

# Decision Tool to Evaluate COVID-19 Risk to Metro Transit Riders

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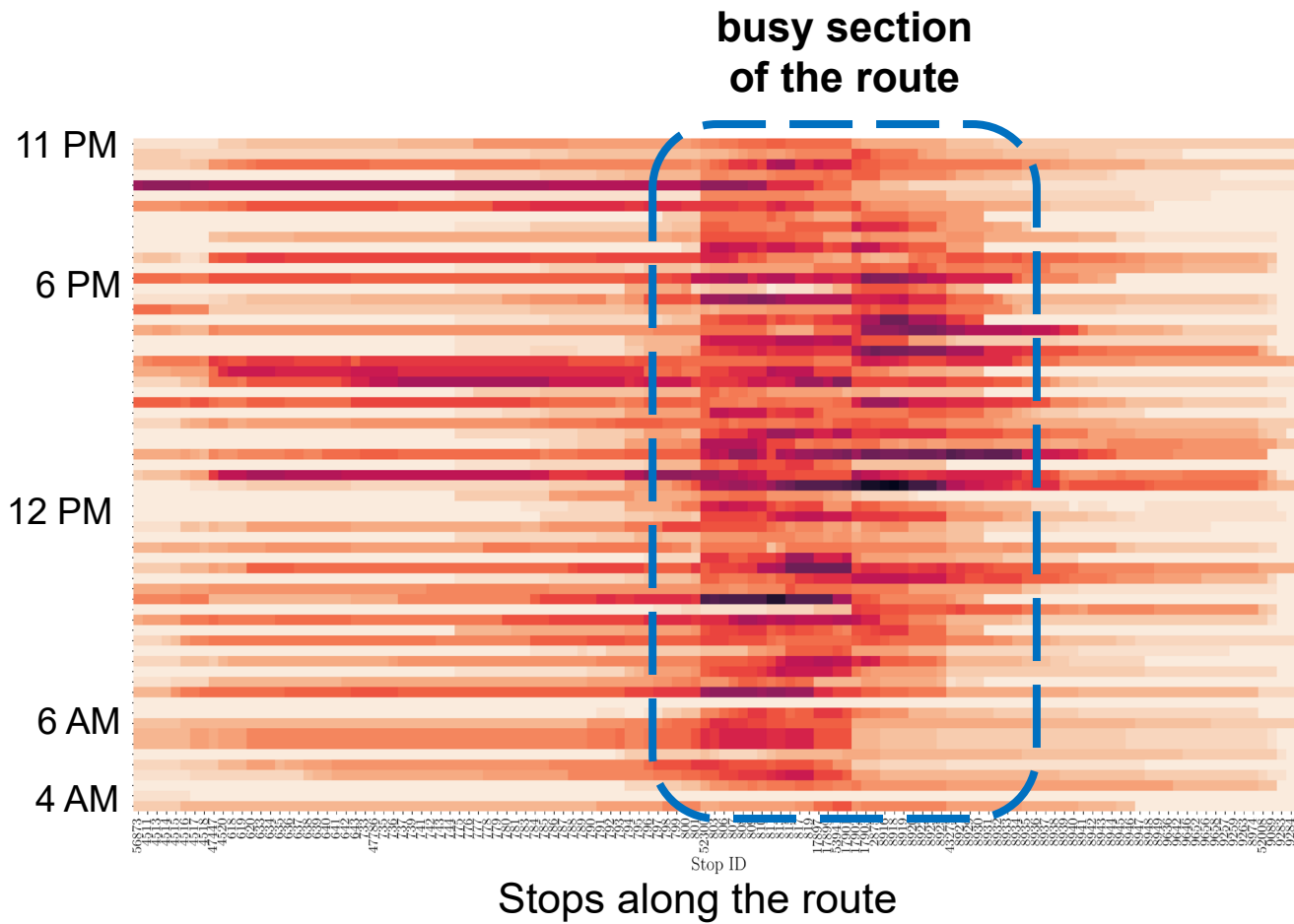
CTS Webinar, University of Minnesota, June 23, 2020



