Dorothea Dix Park Access Study

A Master's Project | April 2021

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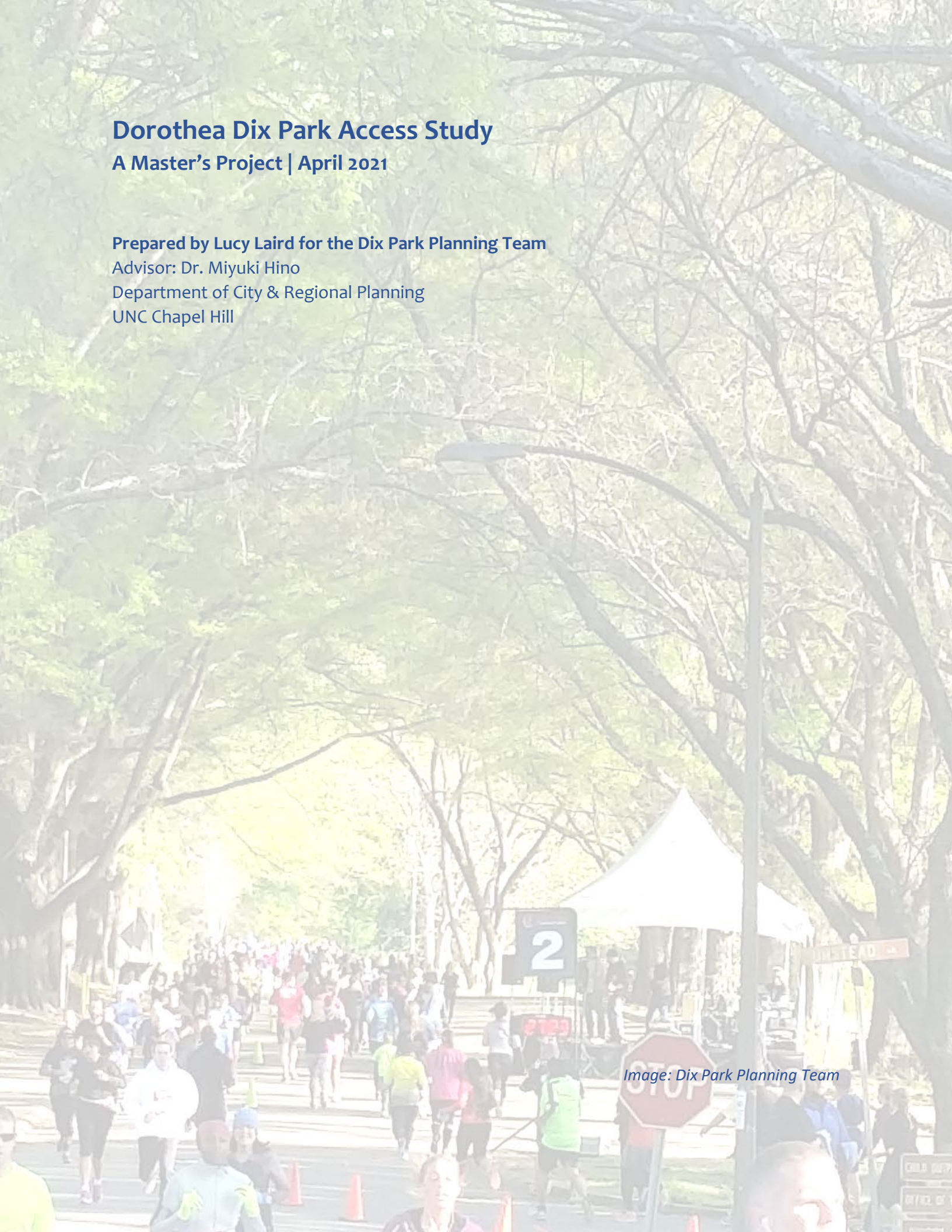


Image: Dix Park Planning Team

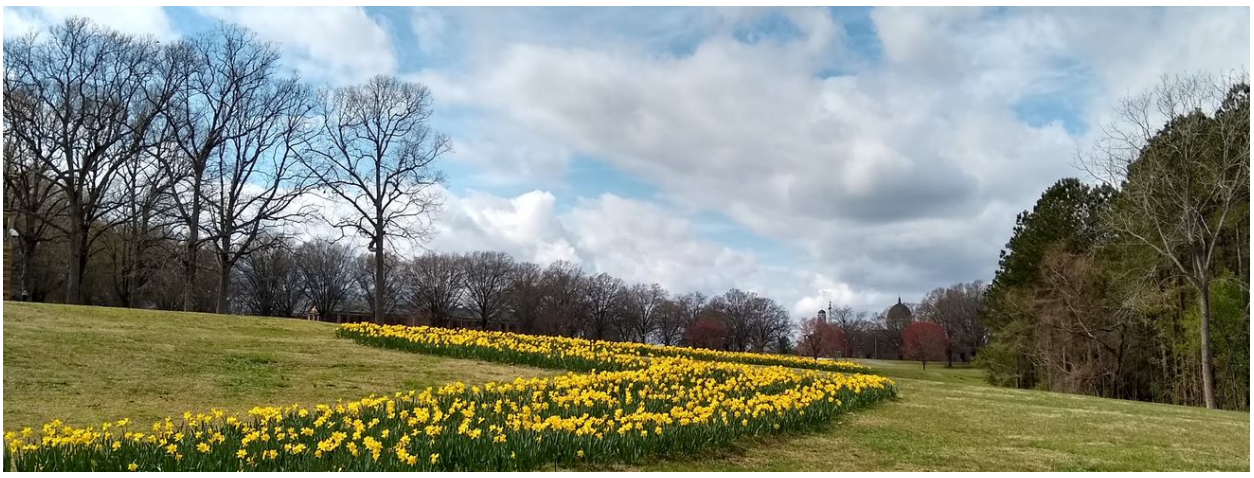


Image: Dix Park Planning Staff

My sincere thanks to Nick Smith at Dix Park and Dr. Miyuki Hino at UNC for their advice, patience, and feedback throughout this process. I could not have done it without you!

Executive Summary

This report considers the most effective and feasible means of increasing community accessibility to Dorothea Dix Park, as a crucial part of the park planning team's core mission of creating a regional destination park **"for everybody."**

The concept of **environmental justice** is central to this analysis. To this end, a Community Vulnerability Index, based on Wake County's index but with the addition of race as a factor, is used to understand the current disparities in park access, as well as the potential impacts of suggested improvements.

Dividing Wake County block groups into communities that are "proximate", i.e. within a mile of the park, with or without park access, and those where inhabitants can currently only access the park via automobile, shows us that communities within a mile of the park but without easy walking and biking access tend to have **higher poverty rates, higher populations of children and elderly people, more inhabitants of color, and be more car-reliant**.

Improving **transit service** is the best way to connect these populations to Dix Park's amenities, while also providing more **travel choices** for those communities beyond the 1-mile proximity threshold. Considering environmental justice impacts and prioritizing transit connections for communities with high community vulnerability, poverty rates, and percentages of non-white residents would point to the addition of Dix Park stops on the lines serving the **Apollo Heights, Chavis Heights, and State Street** neighborhoods to the southeast of downtown. However, the most effective intervention for the bus network as a whole will be strengthening Park connections to the downtown transit hub via a multimodal corridor and wayfinding assistance.

For neighborhoods that are close to the park, where people are within a half-mile bike or walk from Park destinations, the most effective improvements in the near term involve making Dix's entry points more easily navigable and **safer for pedestrians and cyclists**. Proximate access recommendations highlight short-term solutions such as gravel **walkways and bike lanes** demarcated by paint, cones, or bollards. Next steps should incorporate community conversations and be closely aligned with articulated neighborhood priorities.

Introduction

Who has access to parks and green space in American cities? How can park access, as a public good, be more equitably distributed? Who should benefit first when accessibility to parks is improved? Park access is a useful lens through which to view the larger conversation occurring both within and beyond the planning profession regarding the deep inequities in our cities, products of deliberate choices by planners and policymakers alike. While this project only considers a single park in Raleigh, North Carolina, my hope is that it will be valuable in showing how planners can make accessibility choices that consider environmental justice and are steps toward ameliorating the effects of prior exclusionary policymaking.

Background

Environmental Justice

Environmental justice was first conceptualized as the idea that all people should be afforded equal protection from environmental hazards, such as toxic waste sites. In the decades since consideration of environmental justice was mandated for federally-funded projects, the term has come to be used in a positive sense as well, such that all people should be able to enjoy equitable access to environmental benefits such as parks and other urban green space amenities. Dix Park's location within Raleigh, a city in the Southeastern U.S. with a legacy of segregation and redlining, necessitates consideration of populations that have been historically neglected and de-prioritized in the planning process.

Parks are urban amenities with clear, documented health benefits, as people who live near them are "three times as likely to get the recommended amount of daily exercise when compared to those who live beyond walking distance" (Cutts et. al. 2009). Boone et. al. (2009) and Hay (1995) make the argument that because many, if not the majority, of urban parks are public property that provide these significant health benefits, they are a public good which should be *justly* distributed; they define equitable distribution as incorporating "needs, choices, and merits." Acknowledging the ways in which some populations may need better park access than others, and prioritizing improvements such that these populations benefit, should then be a crucial part of any study focusing on improving *equitable* access.

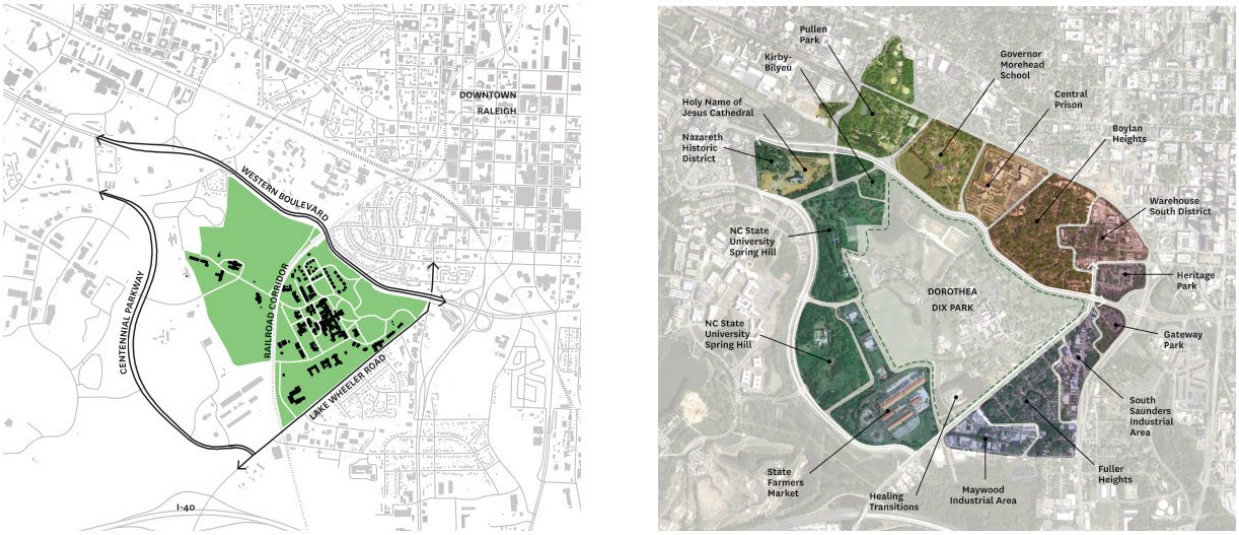
The literature distinguishes a few key populations who should be considered in an equitable distribution of urban green space. Walkable park access is highly important for groups who usually do not have access to automobiles. One such group is children under 18, especially children of color, who in studies of walkable park access and park quality in Phoenix, Arizona and Denver, Colorado were found to be "significantly underrepresented in regions deemed highly walkable and those with access to parks," (Cutts et.al 2009; Rigolon 2017). A second such group is the elderly. Additionally, consideration should be given to the location of minority populations in relation to parks, as neighborhoods with significant non-white populations are less likely to contain walkable streets or bicycle infrastructure (Boone et.al. 2009). Various

demographic indicators, including minority population density, poverty, unemployment rate, renter rate, and yard size have been used to assess disparities in park distribution and greater need for accessibility improvements (Chen et.al 2019; Sister et.al 2010; Rigolon 2017). As discussed further below, similar variables are used in this study to assess current and potential environmental justice impacts of various park connectivity proposals.

Context: Dorothea Dix Park

Dorothea Dix Park comprises a little more than 300 acres adjacent to the southeast corner of downtown Raleigh, North Carolina (Figure 1). The land was purchased by the City of Raleigh in 2015 with the goal of creating a regional destination park attractive to visitors from the Triangle and beyond. With the Triangle region, and Raleigh in particular, experiencing tremendous growth, it is imperative to consider how such an important public asset can be made accessible to all for decades to come.

Figure 1: Dix Park and Surrounding Institutions (From Dix Park Master Plan)



The Dix Park site's existence as a plantation, as the state mental hospital, and most recently as the state Department of Health and Human Services headquarters has shaped its current relationships and connectivity to the surrounding institutions and land uses. Surrounding neighborhoods and the downtown Raleigh area are cut off from the park by high-speed, multi-lane roadways without adequate pedestrian or bicycle infrastructure. North Carolina State University and the State Farmer's Market both abut the park, but flow between each is constrained: in the case of the Farmer's Market by fencing, and in NC State's case by Centennial Campus' sprawl and inhospitality to foot traffic. The positioning of the Central Prison between

Dix and the Hillsborough and Cameron Park areas further limits easy access from neighborhoods in the heart of Raleigh and reinforces the site's imposing, institutional character.

