

Memo: Congestion Implications for Changes to CubeTown's 7th Avenue
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Date: April 12, 2019

INTRODUCTION

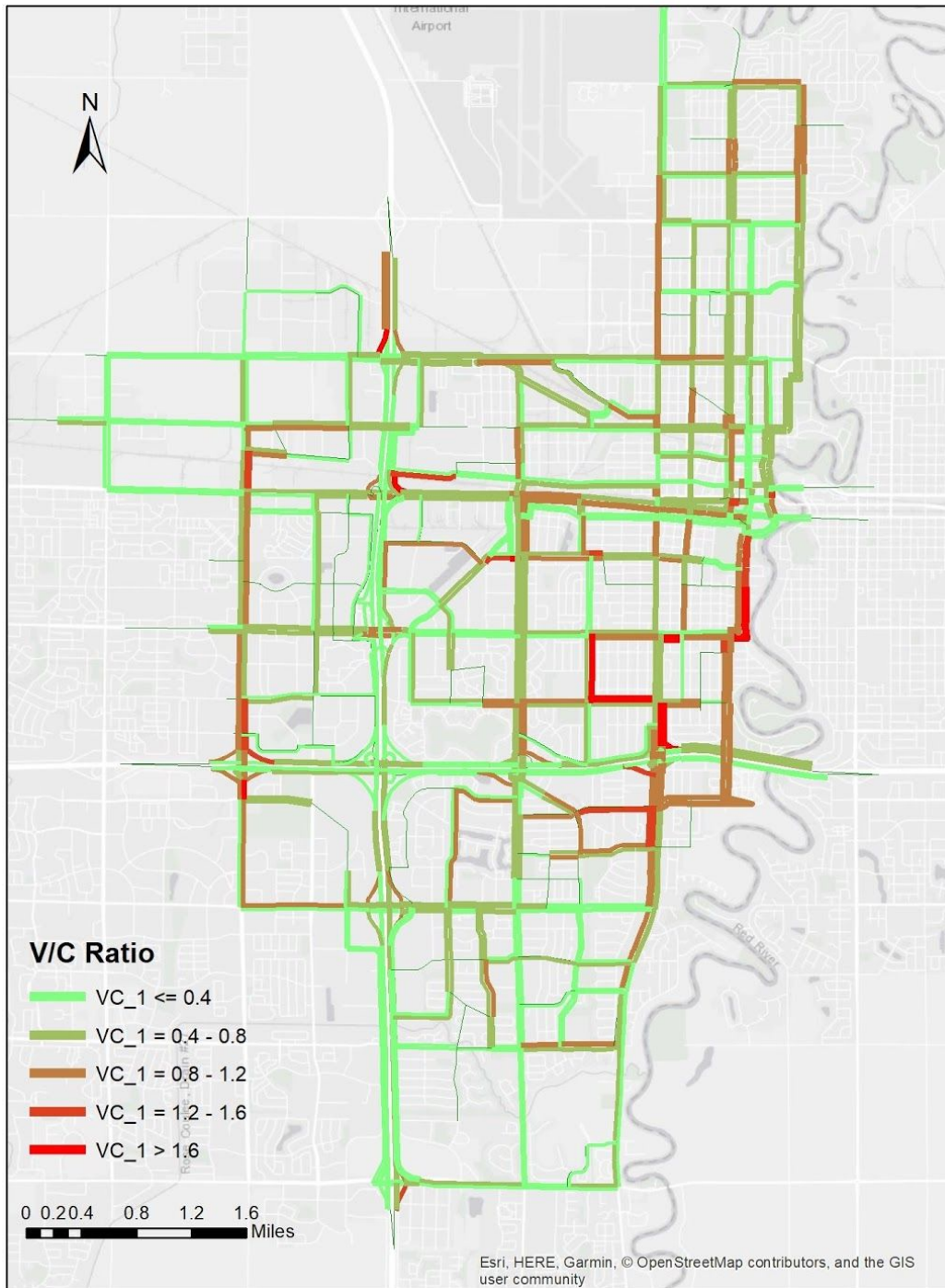
With the imminent closure of CubeTown's Ford plant, CubeTown is considering demolishing the vacant plant and connecting two segments of 7th Avenue North that currently dead-end at the plant. Among other effects, this plan can be expected to cause changes to congestion patterns on CubeTown's road network. In this memo, we use Cube to model the potential effect on congestion of connecting 7th Avenue North, and we also consider two hypothetical scenarios for addressing some of the resulting changes to congestion in the city.

