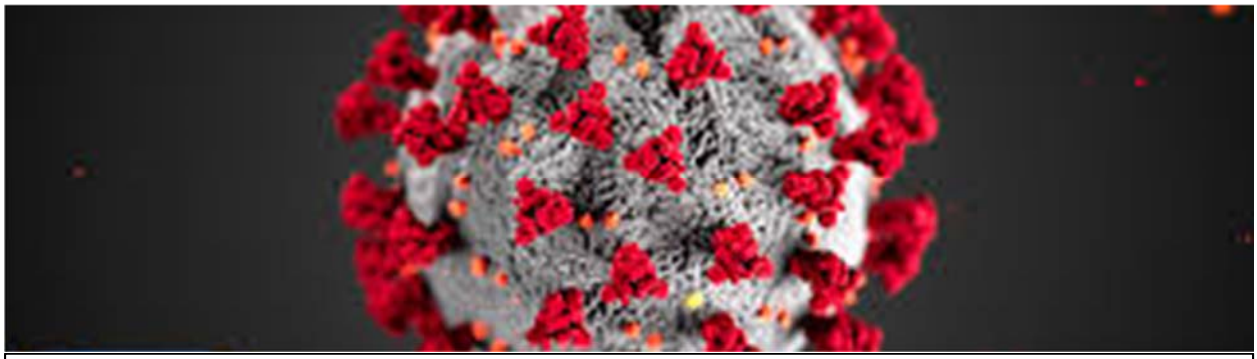
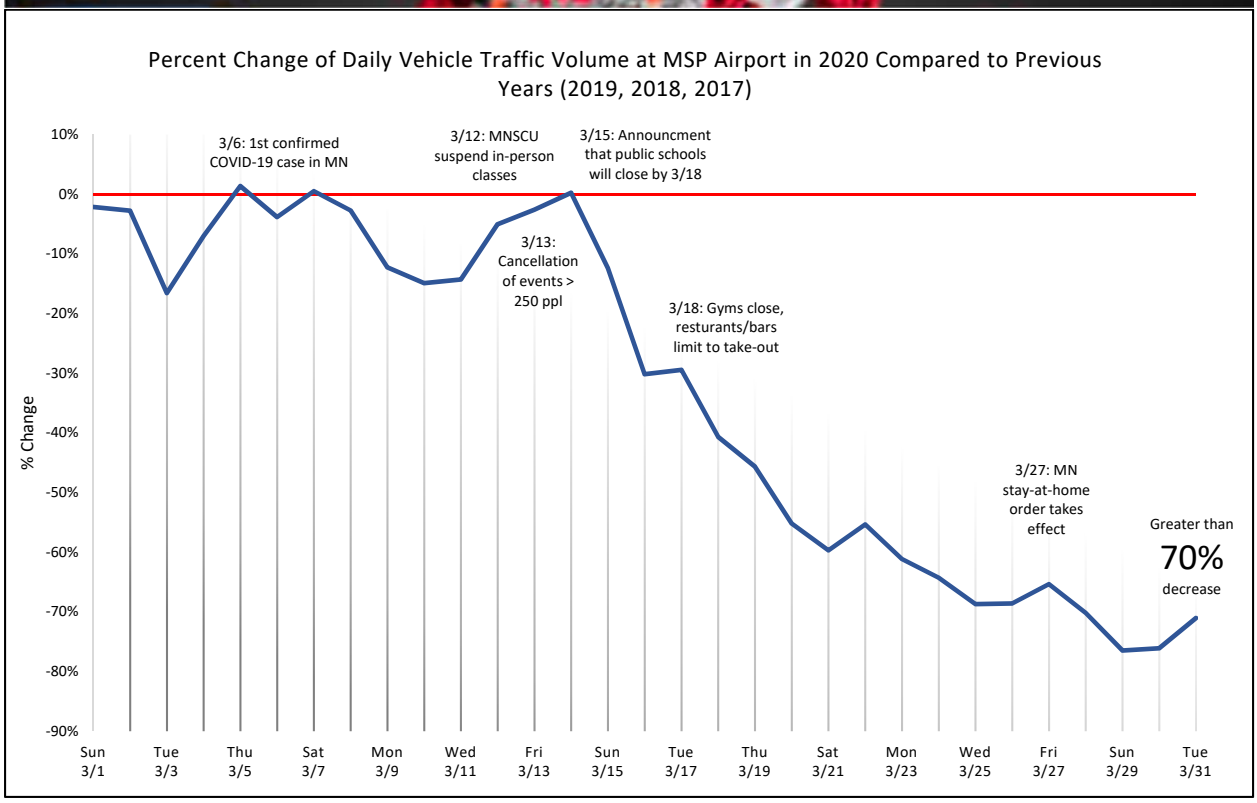
COVID-19 March Impacts to Minnesota Travel Patterns





MnDOT Office of Transportation System Management – Transportation Data & Analysis and
Metro District Office of Planning, Program Management and Transit
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Contents

Intro and Summary

The Minnesota Department of Transportation is coordinating with other state and local agencies to assess the impacts COVID-19 has had on the state to date. In particular, MnDOT has begun an analysis using both internal data sources such as traffic sensors, automatic traffic recorders (ATRs), and weigh-in-motion (WIM) sites, while also relying on StreetLight Insight data to provide a more detailed picture of the changing transportation patterns as a result of COVID-19. MnDOT has made this data available for any public agency to use to analyze the changing patterns in their local area. Additionally, we will include vehicle miles travelled (VMT) across the Twin Cities metro (Metro) area and statewide (Greater Minnesota) once that information becomes available.

In an effort to provide the most up-to-the-date information and analysis on the impact of COVID-19, MnDOT decided to conduct several analyses to estimate changes in average trip length in miles, traffic volume, commercial activity, and other transportation behavior analysis that highlights how the travelling public is responding to the crisis. The following graphs highlight not just how COVID-19 has impacted travel patterns, but also demonstrate how executive actions taken by Governor Tim Walz has had altered Minnesotan's travel patterns. The data used for these analyses are prepared using data from StreetLight Data, which comes from anonymized cell phone location data. The data is also normalized and summarized for analysis within their StreetLight Insight Tool. The tool tracks "trips" by analyzing cell phone "pings" to local cell towers and using an algorithm to determine where and when a trip starts and ends.

The analyses shows a dramatic change in certain travel patterns and smaller changes in others. All of the analyses, with the exception of the concentration of jobs review, compares traffic for the entire month of March to the 3 year average for March 2017-2019. We can see, in figures 1 and 2, sudden declines in traffic to hospitals, and nursing and boarding care homes in both the Metro and Greater Minnesota. The declines begin sharply once the first executive action eliminating gatherings of 250 people or more were announced. Travel around these facilities followed similar declines in percentages in the Metro as in Greater Minnesota.

Traffic volumes around schools (Figure 3) saw similar declines due largely to the Minnesota System of Colleges and Universities (MNSCU) suspending in person classes on March 12th. Vehicle traffic at the Minneapolis – St. Paul International (MSP) airport (Figure 4) also saw sudden and steep declines in traffic beginning after the same restrictions on large gatherings. Trips ending in major job zones in (Figures 5 and 6) saw declines during the weekdays even sooner than schools did as people began working remotely, and saw increases over the weekends as people went shopping on the weekends in preparation for the Stay-at-Home Executive Order. Declines in trips beginning in low and high poverty census tracts almost mirrored each other, beginning on March 9th, as shown in Figure 7.

Another group of analysis, shown in figures 9-18, show declines in average daily trips in every county in Minnesota as well as areas with high concentration of jobs that are at risk from COVID-19 closings and shutdowns, such as retail, arts, accommodation and food preparation businesses.

The last analysis in Figures 19-26, shows changes in trip distribution varied by trip length and geography. The shorter trip distances decreased slightly more during the month in the Metro while the longer

distance trip increased slightly this year. Changes in distribution were much greater and noticeable in the Greater Minnesota counties.

Change in Traffic Volumes at Hospitals

Methodology

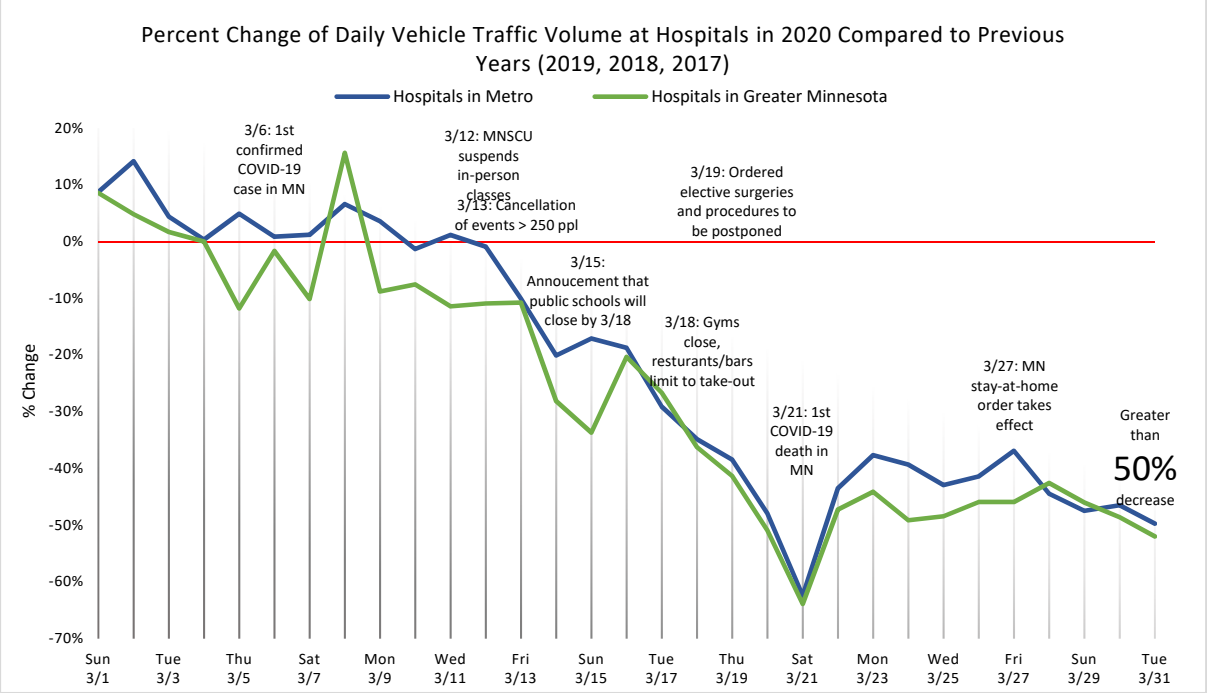
The hospital data came from the resource Hospitals Serving Minnesota, 2020 in the Minnesota Geospatial Commons. The purpose of this dataset is to provide state agencies and the general public with a basic overview of major hospital locations that serve the general population. This data was downloaded and geocoded in March 2020.

In order to upload the data to StreetLight, polygons were created around the hospital points. The size of the buffer was determined by the number of beds at each hospital and only hospitals with a minimum of 100 beds were included. The hospital zones in the Twin Cities were manually edited to only include the hospital campuses. These hospitals were then analyzed to compare the number of vehicle trips that stayed within the hospital campus for at least 5 minutes. The March 2020 daily data was compared to the average of the March 2017, 2018 and 2019 daily data. For the Metro analysis, the seven county area, (Hennepin, Ramsey, Dakota, Scott, Anoka, Carver, and Washington) that aligns with the Metropolitan Council's (METC) definition of the urbanized area was used. For Greater Minnesota, the remaining 80 counties were used.

Analysis

As Figure 1 shows, there is a decrease in traffic volume beginning around March 11th, possibly due to the fact that testing was limited and people were directed to stay home. This decrease could also illustrate that only high risk patients with extreme COVID-19 symptoms were visiting hospitals, excluding family and friends from visitations. The first confirmed COVID-19 death on March 21st, might have contributed to an increase in hospital traffic. From March 22nd to the end of the month, vehicle traffic volume at hospitals remained static with a decrease of roughly 40-50% from previous years.

