



Planning Minnesota's
Transportation Future

TELEWORK AND E-COMMERCE TREND ANALYSIS

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SUMMARY

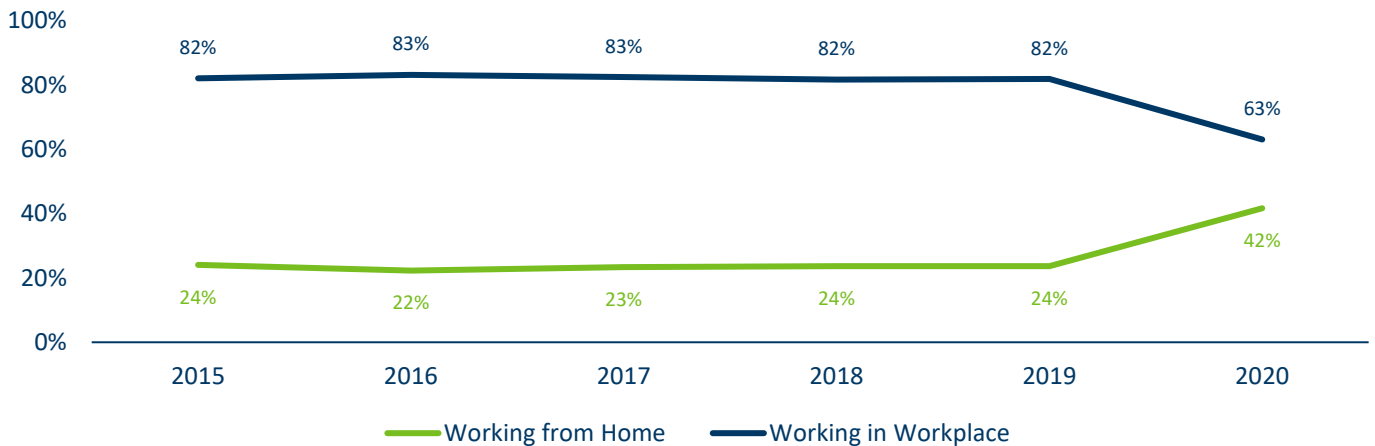
The effects of COVID-19 on the way we work, shop and live are hard to overstate. Many daily activities have moved online, and the exchange of goods and ideas can occur with one click. The concept of working from home went from being a trendy perk provided by a few employers to a national shift and for some employers, a permanent practice. The work from home trend does vary, however, based on job type and other socioeconomic factors. Online shopping or e-commerce continues to grow and affect how people buy goods. These changes have implications for greenhouse gases, infrastructure demand and financing, safety and cyber security. Due to more options available for online shopping, delivery trucks and couriers are taking more and more trips. This shift in use and record-setting demand for convenient deliveries affects congestion, the environment and presents safety concerns for pedestrians and bicyclists.

TELEWORKING AND WORKING FROM HOME

NATIONAL TRENDS

In the United States, the percentage of individuals working from home remained steady up until 2020. From 2015-2019, 22-24% of workers worked from home according to the Bureau of Labor Statistics (Table 1). In 2020, however, an average of 42% of workers worked from home.¹ This is an increase of nearly 75% while the percentage of workers that reported to their workplaces regularly decreased by over 30%.

Figure 1: Percentage of workers working from home or in their workplace Nationwide²



Employees are also working more hours from home. The American worker spent on average 5.8 hours a day working from home in 2020, a 75% increase from the previous year (Figure 2). The average hours a worker spent

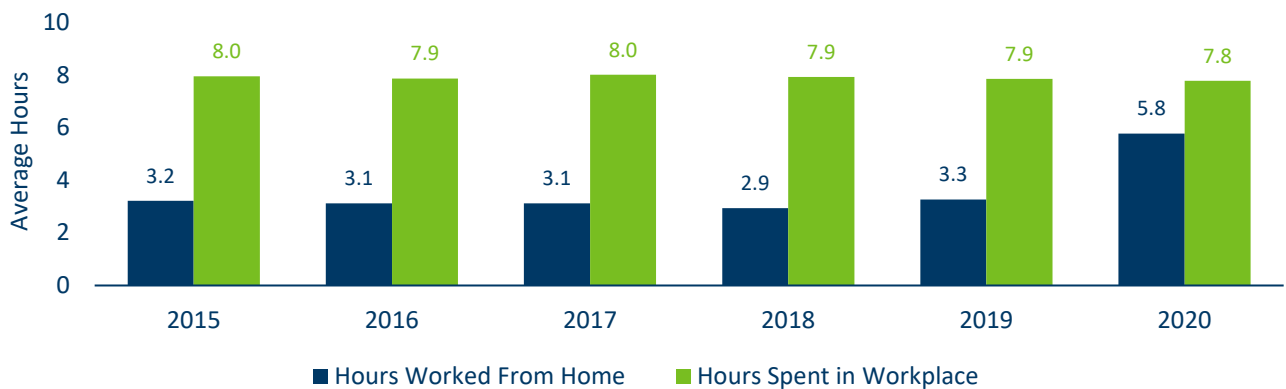
¹ "Table 4. Employed persons working and time spent working on main job at home or workplace, by class of worker, occupation, industry, and earnings, averages for May to December 2019 and 2020," United States Bureau of Labor Statistics (2021). <https://www.bls.gov/news.release/atus.t04.htm>

² American Time Use Survey, Bureau of Labor Statistics (2021). Note: Due to COVID-19 Pandemic, data collection did not occur from mid-March to mid-May 2020. Because the omitted time period included some of the most restrictive policies, the work from home estimates are likely conservative for the year.

in their workplace has stayed relatively flat going in to 2020. This is for two reasons: the fact that front line workers often worked throughout the pandemic (some even worked more than the typical 40 hours due to staffing issues) and the data in 2020 not including mid-March to mid-May 2020 due to the halt of surveying by the Bureau of Labor Statistics. Seventy percent of workers in frontline positions (such as the healthcare and grocery industries) were unable to work from home.³ Even with a push for employers to return to the workplace, it is widely believed that employee hours working from home will unlikely return to pre-pandemic numbers.⁴ This is largely because not having employees report to the office lowers overhead costs for employers and many workers preferring working from home.

There is also a national trend of hybrid working, where workers still spend significant time working from home even though they have increased their hours working in the office. This could have large effects on our land use, economic development, and transportation patterns.

Figure 2: Average hours American workers spend working in their workplaces and home from 2015-2020⁵



There are also several non-pandemic explanations for the rise of teleworking. Issues such as commute times and office distractions contribute to the losses that come with mandatory office attendance. Pre-pandemic, U.S. employers lost approximately \$1.8 trillion a year to lost productivity at the office.⁶ Many employers in technology, consulting, business and government are maintaining a remote or hybrid environment even after mandated lockdowns largely to save on the overhead necessary for an office, retain and attract workers, as well as to make up for lost productivity.