Project Purpose

The Dix Park Master Plan reinforces some of the difficulties surrounding park accessibility at Dix:

> *" …. after over 150 years of growth and change, the site is split in two by a railroad corridor; its edges are difficult to perceive and cross; and many of its features, such as the Rocky Branch and the historically significant design by Davis, have been compromised by modification or neglect. The site is not easy for pedestrians to enter or traverse. It is disconnected from city systems, such as transit…" (Dix Park Master Plan 2018).*

This project's main purpose is to assess potential accessibility improvements for Dorothea Dix Park with an eye toward the disparities between the current accessibility situation and park planners' vision for the future. Suggested improvements are informed by the ways in which access varies both among the neighborhoods proximate to the park, and between these neighborhoods and the rest of the city and county. This analysis also considers the environmental justice implications of suggested improvements through a geospatial analysis of various demographic variables, both disaggregated and as part of an index of community vulnerability.

City of Raleigh Planning Documents

Planning documents from the City of Raleigh and the Dix Park Conservancy were key to the creation of an accurate inventory of current and potential accessibility options for Dix Park, as well as for ensuring that recommendations made as a result of this study align with both the Dorothea Dix Park Master Plan and the current planning priorities, design standards, and values of the city of Raleigh.

Documents consulted include Raleigh's 2030 Comprehensive Plan; GoTriangle's Short-Term Transit Plan and GoRaleigh's Downtown Transportation Plan; the Raleigh Parks, Recreation, and Cultural Resources Department's system plan, greenway planning guidance, and Neighborhood and Community Connection policy documents; and the streetscape, bicycle, and pedestrian plans from the city's Transportation Planning division. Key takeaways include prioritization of complete streets infrastructure in future planning (as opposed to improvements purely focused on greater mobility for automobile users) and the facilitation of multimodal travel choices, particularly within the downtown area, as well as system-wide improvements which will allow for the safe and use of the transportation system by all individuals, regardless of identity or ability.

Specific goals expressed in the Master Plan are described in more detail below.

Dix Park Connectivity Goals

Broadly, the Master Plan expresses the goal that "Dix Park should reach out and connect to as much of Raleigh as possible," with particular importance placed on a direct connection between the Fayetteville Street area of downtown (Dix Park Master Plan 2018). Enhanced connections with downtown, as well as Raleigh more broadly, are to be achieved through improved integration into existing regional networks. Future plans include the Bus Rapid Transit corridor to the north of the park along Western Boulevard and the placement of new transit stops inside the park, as well as connections with existing greenways and bikeways

Surrounding the park, "complete streets" infrastructure such as sidewalks, pedestrian- and bike-friendly intersections, benches, bike lanes, and street trees are proposed in order to strengthen links to nearby neighborhoods and to downtown Raleigh, especially along Lake Wheeler Road, which is currently inhospitable to non-vehicular travel (Master Plan 2018). The overall goal is a well-connected park that allows for easy access for all, especially those travelers such as the elderly and children who are most likely to benefit from improvements prioritizing the safety of those who are not in vehicles.

Methodology

Defining Park Access: Modified Experience-Based Model

The basis for the proximate analysis (the distinction between the external and proximate analyses is explained further below) is a Raleigh Parks, Recreation, and Cultural Resources policy document proposing an experience-based park access model, using a 0.5-mile (equivalent to a 10-minute walk) acceptable threshold for park access in Raleigh (PCRC 2014). In the literature, Cutts et. al. (2009) and Maantay (2018) use a quarter mile as an acceptable distance for people to have to walk to get to a park, while Rigolon et. al. (2018) also use a 10-minute walk as a park access proxy. Harnik (2004) cites the National Recreation and Parks Association, the Trust for Public Land, and the Congress for the New Urbanism in arguing that people become much more likely to drive rather than walk if the distance to a park is greater than a half-mile, and that parks that are farther away become more of "a formal destination, not a place to drop in." Boone et. al. (2009) similarly argue that as the distance to the closest park increases, so reduces the "[chance] that unplanned exercise can occur" as it does in nearby neighborhood parks.

Due to Raleigh's relative sprawl and auto-dependence, as well as the standards used in Parks Department's preceding park access analyses, the 0.5-mile accessibility threshold is used here. Additionally, much of the literature uses census block groups as the geographic unit of interest in assessing equitable park access, so as to best approximate the neighborhood unit. I use block

groups for this same reason, as well as for the reason that Wake County's existing Community Vulnerability Index also uses block groups.

As explored in the literature review, similar studies typically highlight a few key variables that are most relevant for assessing park accessibility. For my purposes, several of these variables of interest are aggregated into a community vulnerability index (discussed further below), while a few are considered separately: these are the poverty rate, the percentage of non-white people, and the percentage of dependent persons among the population, as well as the percentage of people who do not use a car to commute to work ("carlessness"), which was pulled separately from 2019 ACS data and was not indexed into the CVI.

Each of these four variables were compared for block groups which have access, block groups that are proximate to the park but do not have access, and those from which the park can only be accessed by car. Using the Community Vulnerability Index and each of these four variables as layers in the GIS analysis explained below allowed for a visually straightforward method of determining what kinds of communities would benefit from the various accessibility improvements proposed in this study.

Creating the Community Vulnerability Index

In order to geospatially assess environmental justice impacts, I use a Community Vulnerability Index (CVI) that aggregates several demographic variables at the block group level. Wake County's Community Vulnerability Index, which is the basis for my index, uses similar variables as several studies referenced above. The five variables indexed in the original Wake County CVI (from 2019 American Community Survey 5-year data) are:

- the percentage of households below the federal poverty line (poverty rate),
- the unemployment rate,
- the percentage of adults without at least a high school diploma or GED,
- the percent of the population that is classified "dependent" based on age (i.e. 65+ or under 18), and
- the vacancy rate.

Image: Dix Park Planning Staff

At the encouragement of Raleigh Parks staff, I included the percentage of the population within each block group that identified as “non-white” as an additional factor in my project CVI. Another reason for this addition is that race was a common variable used in the park access studies reviewed during the preliminary research stage of this project.

I used the same methodology as Wake County in tabulating the block group ranking (although I added race as an additional factor). After the value of each variable was calculated for each census block group, the block groups were ranked 1-455, with 1 being the lowest occurrence of each variable and 455 being the highest. The sum of each variable’s rankings was calculated, and then this sum was then ranked 1-455, such that the block groups with the lowest sums are the “least vulnerable,” while those with higher sums are more vulnerable. Figures 2 and 3 below show the resulting maps comparing Wake County’s original CVI and the new CVI which includes race, with Dorothea Dix Park in green in the center of the map.

Figure 2. Mapping Wake County's original Community Vulnerability Index: darker block groups indicate higher vulnerability rankings.

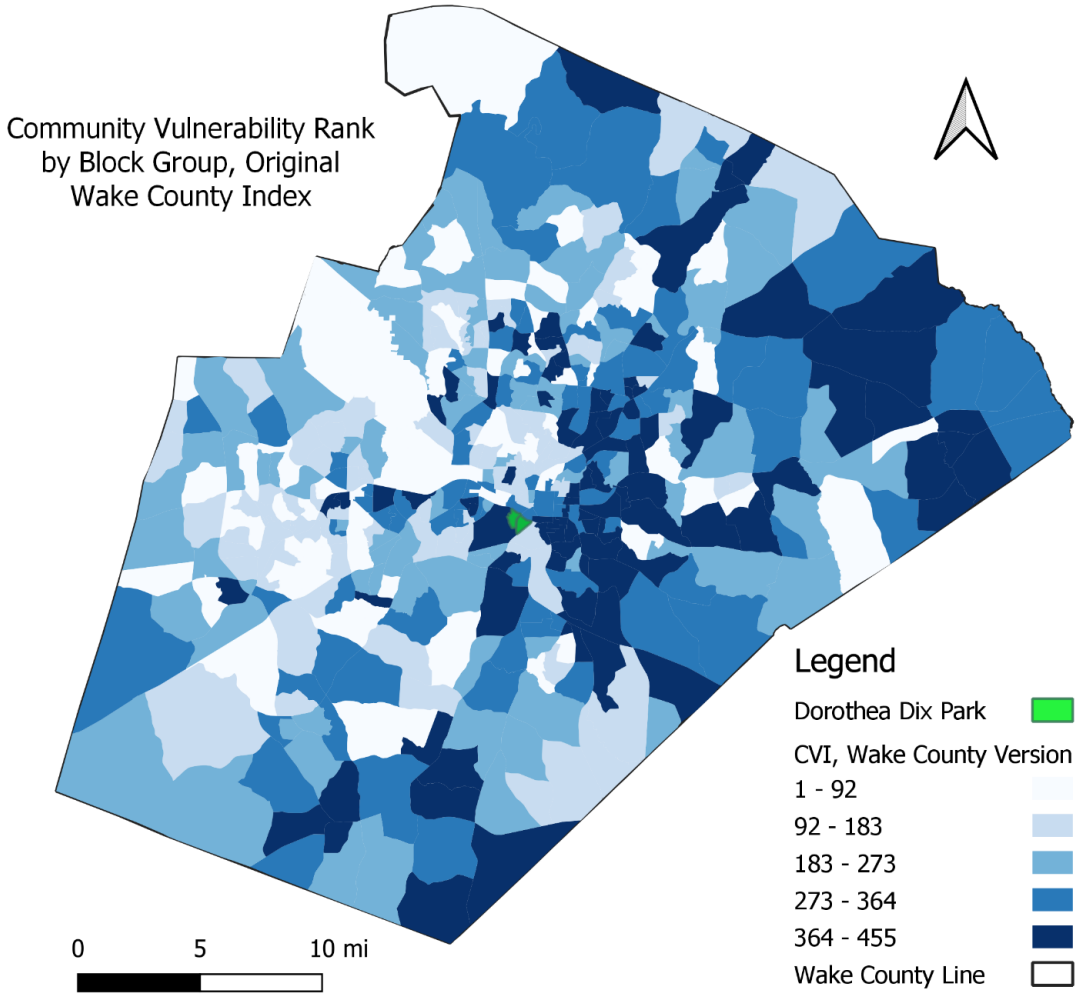
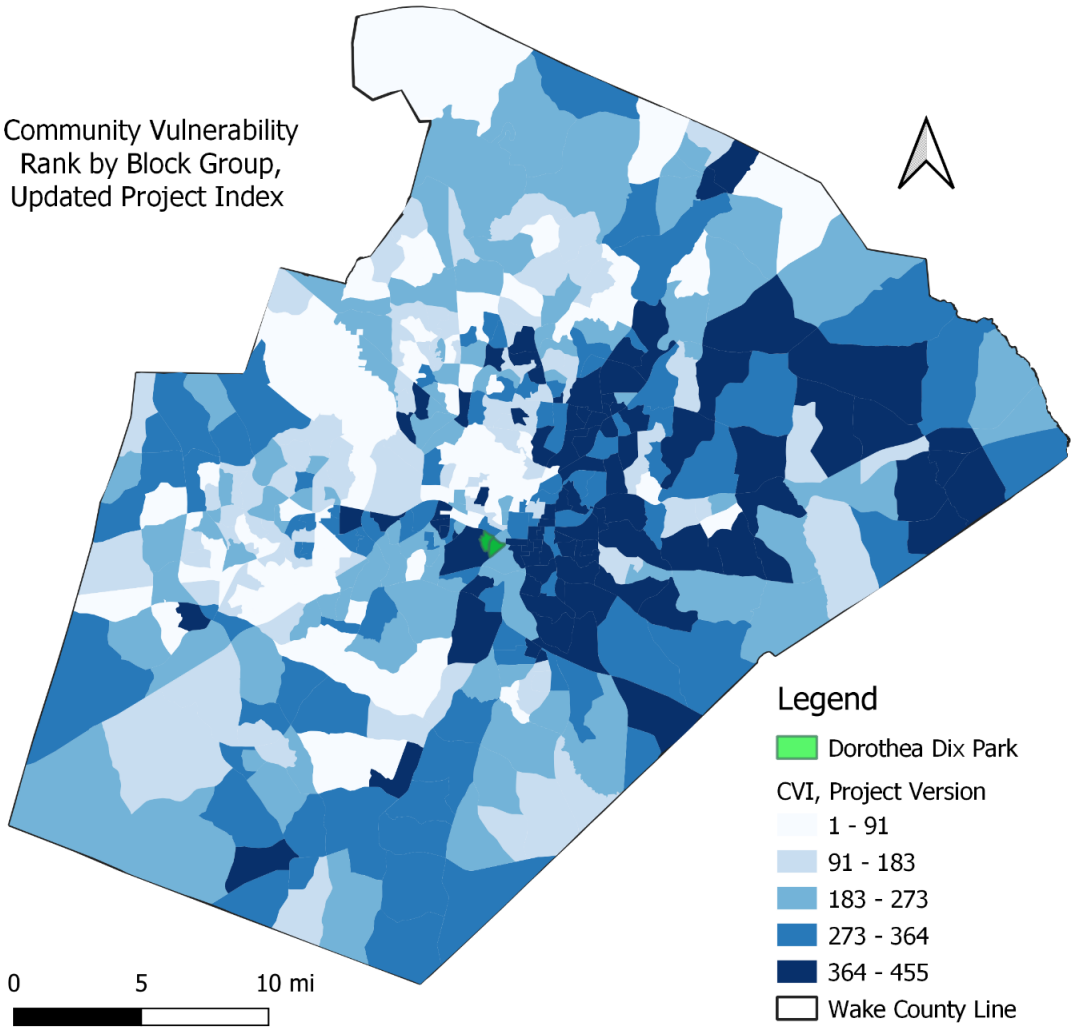


Figure 3. Mapping the updated CVI, which includes the percentage of the population of each block group identifying as non-white as a variable. The geospatial distribution of vulnerability changes slightly as a result.