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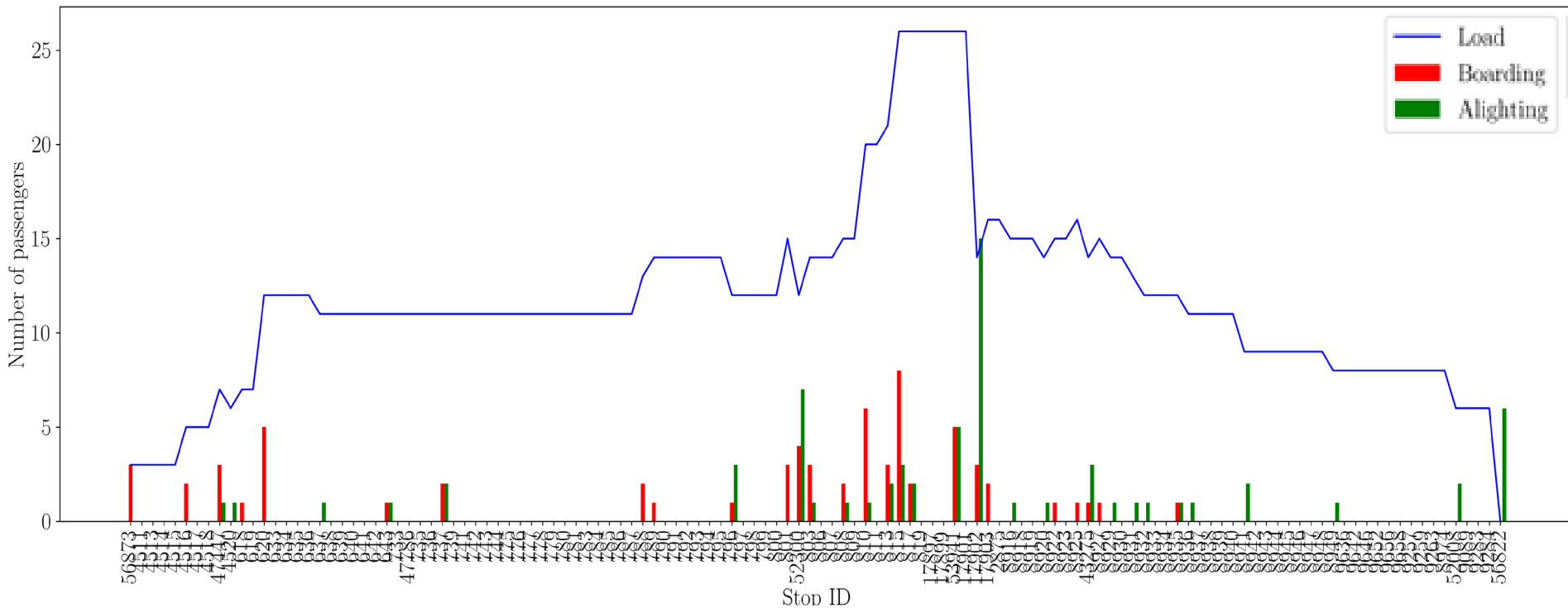
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# Route 5 Passenger Loads on May 12, 2020

