

The COVID-19 Pandemic's Influence on the Copenhagen Metro M1 and M2

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Abstract:

This project builds on an analysis of the Copenhagen metro system for the lines M1/M2, and the stations: Øresund, Forum and Nørreport.

Through the last years' time the world has felt the effects of the COVID-19 pandemic, and the public transport systems have been hit hard especially. This is further signified by the huge decreases in ridership, the demand for social distancing, as well as other restrictions. This project aims to focus on how these parameters and restrictions have impacted M1/M2 network, as well as shed some light on what can be done to improve the passenger flow on the stations.

This project utilizes the software: Bentley Legion, to evaluate the chosen stations by providing microsimulations from before the COVID-19 outbreak, during the COVID-19 outbreak, as well as a sensitivity scenario such as the "during COVID-19 scenario", but with increased ridership. The data used in the project has been provided by Metroselskabet (the Copenhagen Metro Company), of whom, have multiple passenger counting sensors installed at all the stations, which allows for exact modelling, and to accurately determine the origins and destinations of passengers in the system.

To determine passenger behavior, several international studies have been used to determine specific parameters such as average passenger space requirements and walking speed distributions.

The analysis methodology for this study focuses on a station size classification, where all the stations in the M1/M2 network have been classified based on passenger numbers, since the projects main focus is passenger flow. The stations on the network have thereby been assigned a size class based on passenger numbers: Large stations - represented by Nørreport Station, Medium stations - represented by Forum Station, and Small stations - represented by Øresund Station.

The simulations with Bentley Legion provides an overview of the stations, since the output clearly identifies problematic zones and bottlenecks by mapping results such as passenger density, social distance breaks and overall space utilization. Additionally, the simulation models have provided data to determine doorway utilization, which have led to a theoretical approach to determine potential dwell time decreases, to improve the runtimes of the trains or to reduce the number of active trains, and thereby achieve savings on active rolling stock.

The results generally show that COVID-19 does not create any significant passenger flow issues for Forum Station and Øresund Station, but a string of issues does arise on Nørreport Station. In addition, the result point to a general improvement of the passenger flow, going from before COVID-19 to during COVID-19. Though when looking into the COVID-19 scenario with increased ridership, a lot of the same tendencies and complications, as seen before the COVID-19 outbreak shows, but with increased effect. It's proven hard to make day-to-day improvements for the stations, since expanding platform space and increase in escalators isn't a day-to-day improvement. Though design choices like these can be thought into future station designs, to accommodate for future pandemics by making the infrastructure more robust.