

Routes of Health Appendix C: Charlotte, North Carolina

I. Background and Key Demographics

Charlotte is in south-central North Carolina and is the state's most populous city. It encompasses a sprawling mix of urban and suburban areas, covering 309.5 square miles of the state's most populous county, Mecklenberg County. The Charlotte metro is an important commercial hub for the region and has been among the fastest-growing U.S. metro areas in recent years. It has an estimated population of 912,096 with 2,500 inhabitants per square mile. Charlotte is a desirable location for those seeking jobs, urban amenities with a small town feel, and a lower cost of living compared to other metro areas in the U.S. Charlotte is expected to gain 400,000 residents by 2040 according to the [City's Transportation Action Plan](#).

Charlotte is racial and ethnically diverse, yet segregated. The population is 48.8% White, 35.2% Black, 14.3% Hispanic/Latino, and 6.5% Asian. 12.3% of residents speak Spanish. The median household income is \$62,817 with a 12.8% poverty rate. The city is racially and economically divided into areas known as the "crescent" and the "wedge." Wealthier white residents tend to live in the wedge-shaped slice of south Charlotte while lower income people and people of color tend to live in the crescent-shaped areas to the north, east, and west¹. Charlotte's new [2040 Comprehensive Plan](#) outlines ways that the City can address existing inequities in everything from transportation to housing. Their approach aims to protect current residents from displacement while welcoming new residents, thus making Charlotte more livable for everyone.

II. Programs, Plans and Policies

According to [City of Charlotte's Vision Zero page](#), the city has added almost 200,000 more drivers, pedestrians, and cyclists over the past ten years. This growth has caused an increase in traffic congestion, speeding, and traffic-related fatalities. In response to this growth, Charlotte upgraded their intersections and bike and pedestrian facilities and created a [Vision Zero Action Plan](#) in 2018. Charlotte's Vision Zero plan commits to eliminating all serious injuries and traffic fatalities by 2030. There is also a [Vision Zero Task Force](#) that provides input on the action plan implementation.

Charlotte Department of Transportation (CDOT) has walking and biking plans aimed at improving and increasing active transportation around town. In 2017, City Council adopted [Charlotte WALKS](#), the city's first comprehensive pedestrian plan. Charlotte WALKS aims to make Charlotte a walkable city for people of all ages and abilities. The [Charlotte BIKES](#) plan was adopted by City Council in May 2017. The goal of this plan is to make Charlotte a bike-friendly city which includes expanding bike facilities and creating a culture of biking. Charlotte's [Shared Mobility Programs](#) also include bikeshare and e-scooter programs.

While Charlotte does not have a subway system, Charlotte Area Transit System (CATS) offers a number of public transportation options including over 70 bus, light rail, commuter rail, and street car routes. The City's [2030 Transit Corridor Systems Plan](#) aims to integrate transit and land use to increase the number of people traveling by public transit and reduce the number of people driving. The plan will connect various transit modes, expand the transit network, and improve access to key

¹ Portillo, Ely. [Five Maps that Show Inequality in Charlotte in Surprising Ways](#). Accessed June 14, 2021.

destinations around Charlotte. These changes will begin to address the transportation demands of a growing city, make transit more functional, especially for low-income residents who tend to be transit riders, and make the transit-system more climate-friendly.

III. Existing Conditions

Charlotte's street network is maintained by CDOT and the North Carolina Department of Transportation (NCDOT). 604 miles of streets are maintained by CDOT and 2,455 miles of streets are maintained by NCDOT. The City also maintains 1,890 miles of sidewalks and 190 miles of bicycle facilities. According to the most recent assessment of Charlotte's street network, completed between 2012 and 2016, 48% (432 miles) of the network needs improvement. A similar assessment of the bicycle network shows that 79% (566 miles) of the network needs improvement. Much of these improvements aim to tackle high traffic volumes, inadequate infrastructure and safety issues, and poor design. The City has started to secure local and state funding for transportation improvements, but more funding will be needed to address the demands of the growing population.

Charlotte is also a product of mid-20th century car culture, meaning that roads were designed to be maximized for vehicle capacity. Most residents and commuters travel by car and more than 93% of commuter trips are made with personal vehicles. When commuting, 76.3% of people drive alone, 3.3% take transit, 2.1% walk, and 1.3% travel through other means. 6.4% of households have no access to a car. According to the City's [2016 transportation survey](#), 43% of Charlotteans think it is difficult to drive in Charlotte, 50% of respondents say it is difficult to walk in Charlotte, 62% of respondents say it is difficult to bike in Charlotte, and 42% of respondents think it is difficult to take the bus or train in Charlotte.

The City is making concerted efforts to improve its transportation system and shift to less car-centered design. Changes include improvements to the 1,890 miles of existing sidewalks and building new sidewalks on Charlotte's local and connector streets, funding trail and greenway facilities, and developing a corridor-connected transit network. Residents are encouraged to work with the CDOT's [neighborhood traffic management program](#) to implement traffic calming interventions such as speed humps, roundabouts, and school crossings. Residents can request a traffic calming evaluation in their neighborhood through the program. CDOT also has a number of programs and safety campaigns to encourage safe active transportation and transit use. Along with being a Vision Zero city, Charlotte-Mecklenberg County as a robust [Safe Routes to School program](#) and a number of walking and biking groups and organizations like [Sustain Charlotte](#), a community-based non-profit working towards sustainable growth across the region.

IV. Community Engagement Summary

The Safe Routes Partnership collaborated with a team of key stakeholders to receive input on the challenges of navigation apps in Charlotte. Key stakeholders included representatives from:

- Charlotte Department of Transportation
- Safe Routes to School Charlotte-Mecklenberg County
- Mecklenberg County Public Health Department

- Sustain Charlotte
- University of North Carolina Chapel Hill

We used CDOT crash data and demographic data to identify the Hidden Valley neighborhood as our community engagement priority area. Hidden Valley is located five miles north of Charlotte’s city center and borders several main roads and highways including I-85, North Tryon Street (Route 29), and Sugar Creek Road (Route 4). Hidden Valley was developed in 1959 as a predominately White neighborhood, but once Black residents began moving to the area in the 1970s most of the White residents left. Today Hidden Valley is a predominately Black community with around 20,000 residents, many of whom are homeowners.