Employers see telework as an opportunity to expand their talent pool. In May 2020, Facebook announced that they could have 50% of their employees working remotely in the next five to 10 years. With that transition,

³Essential and Frontline Workers in the COVID-19 Crisis | Econofact

⁴ Matthew Haag, "Remote Work is Here to Stay. Manhattan May Never Be the Same" New York Times (2021) [Remote Work Is Here to Stay. Manhattan May Never Be the Same. - The New York Times \(nytimes.com\)](https://www.nytimes.com/2021/05/11/nyregion/remote-work-is-here-to-stay.html)

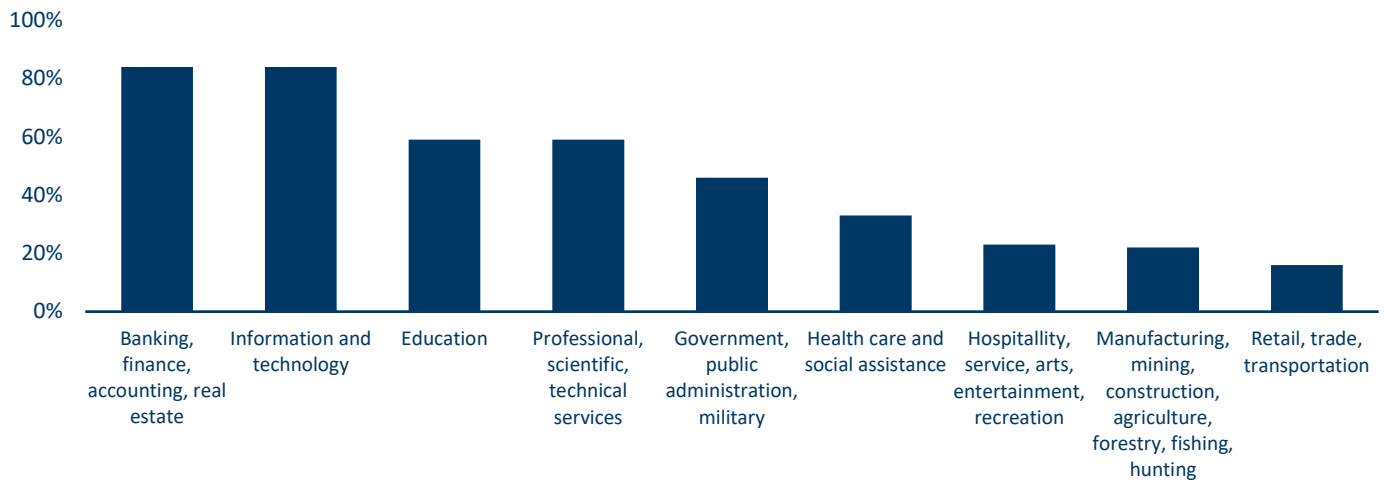
⁵ [Table 6. Employed persons working at home and at their workplace and time spent working at each location by full- and part-time status and sex, jobholding status, and educational attainment, annual averages \(bls.gov\)](https://www.bls.gov/news.release/homeworking.htm)

⁶ Andrea Loubier, "Benefits of Telecommuting for the Future of Work," Forbes, July 20, 2017, <https://www.forbes.com/sites/andrealoubier/2017/07/20/benefits-of-telecommuting-for-the-future-of-work/#572887b016c6>.

Facebook is considering adjusting paychecks to reflect the cost-of-living differences—the cost of living in rural Wyoming is less than living in San Francisco.⁷

Access to teleworking is often income-based. Teleworkers tend to earn the highest incomes. Sixty-two percent of workers earning in the top 25% of salaries say they could work from home. In contrast, only 9% of workers earning wages in the bottom 25% say they can work from home.⁸ Access to teleworking is also largely based on the industry the employee is in. Industries that are typically office settings (like banking, finance, real estate, and IT) have a straightforward transition to remote work while the hospitality, manufacturing, construction, agriculture and retail industries do not have the same ability to do so as shown in Figure 3.

Figure 3: Percentage of employed adults who say their job can be done from home by industry⁹



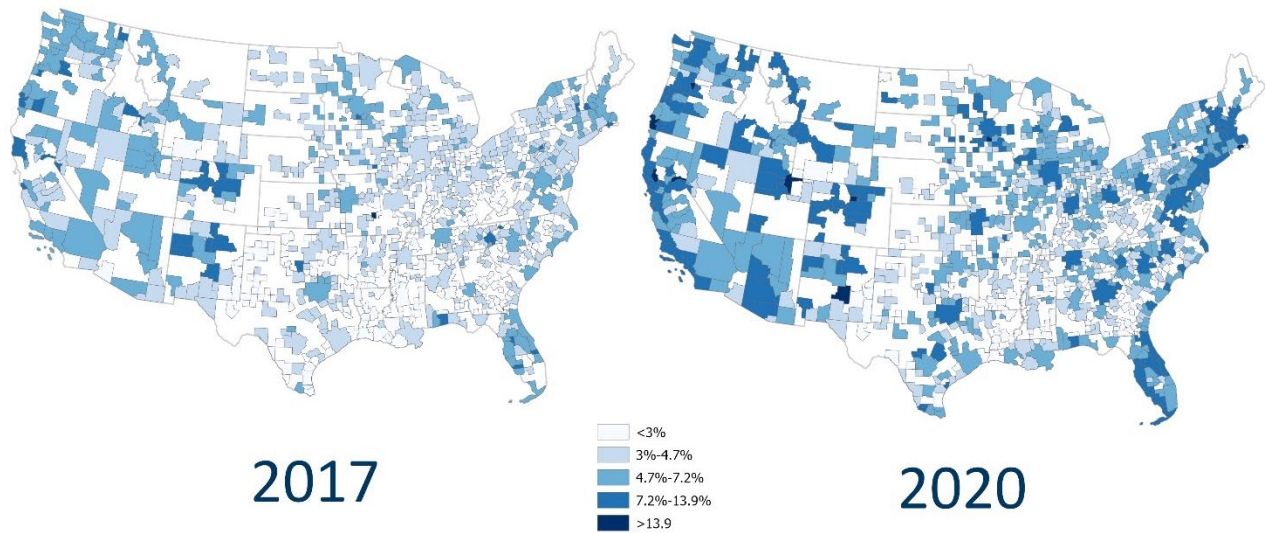
Prior to the COVID-19 crisis, the percentage of teleworking varied across regions of the United States. Figure 4 shows the teleworking trends of America’s Metropolitan/Micropolitan Statistical Areas for 2017 and 2020. Several trends emerge from comparing these two maps, such as the coasts experiencing a high increase of teleworkers. Nearly every metropolitan area on the map became darker, showcasing that the rise of teleworking in the pandemic impacted many urban regions.

⁷ Rachel Lerman and Elizabeth Dwoskin, “Facebook Will Now Let Some Employees Work from Anywhere, but Their Paycheck Could Get Cut,” Washington Post, May 21, 2020, <https://www.washingtonpost.com/technology/2020/05/21/facebook-permanent-remote-work/>.

⁸ Katherine Guyot and Isabel V. Sawhill, “Telecommuting Will Likely Continue Long after the Pandemic,” Brookings Institution, April 6, 2020, <https://www.brookings.edu/blog/up-front/2020/04/06/telecommuting-will-likely-continue-long-after-the-pandemic/>.

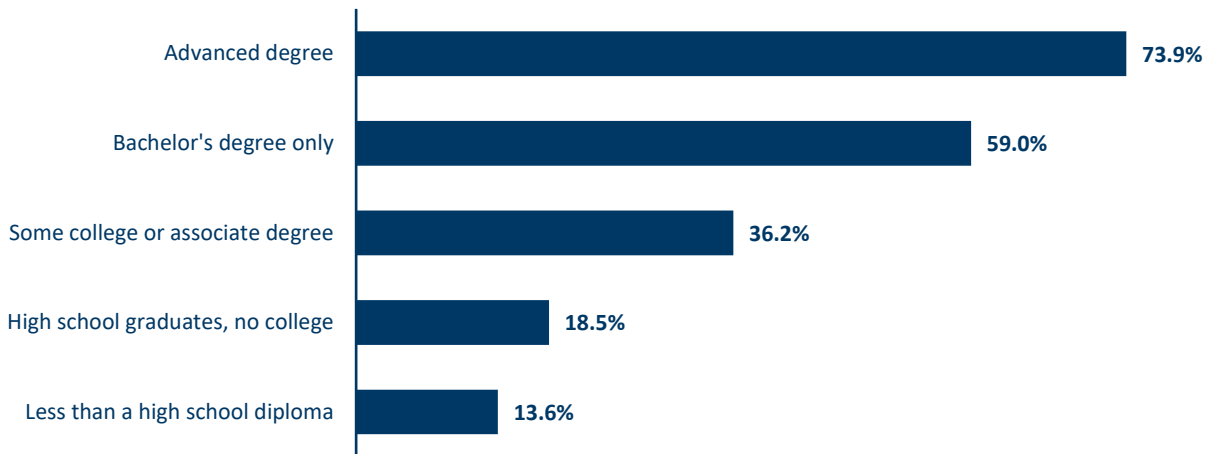
⁹ Pew Research Center Survey of U.S. adults conducted Oct. 13-19, 2020. [Telework is hard for many amid COVID-19 even in sectors where it’s common](https://www.pewresearch.org/2020/10/21/telework-is-hard-for-many-amid-covid-19-even-in-sectors-where-it-s-common/) | [Pew Research Center](https://www.pewresearch.org/)

Figure 4: Percentage of Teleworkers in Metropolitan Statistical Areas—2017 and 2020¹⁰



Workers in metro areas are also more likely to work remotely than those outside of metro areas for several reasons, including access to internet.¹¹ Moreover, increased education is positively correlated with the likelihood one would work from home: those with bachelor's degrees are more than twice as likely to work remotely than someone with only a high school diploma, as shown in Figure 5.