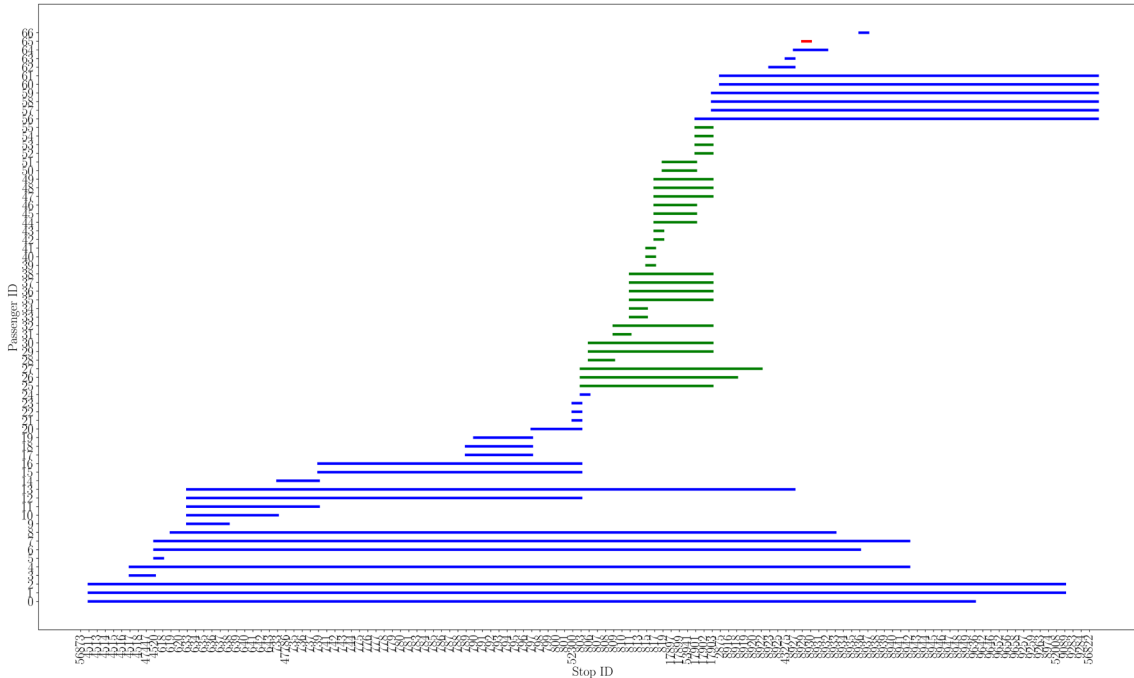


# Sample Vehicle Trip (from APC data)

- Aggregate passenger volumes (no individual passenger records)
- No connection between boarding and alighting of the same passengers

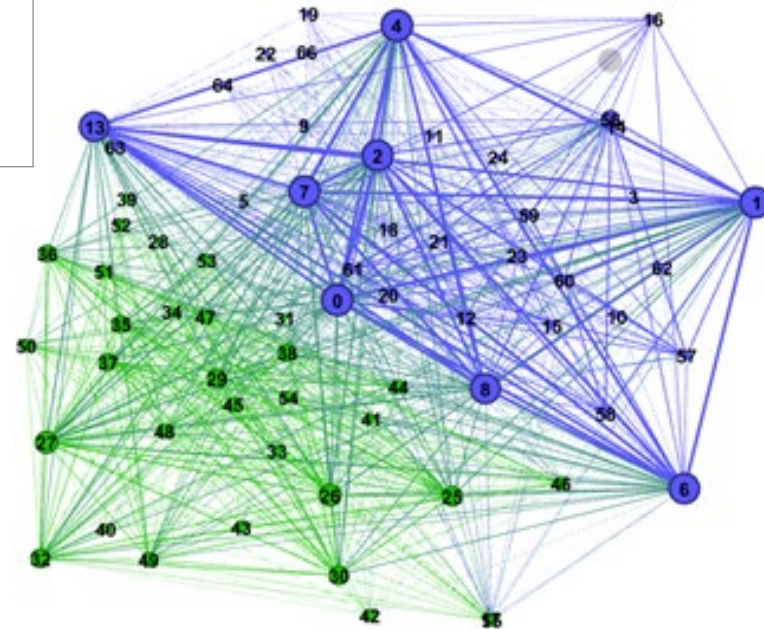


# Individual Passengers and Communities



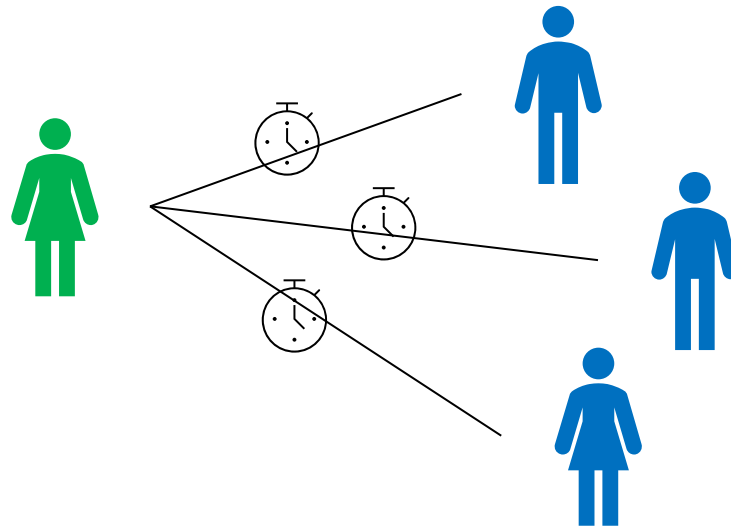
Individual passenger trajectories were estimated using a mathematical model and plotted along the route.

Passenger contacts and communities were detected to form a social contact network.



