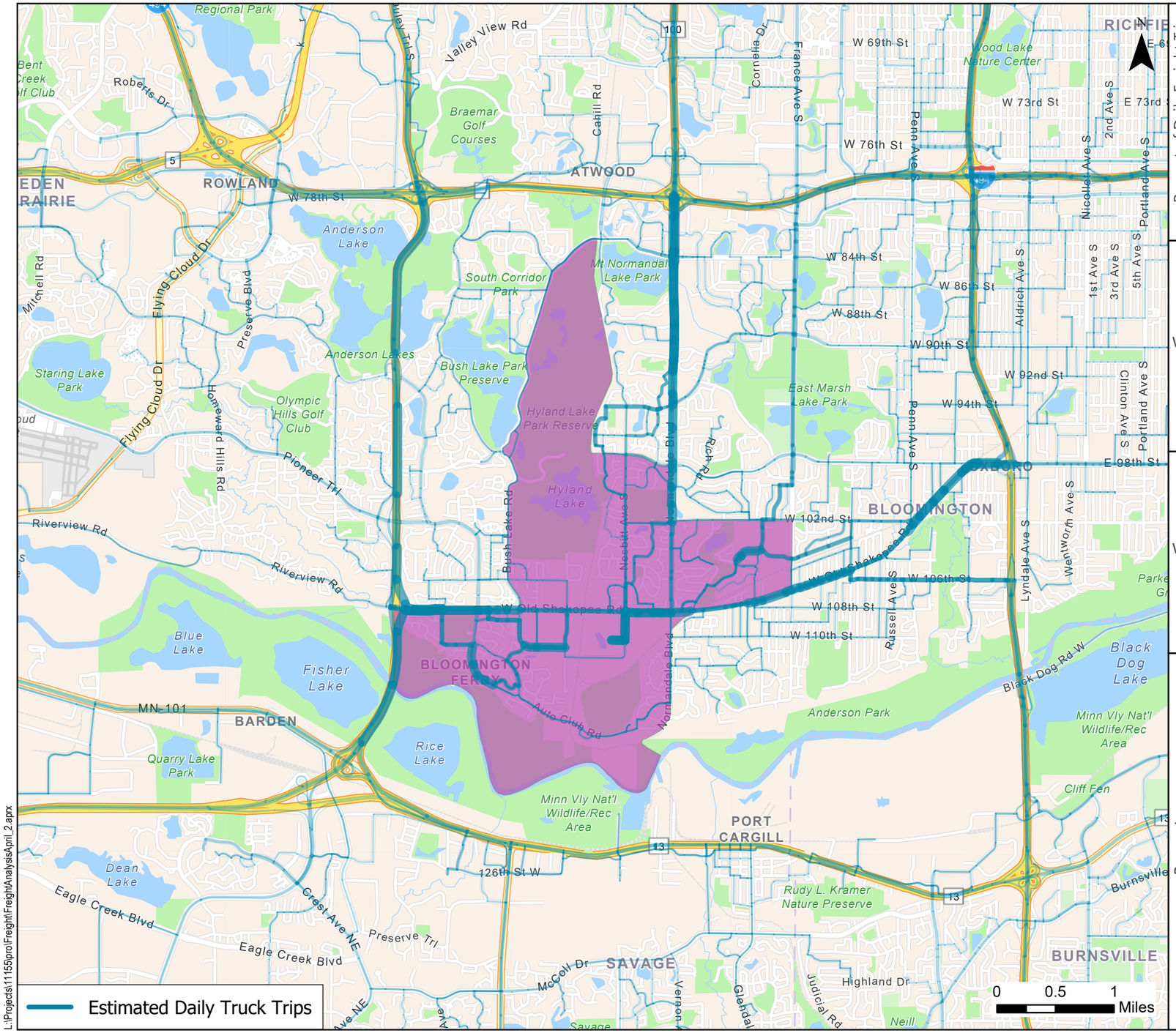
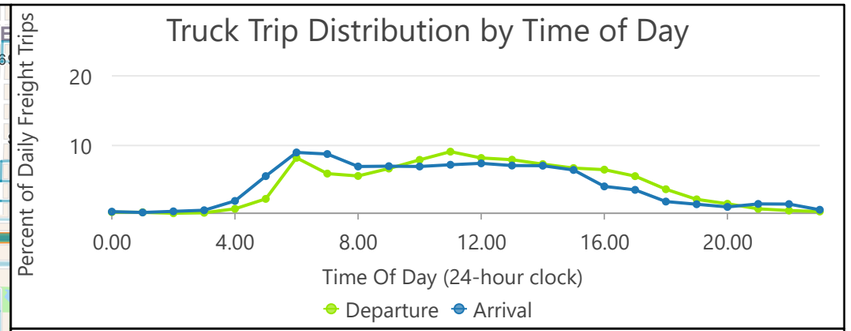
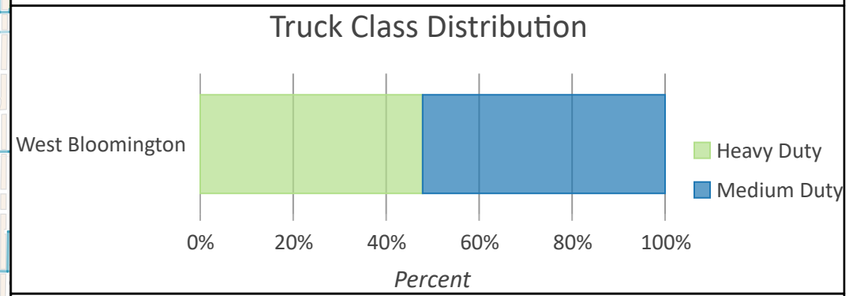