We attended a Hidden Valley Homeowners Association meeting to get feedback from residents about some of the traffic safety challenges they are facing, including those caused by navigation apps. Approximately 35 people attended the meeting. Attendees cited a high amount of cut-through traffic on Tom Hunter Road, which runs directly through Hidden Valley and connects I-85 and North Tryon Street. Several residents noted that drivers were cutting through to access North Tryon Street, one of the main streets that leads to downtown Charlotte. While they could not point to navigation apps as the direct cause, they did say that an increase in road traffic is causing people to re-route through the neighborhood. Residents also said that drivers do not need to use navigation apps because they know that Hidden Valley is a viable shortcut to reach I-85, North Tryon Street, and Sugar Creek Road. Sugar Creek Road was cited several times as a road with a lot of traffic that drivers try to avoid. With new development is coming to Hidden Valley and the surrounding area, residents expressed concerns that traffic will worsen and that newer residents who might use navigation apps could cause safety issues.

Community members also talked about the impact of commercial trucks and delivery vehicles on residential streets. Residents noted that commercial trucks have run into lights and stop signs in the area and sometimes park on lawns. This issue, along with speeding, has caused serious concerns, especially for kids who usually play in the street because there is a lack of sidewalks. Zone enforcement is working with community members to address this problem. Residents are also requesting more speed humps to slow down drivers, commercial vehicles, and ATVs. Moving forward, residents want to continue working with the City agencies to address traffic safety challenges and ensure that new developments are designed and built with traffic safety in mind.

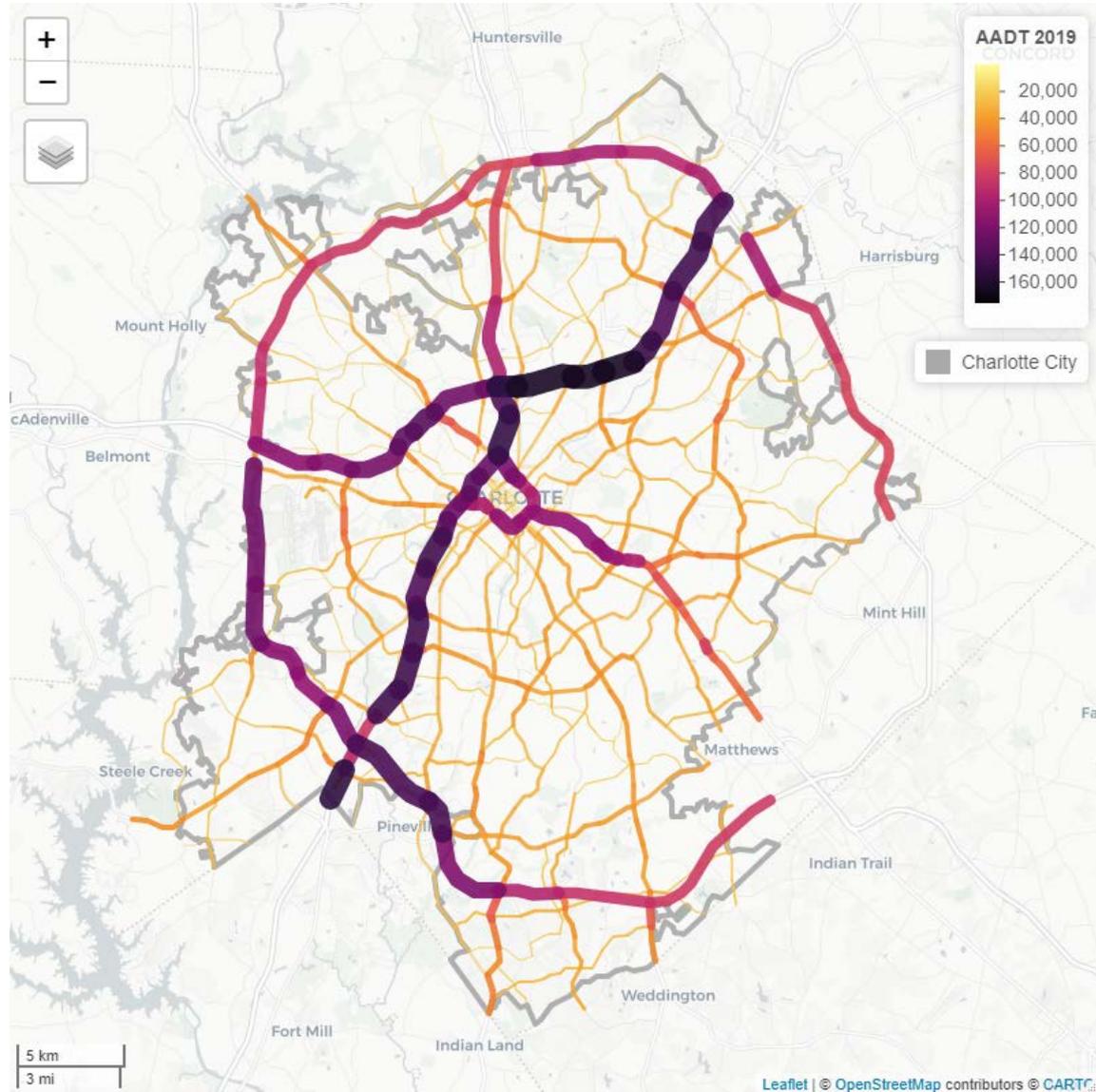
A. Key community engagement takeaways from Charlotte:

- Commercial and delivery vehicles on residential streets might play a role in navigation app challenges.
- New developments should be planned with traffic safety in mind and community input.
- Areas with lack of sidewalks make kids especially vulnerable. Drivers who not used to driving in the area, and are using navigation apps, might not be looking out for kids playing.

