Identifying *Transportation Disadvantaged Populations*

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Executive Summary

Introduction
This project seeks to develop a method to identify and describe transportation disadvantage by combining quantitative data, provided by a research team at NCSU, with qualitative data, collected through field work by a team of transportation researchers at UNC. The project aims to explore the complexities of transportation options within each local built environment and produce a tool for planners and transportation experts to design options that are more reflective of people’s needs and desires. This project comprised a team of seven undergraduate students completing a capstone course, two graduate students, and three research staff members.

Methods
This project began with background research and literature review. The initial task was to develop tools for qualitative data collection, including developing, piloting, and revising questions for key informant interviews and focus groups. All materials were approved by the Institutional Review Board (IRB), since this project involves human subjects. The team conducted anonymous interviews and focus groups in Wilson County, Beaufort County, and Chatham County. The team audio-recorded the data, manually transcribed the audio files, and analyzed the transcripts for themes. The team then coded the transcripts with these themes and summarized conclusions.

Results and Findings
Within Wilson County and Beaufort County, the five identified themes include:

- **Divisions**: Divisions refer to social or political divides that are often linked to a geographical barrier, like the Pamlico River in Beaufort County, or a physical divide, such as the railroad in Wilson County that historically separates the town based on affluence.
- **Informal networks**: Informal Networks, such as carpooling with family, were discovered in the data.
- **Vulnerable populations**: Some populations emerged as being more likely to be at risk for transportation disadvantage, which were identified as vulnerable populations in our analysis.
- **Existing services**: Although the data identifies transportation disadvantage, there were several noteworthy existing transportation systems and services.
- **Infrastructure and distance**: Infrastructure and distances focuses on the interaction between built environment and people’s transportation needs and options.
Conclusions

Three main conclusions resulted.

1. *Transportation disadvantaged populations do exist, but the severity varies greatly within these populations.* The data identified individuals that had their transportation needs fully met, partially met, or were not met.

2. *The relationship between traditional measures of disadvantage and transportation disadvantage is complex and variable.* Although previous research has supported that this connection is present, consistently the key informants interviewed indicated that traditional disadvantage does not always necessarily line up with transportation disadvantage in reality.

3. *The interaction between transportation options, socio-demographic factors, and the built environment should be considered as a holistic system.* It is important to realize that any of these three factors can change the influence of the other two on transportation disadvantage.

Recommendations

After analyzing the data, the team has three primary recommendations for the future of this study. The maps could more adequately serve the needs of this study by incorporating existing transportation networks and the built environment, and also account for varying population densities. Secondly, the field site logistics could incorporate more time between site visits to allow a more complete understanding of a site before more data collection. Finally, the primary limitation of this study involves the lack of input from non-experts. Focus groups aim to gather data from these affected citizens, but were not conducted before this report was finalized due to scheduling conflicts. The team suggests incorporating focus group data to achieve a more complete understanding of transportation disadvantage.
Introduction

This project, supporting a partnership of the North Carolina Department of Transportation (NCDOT), North Carolina State University (NCSU), and the University of North Carolina at Chapel Hill (UNC), seeks to develop a method to identify and describe transportation disadvantage. Populations considered more likely to be traditionally disadvantaged include those who are low income, mobility-limited, of low English proficiency, elderly, or minority, among others. The research project discussed here attempts to look beyond traditional measures of disadvantage, and consider how the built environment and transportation supply intersect with socio-demographics to produce transportation disadvantage. Previous research provided a framework to measure transportation disadvantage, focusing on affordability, availability, accessibility, and acceptability. This background context led to defining transportation disadvantage for this project as the mismatch between available transportation options and people’s needs.

This project uses key informant interviews, citizen focus groups, and map analysis to understand the interaction between transportation options and services offered and the actual ability of individuals to get to where they need to go. For example, if a bus line is available but there are no sidewalks to get to the bus stop, that bus line becomes less effective because of the disconnect to the built environment. Conversely, there may be good infrastructure in an area, but undesirable or widely dispersed destinations may discourage residents from using it. Traditional measures of disadvantage do not capture the complexity of this relationship with environment.

