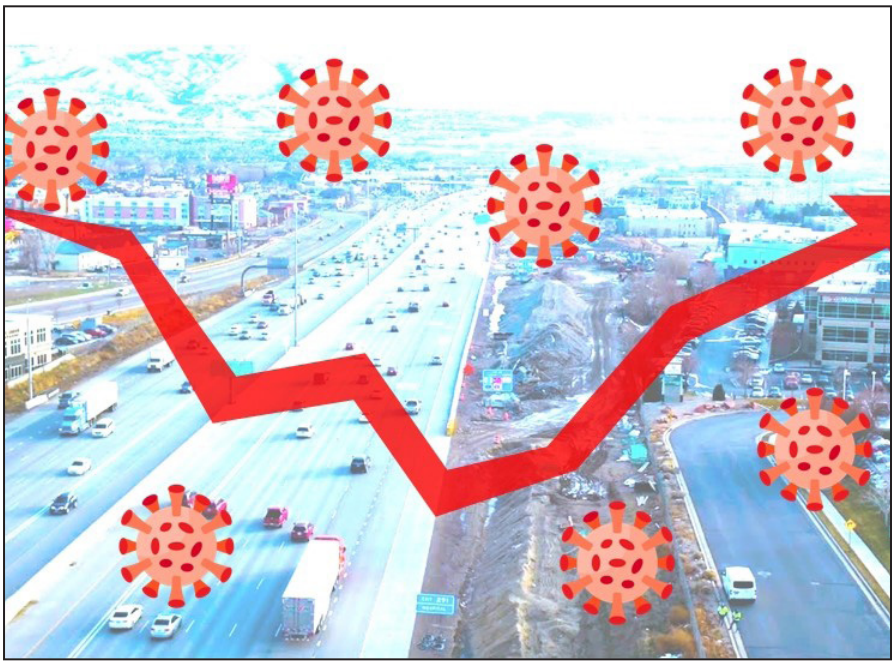
MOUNTAIN-PLAINS CONSORTIUM

RESEARCH BRIEF | MPC 23-502 (project 657) | August 2023

Knowledge-based Machine Learning for Freeway COVID-19 Traffic Impact Analysis and Traffic Incident Management



the ISSUE

The COVID-19 pandemic has had significant impacts on U.S. traffic, including changes in weekday traffic patterns, increases in on-demand delivery and e-commerce traffic, reductions in crash frequency, and increases in crash severity. Most research has focused on these changes during the early stages of the pandemic. There is a need to examine traffic impacts during the latter stages of the pandemic so that transportation agencies can better understand the long-term impacts of COVID-19 on transportation safety and vehicular traffic patterns. An improved traffic prediction model would help these agencies better forecast traffic patterns and adjust traffic management to improve safety.

the RESEARCH

Researchers examined the impacts of COVID-19 on traffic safety in three different stages to better understand the relationship between traffic demand patterns, daily confirmed cases/deaths, state policies, and public perceptions and other factors.

First, the researchers examined the influence of COVID-19 on traffic safety across various stages of the pandemic, with a particular focus on Salt Lake County, Utah. Statistical techniques were employed to determine whether the pandemic's effects vary over time. Negative binomial models were used to examine crash frequency, while binary logit models were used to investigate crash severity. These models consider exposure, environmental factors, and human factors. Further, they investigated any potential secondary effects of the pandemic on factors not directly related to the pandemic in the statistical models. Researchers then analyzed the impact of COVID-19 on traffic patterns in Salt Lake County and Utah County from January 2019 to July 2021. The study identified distinct vehicle miles

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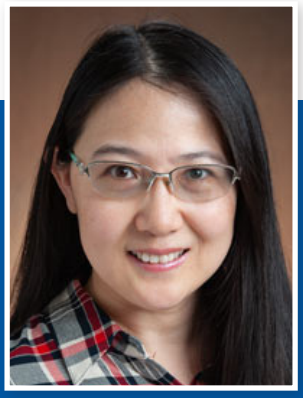

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Project Title

Knowledge-based Machine Learning for Freeway COVID-19 Traffic Impact Analysis and Traffic Incident Management

Sponsors | Partners

NDSU, in-kind support
UGPTI, match support
University of Utah, in-kind support

USDOT, Research and Innovative Technology Administration

the **RESEARCH** (continued)

traveled patterns during the pre-pandemic, early pandemic, and late pandemic stages. The researchers discovered that vehicle miles traveled is significantly influenced by the severity of the pandemic (as measured by the number of new cases), policies, and individual/societal risk perceptions regarding travel during the pandemic.

Finally, a novel traffic prediction model that combines machine learning with graph theory to forecast traffic patterns was developed.

the **FINDINGS**

The researches concluded that:

1. Crash frequency was significantly less than that of the pre-pandemic stage during the entire course of the pandemic. However, crash frequency increases during the latter stage of the pandemic because of relaxed restrictions.
2. Crash severity levels increased during the earlier stages of the pandemic due to the increased speed, prevalence of DUI, reduced seat belt use, and increased presence of commercial vehicles. However, crash severity returned to a level comparable to that of before the pandemic because of reduced speed and increased seat belt use.
3. Vehicular traffic decreased during the early stage of the pandemic because of government restrictions and individuals' risk perception in traveling. With the relaxation of travel restrictions and COVID vaccines, vehicular traffic recovered to pre-pandemic levels.
4. Truck traffic at the latter stage of the pandemic was higher than the pre-pandemic level because of the growth of online shopping and on-demand delivery.

the **IMPACT**

The research provides valuable insights into how the pandemic affected traffic, contributing to more effective transportation planning and decision-making, and introduces a new way to predict traffic using a mix of machine learning and graph theory.

For more information on this project, download the Main report at https://www.ugpti.org/resources/reports/details.php?id=1135

For more information or additional copies, visit the Web site at www.mountain-plains.org, call (701) 231-7767 or write to Mountain-Plains Consortium, Upper Great Plains Transportation Institute, North Dakota State University, Dept. 2880, PO Box 6050, Fargo, ND 58108-6050.

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