Figure 1



Change in Traffic Volumes at Nursing and Boarding Care Homes

Methodology

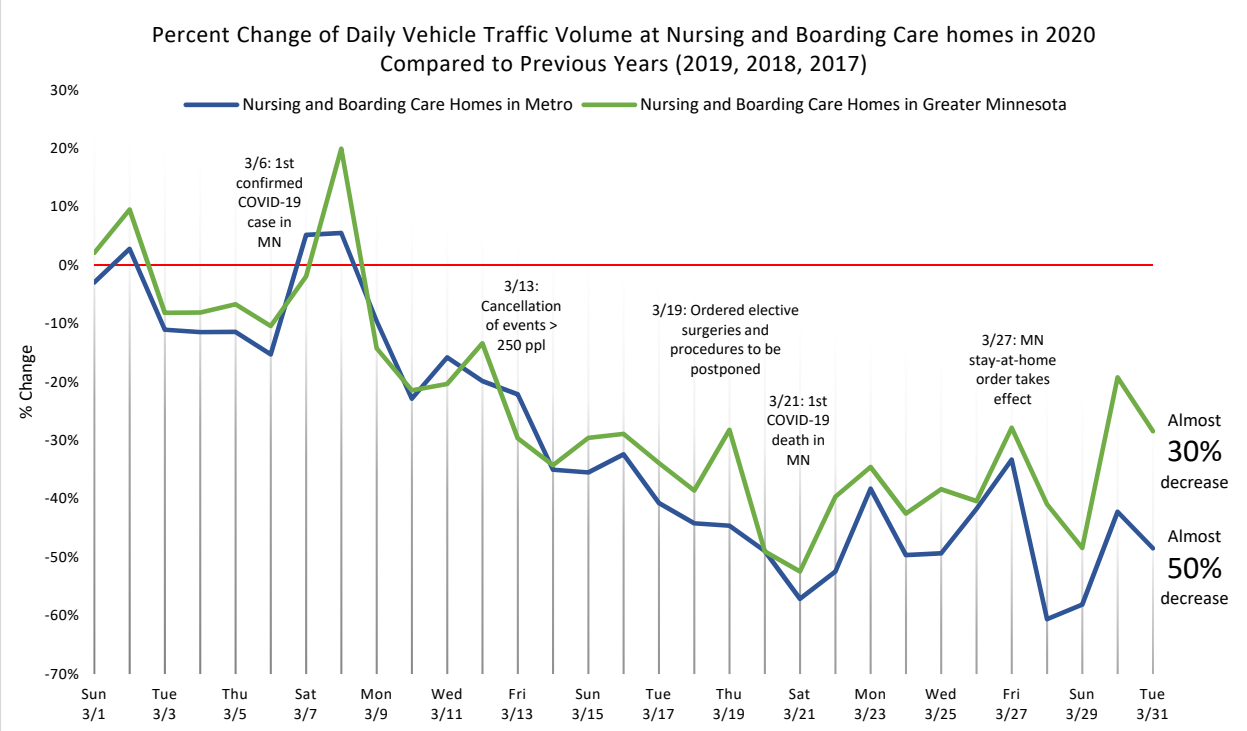
The nursing and boarding care home data came from the resource Nursing and Boarding Care Homes Licensed in Minnesota, 2020 in the Minnesota Geospatial Commons. The purpose of this dataset is to provide state agencies and the general public with a basic overview of nursing and boarding care home locations that serve the general population. The data was downloaded and geocoded in March 2020.

In order to upload the data to StreetLight, polygons were drawn around the Nursing and Boarding Care Home points with a 150 meter traffic analysis buffer. These nursing and boarding care homes were then analyzed to compare the number of vehicle trips that stayed within the nursing and boarding care home area for at least 5 minutes. The March 2020 daily data was compared to an average of the March 2017, 2018 and 2019 daily data. Geographic boundaries for Metro and Greater Minnesota remain the same counties as the analysis above.

Analysis

Figure 2 below shows that in the beginning of March, there was an increase in traffic volume on the weekends when family and friends tend to visit more frequently. However, as social distancing practices became more common, visits, and thereby traffic volume, begin to decrease after March 8th. Similar to the impact at hospitals, the 1st COVID-19 dead on March 21st produced a change in vehicle traffic activity at nursing and boarding care homes as well. The second half of the months shows a leveling out of traffic volumes, with a slight increase in the last days of the month, possibly due to increase in COVID-19 related hospitalizations.

Figure 2



Change in Vehicle Traffic at Schools

Methodology

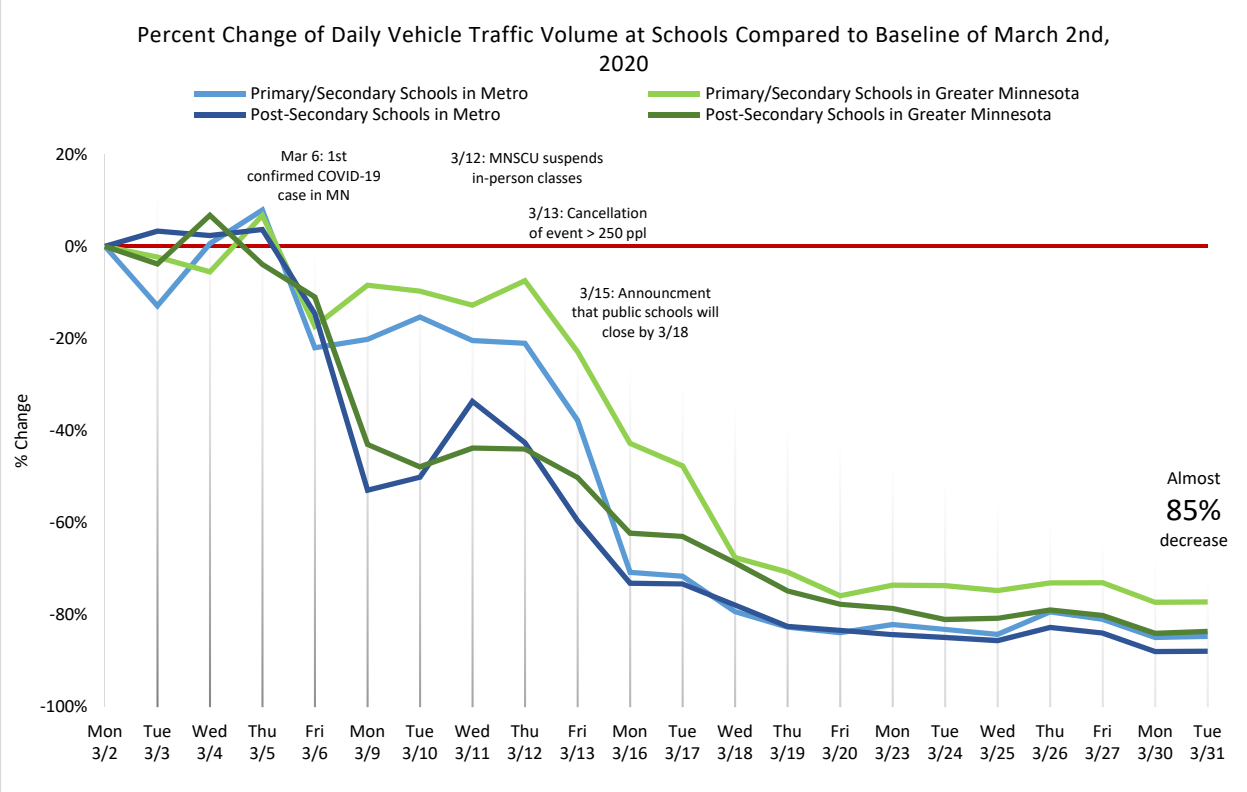
The school data came from the resource School Program Locations, Minnesota, 2020 in the Minnesota Geospatial Commons. The Minnesota Geospatial Information Office (MnGeo) and the Minnesota Department of Education (MDE) have been in contact with Minnesota school districts since 1998, identifying school program locations.

In order to upload the school locations to StreetLight, a polygon buffer was applied around the school campuses. The school locations consisting of primary, secondary and post-secondary schools were then analyzed to compare the number of vehicle trips that stayed within the school campus for at least 5 minutes. The March 2020 daily data was compared to an average of the March 2017, 2018 and 2019 daily data. Geographic boundaries for Metro and Greater Minnesota remain the same counties as the analysis above.

Analysis

As Figure 3 shows, traffic volume at post-secondary schools decreased during the second week of March. After Governor Walz authorized a temporary closure of K-12 public schools on March 15th, traffic volume at primary and secondary schools quickly decreased. Traffic activity at schools remained constant during the last two weeks of March. While schools are closed, food distribution services could be one of the reasons for remaining traffic activity at schools.

Figure 3



Change in Vehicle Traffic at Minneapolis – St. Paul International Airport

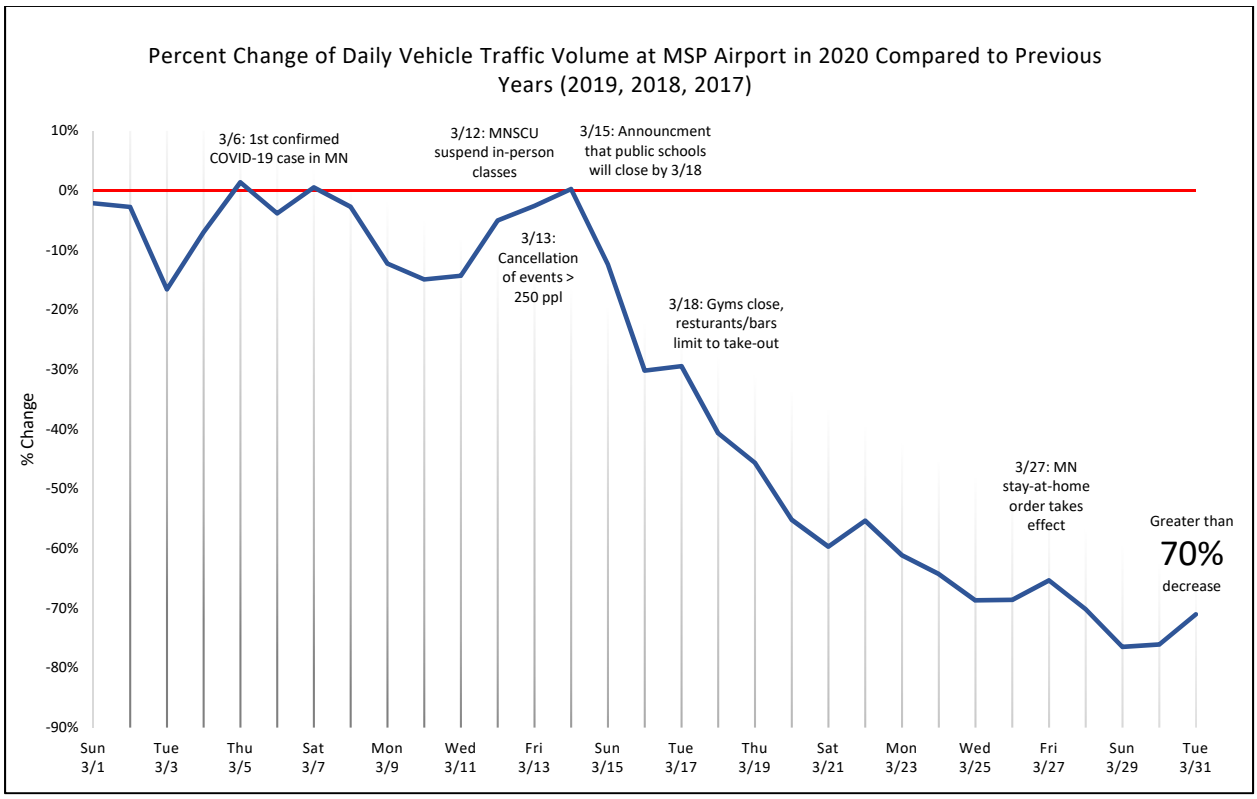
Methodology

A polygon zone around the Minneapolis-St. Paul International Airport (MSP) was analyzed to compare the number of vehicle trips that stayed within the polygon zone for at least 5 minutes. The March 2020 daily data was compared to an average of the March 2017, 2018 and 2019 daily data.