The goal of this project is to combine quantitative data provided by a research team at NCSU, with qualitative data collected through field work by a team of transportation researchers at UNC. The NCSU team developed maps using traditional census data (see Appendix A). The maps layered thresholds of several variables—some representing disadvantage, including low English proficiency, lack of access to a car, and household size. The more thresholds a particular census block group meets, the darker the color on the map. These thresholds represent a possible link to transportation disadvantage, which the team further explored and developed through key informant interviews and focus groups conducted on the ground. By understanding where there are gaps in relation to existing transportation services, this project aims to introduce a framework in which NCDOT can eventually more easily invest in transportation services. The NCDOT funded this project to provide a tool for local planners and transportation experts to design options that are more reflective of people’s travel needs and desires.

This semester-long project is part of a UNC environmental capstone course, which is required for Environmental Studies majors, Environmental Sciences majors, Environmental Engineering
majors, and Sustainability minors. Capstone teams work closely with a client and produce concrete deliverables. Students are expected to spend ten hours per week on the project. This particular project consisted of a team of seven undergraduate students, two graduate students, and three staff members. The first weeks were devoted to organization, familiarization with background material, establishment of goals, and development of a work plan and timeline. The UNC researchers offered oversight and guidance throughout the semester. Although the UNC and NCSU researchers will continue this project, the capstone concluded with a final written report and presentation to the client (NCDOT), UNC researchers, interested members of the campus community, and other capstone students.
The team members began this project with little prior knowledge of transportation disadvantaged populations. In the first phase of this project, the team consulted previous research relating to transportation disadvantage including: technical reports, literature and data reviews, and previous presentations to stakeholders. In conducting background research several themes emerged:

1. **Rural context:** The rural context, while challenging to define, requires significant attention in terms of transportation needs and services. With significantly less population density, covering 75% of total land area and only holding 16% of the total population in the US, rural areas’ transportation options often lack depth. According to the “Rural Context” the livability principles suggest more total transportation options are needed since commutes require more time and money than in more densely developed locations. In addition, the current infrastructure is not designed for multi-modal purposes, which further limit transportation access (“Supporting Sustainable Rural Communities”).

2. **Vulnerable populations:** The reports identified several vulnerable populations that require separate consideration in transportation planning efforts. People with disabilities such as visual impairments or physical limitations require accommodations when using public transit, such as GPS assistive technology and voice activated mapping. These improvements are viable and could improve transportation access, but require investment and policy support (“Technological Innovations in Transportation for People with Disabilities”). As outlined in the data review summary, several variables of interest include: low-income, minorities, limited English proficiency, zero-car, elderly, disabled can reveal social and travel patterns. Due to confidentiality measures, there is limited data on commuting between origin and destination in relation to socio-demographic information, but this data would provide valuable information and complexity to the study of transportation disadvantage. Currently, the “Literature Summary” addresses the four A’s as a popular measure of transportation advantage, including Accessibility, Availability, Affordability, and Acceptability (Combs). Although these broad categories are a starting point, their interaction is often complex and needs to be further explored.

3. **Livability:** Transportation options and availability are one of the factors contributing to general livability. Livability is related to the quality of life in a place. In terms of transportation, this includes ease of reaching desired services, having a variety of transportation choices, sustainability, affordability, local economy, community, and safety. Many of the strategies for increasing livability aim to increase transportation options by developing access of non-motorized travel by integrating transportation and
land use decisions, such as mixed-use development and complete streets. Creating roadways that equally and fully support multiple types of street use, including driving, walking, biking, and public transit, means more transportation options exist. However, livability relies on interagency cooperation and policy that is often beyond the control of an individual community (“Livability Literature Review”).

4. **Grants and Funding:** The research reviewed eighty federal programs that fund transportation services. Although the Coordinating Council has led the government-wide transportation coordination effort since 2003, the research consistently identified problems with interagency coordination which lead to duplication, overlap, and fragmentation of provided services. Only four programs focused specifically on supporting transportation-disadvantaged populations and only seven programs primarily funded transportation. The other programs focused on providing services such as job training or education rather than explicitly transportation. In addition, state and local coordination efforts face several key challenges, including: lack of federal leadership, changes to state legislation and policy, limited financial resources (“Transportation Disadvantaged Populations”).

