Blue Bus Logistics in the Age of COVID-19

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Overview

We attempted to solve the problem of optimizing public transit logistics for the reduction of the spread of disease

The current system results in overcrowding of both buses and bus stops, extensive mingling between riders going to disparate locations, and inefficient allocation of buses to varying needs throughout the day

Our solution included multiple phases

- Revising the bus routes to better service common commutes as opposed to longer southwest/northwest routes
- Incentivizing students to provide information on their planned commutes in advance to determine what routes require the most buses during what times and to develop a robust model of campus-wide ridership
- Painting social distancing guides at bus stops to decrease crowding

This solution

- Is inexpensive
- Requires little modification of current assets
- Addresses issues with the bus system that existed before COVID-19 and will be beneficial after it

Problem Statement

- As regular bus riders and secret transportation logistics nerds, we were interested in **transportation** plans
- Knowing that Blue Buses are a petri dish even in non-pandemic times, we wondered what could be done to reduce the rate of transmission on them

Given that our bus system does not account for the spread of disease in the planning of routes and allocation of buses, what could be done with our current physical resources to allow for improved social distancing and decreased rates of illness among riders?

Needs assessment

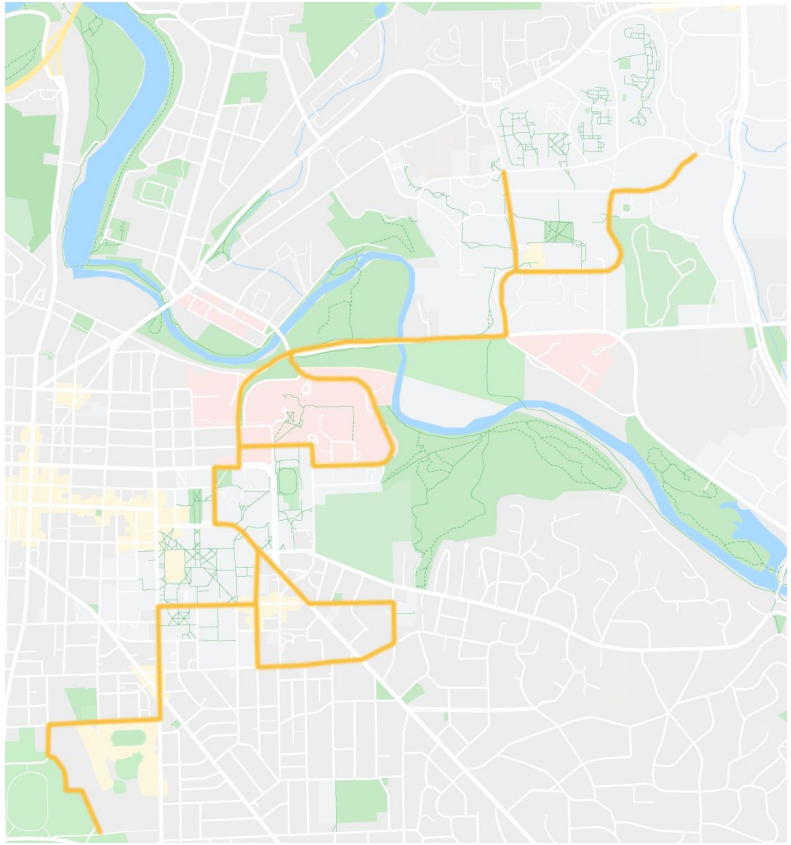
- Goscé and Johansson(2018) found a definitive link between influenza transmission and rider density in the London Underground, establishing public transit as an epidemiological risk
- This model has similarities to the Blue Buses like
  - Rush hours
  - Closed compartments
  - Extensive routes
- And dissimilarities that could decrease the rate of transmission at U of M, like
  - Open air bus stops
  - More flexible routes on account of buses

Current routes

- Looking at the current routes, we noticed several issues that could increase the risk of disease spread
  - Redundant routes, increasing the population in contact over several lines
  - Long routes across campus, resulting in geographically separate students in contact
  - Limited changes in system logistics outside of major shifts in service
  - Having lots of stops close together increases accessibility but also overall, unnecessary ridership
- Also noted that bus stops are not conducive to social distancing due to excessive crowding.
  - Why? The most common routes, mainly between the CTCC and Pierpont are underserved for the number of people who solely ride between them

Highly serviced routes

- These are areas currently covered by multiple bus routes under the current system
- While certain areas do see frequent use (CCTC, Pierpont Commons), others do not, yet many buses are sent to those areas (Oxford, Crisler Center)



Highly serviced routes

- Highlighted routes are direct routes to areas served by other routes, making them redundant
- For the purposes of preventing the spread of disease, rather than remove these routes, we should instead only have one route that go to each area exclusively