ANALYSIS

Scenario 1: Base Case

First, we consider Cube's predictions for congestion on CubeTown's roadway network as it exists now, with 7th Avenue North unconnected where it meets either side of the Ford plant. Currently, Cube predicts relatively little congestion on CubeTown's roads, most of which experience a V/C ratio less than one. There are several exceptions: to the west of the north-south highway I-29, 45th Street South experiences moderate congestion. To the east of I-29, several routes leading to and from downtown CubeTown experience the most intense congestion in the city. These include 25th Street South, South University Drive as it meets the east-west highway I-94, 5th Street South as it becomes 4th Street South, and 4th Street South as it enters downtown CubeTown. In addition, arterial roads connecting these most-congested routes seem to experience some congestion themselves.

Figure 1: Traffic Congestion (V/C Ratio) in CubeTown under Base Case:

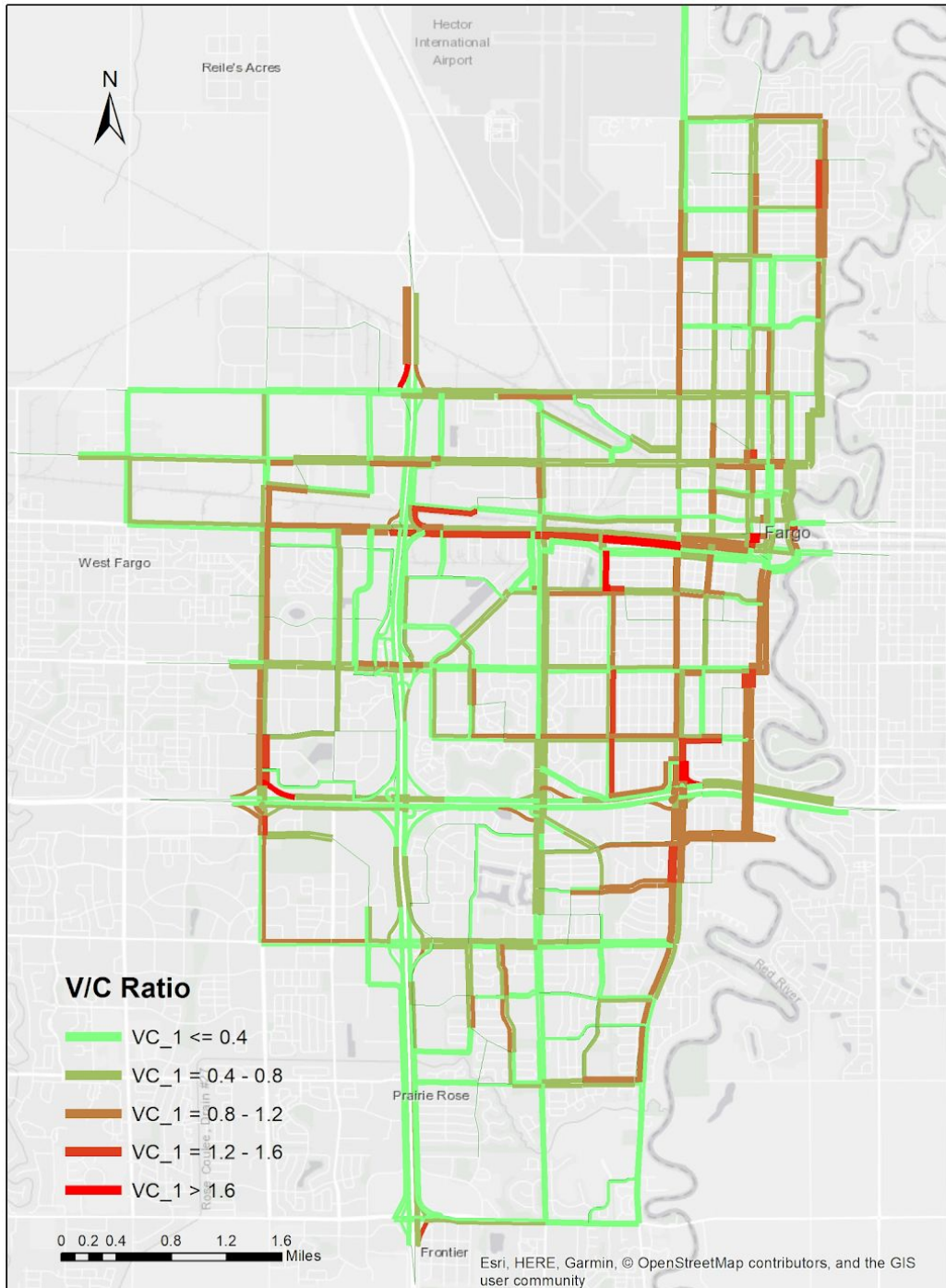


Currently, 7th Avenue North cannot serve the connecting role between downtown CubeTown and I-29 played by other arterial roads. As the map and discussion below show, reconnecting 7th Avenue seems to allow it to play this role, which results in changes to congestion on other nearby routes.