Performing the GIS Analysis

GIS analysis was performed using ArcGIS online and QGIS. The Wake County census block groups were joined to the Community Vulnerability Index and the other demographic variables, and data on transit, street, and pedestrian and bicycle networks from Wake County Open Data were added to the model. Sets of Dix park entry and destination points were created in QGIS using Google Maps, park visitor information, and the Master Plan. Using the "Create Drive-Time Areas" function in ArcGIS online, I assessed the following travel distances and times from the set of park entry points:

- 5- and 20-minute drive-time areas
- 0.25- and 0.5-mile bike and walk-sheds

- 1-mile bikeshed
- 0.25-mile walkshed to Citrix Cycle bikeshare facilities and 0.25-mile buffer around other existing bike facilities
- 0.25-mile buffers around stops on R11 and R21, the two transit lines that currently link to Dix

These various analyses allowed me to narrow down my two main areas of interest: for the proximate study, the 0.5-mile bike and walk-shed, which was re-created using a park visitor's map for the park destination points, and for the external study, the transit lines which could potentially link to Dix.

Proximate vs. External Accessibility

In order to clearly delineate between the types of recommendations proposed here, I distinguish the "proximate" (in relation to the park) from the "external" study. External accessibility considers how best to connect the wider Raleigh and Wake county regions to the park, and this aspect of the study focuses on proposed transit improvements. I explore potential improvements to transit accessibility by choosing a few GoRaleigh transit lines that could connect to the park with the addition of one (or a few) stops, and comparing the demographics of the newly-accessible block groups to those that currently have transit access via the R11 and R21 lines. I illustrate the geospatial impacts of prioritizing certain factors, such as total population reached, or CVI, through comparative maps.

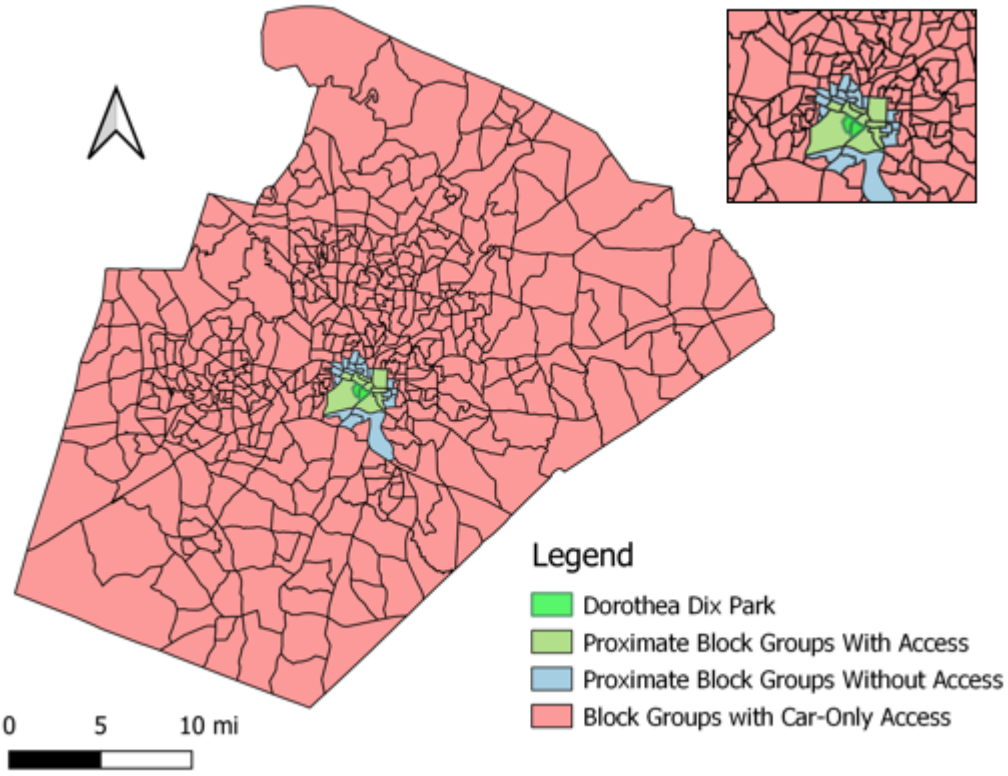
Proximate accessibility focuses on improving connections from nearby neighborhoods to various destinations within the park, and the main recommendations are geared toward improving pedestrians' and cyclists' travel experiences. I used the 0.5-mile travel-sheds from both the Dix internal destinations data set and the Dix entry points data set to see which proximate block groups (neighborhoods) intersected with each, and compiled data on the variables of interest for each of these block groups. The table of variables can be found in the Appendix—for the proximate analysis, I ended up focusing on how best to make the existing and planned park entry points safer and easier to use for people who wish to walk or bike over from nearby neighborhoods.

Analysis

Comparison of Variable Distributions

Nine block groups have access, as determined by their intersection with the half-mile travel-shed (from either the Dix entry points or the Dix destination points). Eighteen block groups are proximate to the park, intersecting with a mile buffer around the park's borders, but do not have easy access. The rest of the block groups within the county, 428 in total, can currently only access the park via automobile.

Figure 4. Visualization of 3 Park Accessibility Tiers, by Block Group

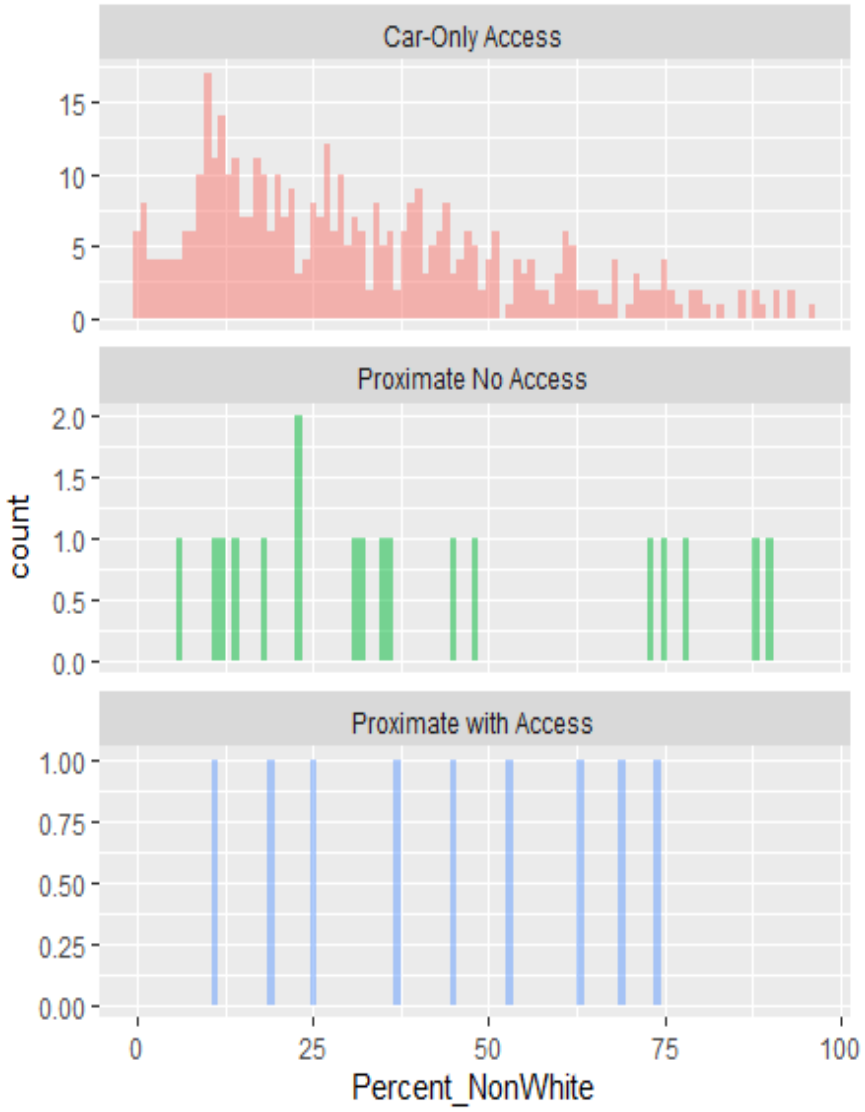


The variables, as discussed above, are the percentage of the population in the block group that is non-white, the poverty rate, the percentage of the population that is dependent, i.e. children under 18 or people over 65, and the percentage of commutes taken not in automobiles. The distributions of each of these variables appear in Figures 5-8 below, and are also summarized in Table 1.

Table 1. Summary of variables across the three accessibility categories.

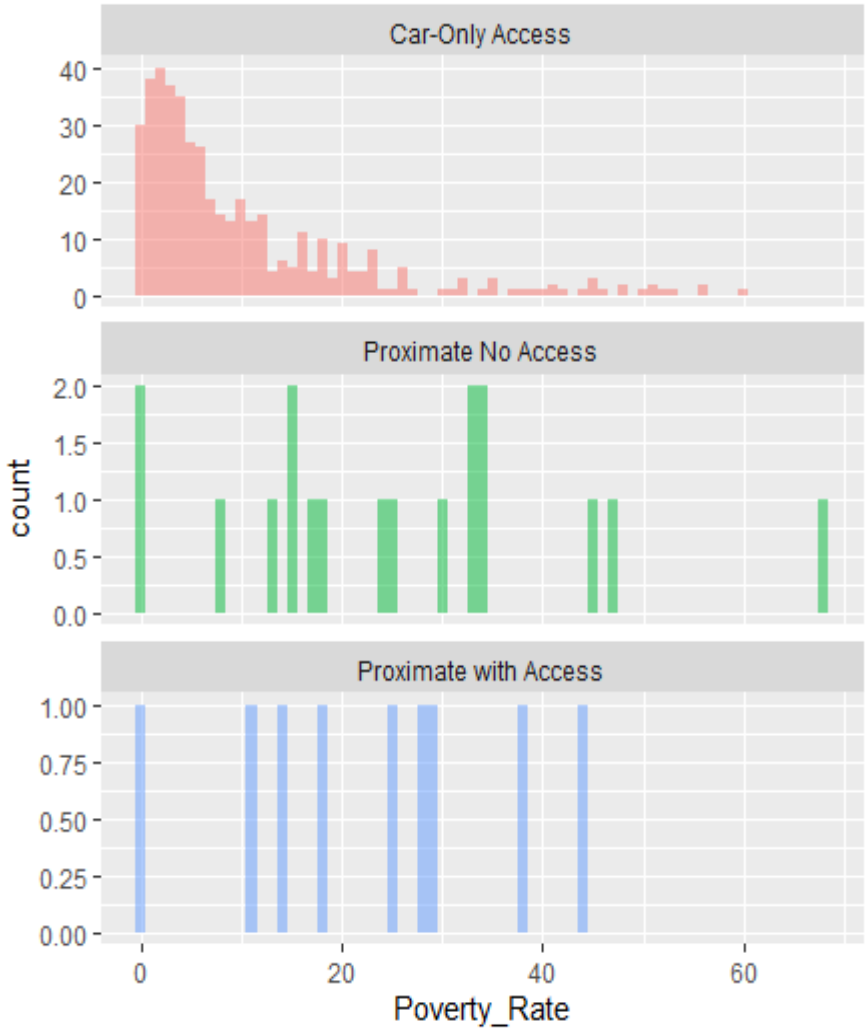
	Count	Poverty Rate	Non-White Population	Dependent Population	Percent of Non-Car Commutes
Proximate with Access	9	22.95	43.99	15.69	30.74
Proximate without Access	18	25.49	40.94	22.05	25.95
Car-Only Access	428	9.92	31.44	35.86	13.03

Figure 5. Non-White Population Distribution Across Accessibility Categories.