Figure 5: Percentage of employed persons working from home by education level in 2020¹²



Teleworking has immense impacts on transportation planning, funding and the environment that have been exacerbated since the start of the pandemic. One example of this is a dip in transit ridership, with data from the application “Transit” showing a 58% decrease in ridership nationally from 2019-2020. These declines are higher in certain cities. For example, Washington DC’s Metrobus ridership fell 66% and New York’s MTA fell by nearly 95%

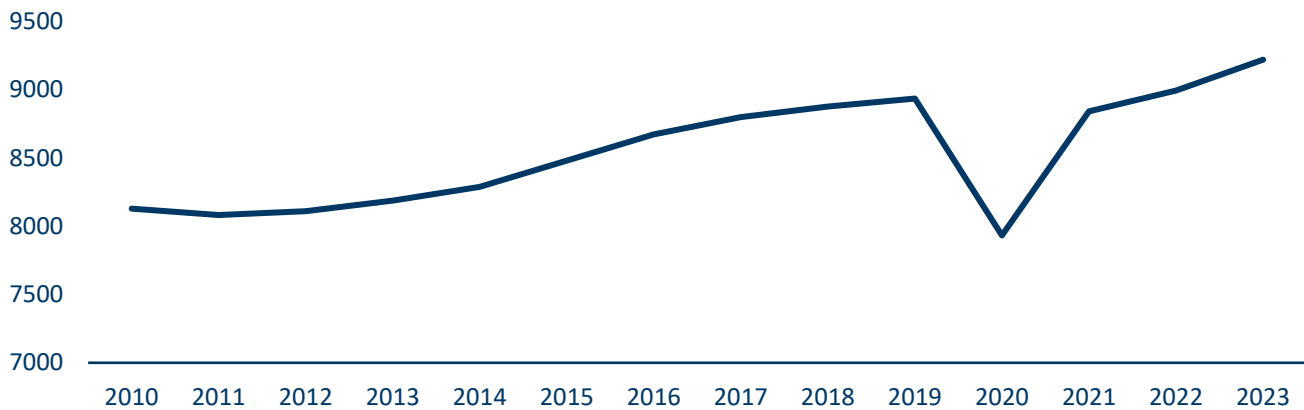
¹⁰ United States Census Bureau American Community Survey 5 Year Estimates.

¹¹ Ibid.

¹² [Table 6. Employed persons working at home and at their workplace and time spent working at each location by full- and part-time status and sex, jobholding status, and educational attainment, annual averages \(bls.gov\)](#)

in the spring of 2020.¹³ Personal vehicular traffic also declined rapidly, which is how most Americans get to work. While individual car travel was steady in the years prior to 2020, there was a reduction in vehicular use of 77% from 2019 to the most restrictive parts of the pandemic and ensuing lockdown.¹⁴ Data from the United States Energy Information Administration showed that there is an estimated 1 billion fewer daily miles driven since 2019, a decrease of 11.2%.¹⁵ In 2021, this dataset shows a sharp increase in daily vehicle miles traveled, nearly matching 2019's peak. This positive trend is project to continue in 2022 and beyond (Figure 6).

Figure 6: Average Daily Miles Traveled by Automobile from Years 2010-2022.¹⁶



A 2018 study linked urban sprawl and teleworking. In a review of 7,500 Dutch workers between 2002 and 2014, individuals who worked from home at least one day per month were "willing to accept 5% longer commute times."¹⁷ Moreover, a 2016 simulation of mid-sized cities (i.e., Charlotte, Indianapolis, Kansas City and San Antonio) decreased transportation costs by 20% and increased the geographical footprint by 26% if every worker teleworked at least one day a week.¹⁸ Not every job can be remote, but the simulations shed light on the potential impacts of teleworking. There was also a common thought during the pandemic that high density areas would be more susceptible to the spread of COVID-19, which led for some to relocate temporarily or buy second homes elsewhere. This caused a temporary real estate boom in suburban developments and is likely to increase the sale of and reliance on private vehicles.¹⁹ There is little evidence to support that higher density areas had higher transmission rates, however, with some studies showing higher rates of spread in less dense areas.²⁰

There are also mode change trends that create both challenges and opportunities for the resiliency of our transportation system. For example, New York City saw their bicycle sharing program's usage decrease at a much

¹³ [COVID-19 trends impacting the future of transportation planning and research | National Academies](#)

¹⁴ Ibid.

¹⁵ United States Energy Information Administration, "Vehicle Miles Traveled, Annual." Accessed 07/25/2022. [U.S. Energy Information Administration - EIA - Independent Statistics and Analysis](#)

¹⁶ Ibid.

¹⁷ Duco de Vos, Evert Meijers, and Maarten van Ham, "Working from Home and the Willingness to Accept a Longer Commute," *The Annals of Regional Science*, July 5, 2018, <https://link.springer.com/article/10.1007/s00168-018-0873-6>.

¹⁸ William Larson, Weihua Zhao, "Telework: Urban Form, Energy Consumption, and Greenhouse Gas Implications," *Economic Inquiry*, vol. 55, no. 2, October 8, 2016, <https://onlinelibrary.wiley.com/doi/full/10.1111/ecin.12399>.

¹⁹ Klaus R. Kunzmann, "Smart Cities after COVID-19: Ten Narratives," *disP – The Planning Review*, Vol. 56 (2020) [Full article: Smart Cities After Covid-19: Ten Narratives \(tandfonline.com\)](#).

²⁰ Ayyoob Sharifi and Amir Reza Khavarian-Garmsir, "The COVID-19 Pandemic: Impacts on Cities and Major Lessons for Urban Planning, Design, and Management," *The Science of the Total Environment*, vol. 749 (2020). [The COVID-19 pandemic: Impacts on cities and major lessons for urban planning, design, and management - PMC \(nih.gov\)](#)

lower rate than their transit usage, with evidence indicating that there was a modal shift from the former to the latter.²¹ While bicycle sharing has proven to be resilient in New York City, the reduction of transit use may be longer lasting: negative perceptions of the cleanliness or safety of transit may emerge, further decreasing its usage.