V. Data Analysis

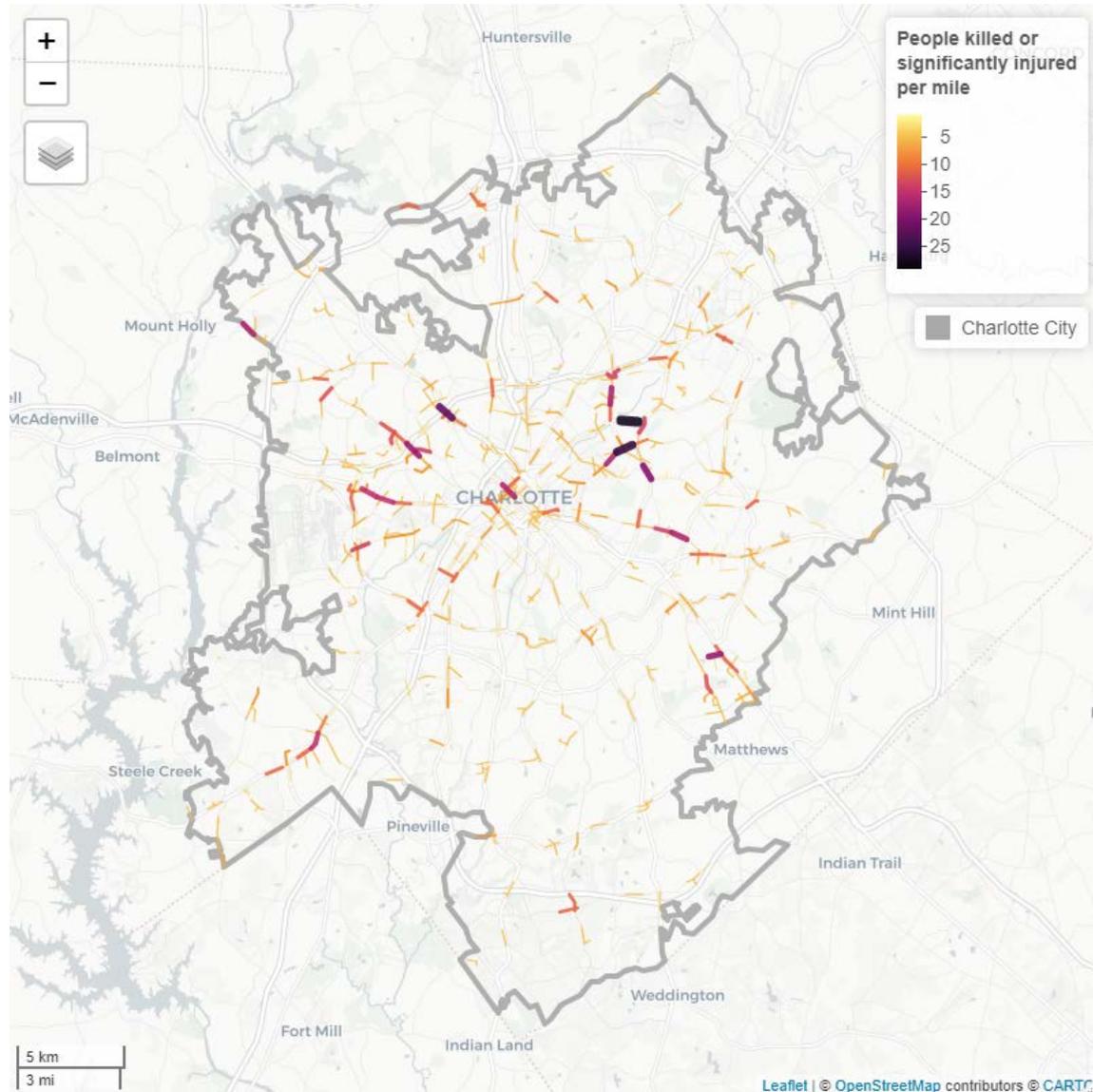
Due to Charlotte's importance as distribution center, two main freeways cross the center of the city: I-77 in the north-southwest direction, and I-85 west to northeast. Additionally, I-485 functions as a beltway allowing through traffic to bypass the city center. Figure 1 shows the annual average daily traffic in Charlotte's primary roads. The busiest sections are on the I-85 east of I-77 and then on I-77 southern section, the average daily vehicle trips on these roads are around 160,000.