Analysis

As figure 4 shows, there was a significant decrease in vehicle traffic volume beginning on March 14th, as people realized the risks of COVID-19 and the severity of the spread. The vehicle traffic volume continued to decrease until March 30th. On March 31st, we see a slight increase but don't predict that the data will continue to increase because of the COVID-19 impacts that have accrued in April.

Figure 4



Change in Vehicle Traffic in Commercial Centers

Methodology

The first study area for this StreetLight analysis derives from the METC's *Job and Activity Center* dataset. This dataset comprises parcels from the metro area that demonstrate a minimum job density of 10 jobs per hectare, as well as a concentration of at least 1,000 jobs. The second study area comprises major job zones in greater Minnesota, which utilizes the same criteria as the metro area dataset. It includes census block groups with at least 1,000 jobs at 10 jobs per hectare, as well as block groups with at least 800 manufacturing or transportation jobs, regardless of their density.

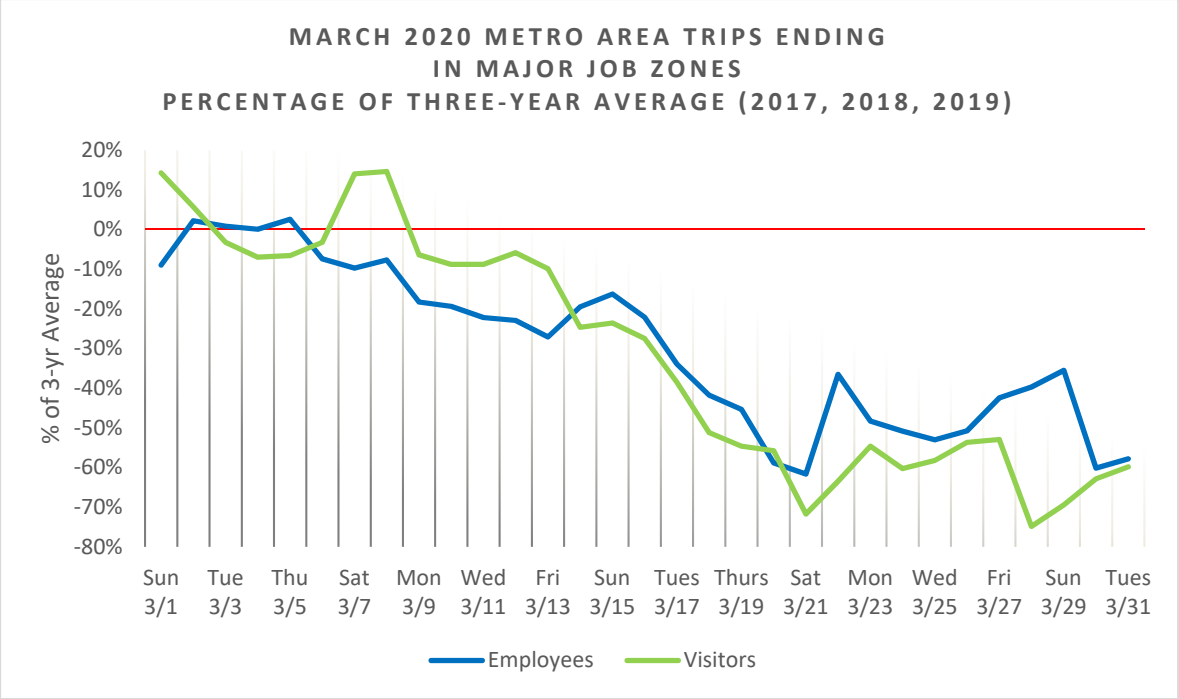
The study period runs from Sunday, March 1st, through Tuesday, March 31st and utilizes daily averages trips for each category of census tracts. Each daily average for March, 2020 was divided by the three-year average from 2017, 2018, and 2019, in order to determine the relative departure from normal for each day. The only trips considered were those that ended within the job zones as the goal was to gauge the impact of COVD-19 on travelers to commercial neighborhoods, rather than those that already live there.

StreetLight allows for the division of the data into work trips and school trips. For this analysis, work trips serve as a proxy for employee behavior while non-trips represent consumer behavior. This grants the opportunity to study of the impact of COVID-19 on different types of travel behavior.

Analysis

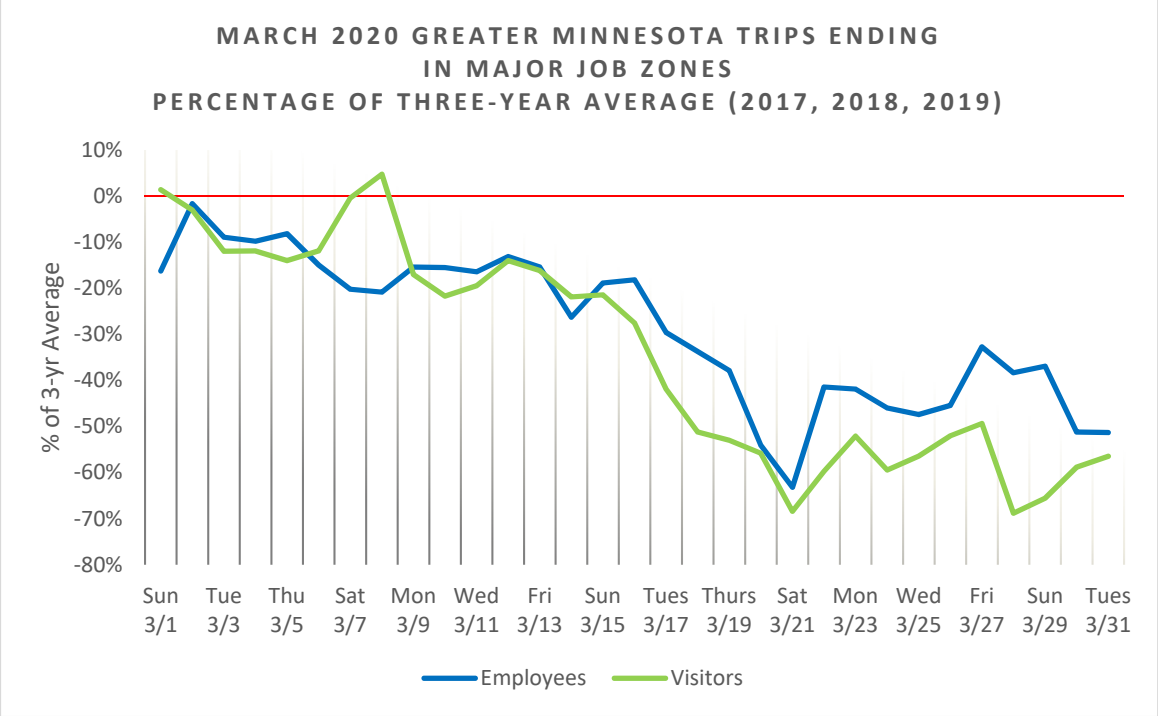
The trend lines in Figure 5 below show somewhat steeper declines initially for workers, with smaller declines for visitors during the following week of March 9th. This means the some employees may already have been staying home while the many members of the general public were attempting to run errands. A spike in job zone visitors over the weekend of the 7th and the 8th may again indicate a surge in shopping for Stay-at-Home preparation. By Saturday the 14th, trips had declined significantly for both workers and visitors. The decline accelerated over the next week, with trips to job zones reduced 60 to 70% by Saturday the 21st. Over the next week, trip levels stabilized with both employee and visitor trips reduced around 60% at the end of the month.

Figure 5



Greater Minnesota shows a very similar trend below in Figure 6. Trips to job zones declined a small amount over the first week, with a spike in visitors on Saturday, the 11th. On the third week, after Sunday, the 15th, both visitors and employees greatly reduced their trips. Visitors bottomed out with an over 70% reduction by Saturday, the 21st, and workers with a nearly 60% reduction. Over the next week, visits tended to be even more reduced than work trips, suggesting that potential customers are following social distancing guidelines, while a reduced number of essential workers still travel to job zones.

Figure 6



Change in Vehicle Traffic by Income

Methodology

This goal of this section is to take an equity-based perspective and determine the transportation impact of COVID-19 on neighborhoods of varying socioeconomic status within the seven county metro. It seeks to determine whether different types of neighborhoods would exhibit different changes in travel behavior.

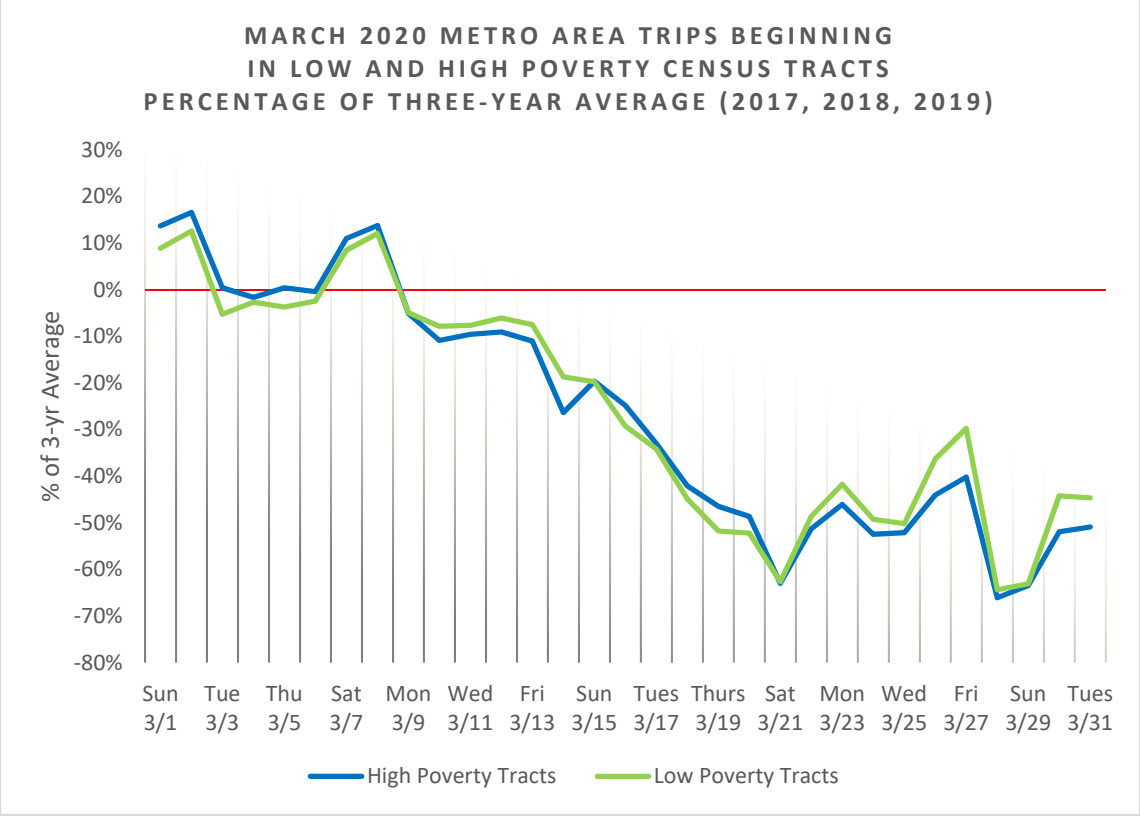
The analysis zones for high poverty areas derive from the METC's *Areas of Concentrated Poverty* dataset. The METC considers concentrated poverty to occur when at least 40 percent of the tract's population lives below 185 percent of the federal poverty threshold. In practice, that amounted to $46,000 for a family of four or $23,000 for an individual in 2017. This dataset also excludes high-poverty tracts where at least 27.5 percent of the population is enrolled in college. Inverting this definition, the current analysis considers low-poverty zones to be those with less than 10 percent of the population living below the 185 percent threshold.

