### Ashley Asmus, Liz Roten, Jonathan Ehrlich Monitoring adherence to social distancing guidelines with traffic data

AMPO, October 28, 2020



### Data and modeling





# Traffic as a measure of social distancing

- Minnesota Management and Budget office (MMB) asked MnDOT, Metropolitan Council and Metro Transit for measures of social distancing
- Measures meant to inform disease modeling efforts and evaluate effectiveness of social distancing policies
- Traffic and ridership data provide near-real-time measures of change
- Existing research was quickly re-tooled







# Sources of traffic data

#### **MnDOT**

roadway types

Metropolitan Council

- sensors on metro area freeways
- Data pulled using an open-source R package written by council staff, {tc.sensors}



#### 100+ Automated Traffic Recorders (ATRs) spread across the state on various

### 2,700+ MnDOT Regional Transportation Management Center (RTMC) traffic





# Approach to estimate "typical" traffic

Selecting a robust baseline was of key importance.

- Used Generalized Additive Models (GAMs)
  - Ideal for data with non-linear trends
  - Accounts for weekday trends and seasonal trends
  - Relies on 3 years of data (January 2018 early March 2020)
- Created one model for each traffic node





### Under the hood: predicted & observed traffic volumes





### Traffic trends, March 8 - Present



#### Traffic Sensor Group

- MnDOT Metro Freeways (1000+ Stations)
- MnDOT Statewide (105 Stations)

#### **Trend Line**

ways – 7-day rolling average



### Sharing and collaborating





### Interactive visualization

#### Principles

- Make the data and code available to everyone
- Make space for feedback

#### Goals

- Plot and map the most recent data
- View and download tabular data
- Share detailed methodology







# **R** and Shiny

- R is a free software environment for statistical computing and graphics.
  - Used in academic and industry settings
  - Strong support for large spatial data
- Shiny is an open-source R package that makes it easy to build interactive web applications with R
  - No fancy JavaScript needed







### **Reproducible research**

- The data for this project is massive
  - 292 million observations in 2020 alone
  - Downloaded data from a public feed
- We store the data locally
- Run code to generate the final data tables
- We made the code publicly available in our R package, {tc.sensors}.



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#### COVID-19 Outbreak – Metro Area Travel Declines

#### Traffic data show more metro area residents are staying home

MAP & PLOT DOWNLOAD DATA ABOUT

#### Twin Cities' freeway travel decreasing across COVID-19 timeline

This plot shows the daily relative decrease in freeway travel over time across the Twin Cities metropolitan region after March 1. Points that fall below the zero-line represent decreases in travel relative to typical travel on that day of the year and day of the week. Typical travel is estimated using a statistical analysis of traffic volumes from 2018, 2019, and 2020 prior to March 1.



#### Decreases in freeway travel are occuring across the Twin Cities metropolitan region

The map shows the decreases in travel at individual traffic monitoring sites





### Project management and coordination





# Communication and Coordination

- Purpose
  - Usefulness of health researchers
  - Public communication
  - Decision-making
  - Morale / curiosity
- Coordinating data & interpretation
- Integration into JIC and Council communication
- Speed/agility
- Uncertainty

#### MOBILITY METRICS: CHANGE IN DISTANCE TRAVELED

#### **COVID-19: CASES BY COUNTY**



#### STATE TRAVEL TRENDS

CHANGE FROM HISTORIC TRAFFIC VOLUME

METRO TRANSIT RIDERSHIP (CHANGE FROM FEB 24-28)

CHANGE IN DISTANCE TRAVELED FROM JAN/FEB 2020

CHANGE IN UNPREDICTABILITY IN TRAVEL FROM JAN/FEB 2020



CHANGE FROM HISTORIC TRAFFIC VOLUME

BACKGROUND INFORMATION

This dashboard allows the user to observe social distancing trends at the county or regional level, as well as overall trends in confirmed cases of COVID-19.

All social distancing measures here are shown relative to a pre-COVID baseline. This adjustment helps account for differences between areas where services or other destinations may be closer to home, and areas where destinations may be farther apart.

Two app-based measures include average distance traveled from home ("Radius of Gyration") and unpredictability of travel ("Shannon Entropy," lower values are more predictable). Both measures are important for describing travel, as a person could travel a long distance to and from a single work site (high radius, low entropy), or could travel to many destinations in an urban setting (low radius, high entropy). These measures are shown as their percent difference compared to the average from January 15 to February 29, 2020. Data source: App-based data was provided by Camber Systems (https://covid19.cambersystems.com/), which anonymizes and groups all data at the Census tract level or greater. More about their methodology can be found at https://covid19.cambersystems.com/about/

The difference from typical traffic is the percent difference in vehicle miles traveled compared to the predicted level based on historic trends. These are detected via Metro area loop sensors (over 1,000 sensors) or a statewide network of automatic traffic recorders (105 ATRs). Data source: Met Council and MnDOT (<u>https://github.com/metropolitan-council/loop-sensor-trends</u>)

Metro Transit weekday ridership is the percent difference of transit boardings, compared to average weekday ridership the week of February 24 to 28, 2020. When transit services are shut down (such as the last week of May), transit levels appear as -100%. Data source: Met Council

COVID confirmed cases source: Star Tribune and MDH (https://github.com/striblab/mn\_covid\_data)

MOST RECENT DATA REFRESH: SEPTEMBER 30, 2020



MnDOT Metro Freeways (1000+ Stations) MnDOT Statewide (105 Stations)

### **Contact information**

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- Jonathan Ehrlich, Jonathan.Ehrlich@metc.state.mn.us





### Sources

- COVID Traffic Trends app, <u>https://metrotransitmn.shinyapps.io/covid-traffic-trends/</u>
- COVID Traffic Trends repository, <u>https://github.com/Metropolitan-Council/loop-sensor-trends</u>
- tc.sensors R package repository, <u>https://github.com/Metropolitan-Council/tc.sensors</u>
- R Logo © 2016 The R Foundation. <u>https://www.r-project.org/logo/</u>
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