# Definition of Risk

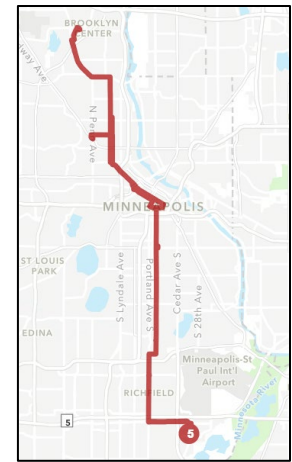
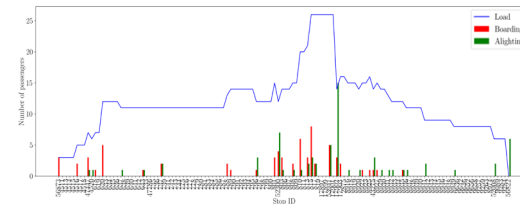
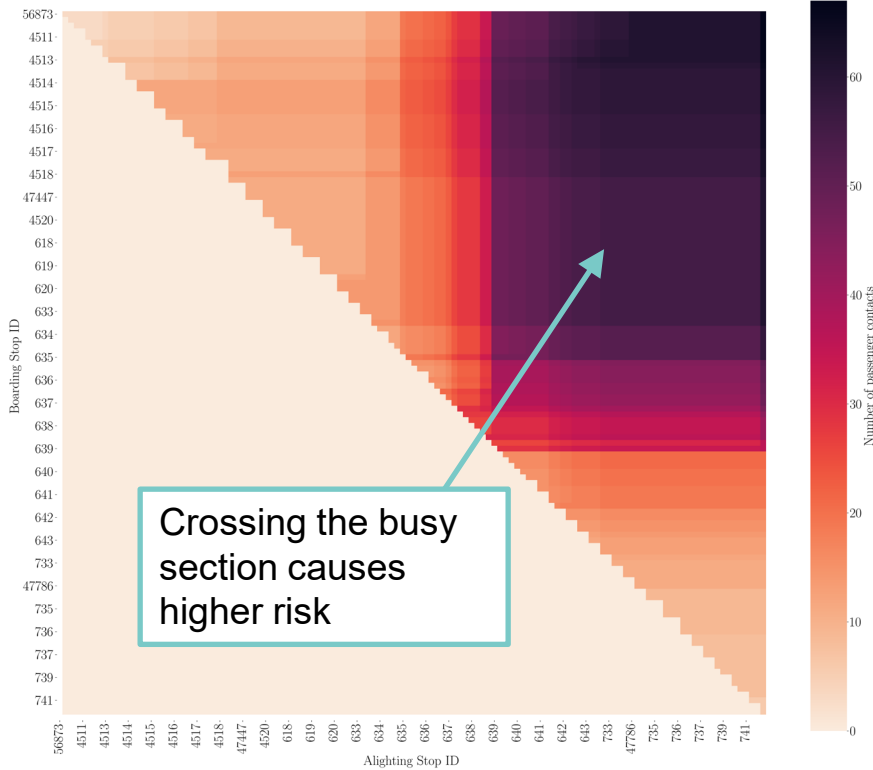
*The number and/or the duration of contacts* that a rider has with other riders during a transit ride.



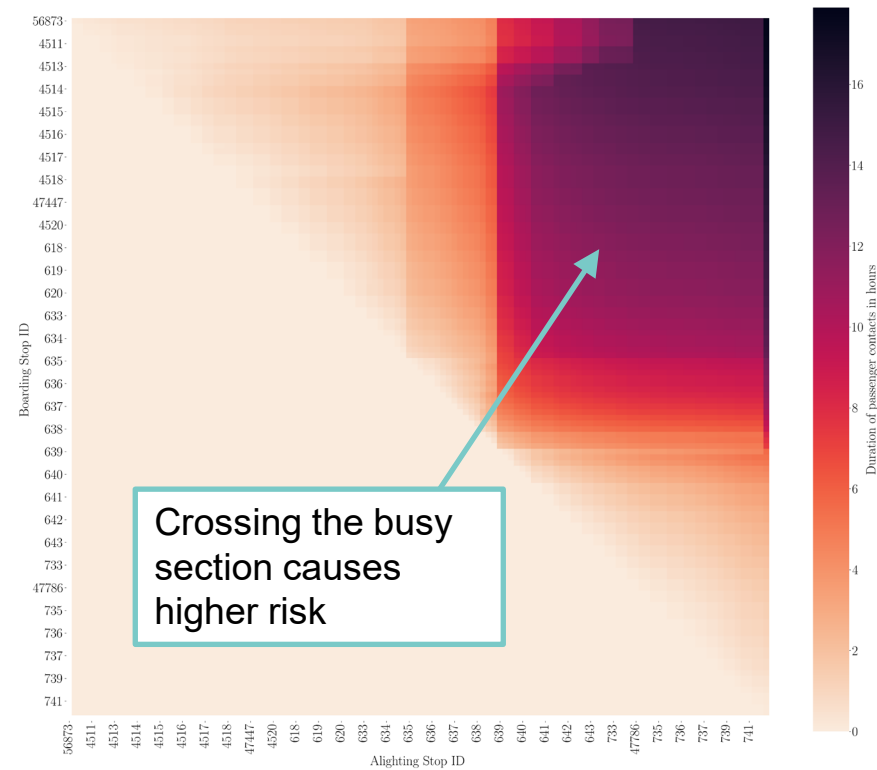
Factors such as wearing mask, sanitation of buses, etc. are crucial but not considered in this study.