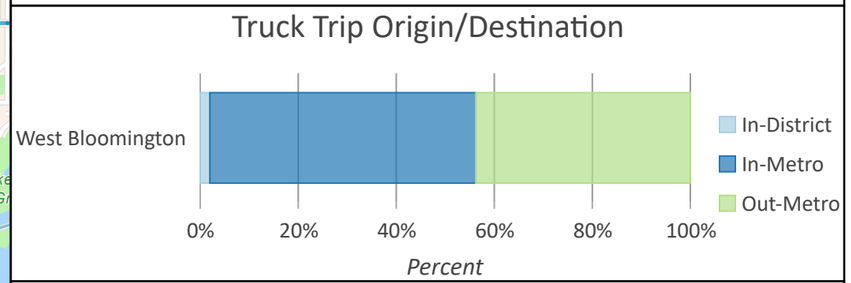
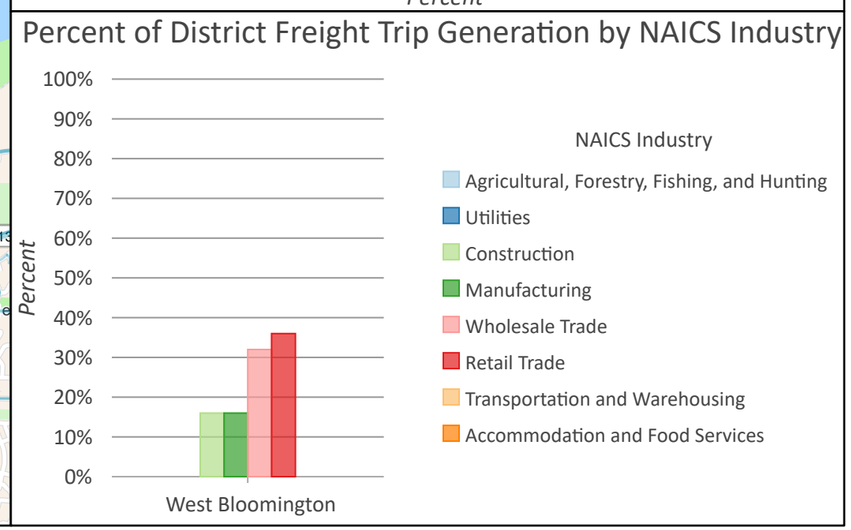
Minnesota Department of Transportation