The study period runs from Sunday, March 1st, through Tuesday, March 31st, and utilizes daily average trips for each category of census tracts. Each daily average for March, 2020 was divided by the three-year average from 2017, 2018, and 2019, in order to determine the relative departure from normal for each day. The only trips considered were those that started within the tracts as the goal was to gauge the impact of COVD-19 on residents of these neighborhoods.

Analysis

Figure 7 below shows whether or not travel was higher or lower than expected on each day. The overall trend indicates that in the first half of the month, residents from across the metro altered travel patterns in similar ways. Overall, trips were somewhat reduced during the week of March 9th and then experienced a large drop beginning on Saturday the 14th. The decline accelerated over the next week, with trips reduced over 60% by Saturday, the 21st. Travel from high income, and especially low income tracts, spiked on Friday, perhaps in anticipation of Governor Walz's Stay at Home executive order on Saturday, March 28th. The increased number of trips over the two weekends in the study period may speak to the efforts of tract residents to stock up for anticipated shut downs. While lower poverty income tracts seemed to show relatively less travel over the first week, and relatively more travel the second week, as compared with the higher-income tracts, both the wealthy and underprivileged tracts showed similar patterns over time. However, by the end of the month, residents of lower poverty tracts were traveling slightly more, with a decline of around 40% as compared with 50% in the higher poverty tracts. This may reflect the decreased ability of lower income residents to travel recreationally in light of reductions in public transportation service.

Figure 7



Change in Vehicle Traffic in Tribal Nations

Methodology

This section examines the transportation impact of COVID-19 on Minnesota's 11 tribal nations in order to determine if residents of these areas experiences different impacts from those in other parts of the

state. Tribal nation boundaries for StreetLight derive from the U.S. Census TIGER Files. Of the 11 tribal nations, only one, the Mdewakanton Community, resides within the seven county metro. The rest lie across greater Minnesota.

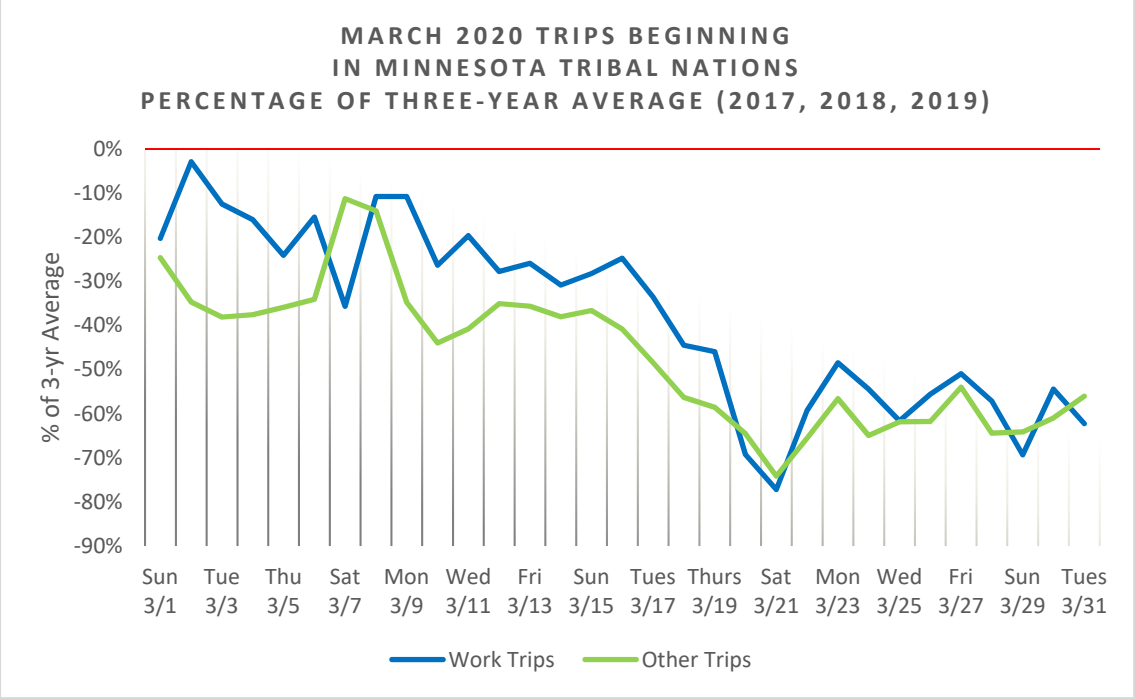
The study period runs from Sunday, March 1st, through Tuesday, March 31st, and utilizes daily average trips for each category of census tracts. Each daily average for March, 2020 was divided by the three-year average from 2017, 2018, and 2019, in order to determine the relative departure from normal for each day. The only trips considered were those that started within tribal nations as the goal was to gauge the impact of COVD-19 on residents of these communities.

For each day StreetLight allows for the division of the data into work trips and non-work trips. This grants the opportunity to study of the impact of COVID-19 on different types of travel behavior.

Analysis

Figure 8 below shows a great deal of variability, which may speak to the difficulty of collecting mobile phone data in isolated rural areas that lack complete network coverage. However, the graph still illustrates a general decline in work trips across the second week, as well as relatively high levels of non-work trips on Saturday, March 7th. The decline accelerated across the third week, with trips reduced by 80% on Saturday, the 21st. Over the following week, trips showed a small rebound, with overall travel reduced around 60%.

Figure 8



Geographic Changes in Vehicle Traffic

Methodology

These maps represent data from the four full weeks in March, with each week of March 2020 serving as the time period for a single StreetLight analysis. In this way, each map represents a daily average for all seven days in its study period. Trips start and trip ends both contribute this average. Each week's average was subsequently divided by the number of daily average trips during the three corresponding weeks from 2017, 2018, and 2019. Thus each resulting map represents a deviation from the long-term average for this time period. Areal units of analysis for StreetLight comprised county and census tracts derived from the U.S. Census Bureau's Topologically Integrated Geographic Encoding and Referencing (TIGER) shapefiles.

Analysis

Figure 9 below shows the relative change in daily travel across Minnesota counties for the first week of March, 2020. It compares the average number of trips starting and ending in each county with the average for same period in 2017, 2018, and 2019.

Figure 9

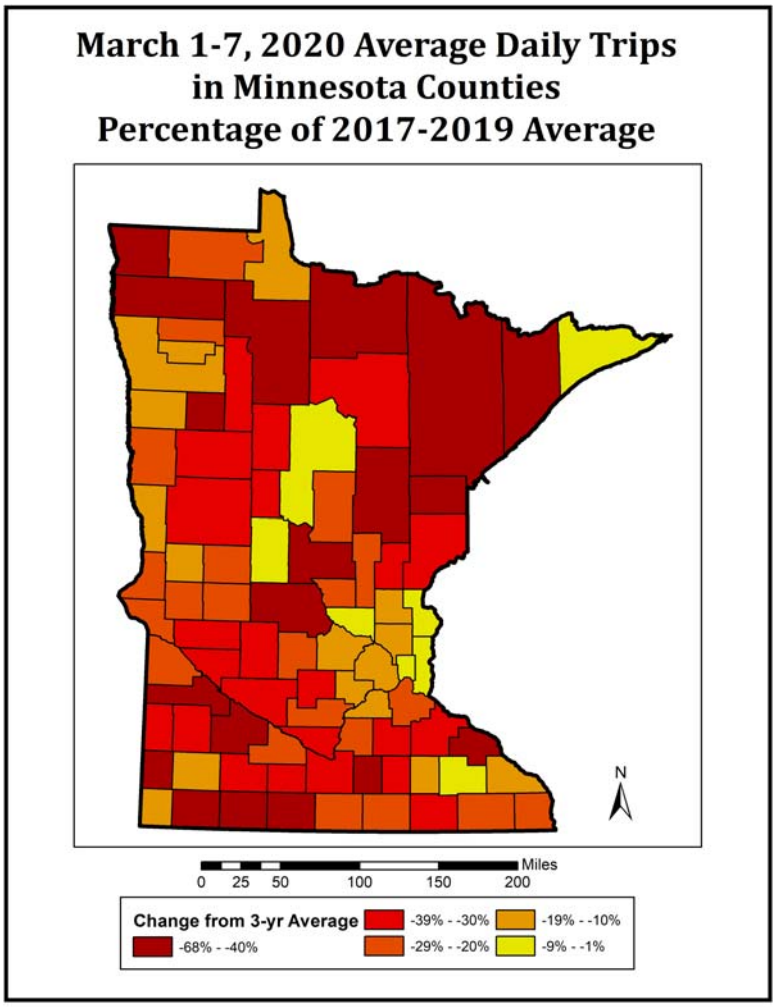


Figure 10 below shows the same data for the second week of March, 2020. It generally shows an increase in the number of counties experiencing large drops in travel. Olmsted County stands out as a location with relative little decrease in travel for both of these weeks, suggesting that increased travel from Mayo Clinic medical staff may have offset travel decreases among the general population. Cook and Hennepin County also stand out as outliers during this week. This may reflect the inherent isolation of Cook County and larger number of residents still required to work in Hennepin. Finally, the lack of decline in Clay County may reflect its integration with the neighboring state of North Dakota, which has yet to enact statewide closures with regard to COVID-19.

Figure 10

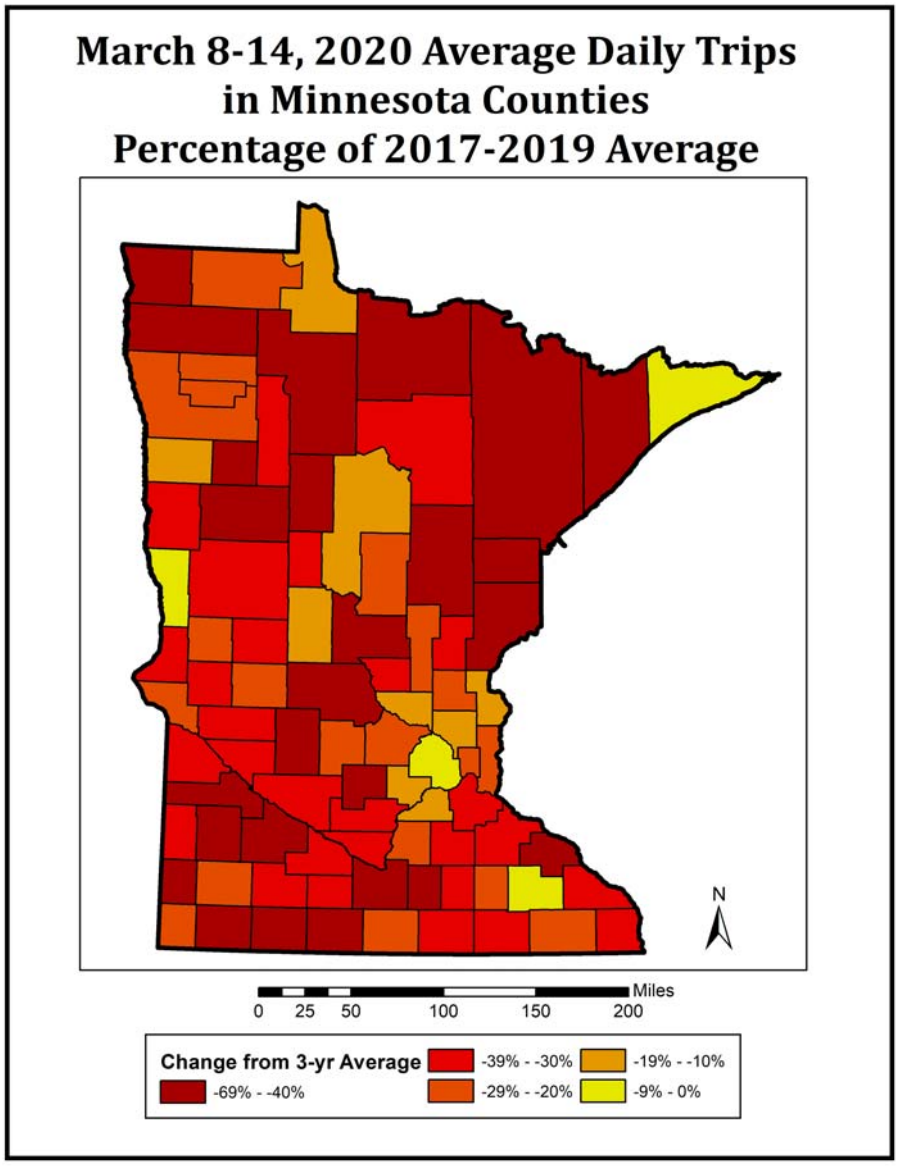


Figure 11 below shows the change in trips across the state for the third week in March. It compares trips over this week with the three year average for the same period. By this week, large parts of the state were showing declines in trips, with many counties registering drops of more than 50%. Some outliers include Lake of the Woods County in the north and Cook County in the northeast.