Driving habits have a direct impact on the environment. Carbon dioxide emissions from vehicles, leaking chemicals, oil extraction and energy generation degrade our environment. In 2018, 28% of greenhouse gas emissions came from transportation and 27% were from electricity production—burning fossil fuels, coal and natural gas.²² About 135 million Americans commuted to work prior to the pandemic, and the rush hour periods were some of the most consistent traffic flow times used for transportation planning. Global Workplace Analytics projects that if half of U.S. commuters worked at least part-time remotely, the greenhouse gas reduction would be equivalent to removing 10 million cars from U.S. roadways.²³ During 2020, there were significant air quality improvements compared to before the pandemic: worldwide, carbon emissions decreased by 7% (a record) with road transport emissions decreasing over 10%.²⁴

A complimentary trend in the teleworking movement is shared workspaces. Shared workspaces are office spaces where individuals can rent a desk to a room. They are a flexible alternative to typical office spaces. Many provide ping-pong tables and free beer. Based on where one lives and their job, a shared workspace could cut that individual's commute time. A 2019 study found that the three largest demographics of coworking spaces were small- to medium-sized enterprises at 38%. 27% were startups and 17% were freelancers.²⁵

However, the economics of the business is challenging, especially in the COVID-19 pandemic. In late 2019, WeWork underwent massive layoffs and sold off locations rapidly. There are several explanations for the struggle. Renting a desk is expensive. Corner coffee shops offer similar resources without a monthly fee or contract. Some large companies are also creating their own sponsored working locations for their employees as a benefit. And 80% of teleworkers say they primarily work from home.^{26,27}

STATE TRENDS

In Minnesota, teleworking is a trend that was gradually increasing in the years prior to the pandemic but has since accelerated sharply. From 2014 to 2018, Minnesota experienced a one-percentage-point increase in individuals working from home, from 5.1-6.1%.²⁸ In 2020, over 19% of workers teleworked in Minnesota (Figure 7) according to the American Community Survey's 1 Year Experimental Data Tables. This is 4% higher than the national share of teleworking according to this dataset, which was under 16%. Prior to the pandemic, Minnesota has generally

²¹ Joao Filipe Teixeira and Miguel Lopes, "The Link Between Bike Sharing and Subway Use During the COVID-19 Pandemic: The Case-Study of New York's Citi Bike," *Transportation Research Interdisciplinary Perspectives*, vol. 6 (2020), [The link between bike sharing and subway use during the COVID-19 pandemic: The case-study of New York's Citi Bike - ScienceDirect](https://doi.org/10.1016/j.trpi.2020.100200)

²² "Sources of Greenhouse Gas Emissions," United States Environmental Protection Agency, accessed August 27, 2020, <https://www.epa.gov/ghgemissions/sources-greenhouse-gas-emissions>.

²³ Sandy Batchelor, "Telecommuting for the Planet," University of California - Davis, September 6, 2018, <https://climatechange.ucdavis.edu/what-can-i-do/telecommuting-for-the-planet/>.

²⁴ Karl Kim, "Impacts of COVID-19 on Transportation: Summary and Synthesis of Interdisciplinary Research," *Transportation Research Interdisciplinary Perspectives* (2020). [Impacts of COVID-19 on transportation: Summary and synthesis of interdisciplinary research - ScienceDirect](https://doi.org/10.1016/j.trpi.2020.100200)

²⁵ "Members' Choice Awards Official Data Report," (Coworker Members' Choice Awards, 2019).

²⁶ Peter Fabor, "The Rise of Free Coworking," Medium, March 11, 2019, <https://medium.com/@faborio/the-rise-of-free-coworking-fb2d443de1ec>.

²⁷ Buffer, "The 2020 State of Remote Work," <https://lp.buffer.com/state-of-remote-work-2020> (accessed August 27, 2020).

²⁸ U.S. Census Bureau; American Community Survey, 1-Year Estimates 2014-2018, S0801.

experienced higher work-from-home numbers than the national average, and that trend has continued to be the case in 2020.

Figure 7: Primary Mode of Commute in Minnesota in 2020²⁹

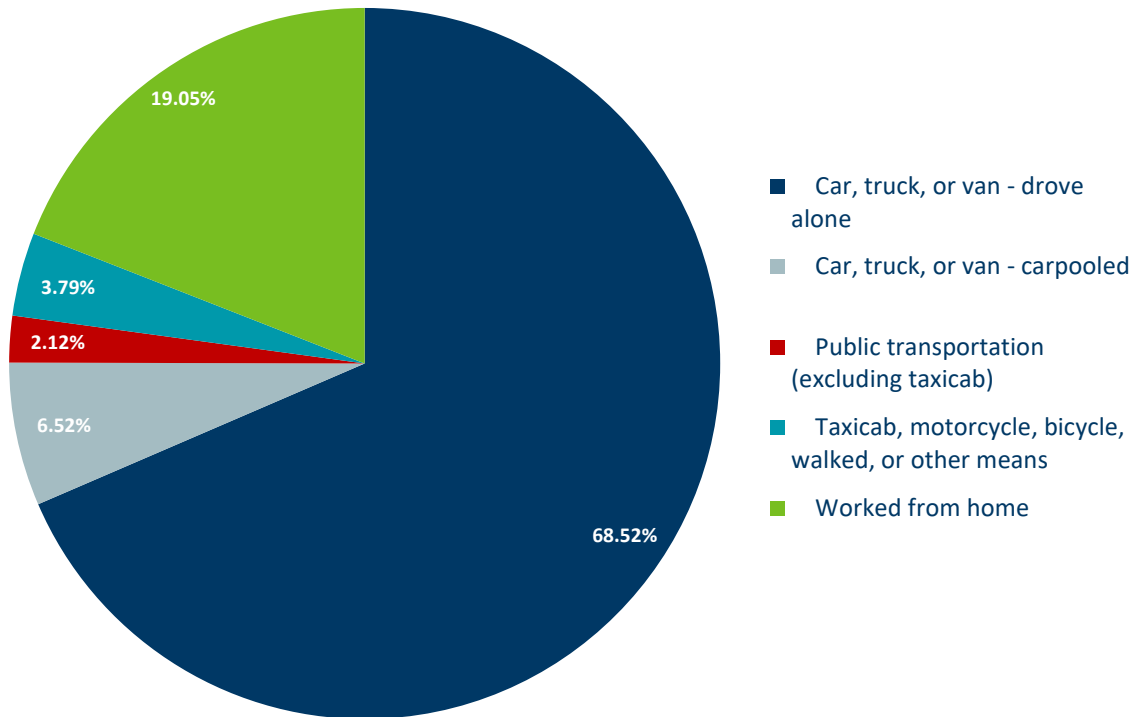
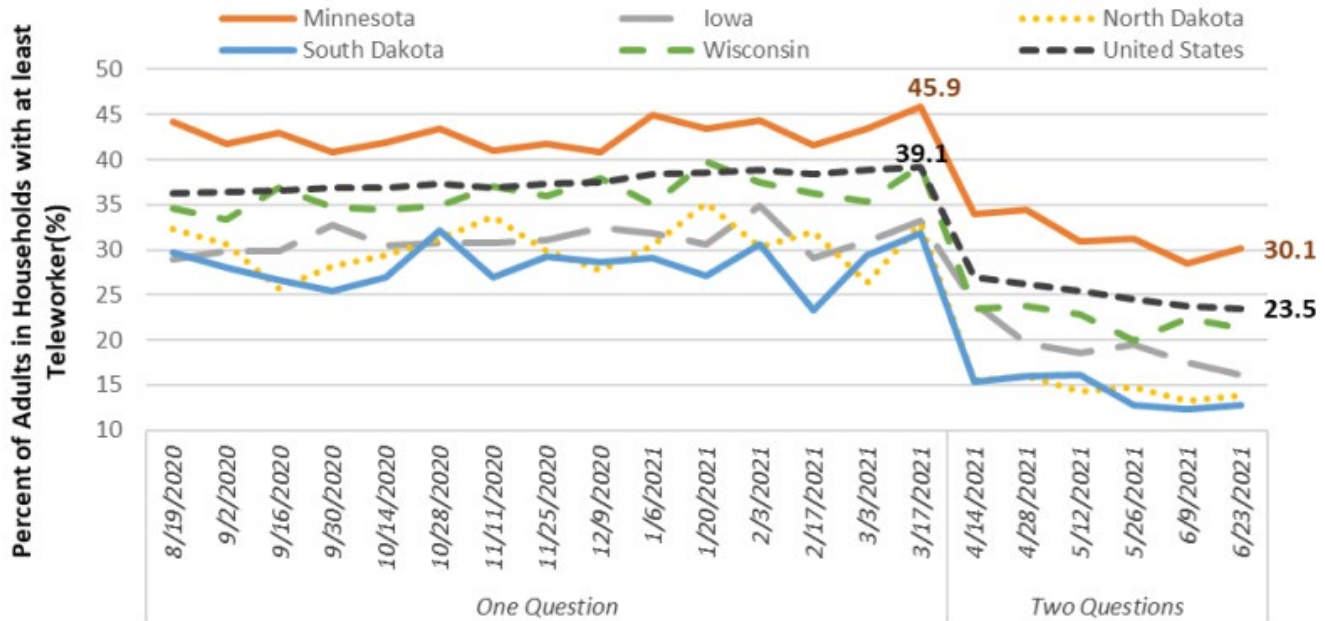