Figure 1 – Annual Average Daily Traffic, Charlotte primary roads 2019



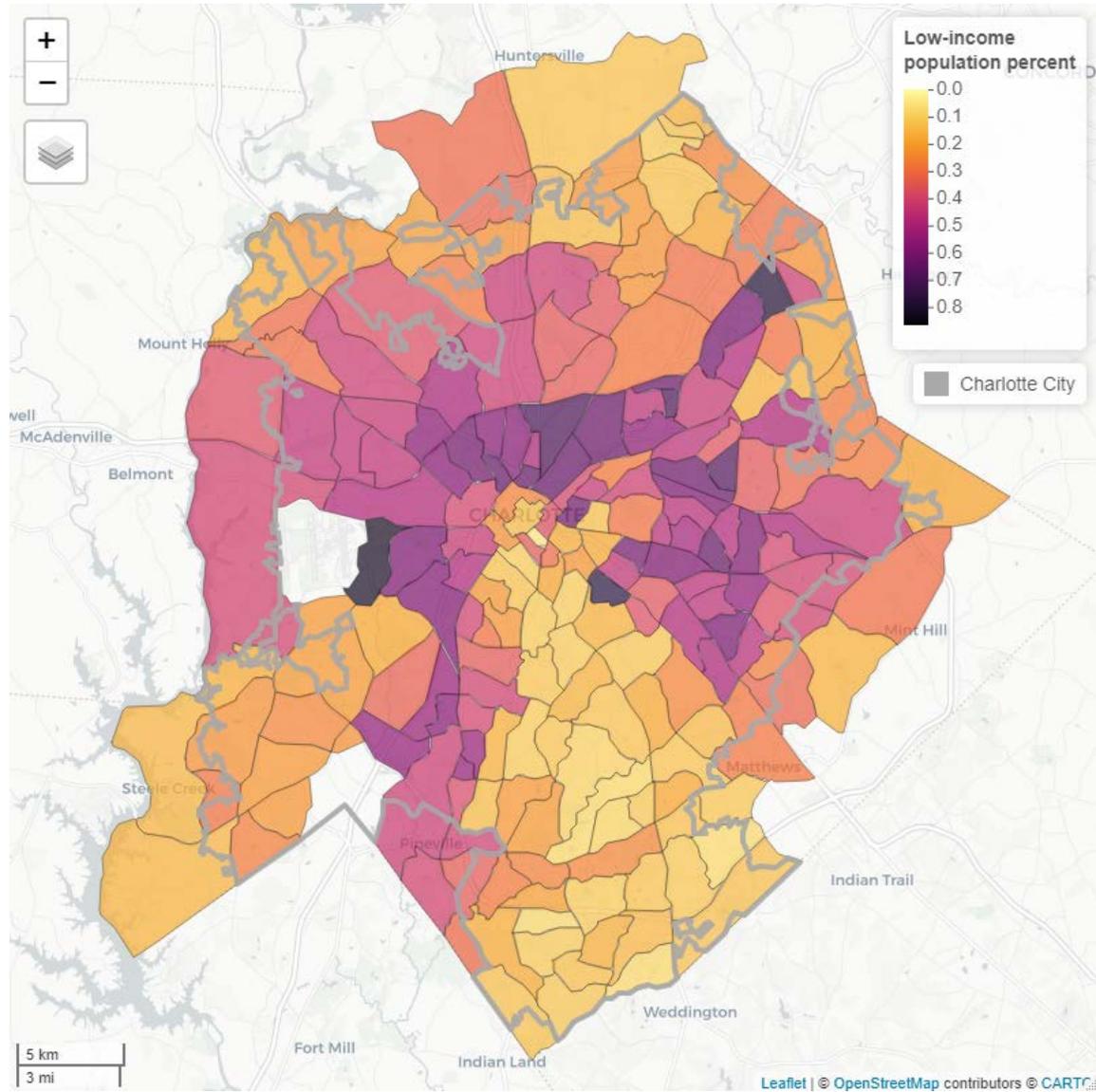
One essential metric for road safety impacts are vehicle crashes with pedestrians and cyclists. Figure 2 shows the city of Charlotte's high injury network, specifically the number of people killed or significantly injured in a crash with a vehicle. Although corridors with a high-crash incidence are dispersed throughout the city, there are some conflicting intersections near I-85, Sugar Creek Road and North Tryon Street. These areas have some correlation with the highest traffic counts and are an element to consider for the selection of the areas of study.

Figure 2 – City of Charlotte High Injury Network



Indicators to measure vulnerable communities, such as low-income residents, have a similar distribution in the city. Commonly referred to as the “wedge” or “arc”, these communities are clearly concentrated east, west, and north of Downtown as shown in Figure 3. These areas forming an arc around the core of the city can be prioritized when evaluating impact of routing apps.

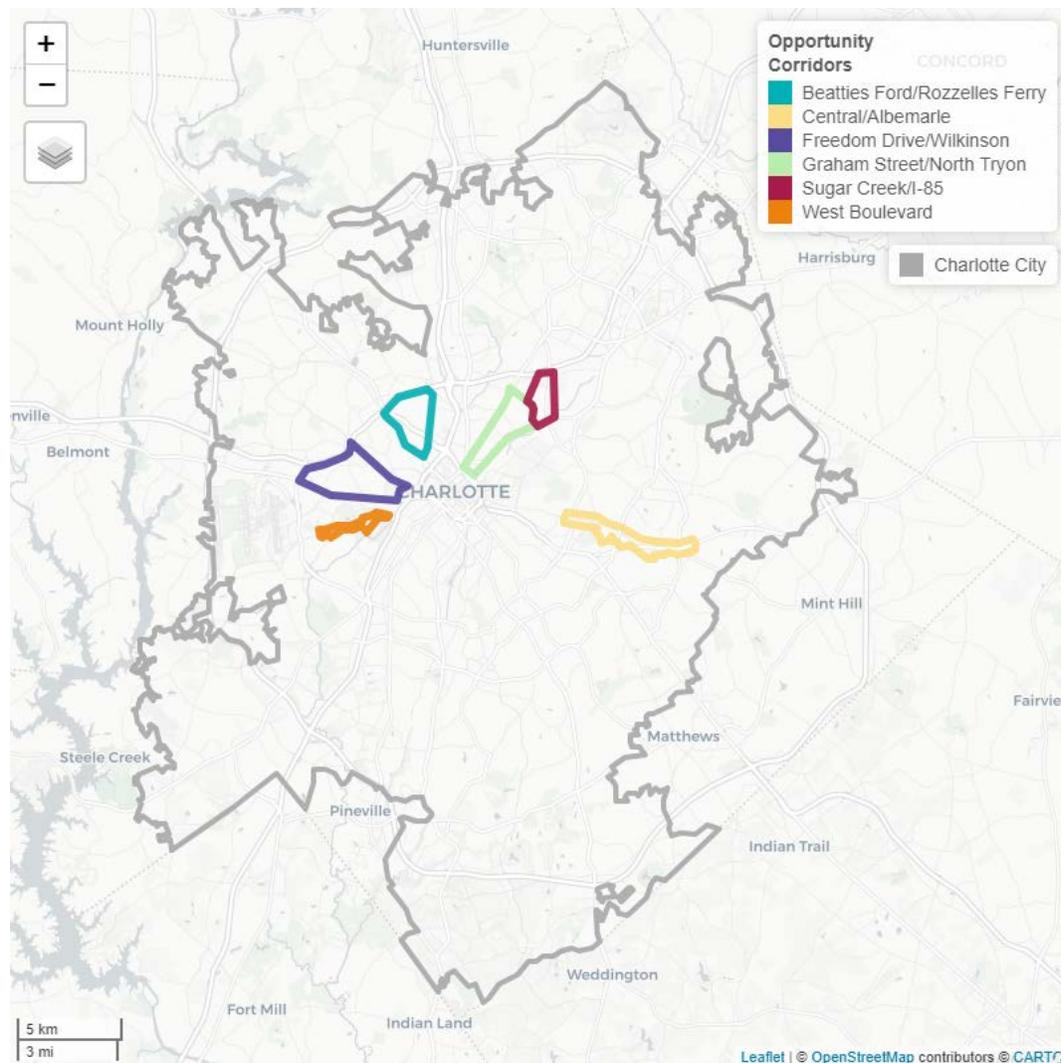
Figure 3 – Low-income residents share of total population by census tract



The city of Charlotte has identified six Corridors of Opportunity to prioritize investment in the upcoming years and further promote the equitable development and economic revitalization of these areas. Figure 4 shows the corridor's areas, three have characteristics in terms of traffic and crash incidence that makes them particularly vulnerable to traffic re-routing.