# Risk Measure for Stop Pairs

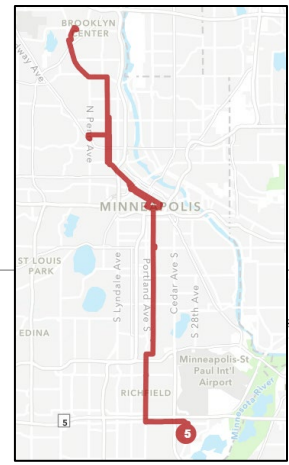
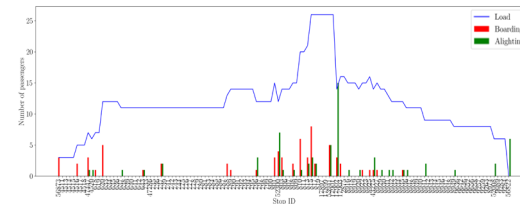
Number of contacts for a rider going from stop i to stop j



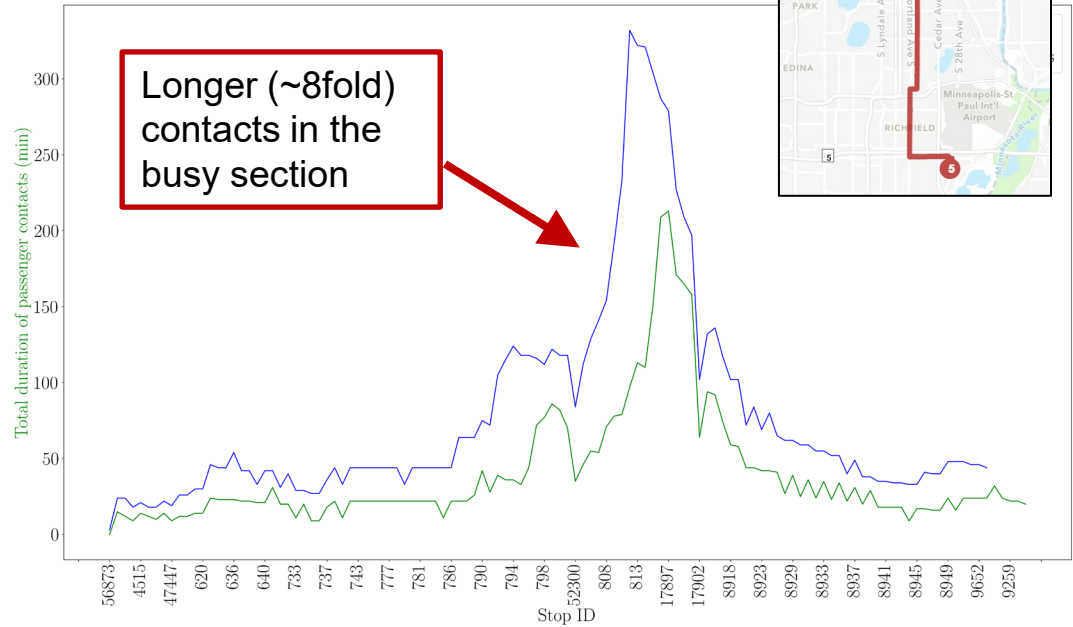
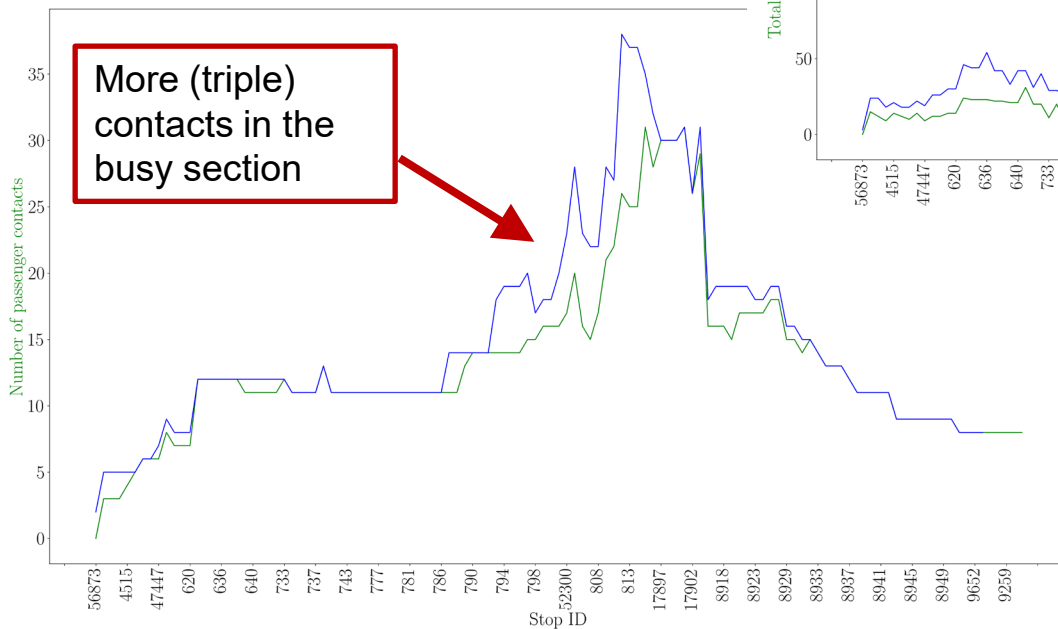
Duration of contacts for a rider going from stop i to stop j