Figure 11

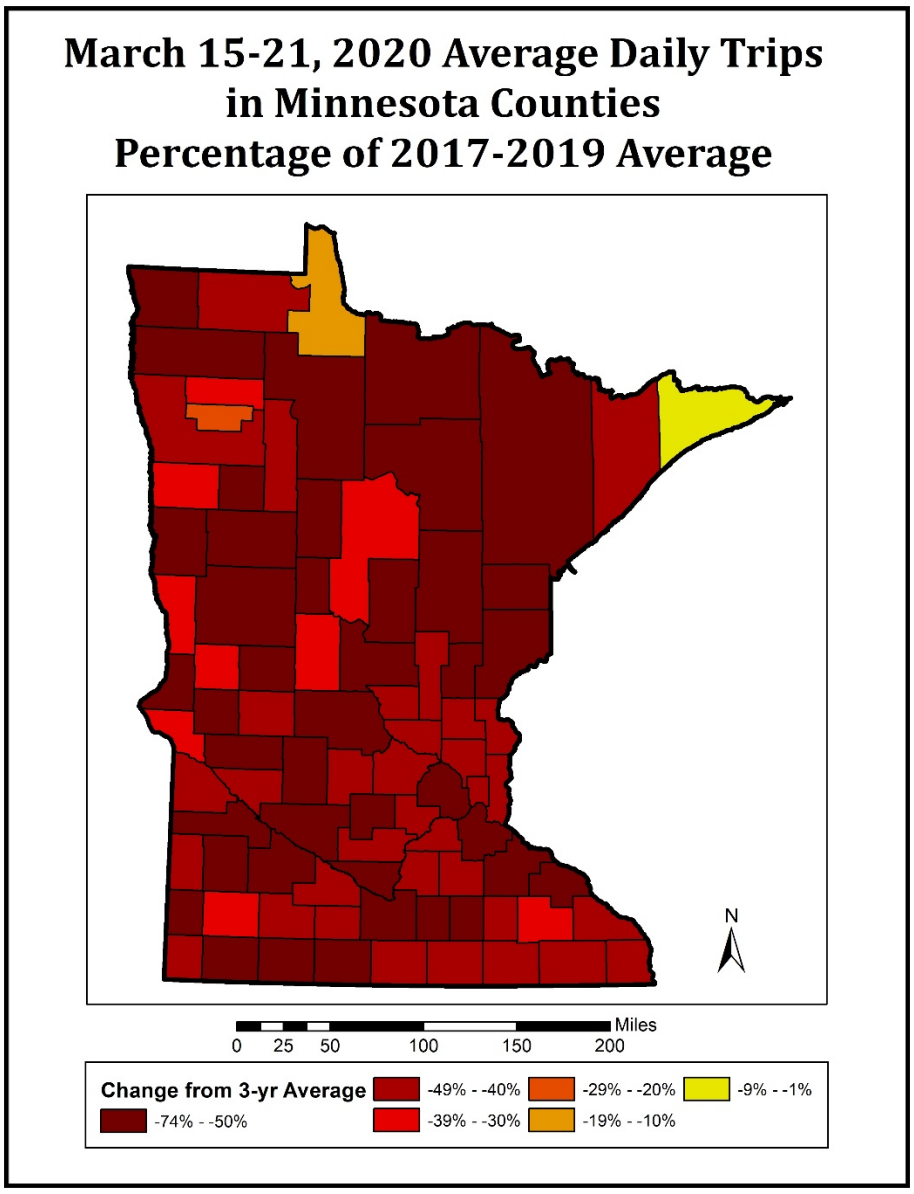


Figure 12 below shows the change in trips across the state for the fourth week in March. It compares trips over this week with the three year average for the same period. Overall it appears that nearly every part of the state was reducing travel, with even Lake of the Woods County and Cass County showing declines of over 30%.

Figure 12

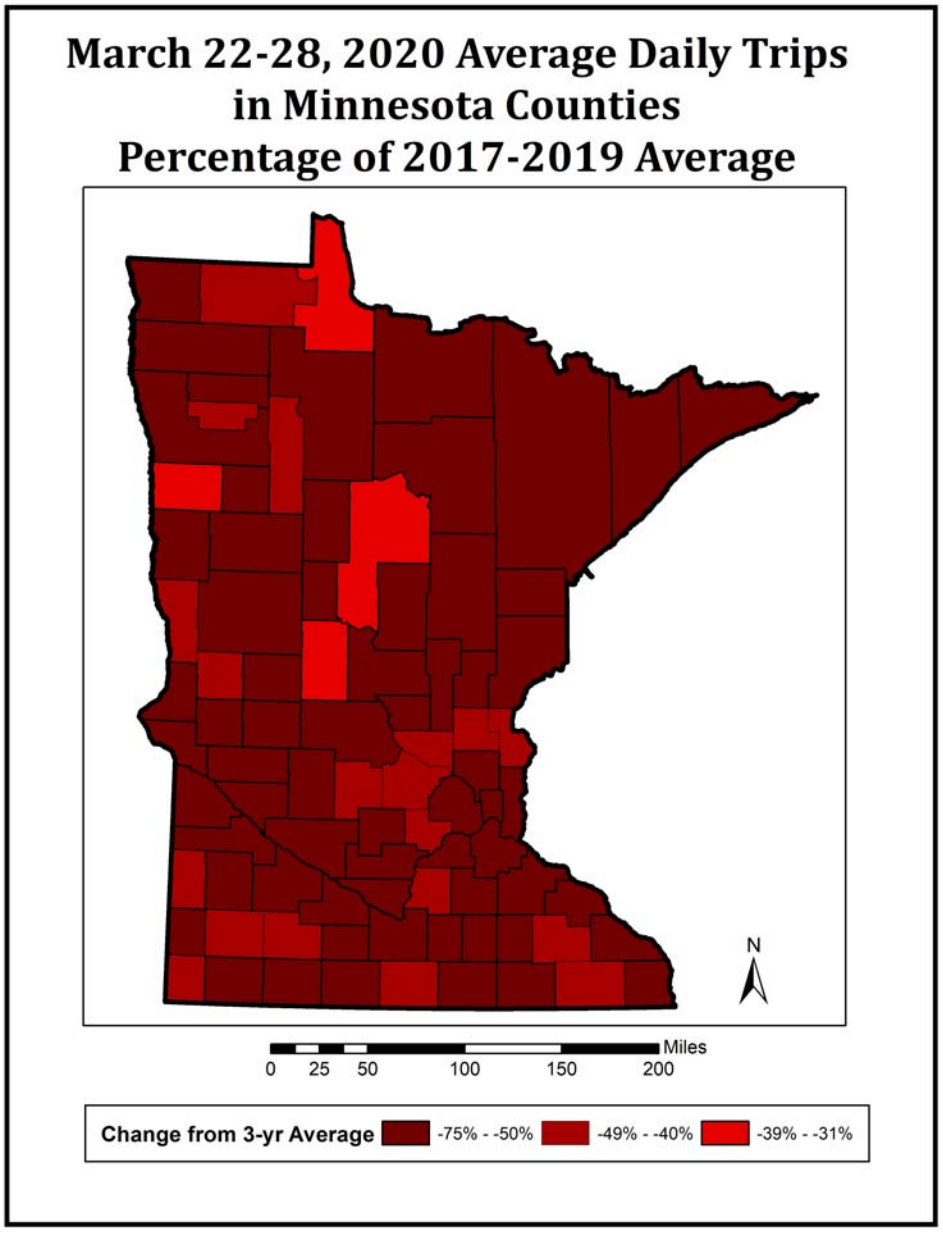


Figure 13 below shows the change in trips across metro zip codes for the first week in March. It compares trips over this week with the three year average for the same period. Overall it appears that major declines had not yet appeared in the densest zip codes.

Figure 13

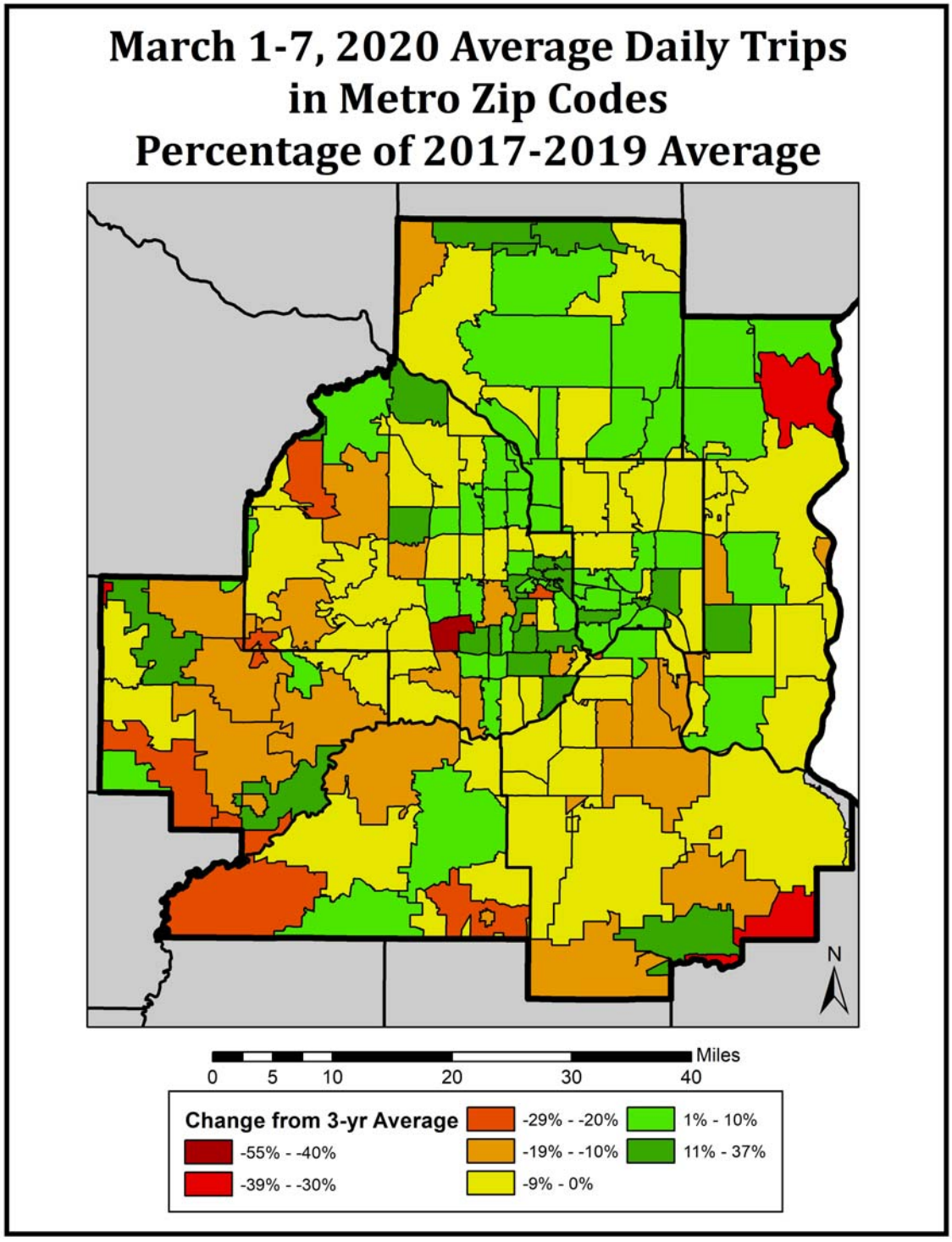


Figure 14 below shows the same measure for the second week of March. Across the metro, far more zip codes now display declining number of trips.