**Relevance**
After considering this research, the team was better equipped to engage in the planned transportation disadvantage research. There were areas of study that had not been previously studied, such as the effect of transportation on overall livability of a community, as well as some of the specific challenges for vulnerable population. This current research has not addressed the complexity of traditional disadvantage measurements with transportation disadvantage. This project aims to address this need by combining quantitative data from GIS mapping with qualitative data from field work interviews.
Methods

Summary of tasks
To begin the project, the group studied background research and engaged in collaborative discussion on the application to this particular project. The following topics emerged from the body of research materials the team reviewed: accessible transportation and rural communities; federal funding and support opportunities and inequalities; community impacts; land use and geographic considerations; rural and disadvantaged-specific considerations and case studies on federal grants; success of transit in the US and interview question development; and community livability, Federal program coordination, and traffic safety. Since the project involves research with human subjects, each team member completed CITI certification for Social and Behavioral Research. Before entering the communities, the team developed key informant questions, a focus group guide, and a map for each (with a “back-of-the-map survey” at the end). All materials were submitted to the Institutional Review Board (IRB) and gained IRB approval. Within each community, the team members conducted anonymous interviews and focus groups. The team audio-recorded the data, manually transcribed the audio files, and analyzed the transcripts for themes. The team then coded the transcripts with these themes and summarized conclusions.

Development of Tools for Qualitative Data Collection
The research this project supports sought to systematically collect and analyze qualitative data as a complement to data-driven mapping of transportation-disadvantaged populations, and relies on a set of variables that measure socio-demographics, built environment, and transportation supply. This required separate but parallel processes to develop, pilot, and revise two different instruments, one for key informant interviews and one for citizen focus groups.

Key Informants
According to Weiss, the key informant interview process is distinguished by the following principles and capabilities:

- Develop detailed descriptions
- Integrate multiple perspectives
- Describe the process
- Develop a holistic description
- Learn how events are interpreted
- Bridge inter-subjectivities
- Identify variables and frame hypothesis for quantitative research
Applying these to our project, the first (“develop detailed descriptions”) involves learning as much as possible about transportation use in the community. Researchers interview multiple experts in various areas (public health, transportation, education, etc.) to gather different observations about transportation systems in different communities, as a way to integrate multiple perspectives. To describe the process, the questions aim to understand how transportation works, what the local transportation systems involve, and possible consequences of the transit options. Interviews help develop a holistic description, by interviewing individuals whose behavior and stories interact and connect to create a big picture of the transportation issues in the counties. Interviews also help learn how events are interpreted, by evaluating responses by key informants’ and citizens’ and reactions to current transportation options and conditions in local communities. Researchers use interviews to bridge inter-subjectivities, to experience transportation disadvantage from the view of affected citizens and key informants. Finally, interviews help identify variables and frame hypothesis for quantitative research, by informing researchers what topics and what areas to further investigate (Weiss).

Building on the background research, the team devised a set of questions tailored to the key informant interviews, and county maps with significant landmarks to be used in conjunction with the GIS maps from NC State University. Key informants identified perceived transportation disadvantage on these maps (see Appendix B). The questions were piloted with a transportation planner in Carrboro, North Carolina, which provided useful feedback and generated several revisions, after which the team submitted the questions to IRB for approval (see Appendix C). These questions were intended to probe the local knowledge of on-the-ground experts in a variety of positions, whose professional roles and expertise relate to some aspect of transportation.

Focus Group
According to Stewart’s “focus group theory,” the focus group process is distinguished by the following principles:

- Focused research
- Group interactions
- In-depth data
- Humanistic properties

Focused research gathers qualitative information from a diverse set of individuals on a specific question or topic. Assessing group interactions shows how group dynamics affect individual observations and perceptions about transportation use in communities. This involves observing individuals interacting by accepting, rejecting, and collaborating with ideas presented by other participants and encouraging open participation. In-depth data facilitates detailed answers to the questions, such as emotional impacts and motivations of behaviors. The humanistic properties of
conducting focus groups allows researchers to include “empathy, openness, active listening,” etc., during the assessment (Stewart).