Figure 8 shows that from the Fall of 2020-Summer of 2021, Minnesota’s teleworking trends in Minnesota consistently outpaced the peer states of North Dakota, South Dakota, Iowa and Wisconsin. Minnesota never dropped below the national average even when these peer states did and continued to be around 7% higher than other states even as many restrictions were halted in the Summer of 2021.

Figure 8: Telework Rate Trends by State, August 2020-July 2021³⁰

²⁹ United States Census Bureau; American Community Survey 2020 1-Year Experimental Data Tables. Note: The ACS was collected in an experimental format in 2020 so there may be some discrepancies between this data and prior ACS data.

³⁰ Carson Gorecki, “Insights into the Changing Trends of Telework”, Minnesota Department of Employment & Economic Development (2021) [Insights into the Changing Trends of Telework / Minnesota Department of Employment and Economic Development \(mn.gov\)](#).



Source: U.S. Census Household Pulse Survey. Note: the survey began asking about telework in 2 questions in April 2021.

In 2009 the University of Minnesota and MnDOT launched the eWorkPlace program to help private and public employers utilize telework. The study found a variety of benefits for Minnesota workers. For every dollar invested, the participating workplaces gained nine dollars in saved travel time and vehicle costs.³¹ Furthermore, the study found the average "teleworker saved about \$94 a week in fuel, vehicle wear-and-tear, lost time and reduced carbon emissions...the employer's annual benefit was valued at \$447,000."³² The study also found a reduction in daily vehicle miles traveled by teleworking participants—approximately 28 miles less per day. Employee turnover was 45% lower for employees in the program.³³

COVID-19 AND TELEWORKING

In the Spring of 2020, 95% of Americans were under state stay-at-home orders due to the COVID-19 pandemic. This reality tested teleworking. A Massachusetts Institute of Technology report found that 34% of Americans who usually commuted to an office were working from home in April 2020.³⁴ According to a Gallup poll, the percentage of workers who had either flex time or remote work options grew from 31% in mid-March to 62% by the end of the month.³⁵ The same poll also found that most workers enjoyed it: three in five U.S. workers who

³¹ Jackie Crosby, "Minnesota a National Leader in Telecommuting Trend," Star Tribune, June 25, 2016, <https://www.startribune.com/minnesota-a-national-leader-in-telecommuting-trend/384401421/?refresh=true>.

³² Ibid.

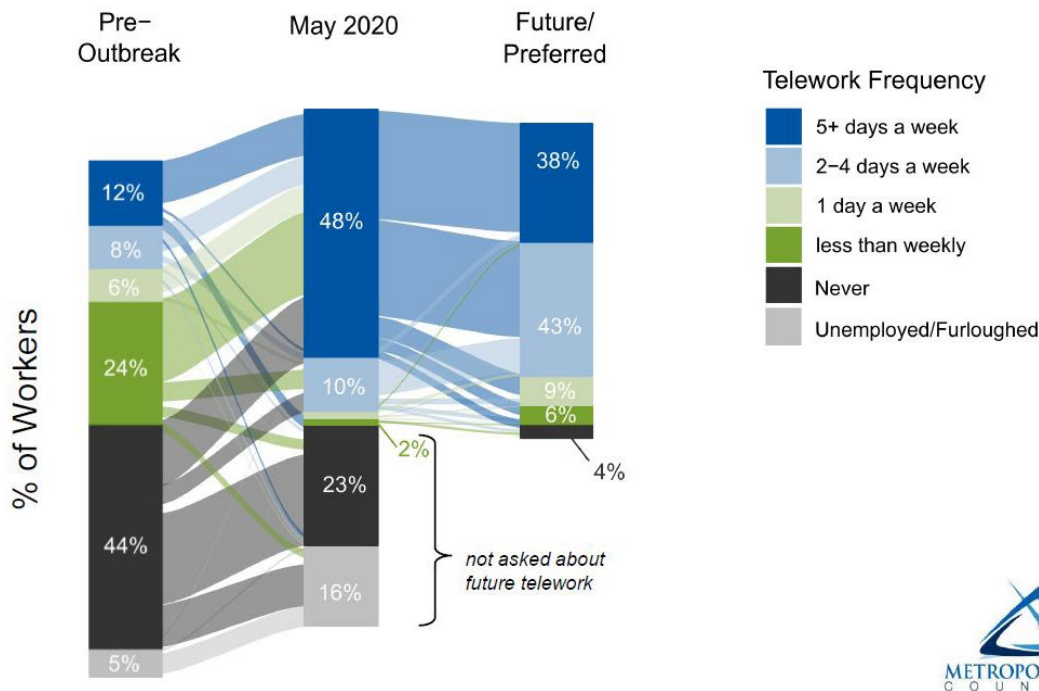
³³ Adeel Lari, "Telework/Workforce Flexibility to Reduce Congestion and Environmental Degradation?" Social and Behavioral Sciences—Transportation Research Arena, 48, 2012, pp. 712-721.

³⁴ Erik Brynjolfsson et al., "COVID-19 and Remote Work: An Early Look at US Data," (Massachusetts Institute of Technology, 2020).

³⁵ Megan Brenan, "U.S. Workers Discovering Affinity for Remote Work," Gallup News, April 3, 2020, <https://news.gallup.com/poll/306695/workers-discovering-affinity-remote-work.aspx>.

have worked from home due to the pandemic indicated they would prefer to continue working from home as much as possible—even after lifting public health restrictions.³⁶

Figure 9: Telework Frequency in the Seven-County Metro Area May 2020



The Metropolitan Council surveyed 3,244 individuals living in the seven-county metro area on their teleworking frequency before COVID, in May 2020 and their preferred teleworking future (Figure 9). Sixty-one percent of the respondents in May were teleworking in some capacity (5+ days a week to less than weekly). The significant data point on the future of telework is that 96% of people teleworking in some capacity in May want to continue after COVID-19. Eighty-one percent want to telework two to five-plus days a week. Before COVID-19, only 20% of survey takers teleworked two to five-plus days a week. The seven-county metro area reporting is a bit higher than the July 2020 Morning Consult survey, which found that one-third of U.S. workers want to permanently work from home after the pandemic.³⁷ Follow up surveys by the Met Council found similar results.

The administration of COVID-19 vaccines played a key role in teleworking trends. Coinciding with the decline of the third wave of the virus, vaccines were administered rapidly from Winter to Spring 2021.³⁸ The rate of employees working from home during this time decreased, leading many researchers in the economic development and health fields to believe these two factors are closely correlated (Figure 10).

³⁶ Ibid.

³⁷ Andrea Noble, "One-Third of U.S. Workers Want Permanent Remote Work," Route Fifty, July 10, 2020, <https://www.routefifty.com/tech-data/2020/07/one-third-us-workers-want-permanent-remote-work/166816/>.

³⁸ Carson Gorecki, 2021.