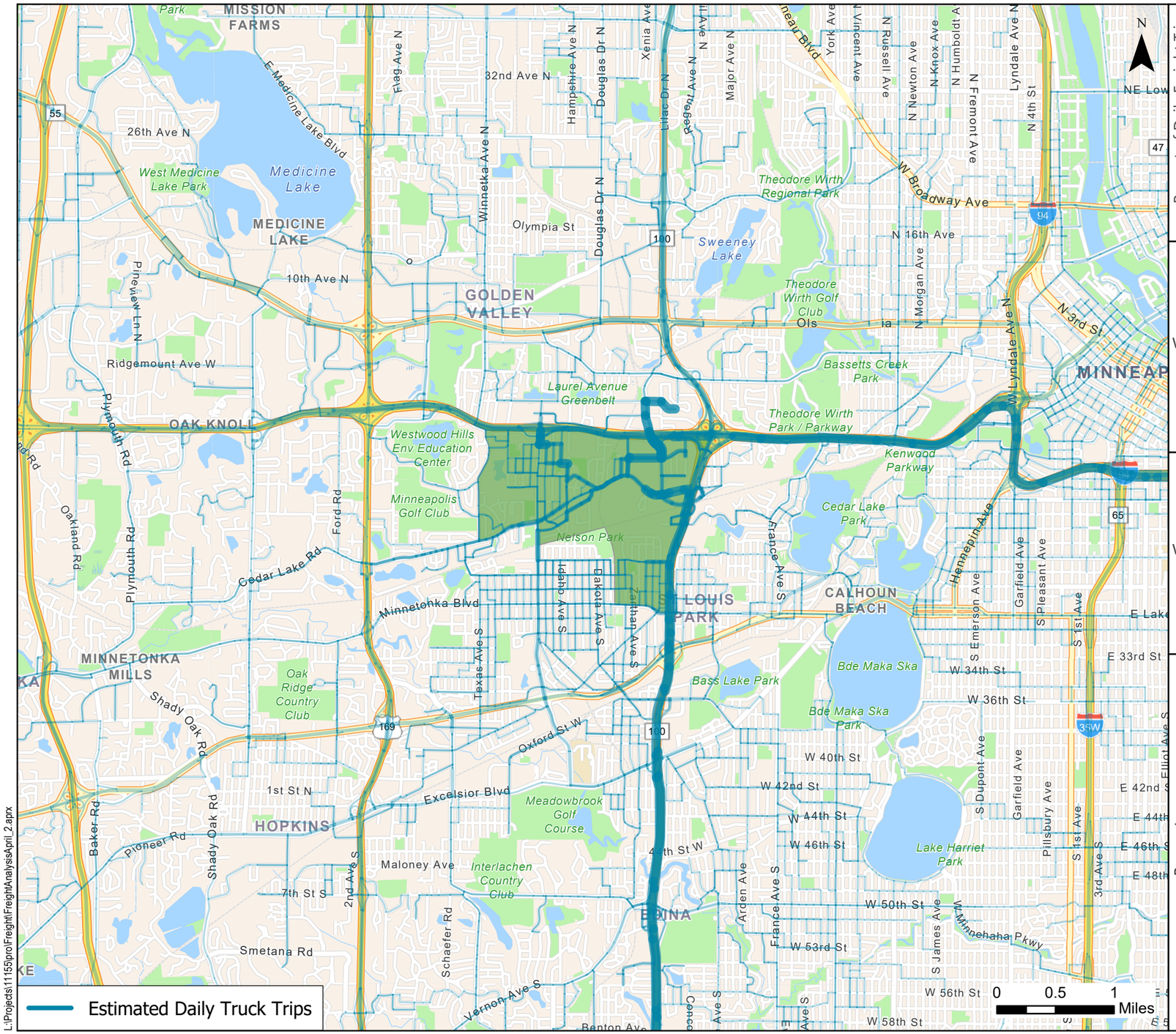


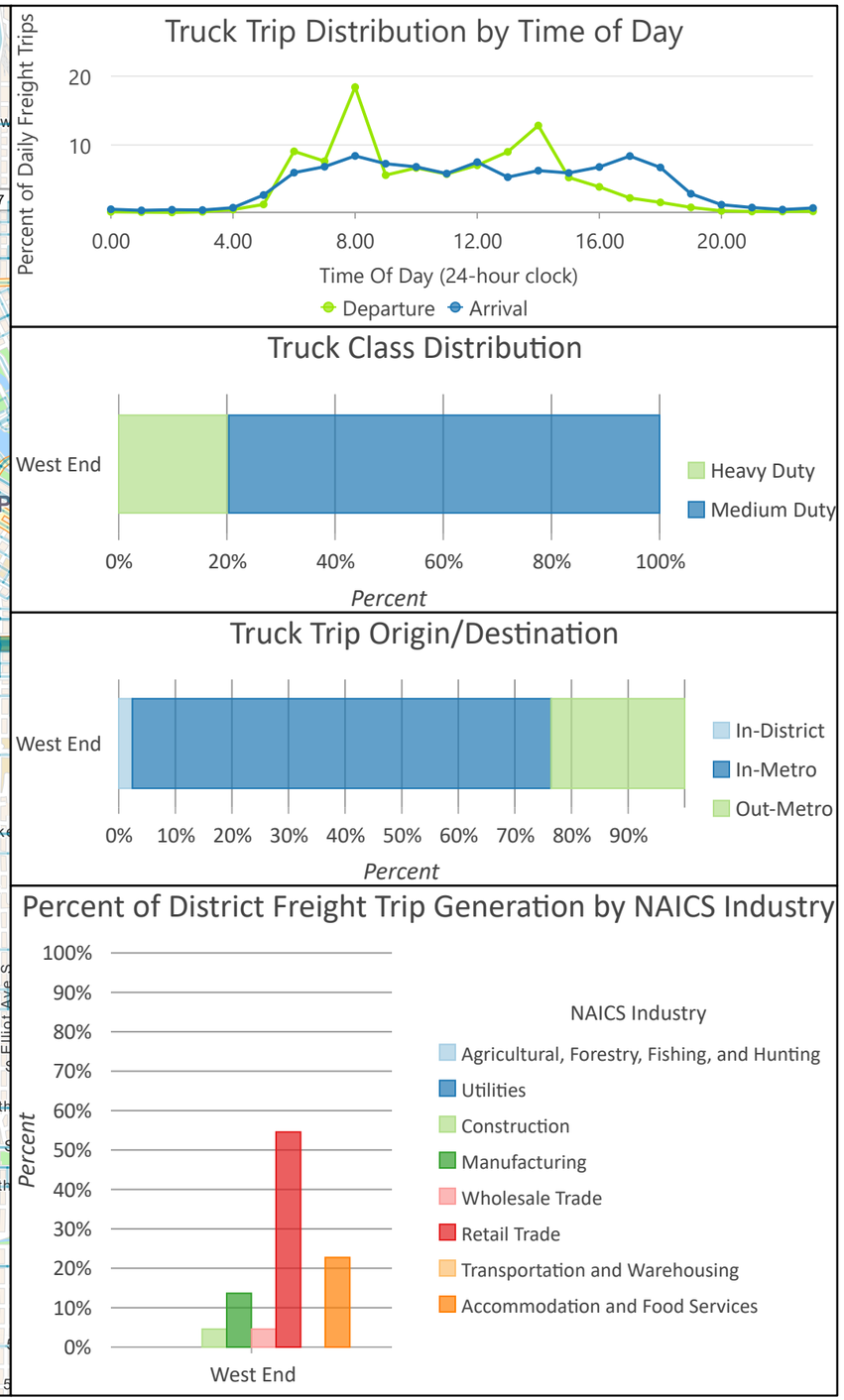


Estimated Truck Trips Originating from or Terminating at West Bloomington Freight District