Scenario 2: Connecting 7th Avenue

In the second scenario, we connect 7th Avenue through the Ford Plant to evaluate its impact on circulation downtown and connectivity to I-29. The connection increases capacity for east-west traffic in the downtown area and provides another access route to the highway. After the connection, Cube predicts that traffic would increase the V/C ratio on major roads adjacent to 7th Avenue, but the majority of roads would still remain uncongested with a V/C ratio below 1.2. In this scenario, Main Avenue has seen the most significant increase in traffic compared to the base scenario, becoming a pinch point to access I-29. Other shifts in traffic include decreases in V/C ratio on 25th Ave and 27th Ave and an increase on 17th Avenue. The increased capacity on 7th Avenue may have induced demand for travel in adjacent areas, causing additional traffic.

Figure 2: Traffic Congestion (V/C Ratio) in CubeTown after Connecting 7th Avenue:



Due to significant changes in V/C ratio and access to I-29, we selected 7th Avenue and Main Avenue to further examine traffic volume shift. Below is a table illustrating the changes in traffic volume on selected streets:

Table 1: Traffic Volumes Before and After Connecting 7th Avenue			
Link	Description	Volume (before connection)	Volume (after connection)
764-772	7th Avenue westbound from N University Drive to 17th Street N	1233.084	1019.454
772-764	7th Avenue eastbound from N University Drive to 17th Street N	226.972	770.638
993-1237	Main Avenue/Route 10 eastbound from 34th Street South toward 27th Street South	2088.354	2240.112
1237-993	Main Avenue/Route 10 westbound from 34th Street South toward 27th Street South	1413.682	1402.634

Changes in traffic volume on selected streets vary. The traffic volume on 7th Avenue eastbound from N University Dr to 17th St North has more than tripled. On 7th Avenue westbound, traffic volume has decreased approximately 1/6. Main Avenue eastbound between 34th St South and 27th St South has increased about 1/10, whereas the westbound direction has decreased slightly.

Scenario 3: Street Widening

As discussed above, connecting 7th Avenue causes the model to predict additional traffic not only along that route, but also along several other major routes in CubeTown. To address this congestion, several changes to the road network might be considered. Widening a congested stretch of road would increase the road's carrying capacity, while increasing the speed limit along

the stretch could increase the rate at which vehicles pass it. Both measures would allow more vehicles to travel along the road in a given amount of time, potentially reducing congestion both along the road itself and on other routes for which the road serves as an alternative.

Although there are several stretches of road that seem to be good candidates for congestion reduction, Main Avenue/Route 10 between I-29 and University Avenue stands out for several reasons. By comparing the no-build scenario with the scenario in which 7th Avenue is connected, it is clear that this segment of Main Avenue experiences an increase in its V/C ratio as a result of the 7th Avenue connection. Moreover, this stretch of Main Avenue serves as a key link to I-29, so widening Main Avenue could conceivably decrease congestion both on the highway and on other arterial routes connected by the highway.

Below, we consider the effect of two widenings of Main Avenue/Route 10 between I-29 and University Avenue. In the first scenario (3.1), this stretch is widened by one lane in each direction, causing the total number of lanes each way to increase to 3 and the capacity each way to increase to 2700 vehicles. In the second scenario (3.2), this stretch is widened by two lanes in each direction, causing the total number of lanes each way to increase to 4 and the capacity each way to increase to 3600 vehicles.