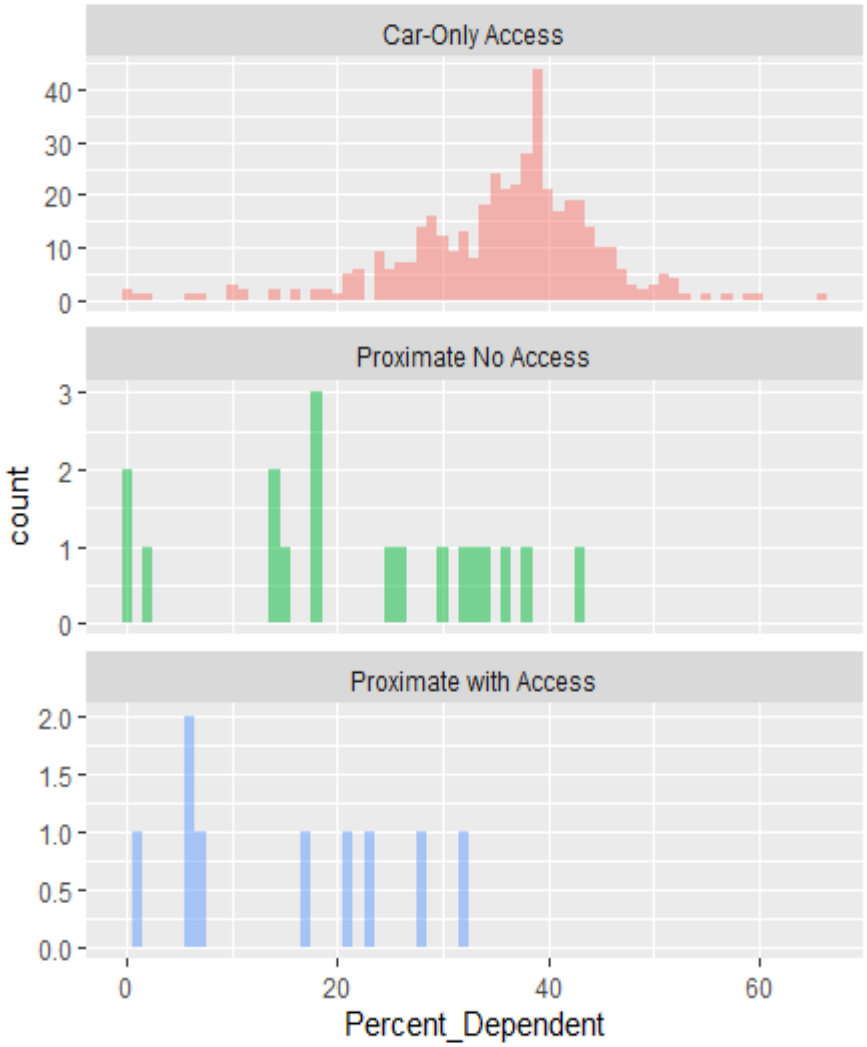
Block groups within a mile (proximate, but without easy access) of the park have some of the highest proportions of non-white people living in them. There is a high concentration of these block groups situated to the southeast, which is currently cut off from the park by high-speed roadways. Safety improvements to the Rocky Branch greenway and improved transit connections would greatly benefit these specific populations.

Figure 6. Distribution of Poverty Rates Across Accessibility Categories.



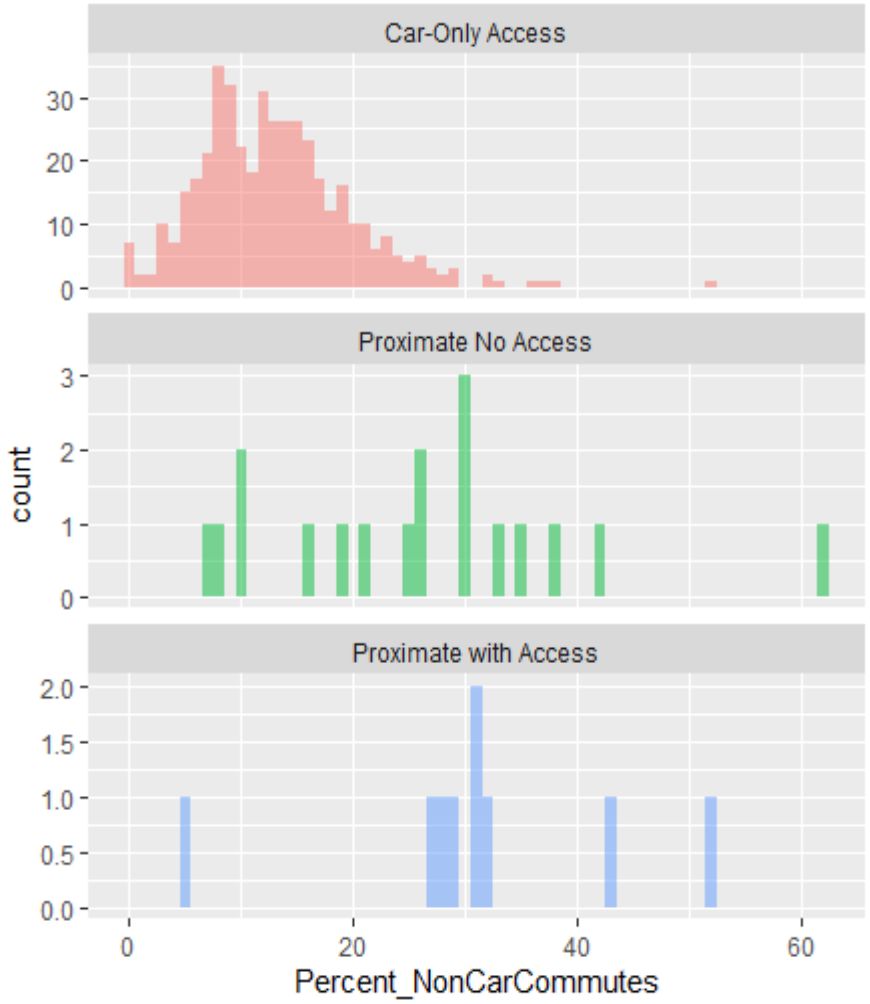
Block groups that are proximate with access or proximate without access have higher average poverty rates. This likely represents the NC State campus population as well as lower-income areas to the southeast of Downtown Raleigh that are within the mile buffer. As with the non-white populations above, improved transit connections would be a highly effective means of more easily connecting these populations to the park.

Figure 7. Distribution of Dependent Populations Across Accessibility Categories.



Block groups with greater populations of children and the elderly are much more likely to need a car to access the park under current conditions. This is another area where external accessibility improvements to the transit system (as youth and elderly passengers can already ride GoRaleigh buses without cost) could have an outsized impact.

Figure 8. Distribution of Non-Car Commutes Across Accessibility Categories.



Block groups where non-car commutes are common are generally closer to the park, though many are within the mile radius rather than the half-mile. The fact that NC State's campus is so close to the park is probably the reason for this. The Triangle is a very auto-centric region, with the exception of places like college campuses. Still, with a reduction in parking facilities a key part of the park's connectivity plan, allowing areas with significant amounts of people who regularly commute by car the ability to access the park without driving will be extremely important.

Takeaways

Overall, block groups that are within a mile of the park but do not currently meet the standard for "accessible" tend to have higher poverty rates, higher percentages of non-white populations, higher dependent populations, and higher rates of non-car commuting. The best solution for connecting these populations to the park, I argue, is expanding transit service.

External Accessibility: Improving Transit Connections

Currently, two GoRaleigh bus lines have stops on streets adjacent to the park: the Avent Ferry line (R11), which stops on Western Boulevard near the Hunt Drive park entrance, and the Caraleigh line (R21), which stops on Lake Wheeler Road at Goode Street. As discussed in the prior section, the park is currently only accessible to most of Wake County's population via automobile. Improving transit connections from across the region, particularly for neighborhoods that are relatively close to the park but do not have easy pedestrian and bicycle access, is the best way to come closer to equitable park accessibility.

Potential Transit Connections

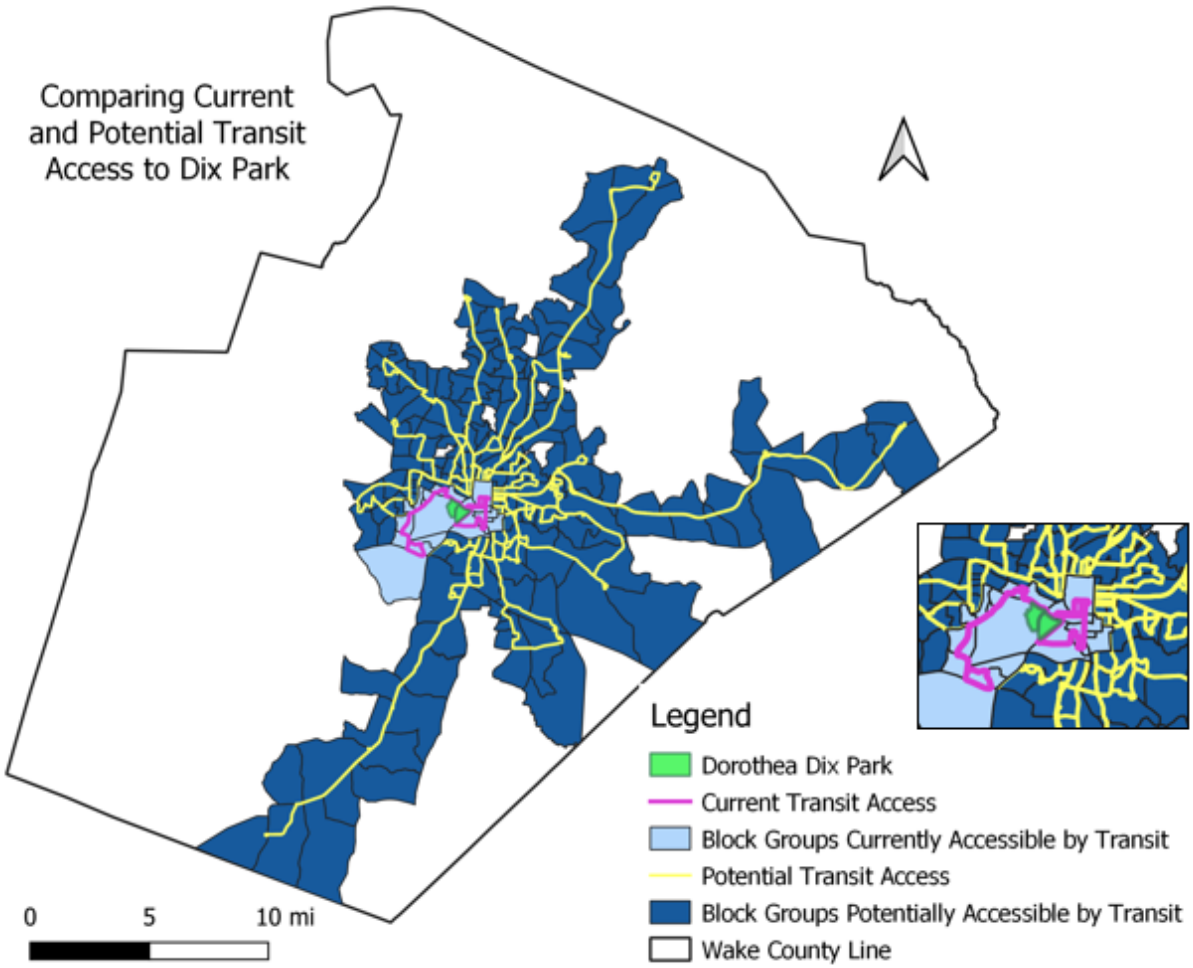
There are 29 bus lines (including R11 and R21 discussed above) which currently have stops within a mile of Dix Park and could be targets for potential service expansion to the park. Figure 9 below shows the locations of these lines in yellow, as well as the block groups that are intersected by or touch them (in dark blue). Contrast this large potential service area with the current extent of park-serving transit service: the light blue block groups and fuchsia transit lines representing the Avent Ferry and Caraleigh routes.

In order to explore which populations could benefit from any number of hypothetical transit connections to the park, the block groups surrounding each of the 29 bus lines were analyzed to understand the occurrence of six demographic factors related to environmental justice that should impact transit improvement decisions.

These are:

- the total population of the block groups,
- the median Community Vulnerability ranking,
- the average (across all surrounding block groups) poverty rate,
- the average percentage of the population classified as dependent,
- the average percentage of the population identifying as non-white,
- and the average proportion of commutes that are not taken in automobiles.

Figure 9.



Tables 2-7 below show the transit lines with the three highest values for each variable. The complete table can be found online here, as well as in the Appendix.

Table 2. Lines with Highest Population Totals

Line	Route Name	Total Population
WRX	Wake Forest-Raleigh Express	62684
FRX	Fuquay-Varina Express	51531
ZWX	Zebulon-Wendell-Raleigh Express A/B	44710

Table 3. Lines with Highest Median CVI Rankings

Line	Route Name	Median CVI
19	Apollo Heights	436
22	State St	430.5
13	Chavis Heights	427

Table 4. Lines with Highest Avg. Poverty Rates

Line	Route Name	Average Poverty Rate
22	State St	37.25
19	Apollo Heights	33.24
55X	Poole Rd Express	33.10

Table 5. Lines with Highest Avg. Dependent Populations

Line	Route Name	Average % Dependent Population
18	Poole/Barwell	39.22
18S	Poole	39.19
ZWX	Zebulon-Wendell-Raleigh Express A/B	36.44

Table 6. Lines with Highest Proportions of Non-White Populations

Line	Route Name	Average % Non-White
5	Biltmore Hills	75.33
17	Rock Quarry	75.09
22	State St	74.45

Table 7. Lines with Most Non-Car Commutes

Line	Route Name	Average % Non-Car Commutes
13	Chavis Heights	28.47
12	Method	27.40
11	Avent Ferry	27.11

Recommendations

The choice of which bus line or lines to connect to the park will depend on city priorities. If planners hope to simply connect the most people possible to the park through transit, the **Express** lines to Wake Forest, Zebulon/Wendell, and Fuquay-Varina should be among the first choices. It makes sense that these three lines have the surrounding block groups with the highest total populations, since they extend far out from Raleigh's downtown core, into three of Wake County's fastest-growing suburban centers (see Figure 10 below).

Using the Community Vulnerability Index as a prioritization mechanism, the **Apollo Heights, State Street, and Chavis Heights** lines, with Chavis Heights also having the highest rate of non-car commutes, are all surrounded by block groups that would greatly benefit from more equitable access to Dix Park (Figure 11).

Figure 10.