Figure 14

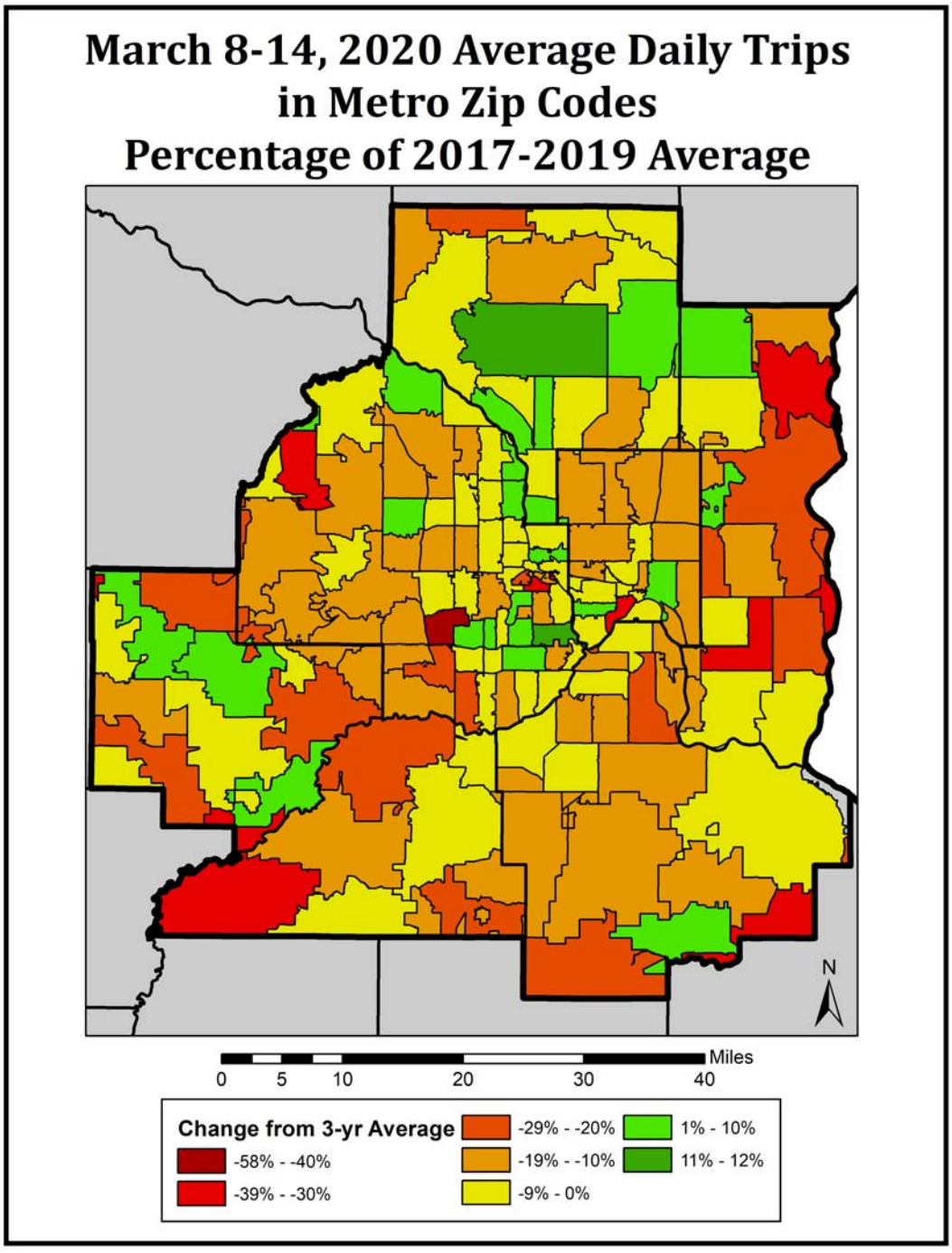


Figure 15 below shows the same measure for the third week of March. Across the metro, far more zip codes displayed steeper declines with large numbers of zip codes showing declines of more than 40%. Even steeper declines occurred in some parts of central Minneapolis. The only areas showing lower declines were zip codes in the western part of Carver County.

Figure 15

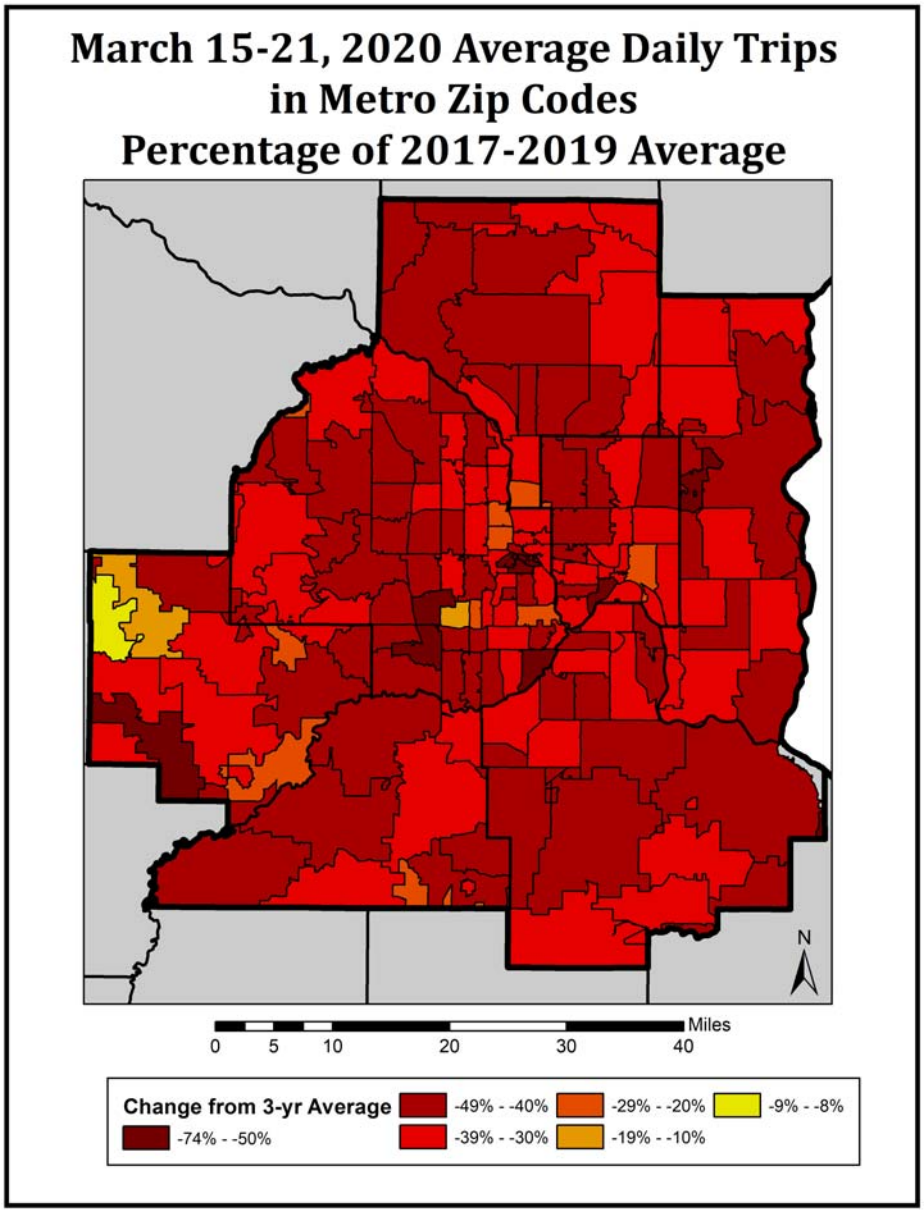
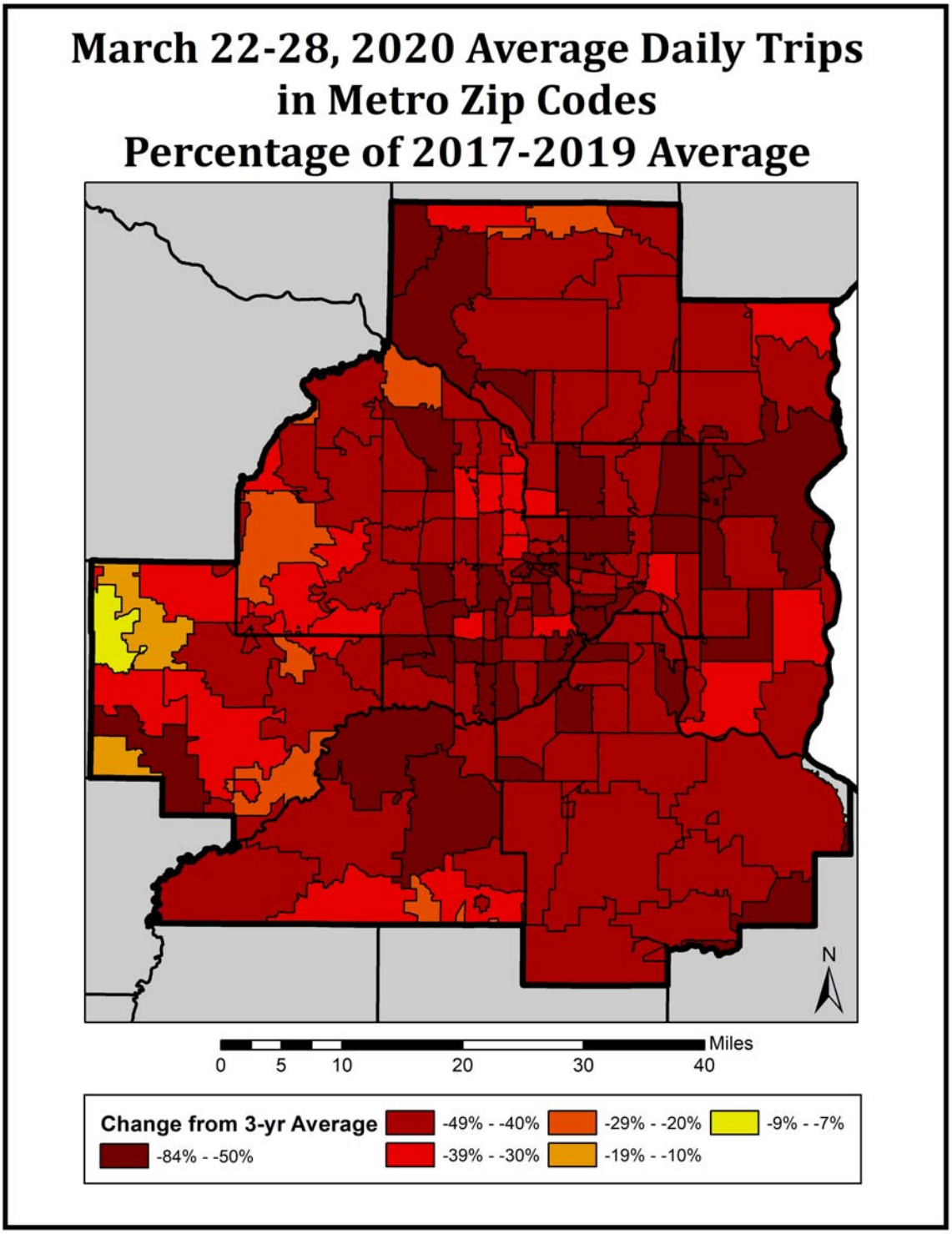


Figure 16 below shows the same measure for the fourth week of March. Across the metro, zip codes continued to display steeper declines with increased areas showing declines of more than 50%. Once again, only areas of western Carver County did not show the same level of decline.