Building on the background research, the team developed a set of questions for the focus group, a focus group guide, and a map for an interactive activity. The goal of the map was to get people thinking about their travel routines, to enrich the group discussion, and to prepare the focus group participants for the back-of-the-map survey. The entire focus group (discussion questions, map activity, and survey questions) was designed to make citizens feel more comfortable sharing information. Additionally, the exercises emphasized that citizens who may not be experts in transportation professionally are still experts on the local conditions and their individual routines and travel needs. The team designed focus groups questions to protect the privacy of all participants in accordance with IRB; no names, addresses, or any other identifying information of participants was gathered. The team piloted the focus group with students from PLAN 247: Solving Urban Problems, a class taught by one of the UNC researchers. Each student assumed the identity of a community member, some, but not all, disadvantaged or facing transportation challenges. The class was split into two groups, each with several team members (students and researchers) serving as focus group discussion leaders and note-takers.

The dry run focus group participated in a map activity, focus group questions, and follow-up socio-demographic questions. The initial protocol proposed:

- Introduction – 5 minutes
- Map activity – 10 minutes
- Interactive portion/sharing of maps – 10 minutes
- Discussion questions – 50 minutes
- Survey questions – 10 minutes
- Closing statements and thank you – 5 minutes

The pilot focus group suggested that the discussion questions do not require 50 minutes, and that the actual in-the-field focus groups could be advertised as taking less time.

In a post-pilot discussion of the focus group dry run, the volunteers provided useful feedback on questions, the map activity, and overall impressions. The team then revised the materials and submitted the questions, map, and focus group consent form to IRB for approval (see Appendices D - F).

**Field Work**

*Logistics*

The research team collected data from Wilson County, Beaufort County, and Chatham County; because of time constraints and the intensive effort required for data coding and analysis, the
team analyzed data from only the first two counties. In Beaufort County and Wilson County, the researchers conducted key informant interviews in the morning and a focus group in the evening. In Chatham County, researchers conducted only key informant interviews, with focus groups scheduled for several weeks following the interviews. At each interview, there was at least one UNC researcher. The team audio-recorded key informant interviews and took notes in real time.

**Key Informants**

Key informants represented a wide range of transportation-related occupations and organizations, including:

- Council of Governments
- Economic Development Professionals
- Emergency Management Coordinators
- Community Planners
- Health and Human Service Employees
- Social Service Workers
- Elected Officials
- Police Department Officials
- Bike and Pedestrian Committee Members
- Human Relations Officer
- Council on Aging Members
- Adult Education Coordinators
- Transit Directors

**Focus Group**

The team conducted focus groups in Beaufort and Wilson counties in the evening after the key informant interviews. The focus groups were intended to reach non-expert affected community members. In each case, the group that convened was different from the targeted population. Instead, the team met with citizens with some level of expertise relating to transportation and social services. Although different from the research protocol for the focus groups, this provided useful information, including insights into how the focus group recruiting protocol could be revised. Return trips to the counties will allow the team to conduct citizen focus groups that meet the research protocol.

**Transcription and Coding**

The qualitative data collected is extremely rich and provides multiple insights and specific examples of transportation disadvantage. To be able to accurately assess the detail present in the interviews and focus groups, the team manually transcribed the audio files from the field work to capture every word. In the rare moments the audio files were inaudible, the team used discretion. UNC researchers uploaded the audio files and transcripts to a password-controlled
section in a university academic website and granted access to the research team. This ensured privacy and anonymity of the subjects and followed our IRB-approved protocol.

After transcribing the audio files, the team identified themes that consistently surfaced in the transcripts. This became the foundation for coding. Coding is a data-reduction technique used to overcome the fact that qualitative data collection can generate an overwhelming amount of information. This method controls the amount of data to be analyzed and therefore allows investigators to reach reasonable conclusions. Coding involves reading transcripts line-by-line and marking relevant areas with a meaningful label, or code. Each team member coded four transcripts they had not previously seen, resulting in two coders per transcript. The pairs of team members were permuted to ensure that no two codes had the same pair of reviewers. The team then reconciled the two coded transcripts to develop one master document for each interview (see Appendix G). The double-coding by shifting pairs was done to reduce bias. The master list of codes was flexible, as team members were allowed to mark additional themes while coding. The coded text was the foundation for data analysis. The research team looked for major themes specific and unusual to each county, similarities and differences between counties, and themes that can be extrapolated and generalized to multiple locations, professional roles, and affected citizens.