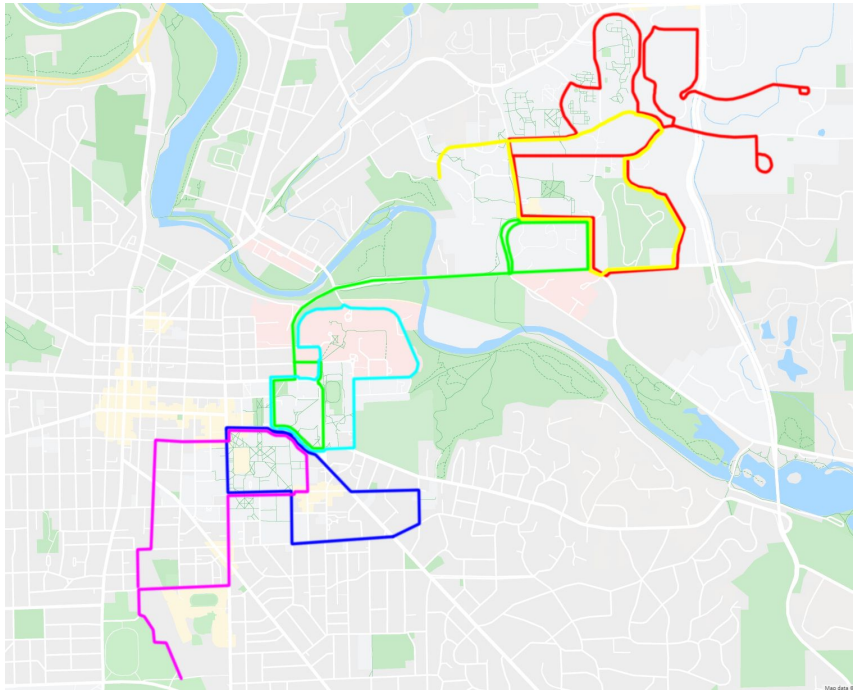
TRANSIT RIDERSHIP
All Routes

	FY19	FY18	FY17
Bio-Research Shuttle	2,047	1,187	874
Botanical Gardens	2,261	1,081	1,763
Bursley-Baits	2,232,565	2,557,429	2,407,707
Charter	71,840	82,283	99,252
Commuter	2,023,899	1,980,944	1,891,245
Crisler Express	24,390	22,195	
Diag to Diag	227,432	219,404	202,923
Football	9,466	8,808	4,355
Med Express	565,560	621,198	547,081
Safe Ride	27,328	20,510	13,348
Northwood	1,344,200	1,434,706	1,385,457
Northwood Express	300,040	290,475	302,823
Oxford	29,764	33,350	28,038
Oxford Shuttle	35,334	33,689	46,326
Paratransit Directly Operated	2,779	3,048	3,850
Paratransit Contracted	7,628	7,797	7,885
Wall Street - NIB	249,247	254,835	220,821
North-East Shuttle	319,650	331,909	283,706
Wall Street Express	17,221	20,430	23,416
TOTAL	7,480,924	7,915,389	7,464,752

F19 Annual Report (Rep.). (2019). Ann Arbor, MI: Facilities & Operations: Logistics, Transportation & Parking, University of Michigan.

Bus Rerouting

- Singular Central to North campus loop will allow for more adequate service to one of the most important functions of the bus system
- Smaller loops within campuses reduce overall ridership for those without accessibility needs while still allowing transit between any two points
- Less routes, more buses more frequently to reduce riders per bus / people waiting per stop



Intelligent Driver Distribution

- Methods exist for optimization of resource distribution in transport system
- Most effective when both behavior of drivers and riders known
- Buses and traffic patterns are already accessible for route planning, the missing variable is data on students
- Students already use Magic Bus but have no way to provide useful information on their travels plans

Our idea:

Give students the opportunity to provide information on route use and feedback on bus system operations to build a robust model of ridership

Utilization of feedback

Student registers intent to ride in advance	Request feedback on ride/bus system after scheduled route	Provide information to students on expected travel times to influence ridership	Build more advanced model
- Riders told that system is adaptive in advance - Possible additional incentives - UMich able to schedule routes to match required capacity	- Checks if student actually rode the bus, building a profile of credibility for further modelling - Allows improvement of bus system	- For a scheduled route, recommend transit options based on travel time and rider density - Influence rider behavior based on information	- New student input builds on known traffic patterns - System robust to students reducing usage as semester continues

Waiting Areas

- Crowding at bus stops is antithetical to social distancing guidelines
- While the aforementioned measures should decrease wait times, students may still be in close proximity while waiting for buses
- We propose the painting of “social distancing squares”, six foot apart single occupancy areas on the sidewalk by bus stops to inform people of how far apart they should be
- The distribution of squares could also be used to carve out a corridor of pedestrians walking by the stop

Miscellaneous ideas

- Requirement of mask wearing, proper sanitation in advertising on bus
- Discounts for parking passes, and parking in general to incentive students with the ability to use their own transportation to utilize it over the bus system
- A stipend for the purchase of bikes to further reduce the number of people riding the transit system (these would be owned by students, not as part of shared bike network)

Timeline of Implementation

- Two major stages
  - Pre-fall semester
  - During / post fall semester
- Pre:
  - App development for rider intent begins ASAP to allow proper dev cycle and Q&A
  - Production of content aimed at informing Blue Bus riders of new safety standards and routes
  - Update University of Michigan app with rider planning and DoubleMaps with route adjustments to take effect 1 week before move in to allot for adjustment period
- During:
  - Use rider data to adjust routes and bus distribution depending on demand
  - With each semester make adjustments to factor in course location changes and continue to strive for the most efficient distribution of resources

Budget

- Personnel expenditures would be directed at discretionary spending on updating the University Michigan App to allow for rider reservations and updating routing as ridership data comes in
- All other expenditures can likely be avoided by using resources already present at the University, such as sidewalk paint for the squares

Budget Proposal	
Project Title: Blue Bus Rerouting Project	
Duration of Project : July 2020 - July 2021	
Nature of expenditure/ Item	**Amount in US Dollars**
Personnel	**$70,000.00**
OTHER Direct Costs	
Documentation (books & Software)	**$1,000.00**
Paint	**$2,000.00**
Mail & Courier	**$100.00**
Communication / Internet/ Photocopying	**$100.00**
Total Direct Costs	**$73,200.00**

References

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