Figure 16



Impact of Job Loss on Vehicle Traffic

Methodology

This portion of the analysis explores whether or not the loss of jobs due to COVID-19 has a measurable impact on traffic as distinct from more general social distancing practices. The goal is to identify any relationship that exists between changes in average daily trips and the number of residents whose jobs might be at risk from the economic fallout like business closures.

This analysis relies on job estimates from the U.S. Census Bureau's 2017 American Community Survey (ACS). The ACS groups occupations into different industry categories from the North American Industry Classification System (NAICS). This analysis concerns jobs that fall into one of three categories: retail trade; arts, entertainment, and recreation; and food preparation and accommodation. These jobs are at the highest risk of disruption because they represent services that often require physical contact with customers. As entertainment and restaurant venues remain closed, as well as many retail stores, service jobs have already experienced great losses. However, fine-tuned data about local gains and losses in specific industries will not be available for severable months. Consequently, this analysis thus relies on past job estimates to gauge impact.

The current phase of analysis comprises a set of maps to show the concentration of residents with service sector jobs.

Analysis

Figure 17 below shows the concentration of service sector jobs across Minnesota's counties according to the 2018 ACS. The concentration of these jobs is highest in areas that depend on tourism in northern Minnesota, as well as college towns like Mankato, St. Cloud, Marshall, and Winona.

Figure 18 below shows the same measure for census tracts within the seven county metro area. Concentrations are highest in lower-income census tracts with large numbers of young people, such as south and northeast Minneapolis near downtown. Large numbers of residents also work in these sectors near major service employers like the Minneapolis-St. Paul Airport and the Mall of America in southwest Richfield and eastern Bloomington. A few other scattered locations are noted in the metro area.

Figure 17

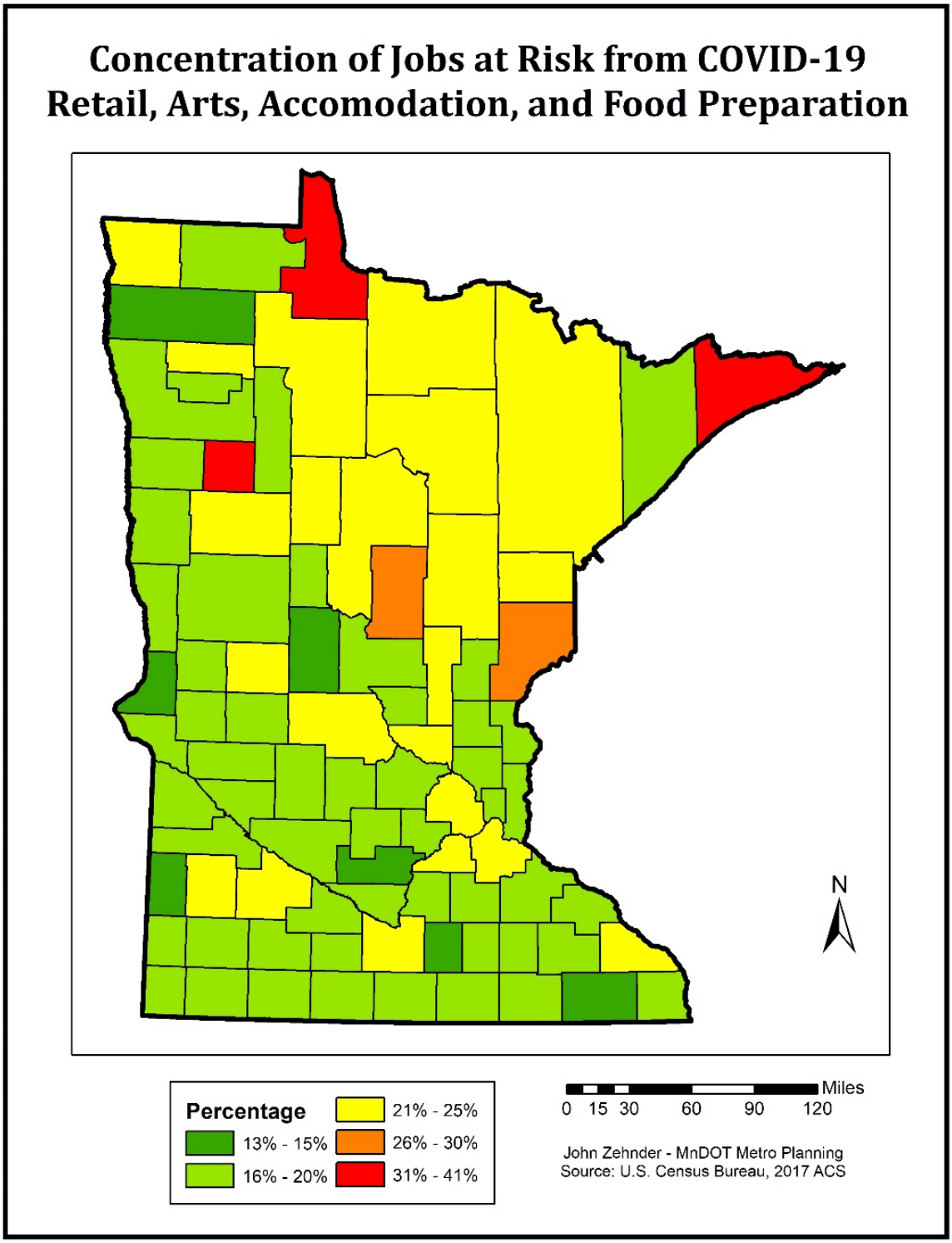
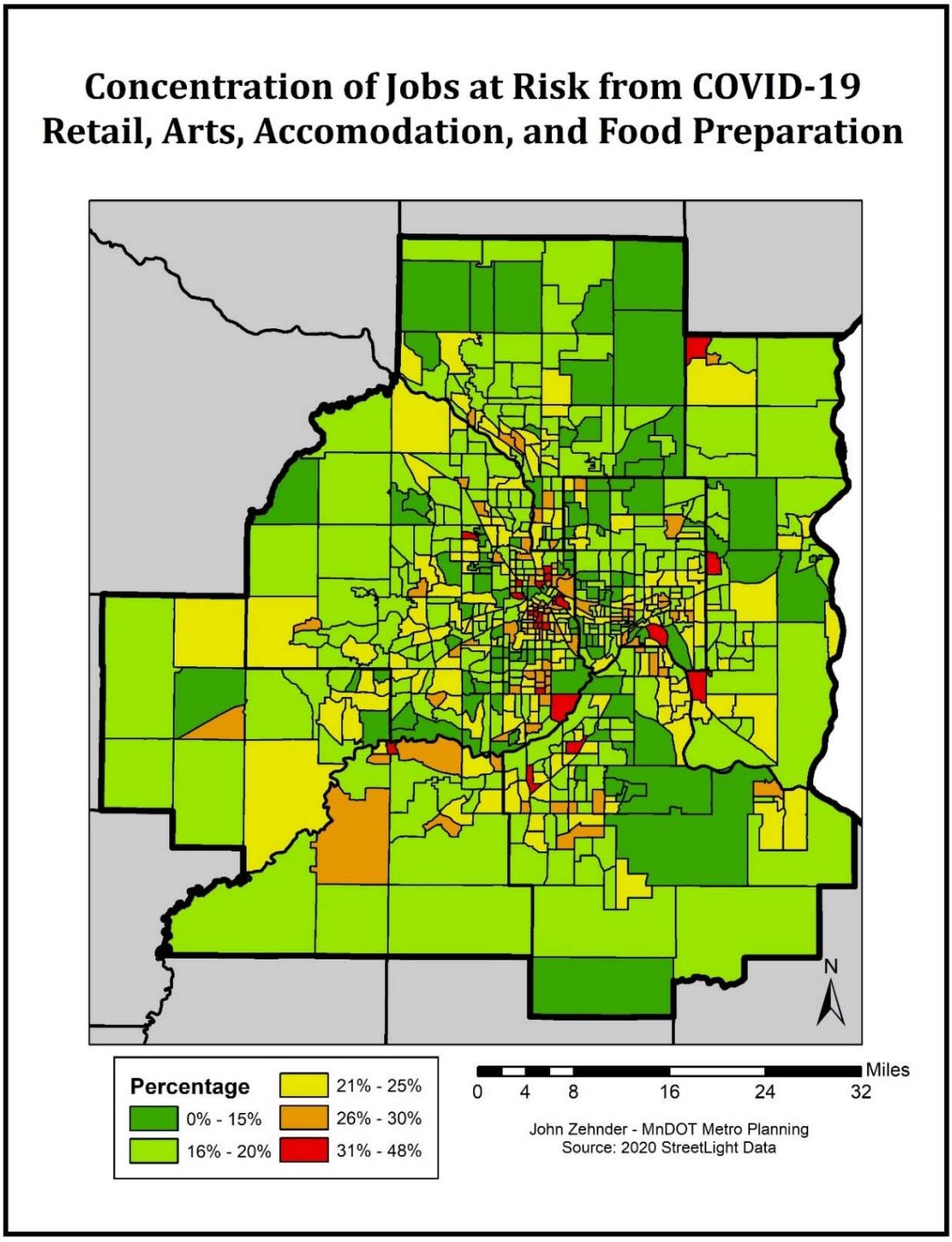

Concentration of Jobs at Risk from COVID-19
Retail, Arts, Accomodation, and Food Preparation
N
Percentage
13% - 15%
16% - 20%
21% - 25%
26% - 30%
31% - 41%
Miles
0 15 30 60 90 120
John Zehnder - MnDOT Metro Planning
Source: U.S. Census Bureau, 2017 ACS

Figure 18


Concentration of Jobs at Risk from COVID-19
Retail, Arts, Accomodation, and Food Preparation
N
Percentage
0% - 15%
16% - 20%
21% - 25%
26% - 30%
31% - 48%
Miles
0 4 8 16 24 32
John Zehnder - MnDOT Metro Planning
Source: 2020 StreetLight Data

Change in Trip Distribution

Methodology

The figures showing trip distribution also used StreetLight Data. Trip lengths were broken into categories by distance and are displayed in the graphs below.

Analysis

This analysis compared distributions of trip length (in miles) over the month of March to similar weeks in previous years. For the Metro analysis, the seven county area, (Hennepin, Ramsey, Dakota, Scott, Anoka, Carver, and Washington) that aligns with the METC's definition of the urbanized area was used. For Greater Minnesota, all 87 counties within the state (excluding the seven metro counties) were used.

To analyze trip length distribution, trip lengths for all of the trips starting or ending in the determined geographic area was compiled and averaged to provide a distribution of trip lengths. This was used to determine trip lengths for the month of March and compare those weeks to similar weeks in 2017, 2018, and 2019. Figures 19-22 show trip distribution by length for the seven-county Metro area while Figures 23-26 show the trip length distribution for the remaining 80 counties in Minnesota.

This data was averaged to get one trip distribution for each of the geographies (Metro and Greater Minnesota). Similarly, the data for the comparable weeks in 2017, 2018, and 2019 were averaged across those years to provide one trip distribution. The graphs below represent all days of the week, for the 12am-12pm time period.