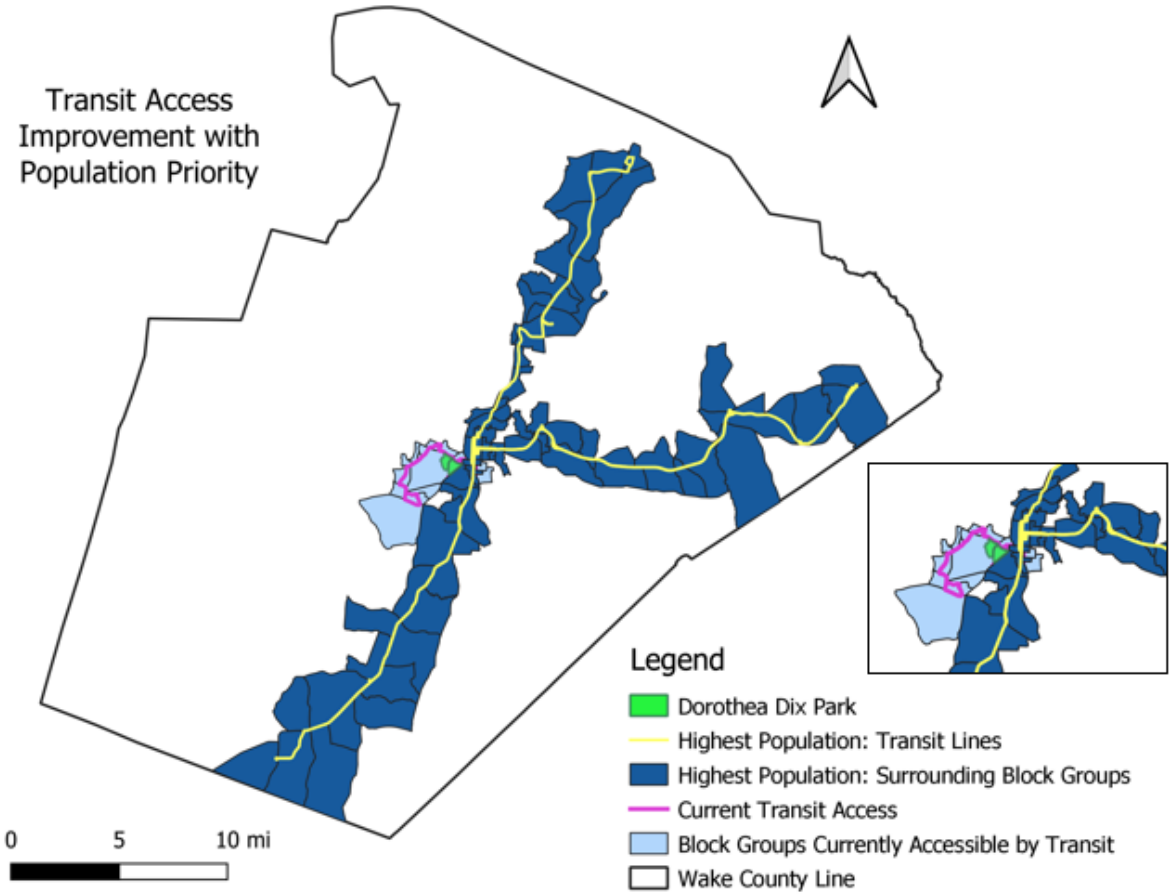

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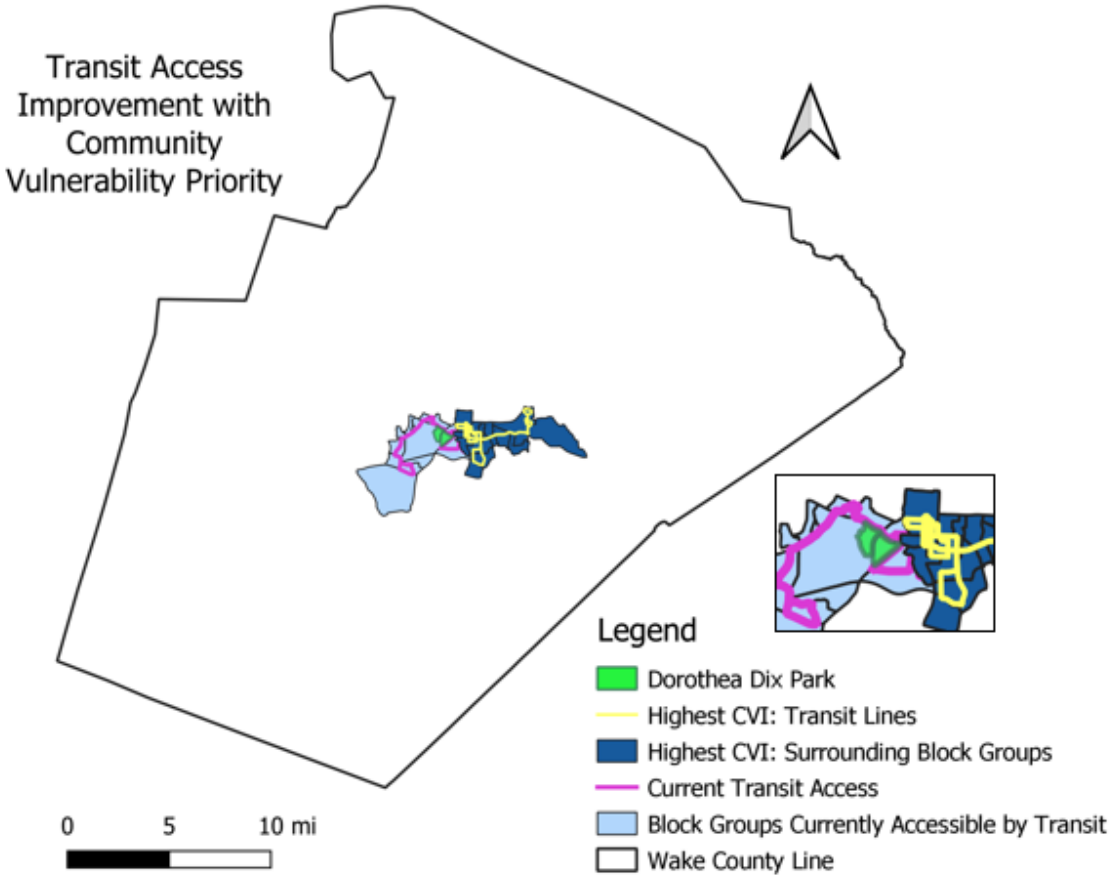
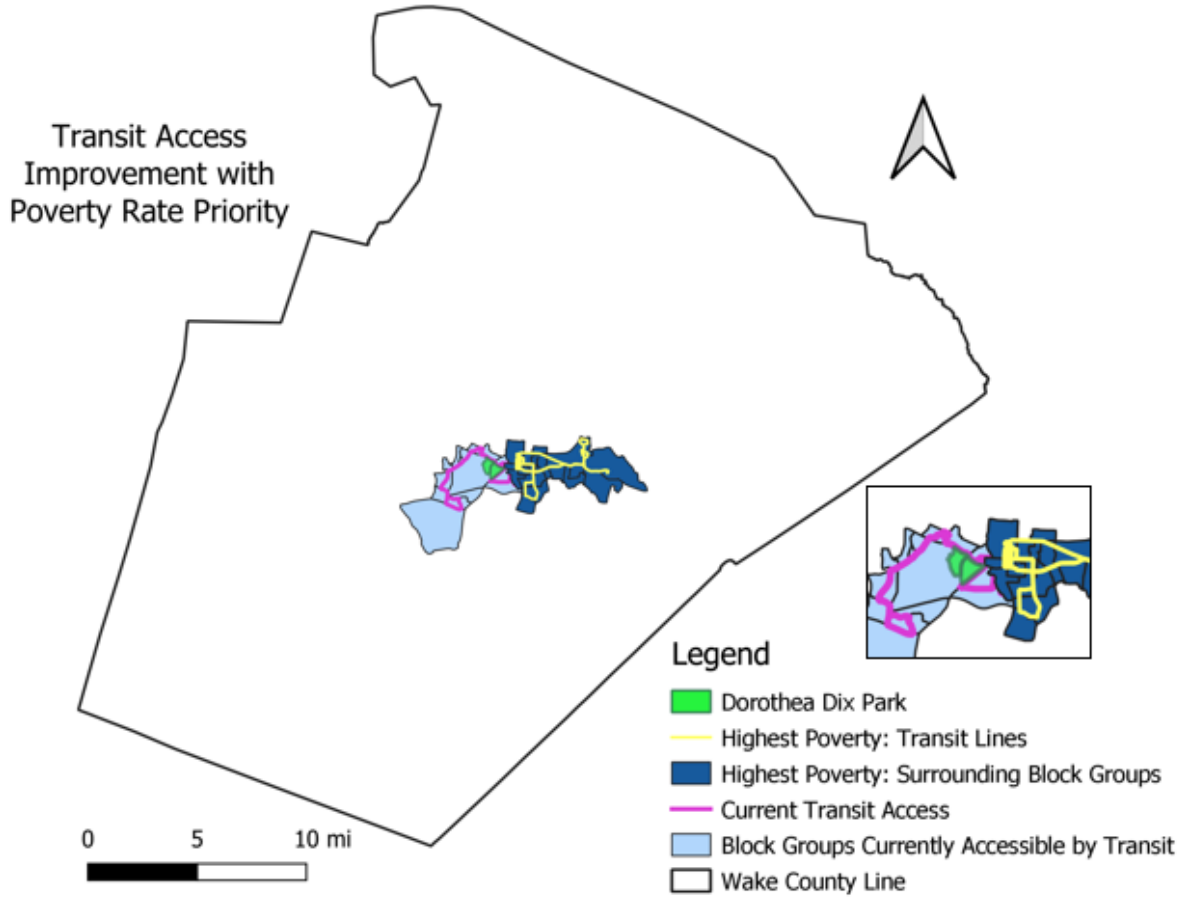
Figure 11.



As can be seen in Figures 12 and 13 below, prioritizing lines with the highest surrounding poverty rates and the highest percentages of non-white populations would result in similar geographic coverage to prioritizing Community Vulnerability Index rankings. The block groups surrounding the State Street line, R22, have one of the highest median community vulnerability rankings, one of the highest percentages of non-white residents, and the highest average poverty rate, making this particular line perhaps the best candidate for prioritized park connection.

Figure 12.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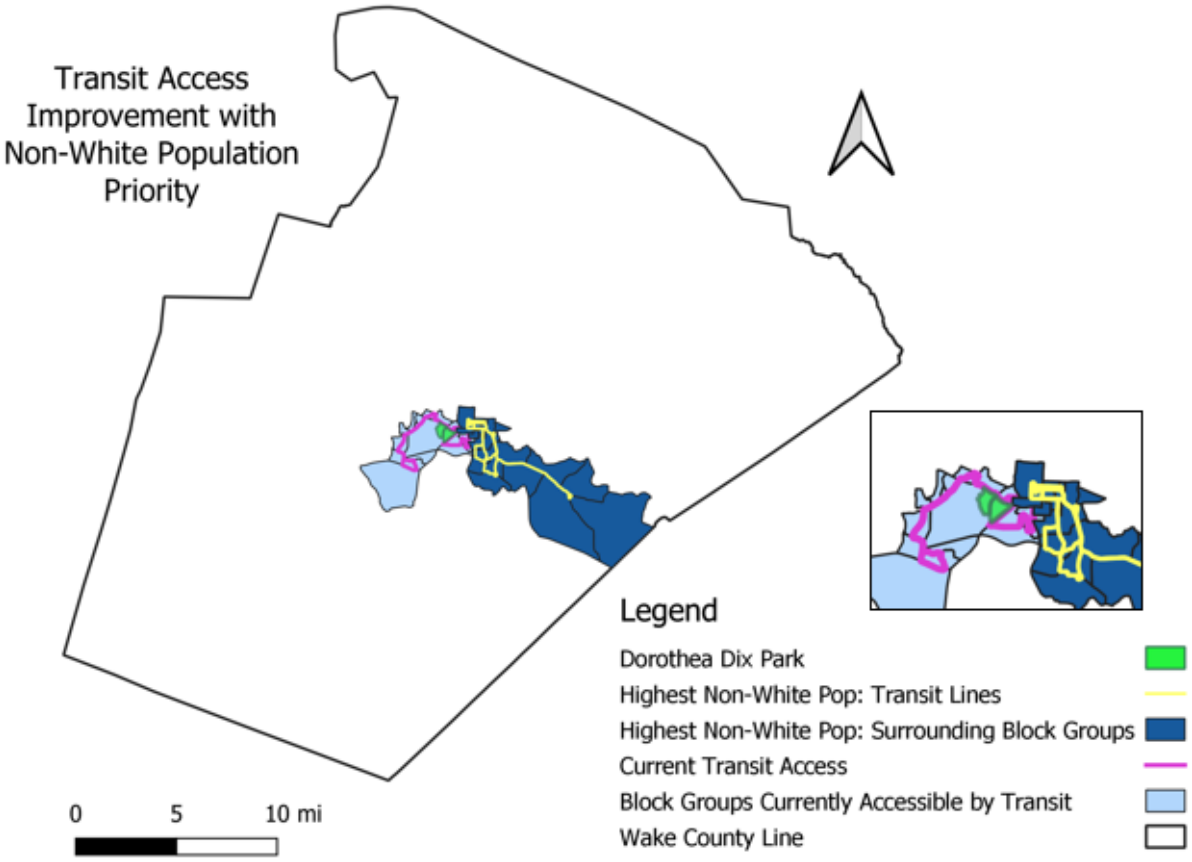
Highest Poverty: Transit Lines
Highest Poverty: Surrounding Block Groups
Current Transit Access
Block Groups Currently Accessible by Transit
Wake County Line

Figure 13.