# Risk Measures along the Route



Number of people a rider encounters while riding 5 / 10 stops



Duration of contacts a rider has while riding 5 / 10 stops



# How Can the Risk be Mitigated?

- Limit the number of people on each bus (capacity reduction)
- Add more buses (increase frequency) to reduce bus loads
- Realign routes to reduce the contact risks, e.g. by:
  - Breaking up long trips
  - Breaking up large communities
  - Reducing transfers

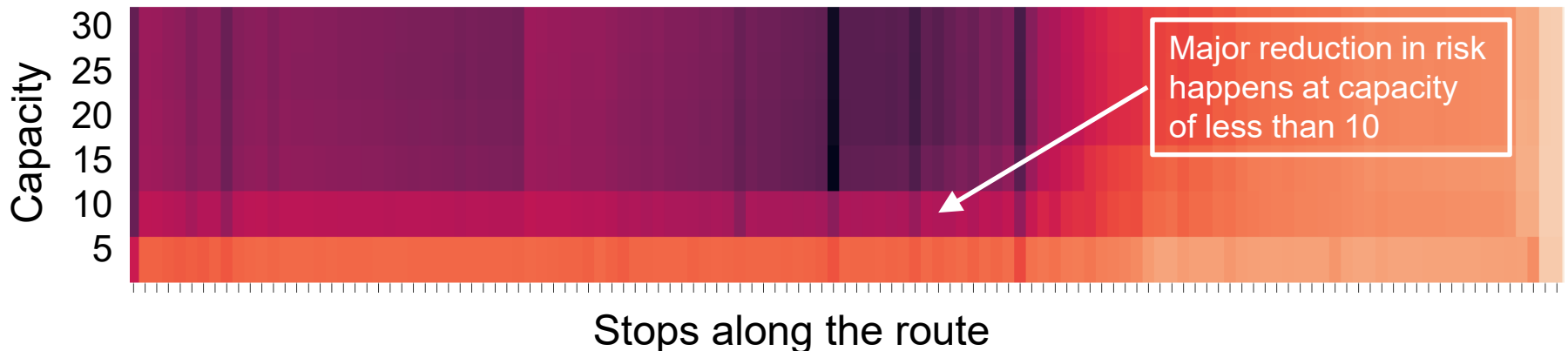
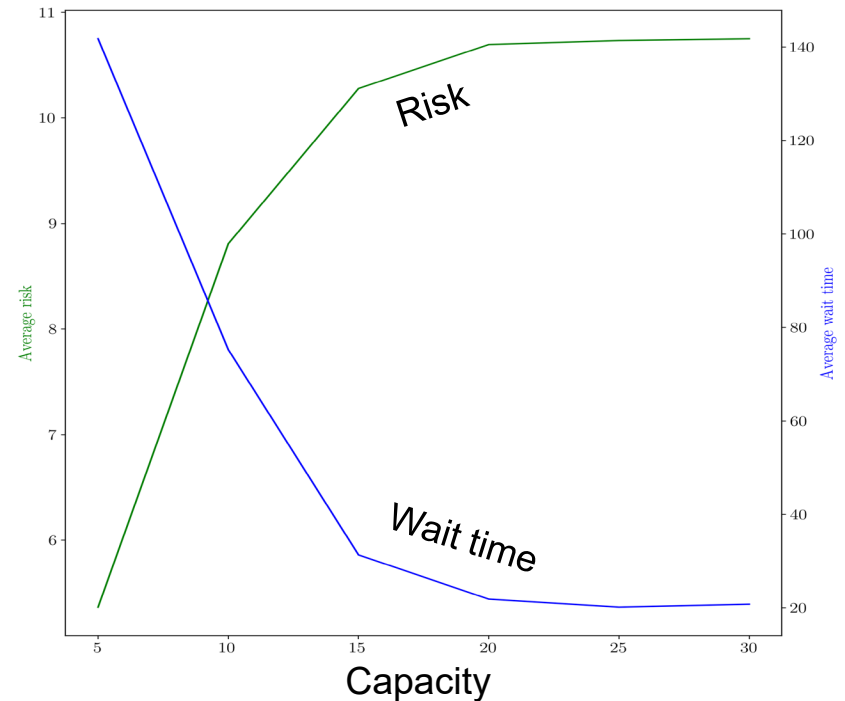
**We use simulation to evaluate the outcome of control decisions**





# Effect of Capacity Reduction on the Risk Measures (Simulation)

- Limiting capacity causes denied boarding and longer wait times.