Figure 10: Estimated number of adults living in a household with at least one teleworker compared to the number of vaccine doses administered in Minnesota, August 2020-July 2021³⁹

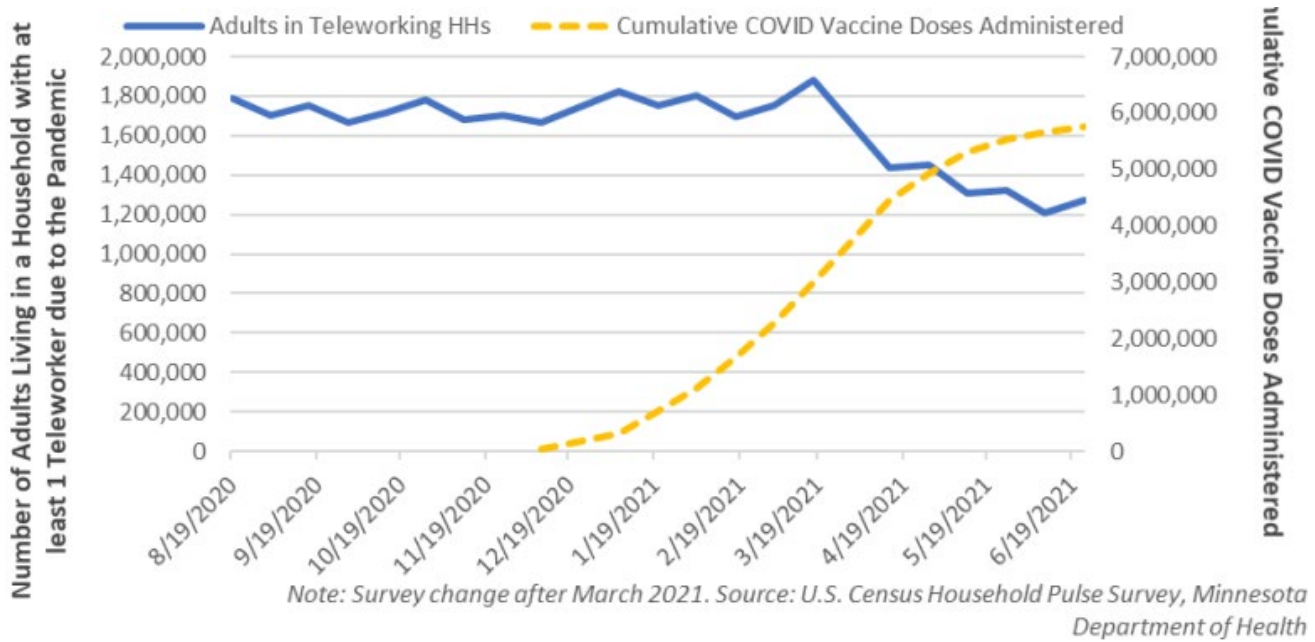
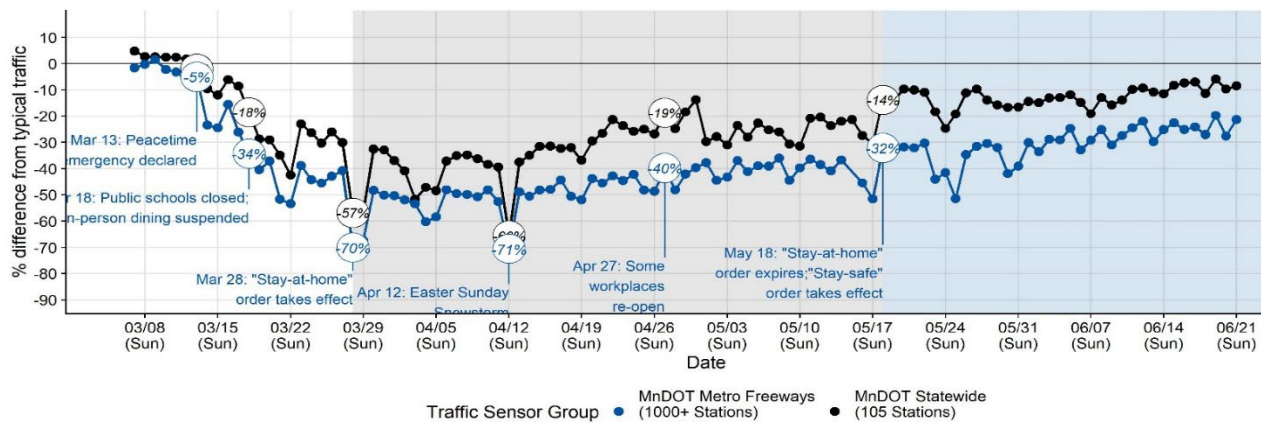


Figure 11: Minnesota Traffic Data and COVID-19 Impacts

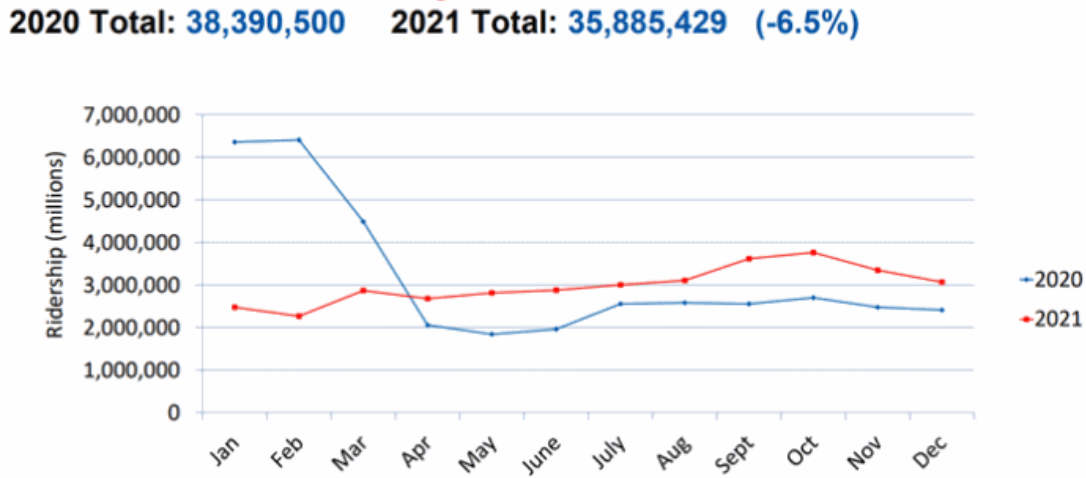


While the ability Twin Cities’ public transit ridership to return to pre-pandemic numbers remains unknown, data from Metro Transit shows that the region has experienced increasingly higher ridership from 2020-2021. While ridership across the transit system dipped from 6 million to 2 million from late February to early April 2020, ridership increased to 3 million in early 2021 before reaching nearly 4 million, even as similar restrictions were faced in 2021 (Figure 12). Metro Transit’s bus rapid transit services increased their ridership by around 23% from 2020-2021 and the Northstar Commuter Rail has increased by 135% since the start of stay-at-home orders. Other

³⁹ Ibid.

suburban transit providers (Minnesota Valley Transit Authority, SouthWest Transit) experienced decreases in ridership while the University of Minnesota’s transit system increased 11% from 2020-2021.⁴⁰

Figure 12: Metro Transit Ridership from 2020-2021⁴¹



CYBER SECURITY INFRASTRUCTURE

The rapid rise in employees working remotely has also created cyber security concerns. In mid-March 2020, the Federal Bureau of Investigation announced an uptick in scammers attempting to steal money, personal information and breach secured systems using fake Centers for Disease Control and Prevention and phishing emails.⁴² In typical office environments, there are multiple layers of cyber security protections. However, a standard home network has less protection. To support the pandemic surge in remote working, organizations rely on Virtual Private Networks (VPNs) and network infrastructure devices to help workers access necessary files while keeping data safe and secure. Some of these tools have new and untested software patches and upgrades.⁴³ This arrangement is vulnerable to savvy hackers using suspicious emails and other tactics to breach government systems. To learn more about cyber security, refer to the Cyber Security and Big Data Trend Analysis.