- Sugar Creek Corridor - It is bounded by major freeways with high traffic counts; I-85 to the north, Sugar Creek Road connecting I-85 and North Tryon Street. It also has a significant number of bike and pedestrian crashes within or near it. The residents in this area are predominantly low income (up to 60% from the total census tract population).
- Freedom Drive/Wilkinson Boulevard - This corridor is between I-85 to the northwest and I-77 to the southeast connecting through the arterials Freedom Drive and Wilkinson Boulevard, making traffic diversion into local roads highly feasible. The share of low-income residents is around 50%.

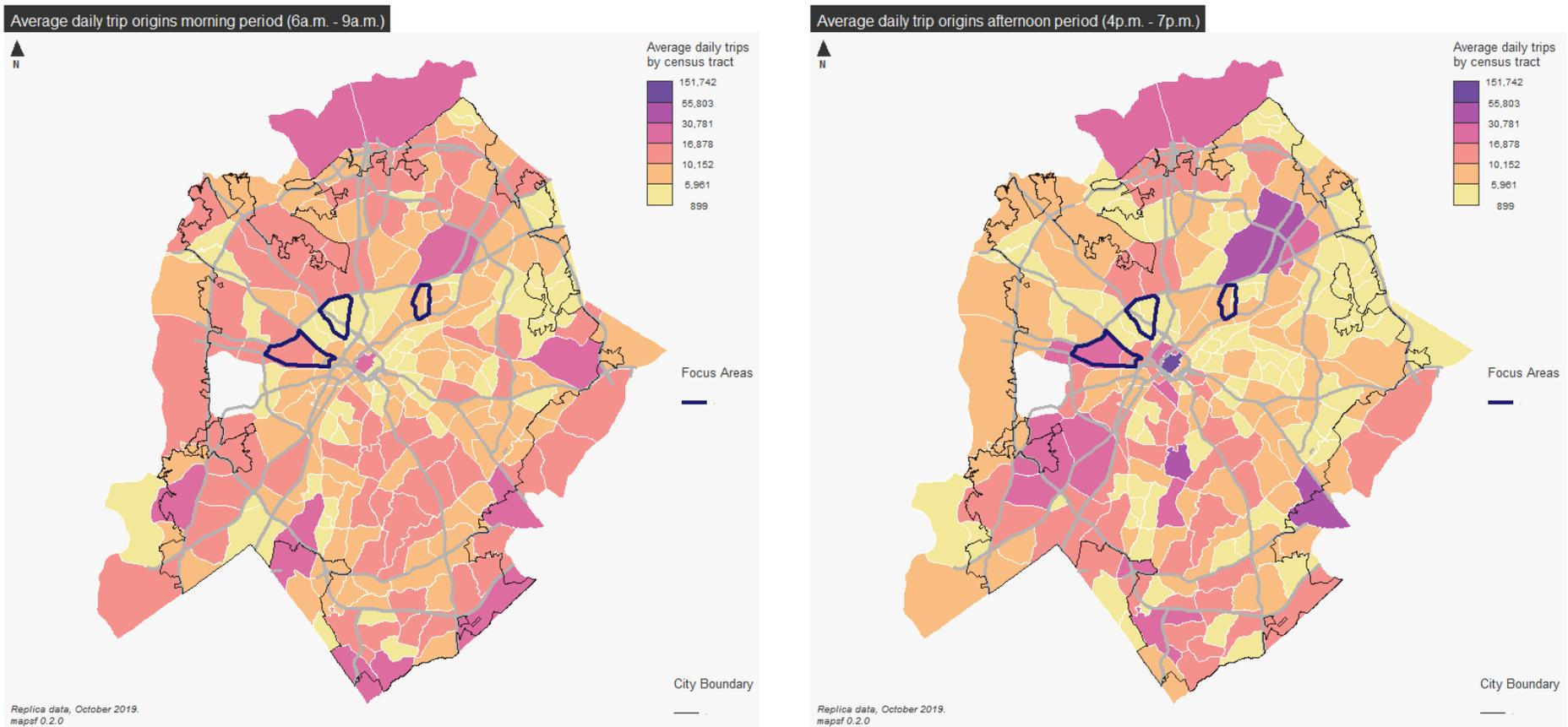
Figure 4 – Corridors of Opportunity, City of Charlotte



Total trip origins by census tract

Maps in Figure 5 show the concentration of trips starting at a given census tract in the three-hour morning and afternoon peak period. During the morning there are several zones dispersed throughout the city with trip origins in the medium ranges (10,000-30,000), with many of them located in the suburbs. This might reflect a traditional commuting pattern with residents commuting to work or school from different areas of the city in the morning. The afternoon period shows more concentration, with areas such as Downtown, University Park, Crown Point, Barclay Downs, and Eagle Lake (south of the airport) in the highest range of trip starts (30,000-150,000). These are major business, industrial, commercial, and shopping areas where concentration of jobs can explain the commuting patterns in the afternoon.