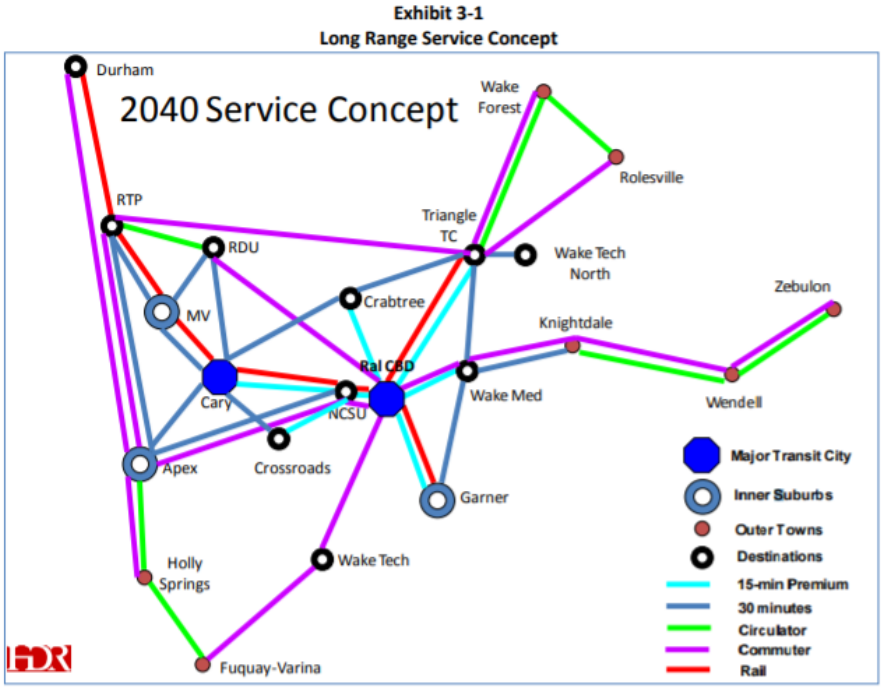


Further Considerations and Limitations

This analysis of external accessibility improvements has important limitations, not least the fact that park staff have little control over GoRaleigh's future decisions around bus service changes. The Capital Area Bus Transit Development Plan has laid out detailed recommendations for transit network improvements such as more frequent service on key routes, the addition of more neighborhood circulator routes for convenient local travel, and transit centers with parking located where more than three bus lines intersect, all of which will work to increase ridership (HDR 2011). However, the plan's Long-Range Service Concept (see figure 14 below) does not include the park as a major node of the future transit network, even though Dix's development trajectory and park planners' vision for a transit center located within the park will as a matter of course make Dix Park an important nexus of the future bus network. Future plans for Bus Rapid Transit in Raleigh, particularly the Western Boulevard corridor, will also be an important means of increasing connectivity to the park.

The key purpose here, then, is to help make the case that transit improvements will be the central piece to making access to Dix Park more equitable in the coming decades. To this end, I considered the hypothetical addition of one or two stops on each of these lines that already stop within a mile of the park. It is important to note that the reason many of these lines intersect with the one-mile park buffer is that they stop at GoRaleigh's central bus station located in downtown. Even if adding these bus stops was feasible, what is **most important** at this point is strengthening the connections from downtown Raleigh to Dix.

Figure 14. Graphic from the Capital Area Bus Transit Development Plan, which does not include Dix Park (located on pg. 51 of the report).



Proximate Accessibility: Improving Nearby Neighborhood Connections

This section discusses eight block groups that are proximate to the park, intersecting with the half-mile travel-shed from either the Dix Park entry points or the Dix Park internal destinations. For clarity's sake, each of these block groups will be referred to by the name of the neighborhood which they approximate: Boylan Heights, Caraleigh, NCSU Centennial Campus, NCSU Central Campus, Pullen, Shaw, South Wilmington, and West Morgan. Five of these neighborhoods overlap with the destination points travel-shed while three overlap with the entry points travel-shed. Each of the sets of points can be seen in Figures 15 and 16 below.

Figure 15.

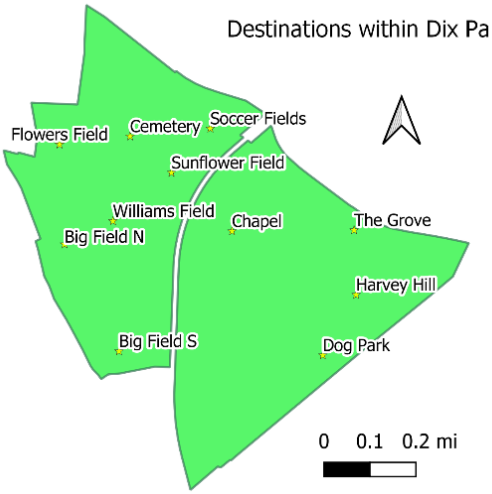
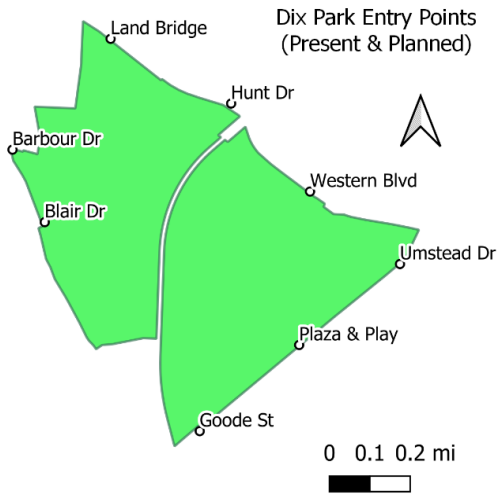


Figure 16.



Neighborhood Access to Destination and Entry Points

A more detailed representation of current accessibility from proximate neighborhoods is shown in figures 17 and 18 below. The Master Plan calls for activation at the edges of the park, taking advantage of each entrance's unique situation within a different Raleigh neighborhood, where "edges will be inviting, allowing passersby to look into the park and pedestrians and bicyclists to enter it. Cultivating dense and diverse neighborhood activity day and night along park edges is essential" (Master Plan 2018). Because of the site's historical context, it is unsurprising that navigating its edges as a pedestrian is largely inhospitable. However, there are short-term solutions that can be implemented rather painlessly at many of the park entrances to open it up to the flow of cyclists and pedestrians from surrounding neighborhoods.

Table A2 in the Appendix summarizes the variables of interest for each of these surrounding neighborhoods, although they are not the basis for the following recommendations.

Figure 17.

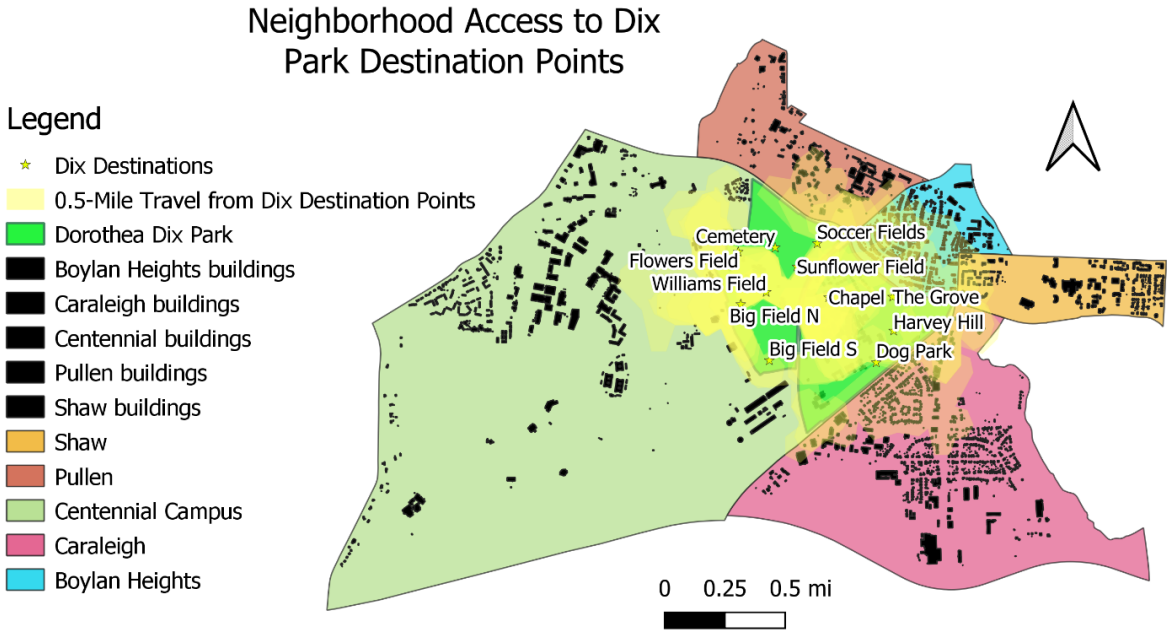
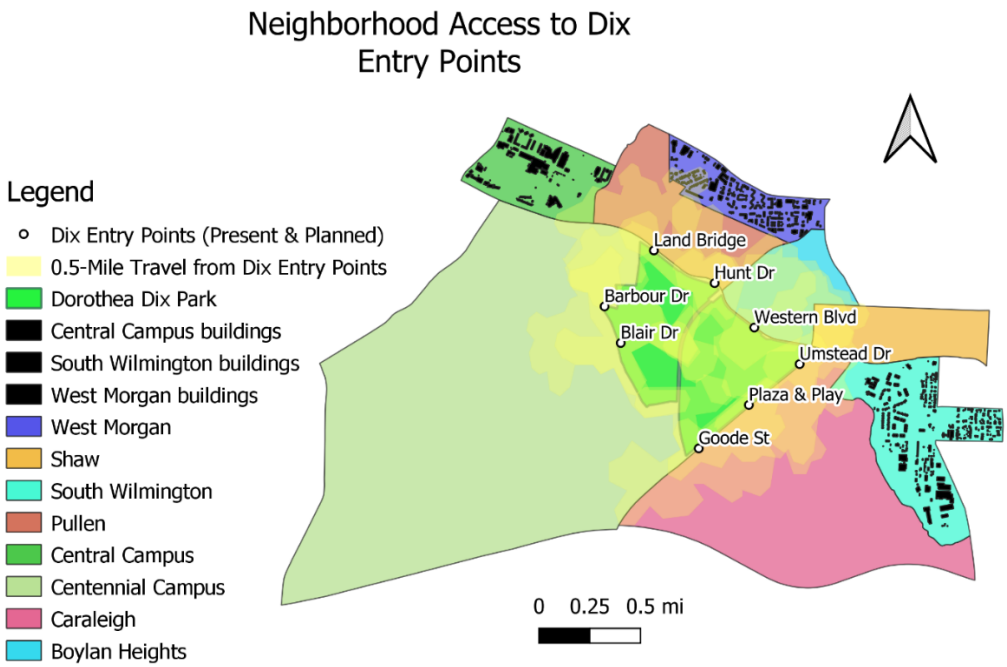


Figure 18.



Connectivity Recommendations

Ensuring that people who live in these proximate neighborhoods can safely access the park should be the first priority for accessibility improvements (they are also likely the action items over which park staff will have the most control). Currently, park entrances (not including the proposed land bridge or the Plaza & Play area) are inadequate to ensure comfortable and safe park entry for pedestrians and cyclists. An example, at Hunt Drive, is shown below in Figure 19.

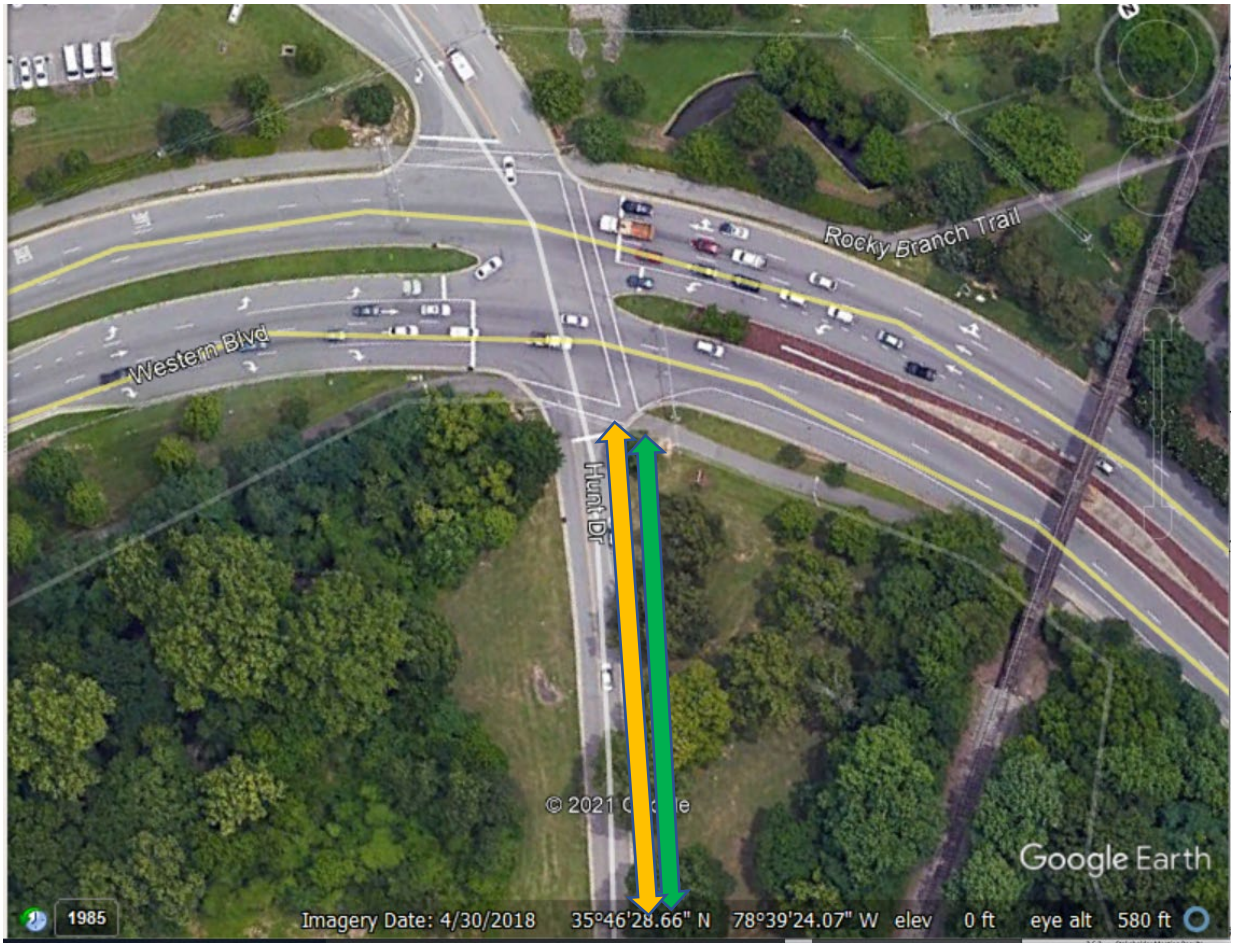
Figure 19. Hunt Dr. Park entrance: suggested accessibility improvements include painted bike lanes and designated pedestrian space, such as gravel (near-term) or ideally, paved sidewalks.