E-COMMERCE

E-commerce is growing in the United States. Any product or service sold over the internet or through a smartphone app qualifies as e-commerce. As shown in Figure 13, the share of total sales in the U.S. through e-commerce grew rapidly before plateauing in 2021. From 2010 to 2019, sales grew 6.5 percentage points.⁴⁴ In the first half of 2020, e-commerce jumped three percentage points to an average of 14% of total sales.⁴⁵ This trend

⁴⁰ Metropolitan Council, “2021 Regional Transit Ridership” (2022). [Regional Transit Ridership - Metropolitan Council \(metrocouncil.org\)](https://www.metrocouncil.org/Regional-Transit-Ridership)

⁴¹ Ibid.

⁴² “FBI Sees Rise in Fraud Schemes Related to the Coronavirus (COVID-19) Pandemic,” United States Department of Justice, March 20, 2020, <https://www.ic3.gov/media/2020/200320.aspx>.

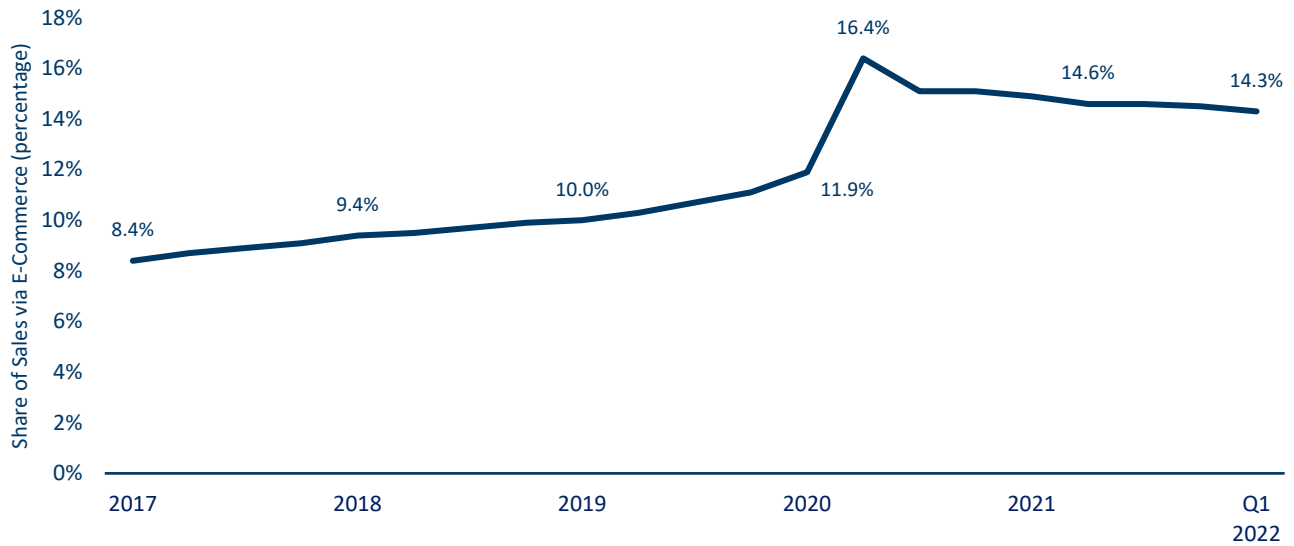
⁴³ Maggie Miller, “Hackers Find New Target as Americans Work from Home during Outbreak,” The Hill, March 14, 2020, <https://thehill.com/policy/cybersecurity/487542-hackers-find-new-target-as-americans-work-from-home-during-outbreak>.

⁴⁴ “E-Commerce Retail Sales as a Percent of Total Sales,” Federal Reserve Bank of St. Louis, accessed August 28, 2020, <https://fred.stlouisfed.org/series/ECOMPCTSA>.

⁴⁵ 2020 is an incomplete year. This data only accounts for quarters one and two.

peaked at 16.4% in 2020 prior to remaining steady around 14%. Due to its convenience and the growth of companies practicing e-commerce, it is likely these numbers will not return to pre-pandemic measures.

Figure 13: Percent of Total Sales via E-Commerce from 2010 to Quarter 1 of 2022 in the United States⁴⁶



There are a variety of reasons why e-commerce has become such a part of our lives other than pressures from the pandemic. Reasons include easy access to products with a smartphone, targeted advertising on social media, online access to a wider array and variety of products than shopping in-person, people’s increasing comfort in getting daily goods shipped to them and quick delivery.⁴⁷

TRADITIONAL RETAIL

Out of all trips made by a household, 19.5% were shopping and errand related prior to the pandemic. This accounts for 14.5% of an average person’s annual miles traveled.⁴⁸ As e-commerce increases, the impact on traditional retail is mixed. The bankruptcies of J.C. Penney, RadioShack, Macy’s and Sears in 2017 are attributed in part to growing e-commerce and fewer visits to these stores.⁴⁹ Small businesses also experienced closures due to COVID-19 factors and the rise of e-commerce, with over a quarter of small retail stores still shuttered in 2022.⁵⁰ On the other hand, big box retailers Target and Walmart are thriving.^{51 52} They offer robust e-commerce sites,

⁴⁶ E-Commerce Retail Sales as a Percent of Total Sales,” Federal Reserve Bank of St. Louis, accessed August 28, 2020, <https://fred.stlouisfed.org/series/ECOMPCTSA>.

⁴⁷ Kyle Wong, “Top 5 Trends Driving E-Commerce: Influential Takeaways From the Report Retailers Cannot Ignore,” Forbes, June 7, 2018, <https://www.forbes.com/sites/kylewong/2018/06/07/top-5-e-commerce-takeaways-from-the-most-influential-report-of-the-year/#4cfb19935696>.

⁴⁸ “National Household Travel Survey: 2017 Summary Statistics for Demographic Characteristics and Travel,” United States Department of Transportation, Federal Highway Administration, accessed August 31, 2020, <https://nhts.ornl.gov/>.

⁴⁹ Tracy Hadden Loh and Jennifer S. Vey, “Retail Isn’t Dead. It’s Just Changing,” CNN, December 24, 2019, <https://www.cnn.com/2019/12/24/perspectives/retail-2020/index.html>.

⁵⁰ The Center Square, “COVID-19 small business closures in Minnesota pegged at 26.6% | Minnesota | thecentersquare.com

⁵¹ Shelley Kohan, “Walmart’s Online Sales Have Surged 74% During the Pandemic,” Forbes, May 19, 2020, <https://www.forbes.com/sites/shelleykohan/2020/05/19/walmart-revenue-up-86-e-commerce-up-74/#43e38a5166cc>.

⁵² Melissa Repko, “Target Reports a Monster Quarter—Profits Jump 80%, Same-Store Sales Set Record,” CNBC, August 19, 2020, <https://www.cnbc.com/2020/08/19/target-tgt-q2-2020-earnings.html>.

drive-up services and Target, specifically, is adding smaller store formats to cater to local needs. They also catered to the essential items (e.g., toilet paper, food, etc.) many American consumers panic-bought in the height of COVID-19 related restrictions.⁵³

From a transportation perspective, it is unclear whether shopping-related transportation is declining. While consumers may no longer travel to retail locations and instead choose to shop online, delivery drivers still need to deliver orders. These delivery trips may put more vehicles on the road than before. The United States Postal Service trucks delivered 5.7 billion packages in 2017. Their deliveries increased to 6.2 billion in 2019, 7.3 billion in 2020 and 7.6 billion in 2021.⁵⁴ Meanwhile, Amazon projects to ship 6.5 billion packages by 2022.⁵⁵

Same-day deliveries are also adding to congestion. Part of the key elements to the continued expansion and development of online retail is building a same-day delivery system that can mimic the speed of shopping at a conventional store. In 2014, Amazon began to offer Prime same-day delivery services with free delivery on a wide range of items from flat-screen TVs to groceries.⁵⁶ To support this system, Amazon relies on a constantly growing fleet of hundreds of thousands of independent contractors driving personal cars and delivery vans. Amazon Flex is a program that pays individuals to pick up packages from Amazon delivery stations, local stores and Whole Foods Grocery (owned by Amazon) and deliver them directly to customers within a few hours.⁵⁷ Grocery and meal delivery applications (like Instacart and Blue Apron) have also seen a sizable increase in usage since the start of the pandemic, especially for the most vulnerable consumers.⁵⁸

New York City officials believe that delivery services doing pickups and drop-offs are mostly to blame for their increasing congestion. In 2018, delivery trucks in New York received more than 471,000 parking citations—a 34% increase since 2013.⁵⁹ Drivers are double parking, blocking buses, cutting off bike lanes and circling for parking. This increase has merit nationwide. A Texas A&M University Transportation Institute study in 2017 found that trucks were 7% of total traffic nationwide, yet they accounted for 28% of congestion.⁶⁰ They estimated that the share of congestion will continue to rise as more people utilize e-commerce.