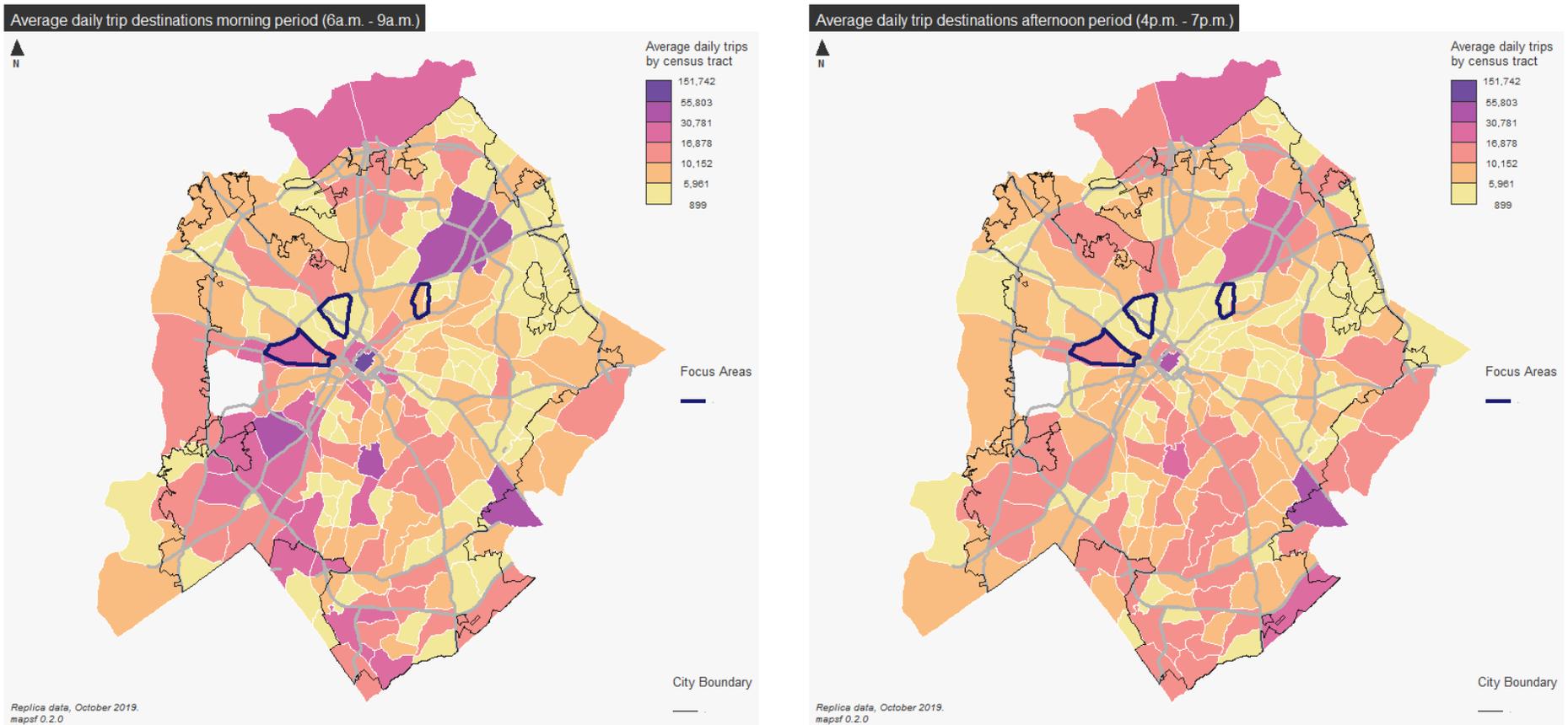
Figure 5 - Total trip origins by census tract, morning and afternoon peak periods



Total trips destinations by census tract

Maps in Figure 6 show the concentration of trips with destination at a given census tract in the three-hour morning and afternoon peak period. The destinations in the morning are highly symmetrical to the origination zones in the afternoon: Downtown, University Park, Crown Point, Barclay Downs are top destinations. Eagle Lake and Ballantyne in the far south of the city with even higher trip destinations in the morning than trip originations in the afternoon (as showed in Figure 6). The destinations in the afternoon are more dispersed and in the medium trip range, except for Crown Point and Downton that has shopping and retail activities.

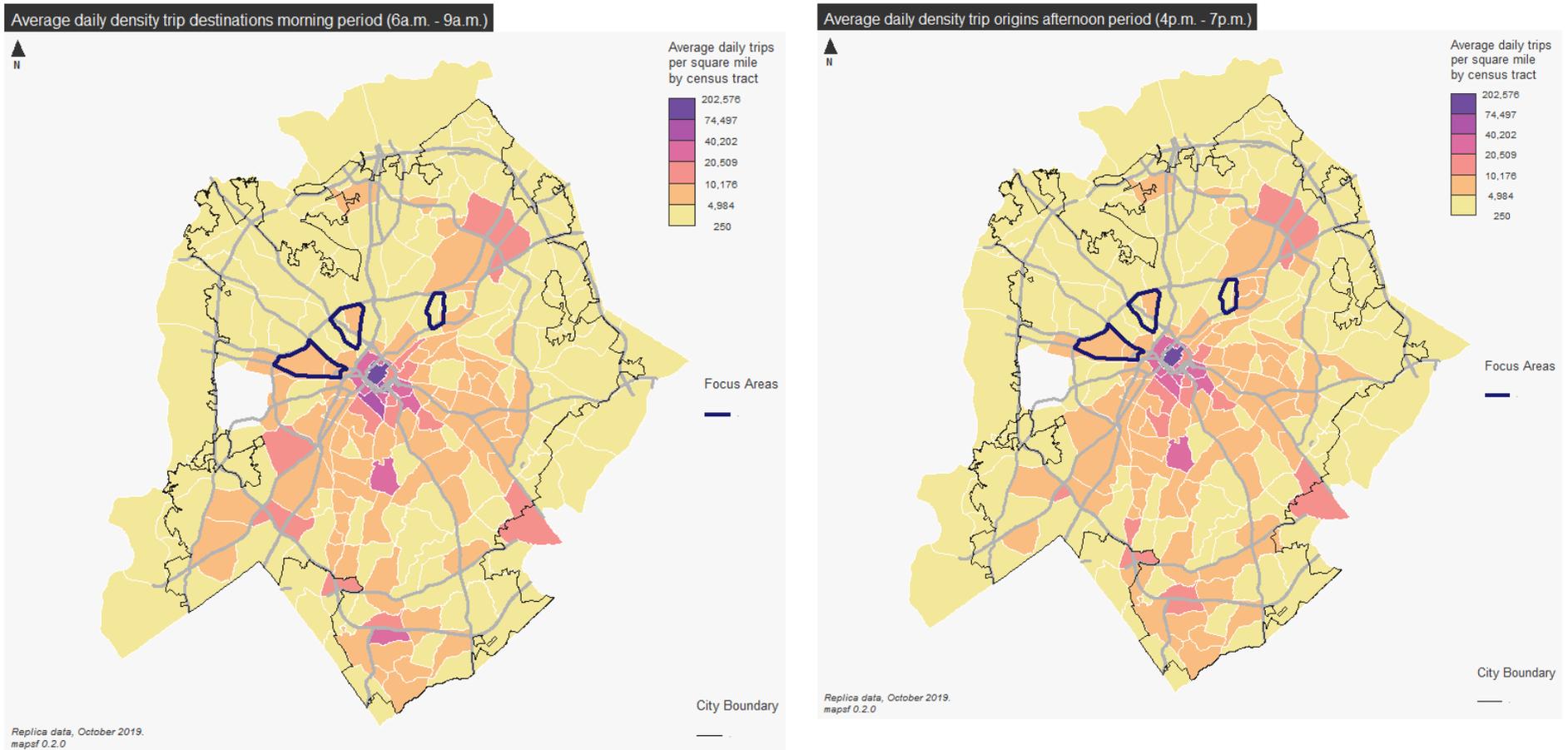
Figure 6 - Total trip destinations by census tract, morning and afternoon peak periods