**Summarization**

The reconciled transcripts were summarized individually to pull out main points that could be easily organized and referred back to when analyzing the information gained from key informant interviews. Using the individual transcript summaries the data analysis team created a comprehensive profile of each county’s transportation system, focusing on its relationship to transportation-disadvantaged populations. These county profiles were then used to synthesize the final findings of the report, which concentrate on exploring the qualitative aspects of transportation disadvantage.
In the process of analyzing the data gathered from key informant interviews, several notable themes emerged that reveal some important patterns of travel behavior and transportation needs in the two counties visited. These themes are consistently interrelated, and viewing them in isolation diminishes the quality of knowledge that can be gathered from this data. The findings fall under six general themes, as described below.

**Politics and Power**
Many issues regarding individuals’ transportation options in Beaufort and Wilson Counties were linked to budgetary concerns or political affairs. Some forms in which these issues presented themselves include politicians who were unfamiliar with local issues and circumstances, inconsistencies between the actions of state and local governments, a lack of available funding, or the effect of influential companies on residents’ transportation needs. However, the influence of such matters is intertwined with each of the other following themes, and thus they are addressed as they become pertinent to each of them.

**Divisions**
Though the research team learned of many transportation-related challenges to the citizens of Beaufort County, the one challenge that was most apparent was the presence of divisions in the county. This division is present on multiple levels, including physical, social, and political, and leads to a lack of connection between residents. The chief physical barrier is the Pamlico River, which bisects the county and is currently only crossable by boat for the majority of its length within the county. This can make crossing from one side of the county to the other very difficult for residents, as they must choose to either give up time waiting for and taking the main ferry across the waterway, or give up money in driving the long way around the end of the river. Additionally, a toll is currently under consideration by state authorities for this ferry. The key informants indicated that most residents strongly dislike this idea, as many of them must take this primarily work-commuter ferry to reach their place of employment, and the toll would greatly increase the expense of their commute. Moreover, the bridge access over the Pamlico River is located near Washington City, and thus rural residents far from the city are hindered more severely when trying to cross the river. The need to travel across the river impedes everyday travel and unity of county institutions, as well as economic development in more isolated parts of the county.

Because Beaufort’s cities and smaller communities are widely dispersed across the county, many of them experience a general lack of connectivity. In some cases a lack of major roadways (or of well-maintained or multi-lane roadways) between town centers is detrimental to connectivity,
and in others a social disparity is present. The city of Washington was especially cited as an example of the latter. Many key informants stated that Washington is a very self-contained city, and implied that it tends to function as its own entity more so than a part of the county community. This means that Washington is very capable of functioning without outside resources, but also that residents outside the city often feel socially and politically excluded. Key informants also mentioned that a majority of the county’s political representation resides in Washington, which has a negative influence on the feeling of political inclusion for some towns. Often the isolation of communities only increases with a decrease in size; there are a number of small towns (e.g., Aurora, Belhaven) that feel isolated from their surroundings geographically, mainly due to a lack of adequate transportation options for reaching other areas of the county. Beyond these small towns are even smaller communities, which are completely “off the beaten path,” as stated by one key informant. It became apparent that if residents in these areas do not own a car or know someone who does, they are virtually out of options for reaching other town centers, which is often necessary due to a lack of services and amenities present where they live.

The county of Wilson, in contrast, does not have a defining physical barrier present like the Pamlico River in Beaufort County. The majority of Wilson County is rural, with the city of Wilson in the center of the county being the main exception. Social division within the city of Wilson, however, was referenced often by key informants with respect to a railroad track that runs through the center of the town. The railroad marks a historic divide within the city with the area north of the railroad representing a traditionally more affluent population. The southern side of the city contains a population that is generally less affluent. This economic divide leads to disparity in social status and availability of transportation options.

Key informants indicated a division between residents living within the city of Wilson and those living in the rural areas surrounding the city as well. The lifestyle differences inherent in urban versus rural residency create different transportation needs. The centralization of amenities within the city means that rural residents must regularly travel to the city to meet their needs.

