Understanding the Effect of Pervasive Events on Vehicle Travel Time Patterns

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Introduction

The facts and figures revealed by researchers worldwide provide an overview of the widespread impact of the COVID-19 pandemic on travel and transportation. In response to the COVID-19 pandemic caused by the deadly SARS-CoV-2 virus, many countries imposed restrictions such as stay-at-home orders, social distancing, and face-covering. These restrictions were put in place to curtail the spread of infection. However, these restrictions also have had a significant effect on travel patterns and travel behavior. For instance, restrictions were imposed during the initial phases of the COVID-19 pandemic. However, in the later phase, restrictions were eased. It is apparent that the effect of the COVID-19 pandemic on travel patterns has varied between different phases of the pandemic. For a comprehensive understanding, it is essential to delve deeper into the specific travel time patterns during different stages of pervasive events such as the COVID-19 pandemic. This research aims to fill this gap by examining travel time patterns during different phases of the COVID-19 pandemic in Mecklenburg County (urban area) and Buncombe County (rural area) in North Carolina. By examining travel time patterns during each stage of the pandemic for different vehicle types, road functional classes, and area types, this study provides valuable insights into how different policies have impacted travel behavior. By comparing the travel time patterns across the phases, researchers, planners, and policymakers can identify the effectiveness of different strategies and policies in managing travel demand and congestion during the pandemic. It will also will assist them in developing targeted strategies to mitigate economic disruptions, enhance transportation resilience, and foster economic recovery during similar pervasive events in the future.

Study Methods

The travel time data for links or segments with varying area types, road functional classes, road geometries, and speed limits in Mecklenburg County and Buncombe County were extracted for three years, i.e., 2019 (pre-COVID-19), 2020 (during COVID-19), and 2021 (post-COVID-19). Furthermore, links from various

locations within each county, i.e., in the central business district (CBD) and urban and suburban areas, were strategically selected to account for the variation in land-use patterns. To ensure fair comparison and account for the seasonal effect on travel time, the same day and month of the years 2019, 2020, and 2021 were selected. Travel time reliability (TTR) and travel time variability (TTV) were computed for the three phases of the pandemic, wherein the TTR and TTV indicators for the COVID-19 period were compared with pre-COVID-19 and post-COVID-19 conditions to investigate the effect of the COVID-19 pandemic on them. For the study, travel time index (TTI), planning time index (PTI), and buffer time index (BTI) were used as the indicators of TTR. Further, a seasonal autoregressive integrated moving average (SARIMA) model was developed to comprehend the effect of COVID-19 on travel time patterns.

Findings

The following are the important conclusions drawn from the study.
1. The COVID-19 pandemic significantly affected the scheduling of trips. Most of the trips during and after COVID-19 were scheduled during off-peak hours.
2. COVID-19 resulted in certain and reliable travel times for links with higher speed limits compared to links with lower speed limits.
3. Restrictions on travel and work-from-home improved the reliability of travel times during COVID-19, especially during Phase II of the pandemic. However, links started showing poor reliability after the easing of governmental restrictions.

Policy/Practice Recommendations

For a comprehensive understanding of the effect of pervasive events such as COVID-19, it is recommended that an analysis be performed concerning different phases of the events. Moreover, collecting and analyzing data for the post-event conditions can help identify whether and how the system is restored to normality. The study also recommends that multiple measures be adopted for a holistic assessment of the effect of pervasive events on travel times. For instance, the PTI enables an understanding of the effect of pervasive events on the worst travel conditions. TTV enables an understanding of the effect of pervasive events on TTV. Similarly, the TTI enables an understanding of how pervasive events influence average travel conditions. Understanding these details improves an understanding of the impacts of the COVID-19 pandemic and provides insight into how future events might also impact travel.

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