Scenario 3.1: Widening Main Ave from Four Lanes to Six Lanes

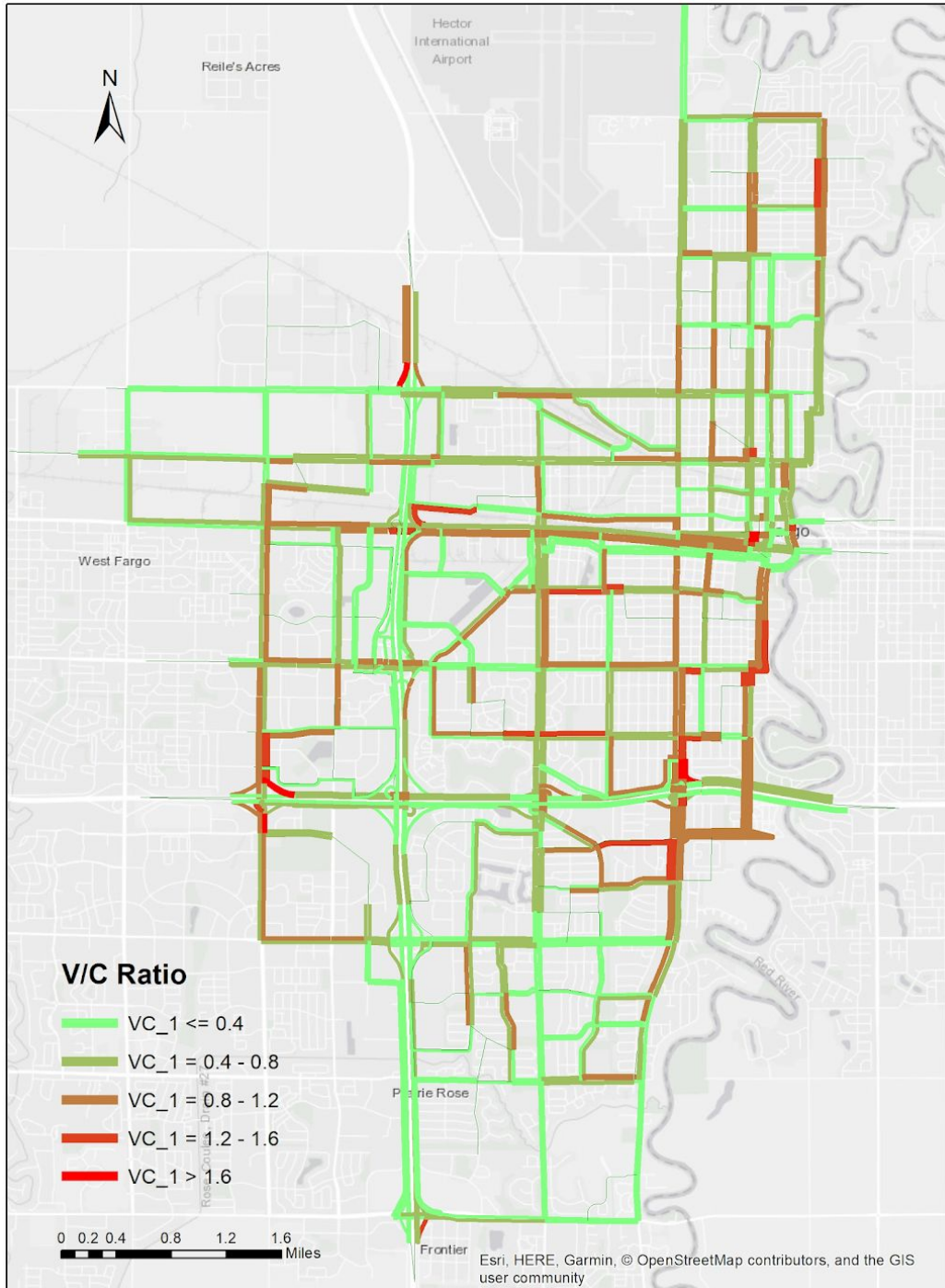
In this scenario, we widened Main Avenue by increasing the capacity to 3 lanes each direction, which increased the capacity to 2700 vehicles on each way. There were no changes made to the speed of these road segments.

As seen in Table 2 and Figure 3, there is both an increase and decrease in the V/C ratio. Increasing the lanes and capacity decreased the load from Main Avenue/Route 10 between I-29

and University Avenue, but increased the load on its nearby roads. Increasing the capacity of Main Avenue/Route 10 has increased auto traffic into 25th Street S, 7th Avenue westbound from N University Drive to 17th Street N and 1st Ave N. The reason for this might be that people will make more trips due to the increase in accessibility.

After combining the number of trips by mode in the Mode Share Report (see Table 3), we can clearly see that widening Main Ave to six lanes has significant impact on public transit trips, as Cube predicts approximately 30% decrease in the total trip number of walking to transit and driving to transit. The most noticeable change in all modes is drive to transit, which drops more than 50% to a mere total of 7,942 trips. Instead of inducing more auto trips, widening Main Ave causes about 20,000 decrease in driving trips (including drive alone and carpool) from 1,076,531 to 1,056,439. Even though congestion level in the system remains relatively unchanged, the total number of trips has decreased by 4%.