**Informal networks**

Because driving is often the only feasible way to travel the long distances between some of the widespread communities in these counties, informal networks for car use often appear among community members. The research team heard from some key informants about friends and family who were willing to offer transportation into town to those who don’t have it, but it is usually understood that a fee will be paid to the driver. Key informants also related that in some situations, drivers expected repayment for gas used during travel, such as in transport networks among many church members. In other situations trips were offered as personal favors to friends or family members. Other informants talked about some individuals starting personal vanpooling businesses going to commonly visited locations, such as the major Beaufort area employer PCS Phosphate, or the BB&T branch located in Wilson. In Beaufort County, the existence of informal
networks also extends to the use of waterways, as the research team learned of residents being ferried across the river by private boats, rather than waiting for the public ferry.

Key informants also stated that informal transportation networks are common among migrant workers. This population is often employed in agriculture in Wilson and in the crabbing and fishing industries in Beaufort. These residents commonly must rely on informal networks among themselves to accomplish shopping and other basic needs. Additionally their employers often offer transportation to and from their place of work, which in some cases may be the only form of transportation available to them. In Wilson, one key informant recounted consistently seeing fleets of former school buses transporting migrant farm workers to the Wal-Mart shopping center. These buses were bought and provided by those overseeing the workers at the farm employing them.

**Vulnerable populations**
A number of population subsets with special transportation needs were brought up in the course of interviewing Beaufort and Wilson informants. One was the elderly population, which was especially large in Beaufort. These residents may be unable to drive themselves or less likely to own a car, and additionally they may have fewer family or community connections left in the area and thus be unable to capitalize on the informal networks explained previously. Residents with special medical needs may be especially at risk of experiencing transportation disadvantage due to their often more frequent and imperative travel needs.

Another population commonly experiencing transportation disadvantage is seasonal workers. These residents are often minorities or undocumented workers. Low English proficiency is a common barrier for this population, which can make securing transit problematic. Additionally those who are undocumented cannot personally obtain a legally registered vehicle or a driver license, and thus must rely on those people they know who can. In some cases the only transportation available to these residents is that provided to and from work by their employer.

A further special consideration that is specific to Beaufort County is emergency transport in response to hurricanes. Due to Beaufort’s location on the coast this is a serious issue for emergency responders, and the county’s lack of connectivity or proper roadways can make reaching those in need very challenging.

**Existing services**
There are a number of existing public transit services in both Beaufort and Wilson. In Beaufort County, the Beaufort Area Transit System (BATS) appeared to be the most heavily utilized transit service available. BATS is an on-demand Para transit system which serves the entire county; the highest demand for the service is for trips for medical reasons, but trips to other destinations such as shopping or the community college are supported as well. The elderly and
residents with special medical considerations often utilize BATS to reach appointments and other needs, but there is a fee for use of the service, which may put it out of reach for very low-income residents. Additionally, to stretch funds BATS often schedules trips for multiple users together. This results in some users being stranded in a town much longer than desirable until the van can return. Other transport services are available, such as one through social services (but users must be eligible for Medicaid to utilize it), one for transport to job searches/interviews, and transport funded by a special grant for senior citizens’ needs. Funding is often limited for these services however, and often only supports a single purpose. Thus users cannot fulfill multiple needs in one trip (e.g., visiting the doctor’s office and getting groceries), which is inefficient and still leaves some residents unable to reach all their desired destinations. Despite these issues, it seems that BATS and the transport offered by social services have high ridership, and are clearly a benefit to the county. Regularly scheduled public transit in Beaufort County is limited to a route serving five communities, operated by BATS. Key informants indicated that implementing one may be beneficial in solving some problems present in the current situation involving only para-transit services, if BATS can overcome some problems that rendered a recent pilot unsuccessful.