Density trips by census tract

For purposes of traffic congestion and potential flow diversion, total trips are a good measure of total magnitude. A complementary metric is trip intensity which can be measured as trips per resident or trips per square mile. Figure 7 shows the trips per square mile destinations in the morning and the trips per square mile origins in the afternoon period. The analysis focuses on surface area, rather on population, because congestion (especially vehicle congestion) is affected more by space than by people density. Both maps show that trips intensity is concentrated in the city's core area and around some commercial corridors.

Figure 7 – Trip origins and destinations per square mile in the morning and afternoon period

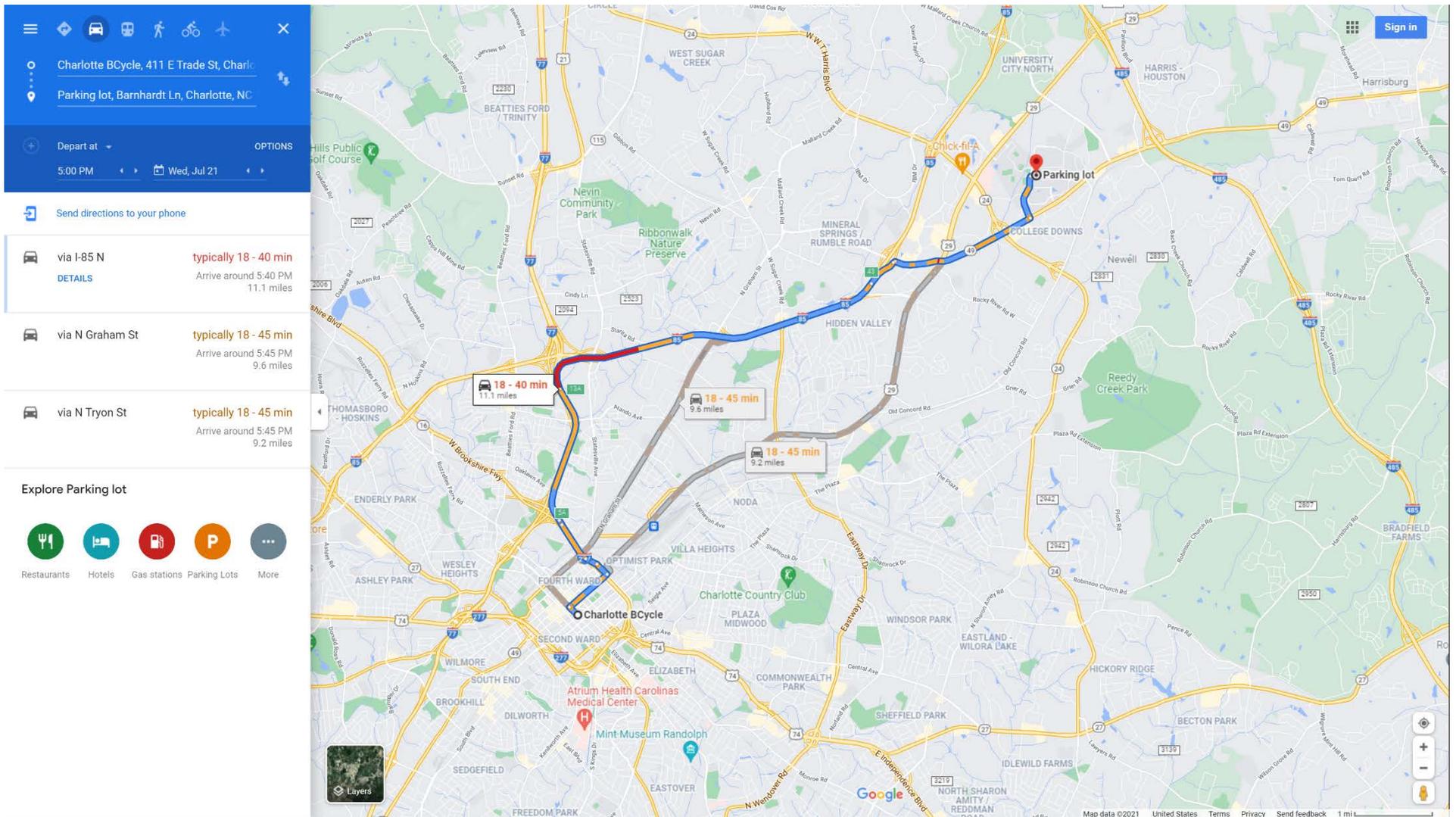


Charlottes's app routing example

Charlotte's trip origin and destination analysis provides guidance on potential traffic flows that might impact the areas of analysis. This example uses the Sugar Creek/I-85 Corridor of Opportunity as a focus area. For this corridor, trip concentration in Downtown and the large census tracts northeast of Hidden Valley (Mineral Springs, University City and UNC) are among the highest, hence trips between those areas traveling on I-85 and N Tryon Street might be potentially diverted. Figure 8 shows the suggested driving alternatives for a 5 p.m. weekday trip from Charlotte Downtown to University City South area in the northeast part of the city. The suggested route is the I-277 northbound, US 21 northbound, I-85 eastbound