For each of the entry points pictured below, I propose specific improvements that will allow for easier pedestrian and bicycle access into the park from its edge neighborhoods (credit for all images: Google Earth Pro). Some of these will involve suggested improvements to state-owned roadways, as a consequence of considering the intersection as a whole. These suggestions are understood to not be under Park control and to be mostly mid- to long-term efforts.

Pedestrian infrastructure, including crosswalks and the like that can also be used by cyclists, appears in **green**, and bicycle-only infrastructure suggestions appear in **orange**.

Suggested improvements at Hunt Drive include a pedestrian walkway alongside the road leading into the park, as well as a two-way separated bike lane.

Figure 20. Hunt Dr. Entrance, onto Western Blvd.



Along Barbour Drive, suggested improvements include a pedestrian area alongside the road to allow neighborhood residents to safely access the park along this route (although they can also walk and bike on the greenway to do so), as well as a two-way separated bike lane.

Figure 21: Barbour Drive, main entrance from Kirby-Bilyeu neighborhood

The main priority at Blair Drive is connecting this park entrance to Centennial Campus' network of bikeways. A pedestrian walkway along the road would also be useful, but until this area of NC State's campus becomes significantly more developed, pedestrian connections are less likely to be utilized.

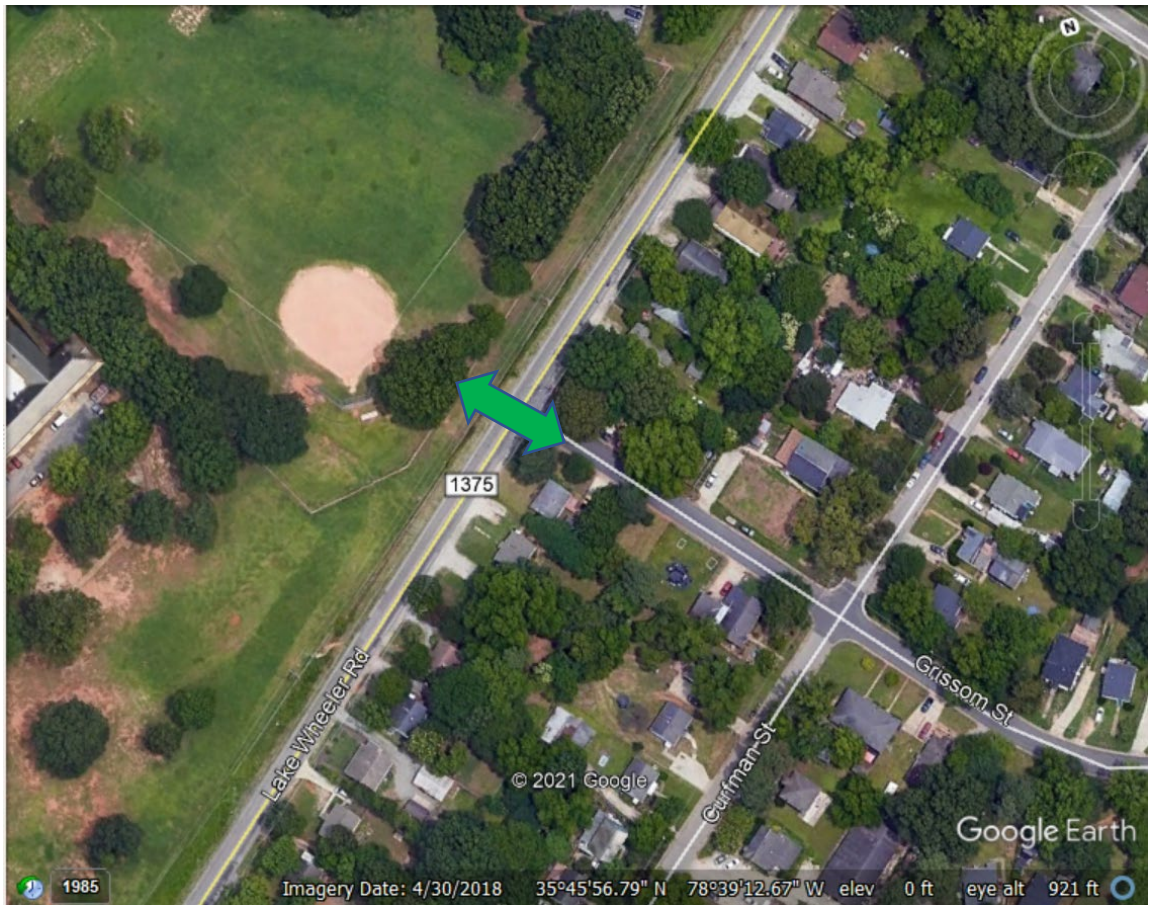
Figure 22. Blair Dr. Entrance, abutting NC State's Centennial Campus

At the Goode Street entrance, suggestions include extending the sidewalk from the existing transit stop at the entrance into the park towards the big field. However, without significant changes along Lake Wheeler Road, I would expect there to be little demand for a bicycle lane on Goode Street.

Figure 23: Goode St, entering the park from Lake Wheeler Road.

Improvements at the Grissom Street intersection, site of the future main park entrance plaza, will also depend on Lake Wheeler Road safety improvements, including signalized pedestrian crossings and sidewalks.

Figure 24: Future main entrance plaza at Grissom/Lake Wheeler intersection.



The Umstead Drive entrance would be highly improved by the placement of sidewalks along Lake Wheeler Road, but for now the ideal pedestrian access point for people coming from the neighborhoods south of downtown is the greenway's crossing at South Saunders Street, which should be made safer with a signalized crosswalk. Once people have crossed South Saunders Street, they enter the park on the greenway, but must take a steep, informal trail up into the main part of the park. This corner of the park could also be opened up to downtown and made more welcoming with landscaping that allows for approaching visitors to catch sight of the Grove.

Figure 25: Umstead Dr and South Saunders St Crossing.

There is a pedestrian crossing at Western Boulevard which allows for residents of Boylan Heights to enter the park; however, it is a fairly quick signal and definitely a nerve-racking crossing for pedestrians. If planners aim to make this entrance the destination of a multimodal corridor from downtown to the park, it needs to be more suitable for people of all ages and abilities, with better signalization and a longer crossing time.

Figure 26: Western Blvd at Boylan Heights.

Downtown

The block group representing Downtown Raleigh barely intersects with the half-mile travel-shed and is not included in the maps above for this reason. Connecting the Park to Downtown is a major Master Plan priority; a safe and direct route for pedestrians and cyclists willing to make the trip to the park from Downtown is currently precluded by Western Boulevard and Dawson and McDowell Streets, all of which have high speed limits and little, if any, bicycle or pedestrian infrastructure. Connecting Downtown with the Park via a multimodal corridor through Boylan Heights, adding a Dix Park stop to one or more transit lines (particularly the R Line), or simply improving wayfinding and signage along a safe route to Dix Park would be the highly effective

ways of connecting the relatively vulnerable, non-white, and non-vehicle commuting population living downtown to the park.

Further Discussion & Conclusions

Gentrification & Development

There is a burgeoning field of research concerning the concept of "green gentrification," whereby "existing lower-income residents are likely to be displaced after their community is improved environmentally" (Maantay 2018). Anguelovski (2016) summarizes the impact of green gentrification as creating "enclaves of environmental privilege." The impact of increased park access on potential gentrification is beyond the scope of this particular project, but certainly warrants further study, probably sooner rather than later--these concepts have clear and urgent relevance to the Dix Park improvement process, and must be a key part of continuing conversations with surrounding communities, particularly the most vulnerable. As Raleigh continues to grow and Dix Park becomes the regional attraction envisioned by the City, demand for housing near the park will only increase. Intentional policy choices must be made to combat displacement of the very residents that are the main concern of this study.

Disability Access

Notwithstanding the lack of smooth, safe walking infrastructure at the park's entry points, which can be challenging even for relatively fit and able-bodied people, the park's topology makes it strenuous and challenging for people with mobility issues. Disability advocacy groups should be key partners as planning staff move forward on various transportation improvements, whether in partnership with GoRaleigh, or considering what internal transportation options will look like for people who need it—will a small electric shuttle patrol the park and make frequent stops? Where will the future internal transit stops be located so as to best ensure that those with mobility issues have equitable access to park amenities? These questions and more should be central to continued analysis of park connectivity plans.

Implementation & Next Steps

While actual implementation of the external accessibility proposals is out of the control of Park staff, my hope is that demonstrating transit's effectiveness at improving equitable access for a significant portion of the Wake County population, including some communities with the highest poverty rates and non-white populations, will prove useful for future conversations with city and GoTriangle staff. The improvements proposed as a result of the proximate analysis are intended to be easier for park staff to implement in the near-term, although they will be far more effective after safety improvements are made to the streets surrounding the park. This will depend on longer-term decisions made by the city of Raleigh and the state DOT.

Immediate next steps should involve the creation of sidewalks and bike infrastructure at park entrances. These can be relatively temporary, as simple as painting a bike lane at entry points like Hunt Drive, Blair Drive, and Barbour Drive, or delineating them using cones or bollards.

Temporary sidewalks can be constructed by placing gravel beside the roadway at key entrances, until such a point as full plans for internal park connectivity are finalized. Another relatively simple accessibility measure would be the placement of wayfinding features leading the way to Dix Park from downtown Raleigh, via signage or eye-catching colorful sidewalks and paths. Over the longer term, the direct integration of the park within the transit network should be a major goal, as transit is key to more equitable accessibility across the city and Wake County as a whole.

Ideally, Dix Park is accessible to the most Raleigh residents possible, regardless of mode choice or direction from the park. Multi-faceted accessibility solutions should consider all the various ways that residents currently access and use the park, as well as the ways that park accessibility and usage will evolve as the park itself evolves, and should stem from community input that is values-driven and equity-minded.

Image: Dix Park Planning Staff

Appendix: Additional Figures & Tables

Figure A1: Spatial Distribution of Non-White Population within Wake County.

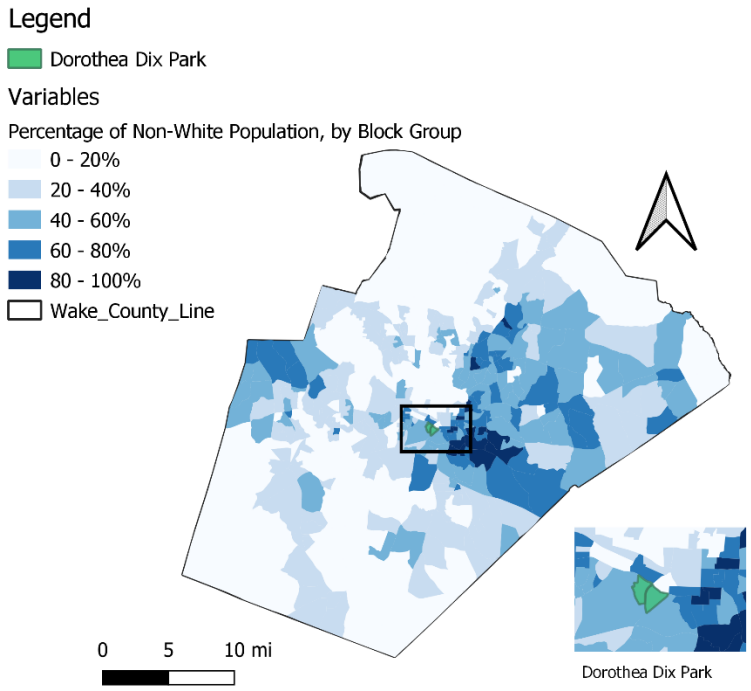


Figure A2: Spatial Distribution of Poverty Rate within Wake County.