I-494 Corridor Freight Study

Minnesota Department of Transportation





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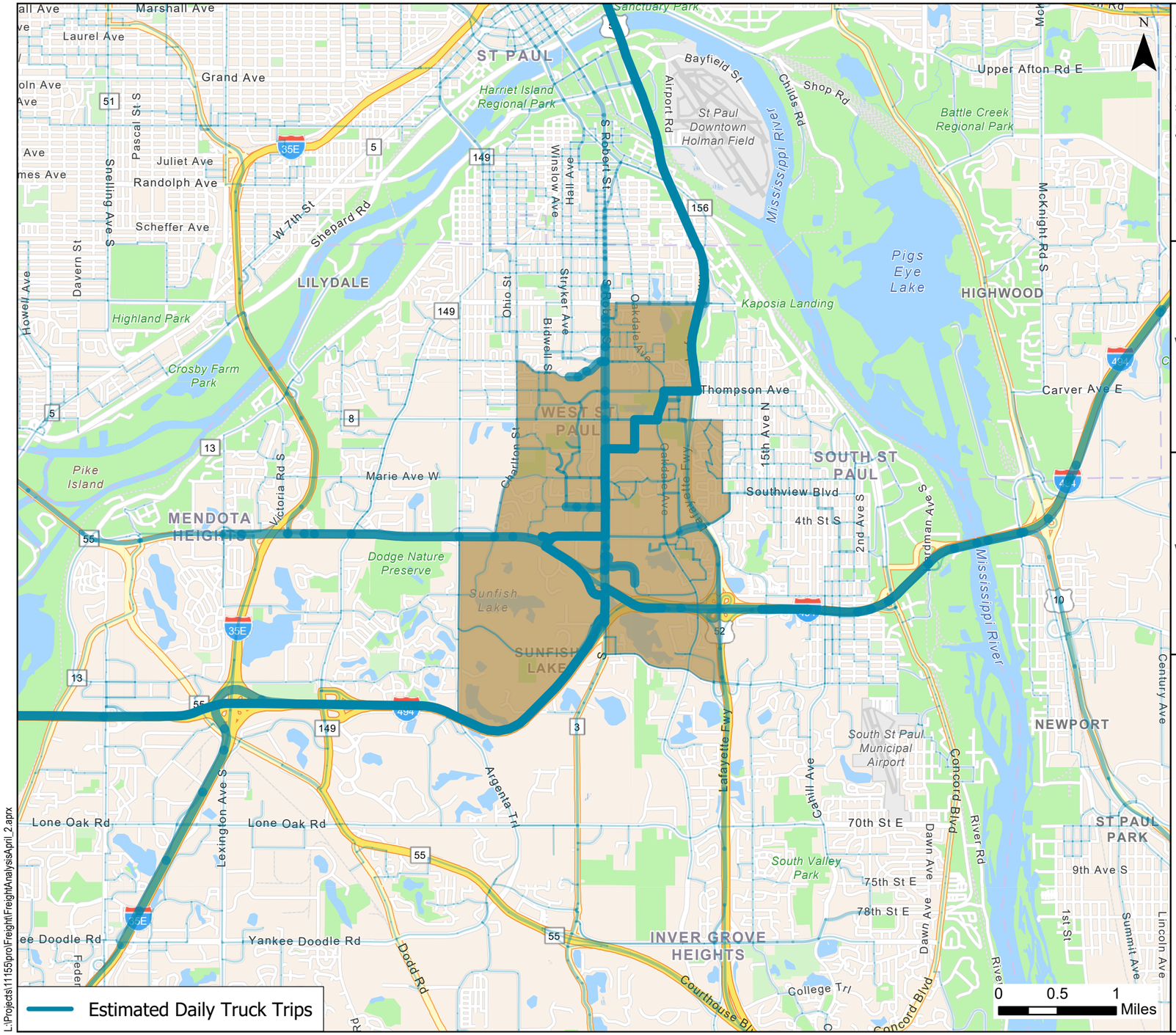
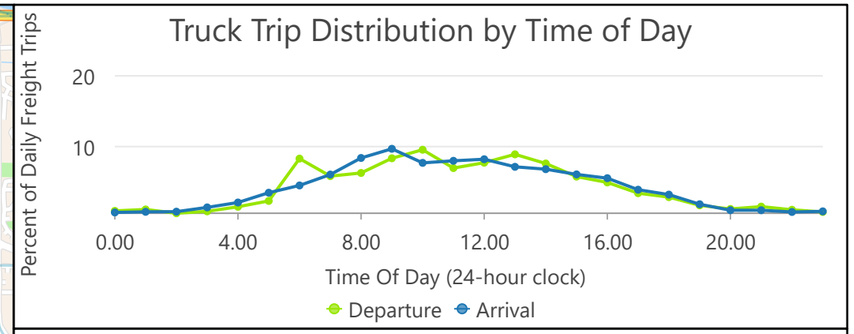
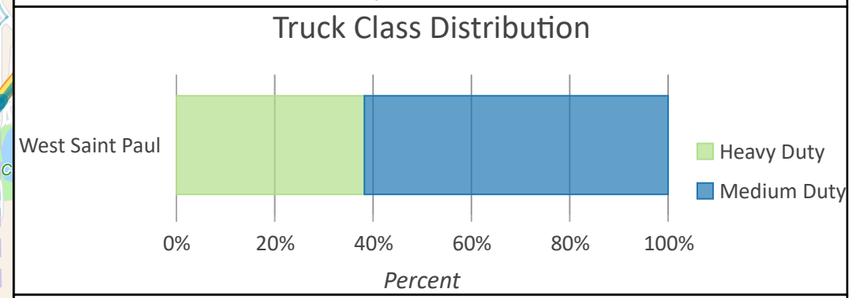
Estimated Truck Trips Originating from or Terminating at West End Freight District