Figure 3: Traffic Congestion (V/C Ratio) in CubeTown after Widening Main Avenue to Six Lanes:



Scenario 3.2: Widening Main Ave from Four Lanes to Eight Lanes

In this scenario, we widened Main Avenue by increasing the capacity to 4 lanes each direction, which was increased the capacity 3600 vehicles on each way. There were no changes made to the speed of these road segments.

As seen in Table 2 and Figure 4, there is both an increase and decrease in the VC ratio but mostly there are decreases in the VC ratio in comparison to the build scenario. Increasing the number of lanes on Main Avenue/Route 10 decreased the load significantly especially on the eastbound route. Increasing the capacity of Main Avenue has slightly increased auto traffic into 25th Street southbound and 7th Avenue eastbound.

During peak hours, the public transit trips are around 9,000 - 9,100. Based on the Mode Share Report, there isn't a significant impact on the number of public transit trips. Comparing the total number of trips to the before widening scenario, driving (driving alone, carpooling), driving and walking to public transportation show a decrease while only walking shows an increase. Walking sees an 8.8% number of trips increase. Driving to public transport sees a significant 25% decrease while walking to public transport only sees a 0.9% decrease. There is only a 0.4% decrease in driving. The total number of trips show a decrease of 0.6%.

Figure 4: Traffic Congestion (V/C Ratio) in CubeTown after Widening Main Avenue to Eight Lanes:

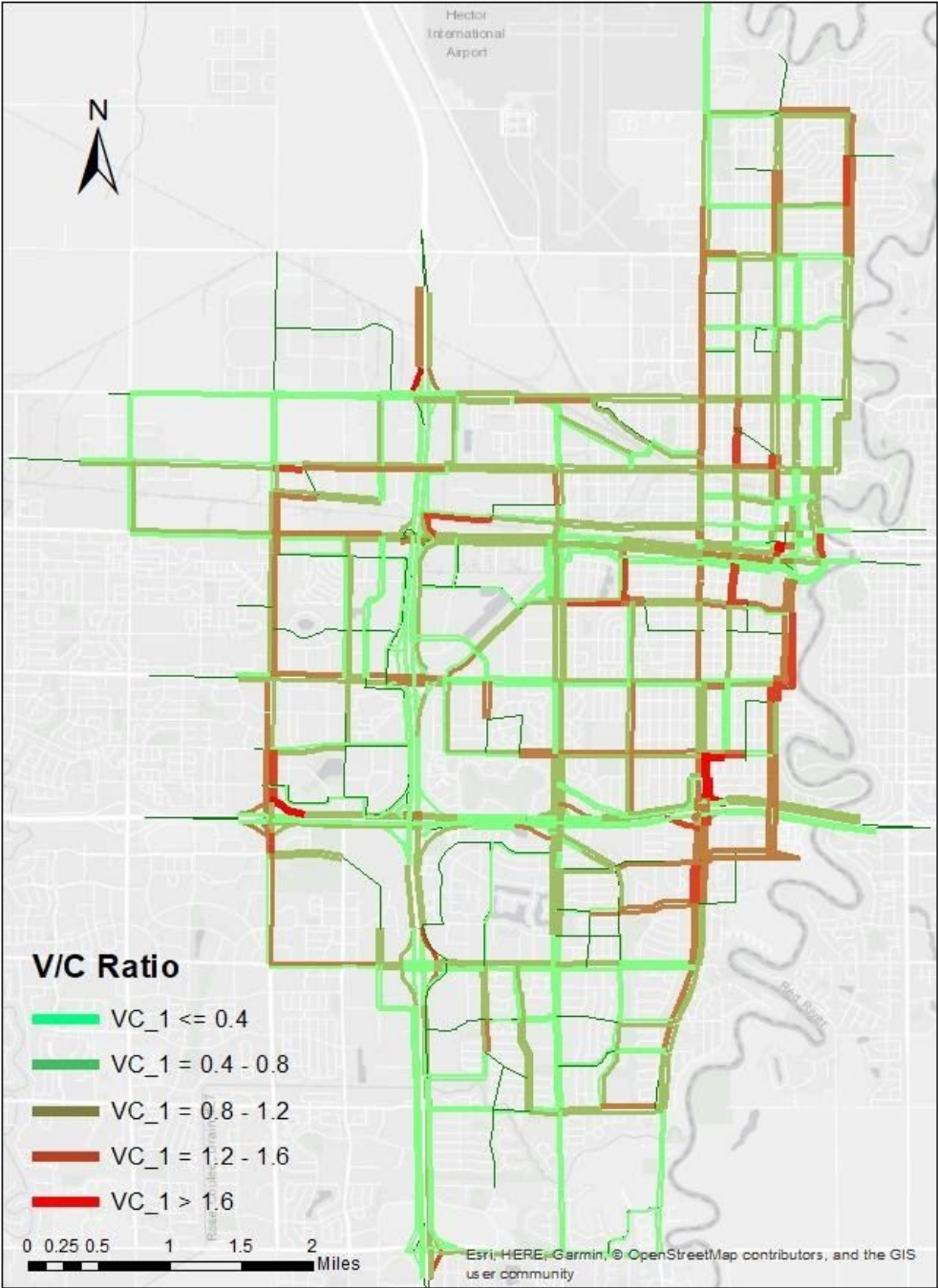


Table 2: V/C Ratios Before and After Widening				
Link	Description	Volume/Capacity Ratio (before widening)	Volume/Capacity Ratio (after widening from 4 to 6 lanes)	Volume/Capacity Ratio (after widening from 4 to 8 lanes)
764-772	7th Avenue westbound from N University Drive to 17th Street N	0.600	0.896	0.597
772-764	7th Avenue eastbound from N University Drive to 17th Street N	0.453	0.425	0.625
993-1237	Main Avenue/Route 10 eastbound from 34th Street South to 27th Street South	1.245	0.956	0.518
1237-993	Main Avenue/Route 10 westbound from 27th Street South toward 34th Street South	0.779	0.561	0.414
733-1003	25th Street southbound from 5th Avenue South toward 13th Avenue South	0.376	0.426	0.498
1003-733	25th Street northbound from 13th Avenue South toward 5th Avenue South	0.733	0.802	0.663

Cube suggests that widening Main Avenue is not a foolproof solution to congestion. On Main Avenue itself, widening clearly reduces congestion. On segment 993-1247 of Main Avenue, for example, the V/C ratio decreases drastically with widening, from 1.245 to 0.956 after widening to 6 lanes and from 0.956 to 0.518 after widening to 8 lanes. On 25th Street and one segment of 7th Avenue, however, the first widening *increases* congestion, and the decrease

in congestion from the second widening leaves some segments more congested than they were before widening. The model suggests that widening Main Avenue improves traffic flow mostly on Main Avenue itself, but it should not be assumed that widening will improve congestion on other routes.

Table 3: Mode Choice Before and After Widening			
Mode	No. of Trips: Before widening - 2 lanes	No. of Trips: Widening from 4 to 6 lanes	No. of Trips: Widening from 4 to 8 lanes
Driving	1,076,531	1,056,439	1,072,714
Walk	22,959	15,727	24,978
Drive to Public Transport	18,512	7,942	13,871
Walk to Public Transport	42,719	33,455	42,320
Total	1,160,721	1,113,563	1,153,883

CONCLUSION

To evaluate the impact of connecting 7th Avenue North and alleviate congestion in CTown, we modeled traffic volumes and observed congestion on the current street configuration. Compared with the traffic volumes under existing conditions, Cube predicts increased traffic on 7th Ave N after the street connection, which also appears to cause congestion on Main Avenue. We widened Main Avenue twice in an attempted response to increased congestion.

As expected, the connection of 7th Avenue North seems to increase its use as a connecting route between other major routes, causing increased traffic in one direction on 7th Avenue itself and significantly more eastbound congestion on Main Avenue/Route 10. To address this congestion on Main Avenue and, it was hoped, on other routes, we essentially

modeled the creation of a new urban highway. Main Avenue was widened first from 4 lanes to 6 lanes, and then from 4 lanes to 8 lanes. As expected, both widenings significantly decreased congestion on Main Avenue, relative to congestion on that route after connecting 7th Avenue North. However, widening Main Avenue did not reliably address congestion on other, nearby routes. On some segments, widening Main Avenue causes marginal or large decreases in congestion, while on others the reverse occurs.

This analysis suggests that connecting 7th Avenue North will increase congestion somewhat, but even very significant widenings of Main Avenue are no solution. In addition, the creation of a new urban highway in CubeTown might not be realistic or desirable for other reasons unrelated to congestion. Another option for addressing congestion might be to improve CubeTown's public transit network. Measure T, currently under consideration, could provide such an opportunity, and we will consider several related scenarios in a memo to follow.