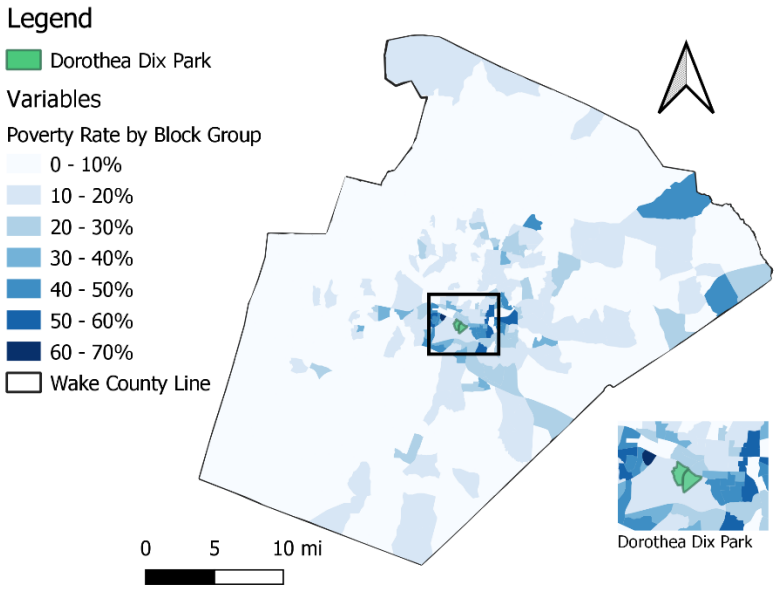


Figure A3: Spatial Distribution of Dependent Populations within Wake County.

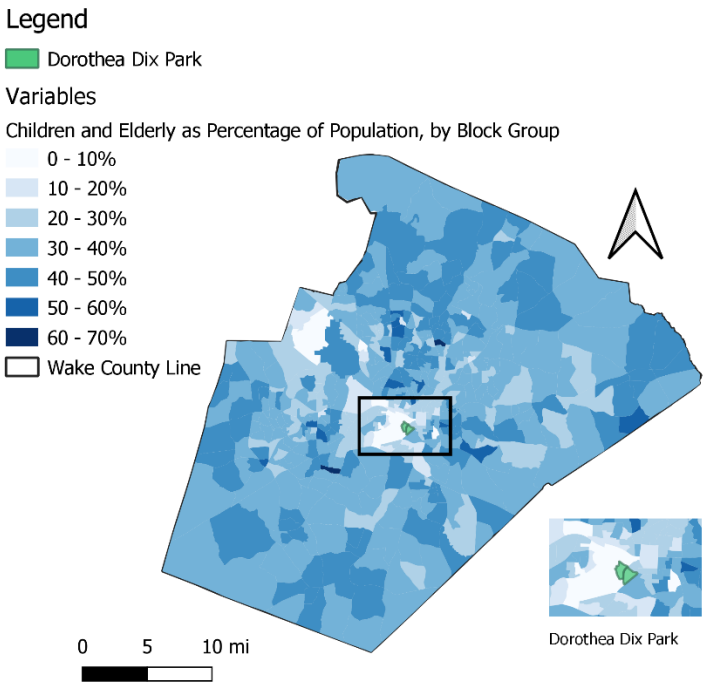


Figure A4: Spatial Distribution of Non-Car Commutes within Wake County.

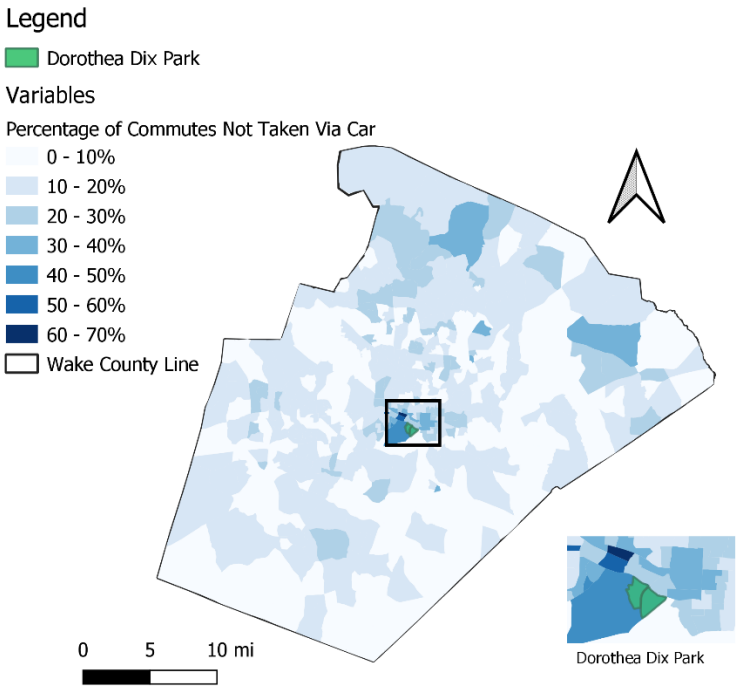


Figure A5: Transit Lines with Stops within 1 mile of Dix Park, Labeled Individually.

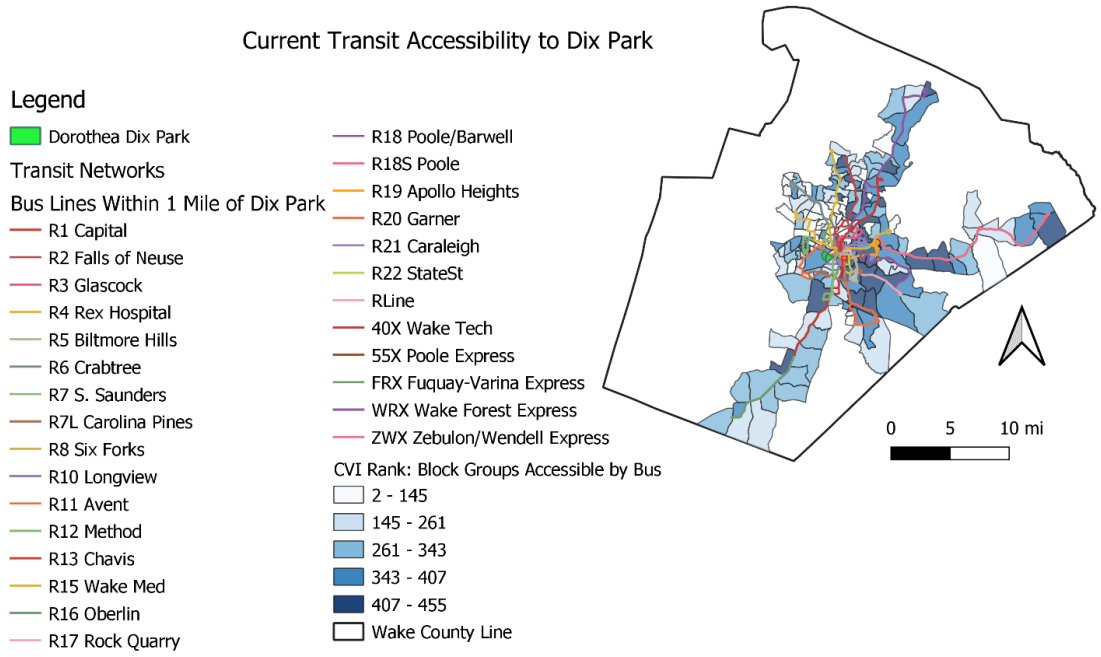


Figure A6: Potential Targets for Transit Improvements, by Variable of Interest.

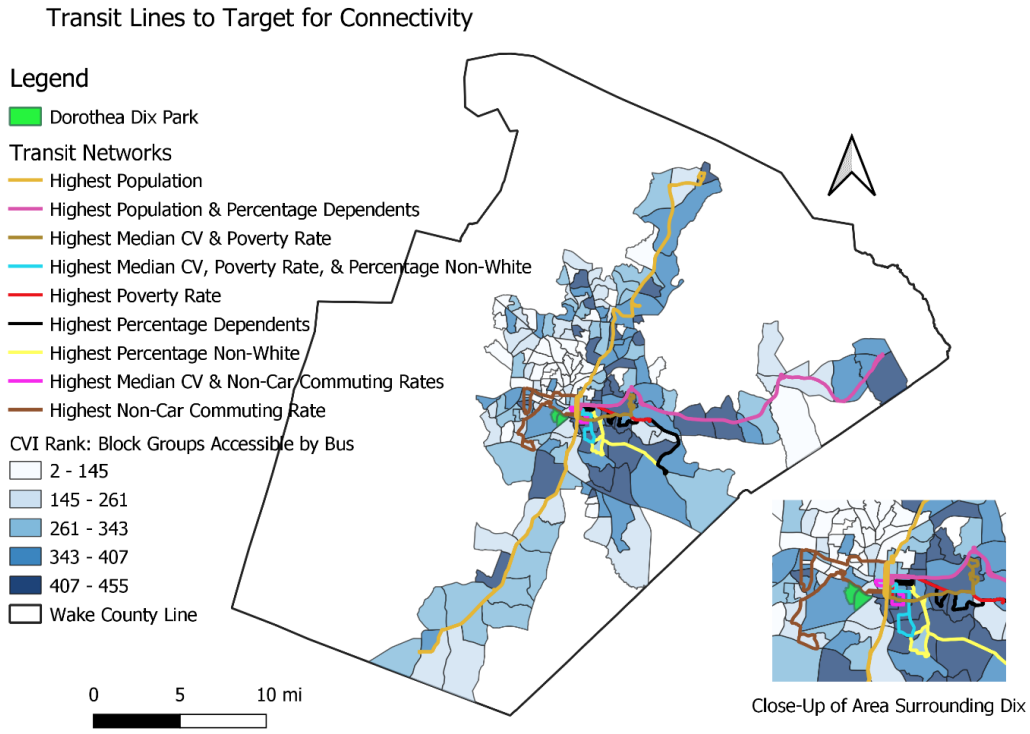


Table A1: Transit Access

Line	Route Name	# BGs	Total Pop.	High CVI	Low CVI	Median CVI	Avg. Poverty	Dep. Pop.	Non-White	Non-Car
1	**Capital**	16	25872	433	24	354	15.41	28.77	41.61	14.27
2	**Falls of Neuse**	22	34520	426	11	216	10.95	36.02	23.73	15.20
3	**Glascock**	9	13244	452	24	322	25.69	25.76	38.86	18.36
4	**Rex Hospital**	19	25075	343	3	136	13.73	24.04	20.89	23.61
5	**Biltmore Hills**	15	24951	453	320	420	29.20	33.80	75.33	18.57
6	**Crabtree**	25	38886	406	11	121	9.05	32.48	18.04	15.66
7	**South Saunders**	8	14253	445	217	326.5	23.67	28.59	50.91	17.49
8	**Six Forks**	28	39889	419	11	152.5	8.05	34.87	17.58	16.39
10	**Longview**	8	12558	452	322	403.5	31.77	30.88	60.86	23.38
11	**Avent Ferry**	15	28439	413	25	267	32.54	12.71	42.34	27.11
12	**Method**	16	21460	408	2	186	20.88	17.12	28.52	27.40
13	**Chavis Heights**	6	8240	455	322	427	31.97	31.02	71.84	28.47
15	**WakeMed**	13	23828	452	101	375	21.54	34.62	57.83	20.05
16	**Oberlin**	17	24581	406	11	136	12.42	30.40	14.99	18.51
17	**Rock Quarry**	14	33567	453	320	404	18.83	35.36	75.09	15.69
18	**Poole/Barwell**	18	33057	453	162	392	24.82	39.22	71.01	16.28
19	**Apollo Heights**	15	22922	455	322	436	33.24	35.30	71.45	20.17
20	**Garner A/B**	18	32283	455	112	404.5	23.71	36.16	55.60	15.40
21	**Caraleigh**	7	10505	455	246	413	30.78	26.26	62.79	26.41
22	**State St**	10	13978	455	322	430.5	37.25	31.81	74.45	23.23
11L	**Buck Jones**	19	33978	408	25	291	29.27	17.25	40.93	22.54
18S	**Poole**	12	18255	453	162	406	29.15	39.19	71.94	18.53

40X	**Wake Tech Express**	16	28314	455	171	321.5	21.64	32.02	45.02	15.11
55X	**Poole Rd Express**	17	24760	455	162	416	33.10	36.04	72.97	20.12
7L	**Carolina Pines**	13	28597	446	217	373	23.79	32.08	61.29	11.26
FRX	**Fuquay-Varina Express**	22	51531	445	171	312.5	15.17	34.70	32.00	13.02
R	**R-Line**	3	5230	413	24	322	19.17	20.25	38.44	25.12
WRX	**Wake Forest-Raleigh Express**	23	62684	451	24	311	14.24	33.08	39.71	13.84
ZWX	**Zebulon-Wendell-Raleigh Express A/B**	25	44710	453	102	378	19.18	36.44	53.16	15.34

Table A2: Proximate Neighborhood Access

Neighborhood	CVI	Total Population	Poverty Rate	% Dependent	% Nonwhite	% Non-Car
Boylan Heights	258	869	29.27	21.26	11.34	27.7
Caraleigh	246	1518	10.51	31.78	52.64	5.09
Centennial Campus	390	1305	18.32	7.29	45.02	42.56
Central Campus	25	2865	0	1.48	19.48	52.17
Downtown	322	2823	13.96	16.81	36.64	31.6
Pullen	343	981	28	5.86	63.11	29.06
Shaw	413	1526	37.82	22.89	68.73	30.71
South Wilmington	438	1390	43.69	28	73.65	26.54
West Morgan	152	929	24.98	5.82	25.32	31.2

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Data

Geospatial data from Wake County Open Data; census data from American Community Survey 5-year, 2015-2019, tabulated for analysis using Social Explorer. Special thanks to Ryan Cooper at the City of Raleigh for his guidance.