FOOD DELIVERY AND COURIER SYSTEMS

On-demand food delivery services are another facet of online shopping. Pizza delivery in cardboard boxes has been around since the 1960s.⁶¹ During the last decade, smartphone apps moved ordering food to an online format and broadened the types of food available for delivery. Frost & Sullivan, a market research consulting firm,

⁵³ Lydia Dishman, “Effects of Coronavirus Pandemic on Food Delivery Businesses”, United States Chamber of Commerce (2020) [Effects of Coronavirus Pandemic on Food Delivery Businesses \(uschamber.com\)](#)

⁵⁴ “A Decade of Facts & Figures,” United States Postal Service, accessed June 10, 2022, <https://facts.usps.com/table-facts/>.

⁵⁵ Andria Cheng, “Amazon Ships 2.5 Billion Packages a Year, with Billions More Coming, in a Major Threat to UPS and FedEx,” Forbes, December 12, 2019, <https://www.forbes.com/sites/andriacheng/2019/12/12/how-serious-is-amazons-threat-to-ups-fedex-study-finds-it-could-soon-beat-them-in-us-package-delivery-volume/#34e3f27468f4>.

⁵⁶ Nick Woltman, “Amazon Prime Now Starts Same-Day Delivery in Twin Cities,” Twin Cities Pioneer Press, October 28, 2015, <https://www.twincities.com/2015/10/07/amazon-prime-now-starts-same-day-delivery-in-twin-cities/>.

⁵⁷ “FAQ,” Amazon Flex, accessed June 11, 2021, <https://flex.amazon.com/faqs>.

⁵⁸ Lydia Dishman, 2020

⁵⁹ Matthew Haag and Winnie Hu, “1.5 Million Packages a Day: The Internet Brings Chaos to N.Y. Streets,” New York Times, October 27, 2019, <https://www.nytimes.com/2019/10/27/nyregion/nyc-amazon-delivery.html>.

⁶⁰ Edward Humes, “Online Shopping Was Supposed to Keep People Out of Traffic. It Only Made Things Worse,” Time, December 18, 2018, <https://time.com/5481981/online-shopping-amazon-free-shipping-traffic-jams/>.

⁶¹ Alexis Madrigal, “The 3 Big Advances in the Technology of the Pizza Box,” The Atlantic, July 18, 2011, <https://www.theatlantic.com/technology/archive/2011/07/the-3-big-advances-in-the-technology-of-the-pizza-box/242116/>.

estimated that the food delivery industry was worth \$82 billion in 2018.⁶² There were devastating negative effects of the pandemic for food and hospitality businesses, including diminished sales, loss of tip revenue for servers and business closures. However, the increase of popularity of mobile food ordering and deliveries was vital for sustaining many small restaurants throughout the pandemic.⁶³ However, the rise of food delivery applications do provide their own challenges for transportation planning. Food delivery and courier systems produce similar congestion as freight delivery—double parking, blocking buses, cutting off bike lanes and circling for parking. A critical difference is the increased demand on parking spaces and temporary uses. Most city streets and parking in front of neighborhood storefronts were never designed to manage such a large flow of delivery and customer parking and walk-up needs.

In February 2020, the San Francisco Municipal Transportation Agency (SFMTA) unveiled its Curb Management Strategy to retrofit its parking needs.⁶⁴ The plan reprioritizes curb space by land use and by function. SFMTA rolled out a series of strategies for delivery vehicles, including giving parking and curb spaces different classifications. For instance, green zones (painted green) are short-term (15 to 30 minute) parking areas in front of commercial uses such as laundromats, drugstores and coffee shops. The strategy made the maximum parking time on all green zones to be 15 minutes to maintain space turnover and access for delivery vehicles. SFMTA also extended parking meter hours into the evening and Sundays to reduce double parking and circling. This policy would address the existing challenge of nearly 100% parking occupancy on commercial corridors after 6 p.m.—when people are dining out and others are using food delivery apps.

Cities such as Minneapolis followed SFMTA's precedent in 2020, introducing temporary curbside pickup zones to achieve similar goals and help small business owners and delivery drivers navigate food service in the pandemic. These spots experienced high turnover and allowed for delivery drivers to park safely and legally. Many of the more than 150 zones have been phased out as businesses started reopening their dining rooms in the Summer of 2021.⁶⁵

DIGITAL GOODS

Digital goods are eliminating trips and delivery services for some items. Books, music and movies can now be accessed completely online. This is perhaps the next iteration of consumerism. Small neighborhood bookstores gave way to big-box bookstores, which are now competing with Amazon Kindle and online formats. Moreover, renting a movie at Blockbuster gave way to Redbox and eventually streaming services like Netflix and Hulu. In a recent survey of 20,398 U.S. adults by the What if Media Group, 20% of respondents said they have no intention to return to movie theaters once a COVID-19 vaccine is widely available, while another 10% said they are somewhat unlikely to return.⁶⁶ These survey results indicate that while the demand for movie theater attendance

⁶² Sarwant Singh, "The Soon to be \$200B Online Food Delivery is Rapidly Changing the Global Food Industry," *Forbes*, September 9, 2019, <https://www.forbes.com/sites/sarwantsingh/2019/09/09/the-soon-to-be-200b-online-food-delivery-is-rapidly-changing-the-global-food-industry/#41644cd7b1bc>.

⁶³ Lydia Dishman, "Effects of Coronavirus Pandemic on Food Delivery Businesses", United States Chamber of Commerce ([Effects of Coronavirus Pandemic on Food Delivery Businesses \(uschamber.com\)](https://www.uschamber.com/effects-of-coronavirus-pandemic-on-food-delivery-businesses))

⁶⁴ "Curb Management Strategy," (San Francisco Municipal Transportation Agency, 2020).

⁶⁵ Brianna Kelly, [City of Minneapolis is removing nearly 150 curbside pickup zones established during Covid-19 pandemic - Minneapolis / St. Paul Business Journal \(bizjournals.com\)](https://www.bizjournals.com/minneapolis/news/2021/06/28/city-of-minneapolis-is-removing-nearly-150-curbside-pickup-zones-established-during-covid-19-pandemic/). Published June 28, 2021.

⁶⁶ Nelson Granados, "How Will Theaters and Streaming Services Coexist After The Pandemic?" *Forbes*, February 21, 2021, <https://www.forbes.com/sites/nelsongranados/2021/02/22/how-will-theaters-and-streaming-services-coexist-after-the-pandemic/?sh=601f20135106>.

is there, the pandemic has for at least some Americans changed the way they prefer to access and consume content. The long-term impacts of the delivery of digital goods on transportation is unknown.

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REVISION HISTORY

Date	Summary of revisions
May 2016	Original paper.
June 2021	Updated data.
July 2022	Revised content and data.