- Limiting capacity will reduce contacts significantly.
- There is a trade off between longer wait time and higher risk.



# Conclusions

- With rigorous mathematical modeling and simulation, epidemic risk can be quantified and mitigated.
- Access to individual-based data is the key.
- We need to plan for transit service after the pandemic.



# Acknowledgments



- Office of Vice President for Research
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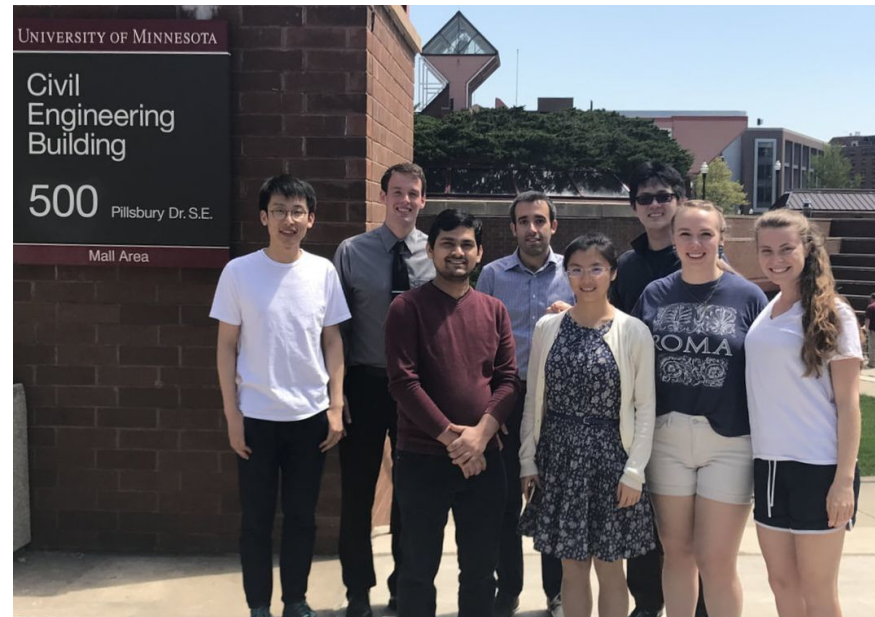
# Acknowledgments



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Questions?

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