Figure 19

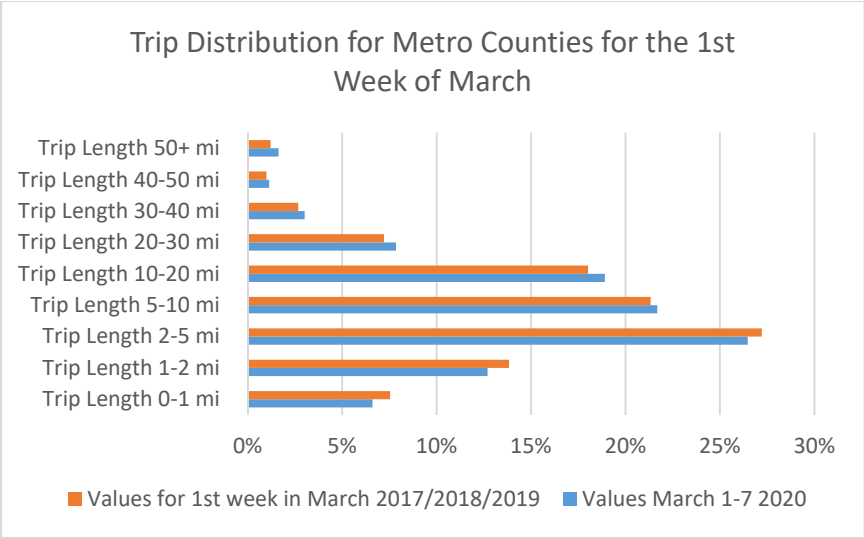


Figure 20

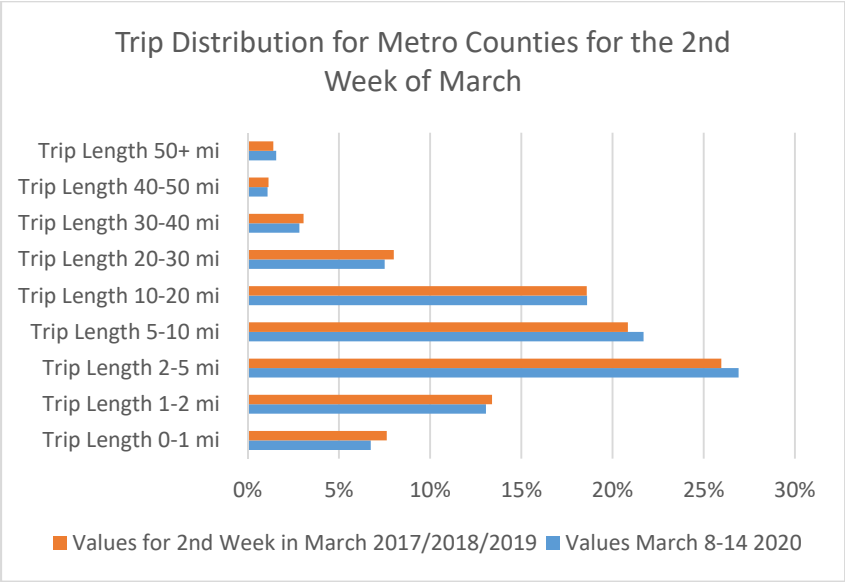


Figure 21

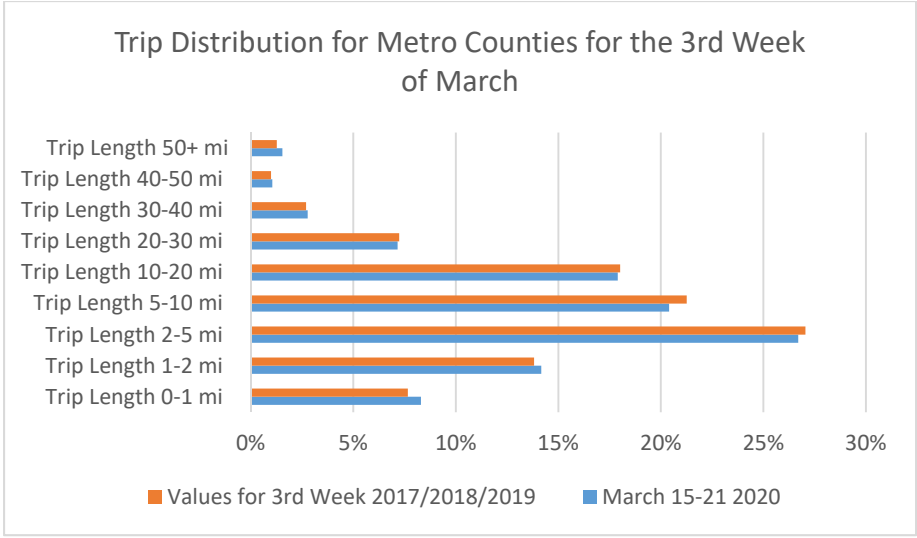
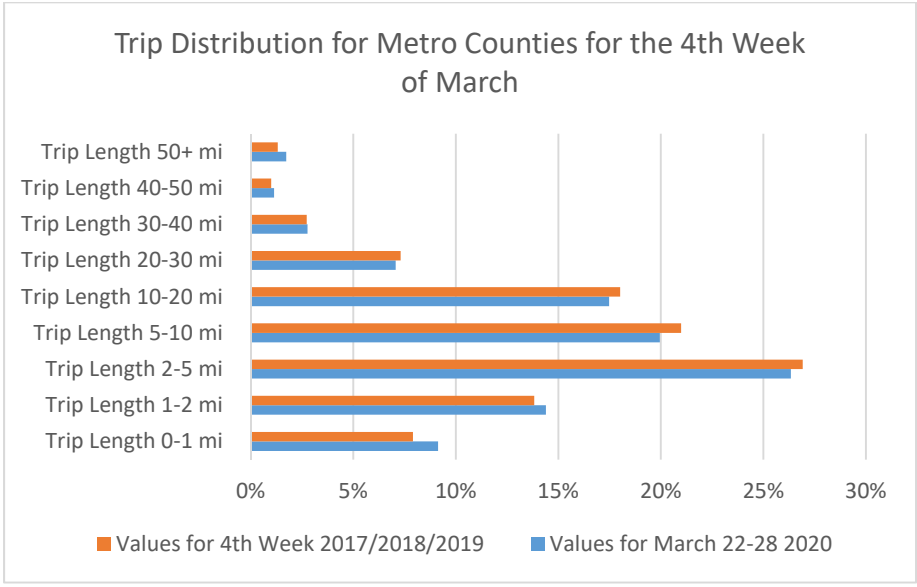


Figure 22



Overall, the trip distribution for the Metro Counties did not change significantly when comparing the four weeks in March to similar weeks in 2017, 2018, and 2019.

For the Greater Minnesota counties in figures 23-26, there was more of a change in the trip distribution between the four weeks in March 2020 and comparable weeks in 2017, 2018, and 2019. This change shows that trips in 2020 skewed to longer trips than in previous years.

Figure 23

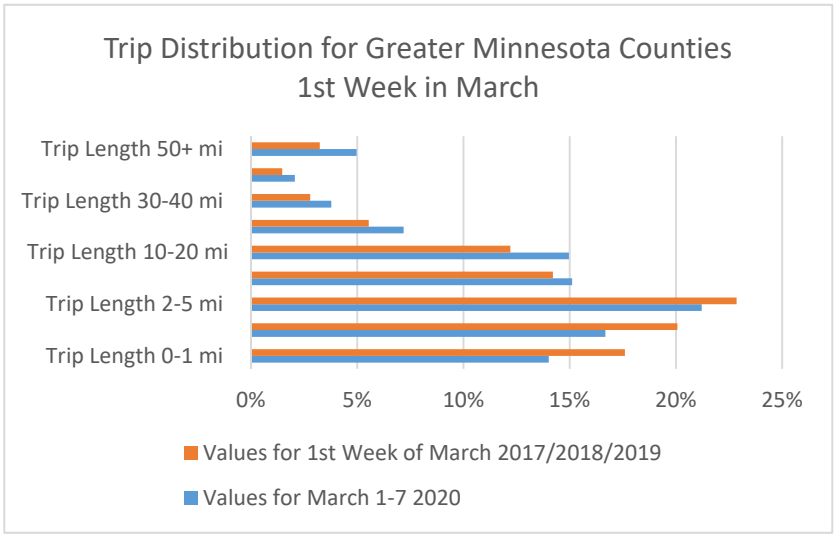


Figure 24

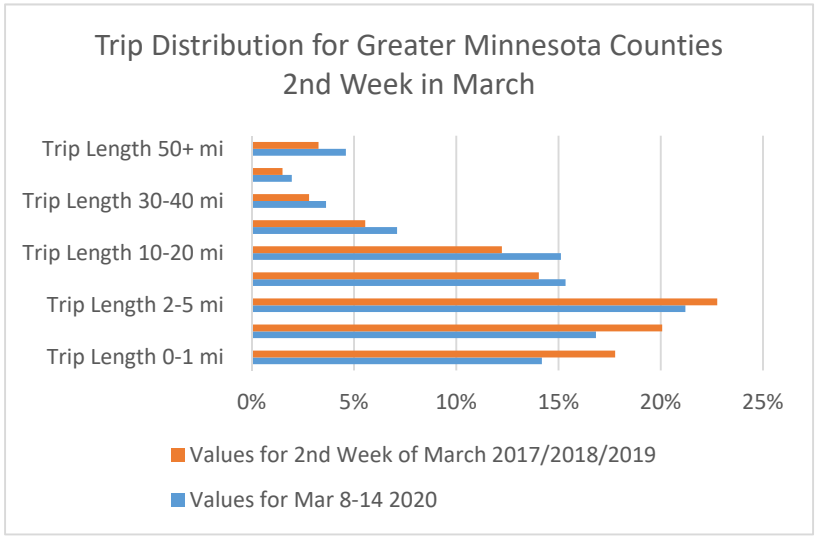


Figure 25

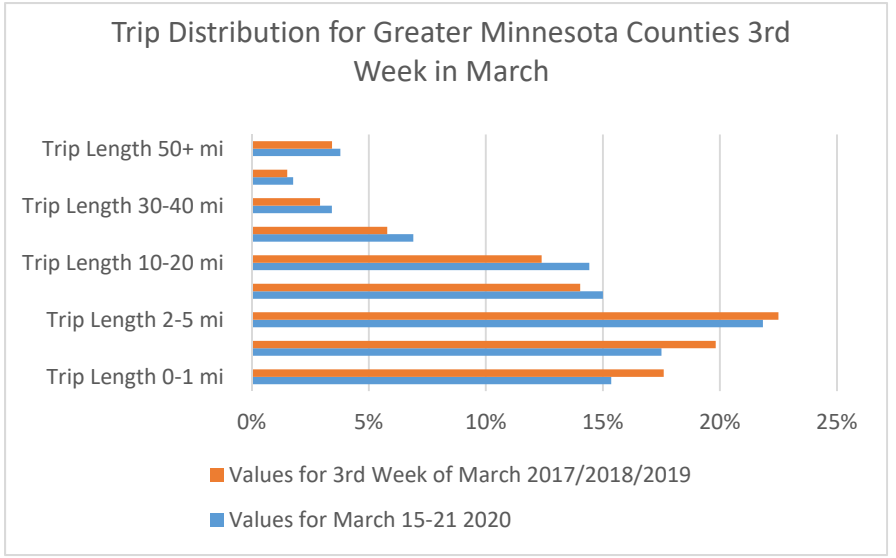
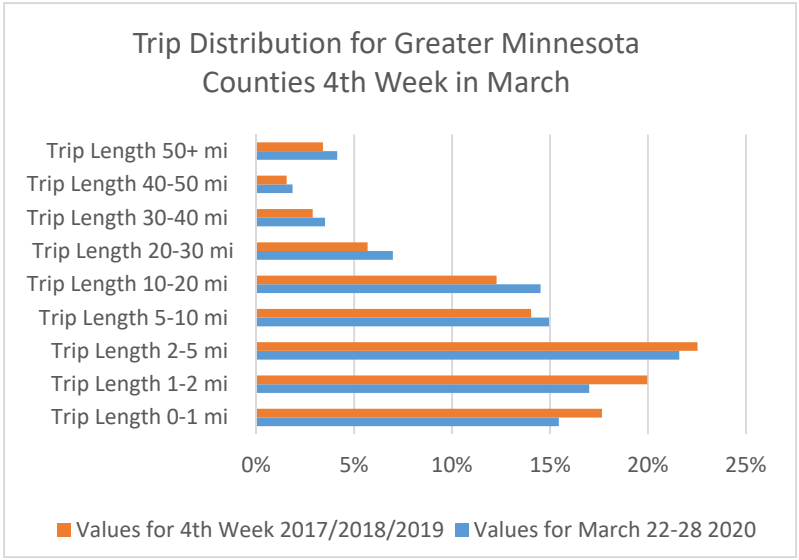


Figure 26



DEPARTMENT OF TRANSPORTATION