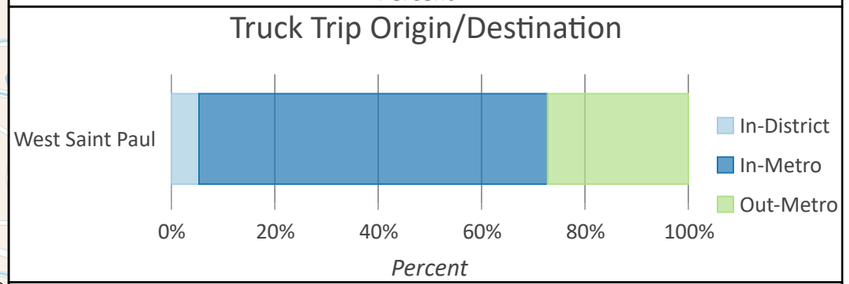
I-494 Corridor Freight Study

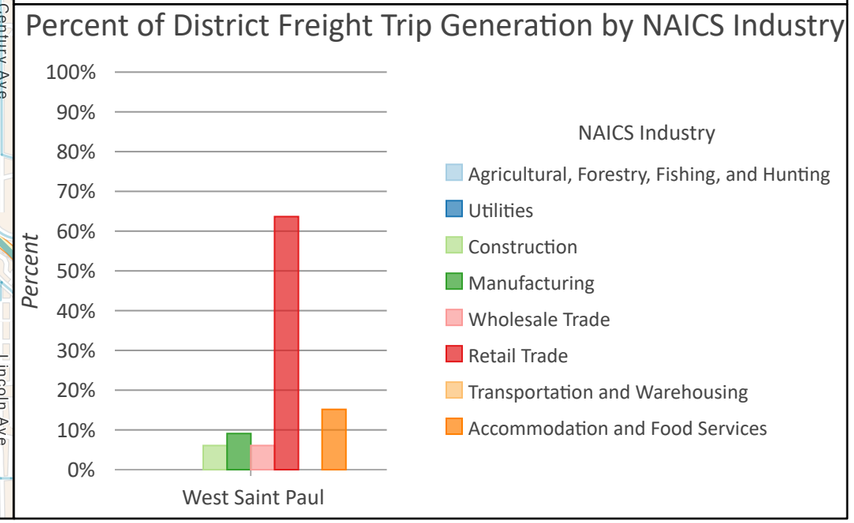
Minnesota Department of Transportation











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Estimated Truck Trips Originating from or Terminating at West Saint Paul Freight District

I-494 Corridor Freight Study

Minnesota Department of Transportation