and then University City Boulevard on the eastbound direction. However, depending on traffic, a diversion through N Graham Street instead of I-277 and US 21, or N Tryon Street and then University City Boulevard eastbound can be also alternatives.

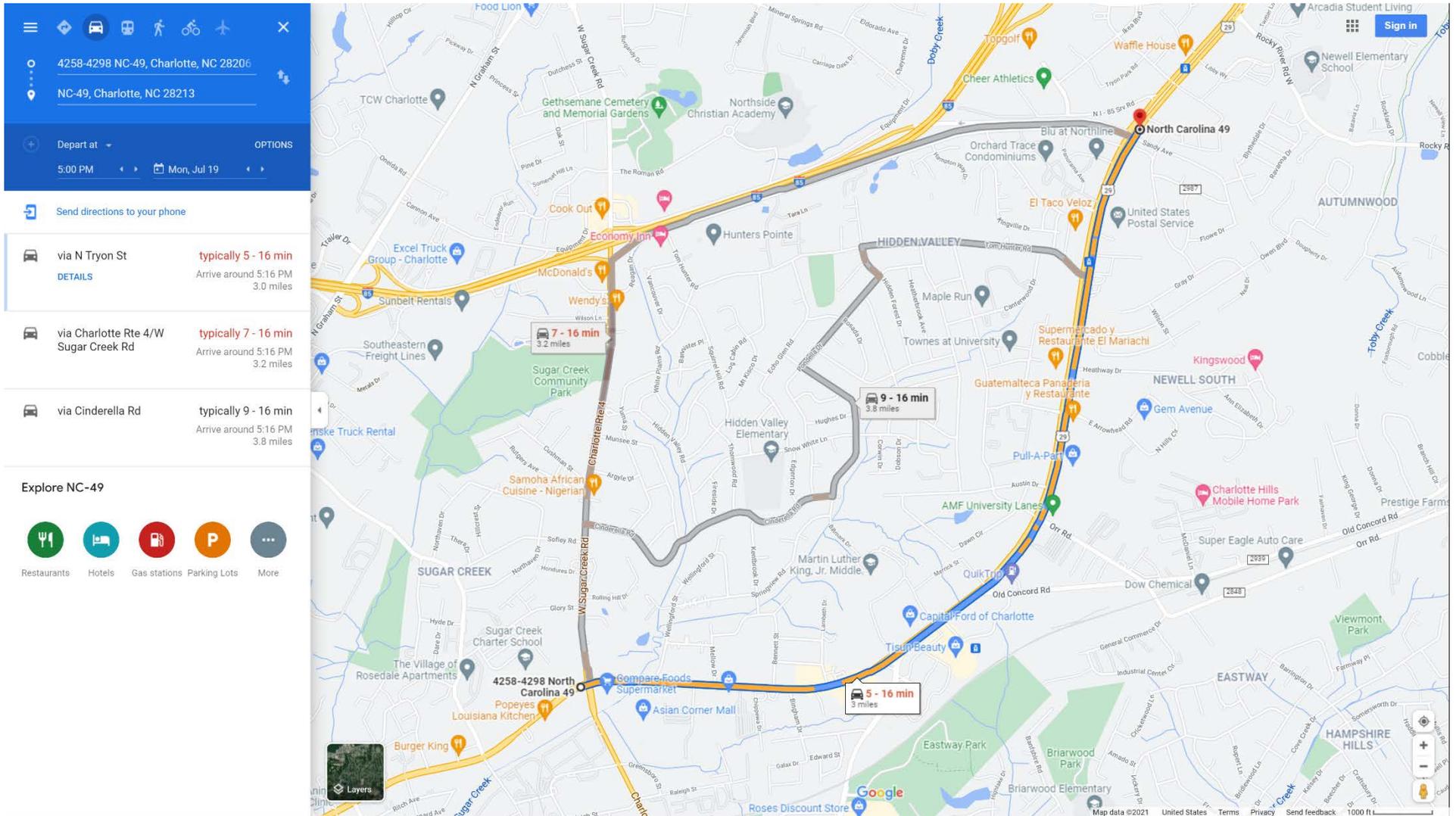
Because of the static nature of this query, it is not possible to simulate real time changes that the app can suggest based on actual traffic conditions. However, the recommended route and deviations will depend on the actual congestion when driving. It is interesting to note that the three alternatives in Figure 8 have a minimum estimated travel time of 18 minutes. If there is enough traffic on the I-85 (near I-277) the shorter route via N Tryon Street might be faster. But what could potentially happen if once in N Tryon Street congestion after Sugar Creek Road increases on N Tryon and eases in the I-85. Figure 9 shows that under those conditions the app could potentially reroute the trip through the Sugar Creek neighborhood back to the I-85. If congestion on Sugar Creek Rd is also high, the app can even reroute the trip through some minor roads in Hidden Valley to bypass the traffic on N Tryon Street.

Figure 8 – Afternoon weekday trip from Charlotte Downtown to University City South



Source: Google. (n.d.). [Google Maps directions]. Retrieved July 21, 2021.

Figure 9 – Potential afternoon re-route trip from Charlotte Downtown to University City South (via N Tryon St)



Source: Google. (n.d.). [[Google Maps directions](#)]. Retrieved July 19, 2021.