By contrast, the city of Wilson has a bus service that covers some, but not all areas of the city. Overwhelming response from key informants was that the bus lines are underutilized due to limited schedule and range of service. Multiple key informants noted that they “rarely, if ever” saw the buses at full capacity, and often saw them completely empty. The north-west section of the city is not serviced by any bus routes, and no buses run anywhere in the city on Sunday. Lack of demand and lack of funding were consistently noted as constraining factors on the city’s bus routes. Outside the city limits of Wilson, there is no bus route due to the lack of demand for what, in this case, would be an impractical service, although the researchers are interested in probing whether it is less a matter of low demand than a mismatch of service and demand. There is a small para-transit van service that offers lift-equipped vans for transportation anywhere within the county. Key informants noted that this option is not feasible for many low-income residents, and more often informal networks are utilized to meet their transportation needs.

**Infrastructure and distance**

Due to the fact that much of both Beaufort and Wilson counties are rural, many community centers are long distances from other needs such as shopping or medical care, and use of a vehicle is often the only viable option for transport. This means walking or biking is not feasible for many residents’ travel needs. However, even when distances being travelled are short, proper infrastructure for safe and efficient biking or walking is often lacking. Many towns do not have sidewalks on some or all of their streets, or have sidewalks that have fallen into disrepair. In Wilson City, even on streets that are required by ordinance to have sidewalks, there may be missing infrastructure due to lack of funding or other limitations. In both counties, these issues make walking along roadways dangerous, as was evidenced by multiple key informants who told
us of pedestrian fatalities in their area. There is also commonly a lack of infrastructure for bicycling, such as bike lanes and paths.

These issues are being addressed to some extent, however, at both county and city levels. Beaufort County is in the process of implementing a comprehensive transportation plan, one area was developing a community transportation project, and the city of Washington has a pedestrian plan in place and is working on a bicycle plan. These projects aim to increase access and viability for non-motorized transit, or focus on improving walkability for the benefits of public health. The city of Wilson has a Pedestrian Plan and Bicycle Plan that was drafted in 2006 and 2008, respectively. In the last 4 years, a pedestrian improvement plan, bike improvement plan, and a pedestrian advisory board have all been organized. Wilson city is currently working with federal, state, non-profits and educational organizations (including UNC-Chapel Hill) to develop more pedestrian and bicycle infrastructure. One key informant pointed out that because most travel outside town centers is viable only using a vehicle, improvements to walking/biking infrastructure should be concentrated in existing city limits, not beyond them. This way trips to larger cities could be improved and streamlined because it would allow multiple people to arrive in one car, and then split up and easily accomplish their own errands on foot. In those towns lacking complete infrastructure for pedestrians this method of travel is not always possible.
Conclusions

The simplest and most fundamental conclusion that the research team reached is that transportation-disadvantaged populations do exist in Wilson and Beaufort counties. Though this fact was definitively clear, the data brought to light that the way transportation disadvantage is defined was less so. The maps produced by NC State University researchers address serve as an initial entrance to analysis, and thus approach transportation disadvantage with a binary view. These maps attempt to categorize areas as either transportation-disadvantaged or having their transportation needs fully met. However, as was expected, it became clear through the interview process that among the subset of the population that can be considered transportation-disadvantaged, there is a wide range of severity in that disadvantage. This refers to the fact that populations that are disadvantaged in this way include both individuals who have a complete lack of transportation options to fulfill their basic needs, as well as those whose transportation needs are being fulfilled to some degree but not in a complete or efficient manner. The needs of all individuals on the spectrum of transportation disadvantage deserve consideration.

Another major conclusion reached by the research team is that the relationship between traditional measures of disadvantage and transportation disadvantage is complex and variable. Traditional disadvantage refers to characteristics such as low household income, low English proficiency, ethnic minority status, having seniors or mobility-impaired persons in the household, etc. The method the NC State University research team used in creating maps implicitly assumes that there is at least some correlation between these metrics of traditional disadvantage and the existence of transportation disadvantage. Although previous research has supported that this connection is present, consistently the key informants interviewed indicated that traditional disadvantage does not always necessarily line up with transportation disadvantage in reality. Sometimes even traditionally disadvantaged persons or populations can have adequate personal support systems, or reside in an area with access to a range of transportation options. Conversely there are traditionally privileged individuals or populations that may experience a lack of adequate transportation due to special circumstances.

A final vital conclusion of this project regards the important interaction between and integration of transportation options, socio-demographic factors, and the built environment. These concepts are often considered individually but are rarely addressed as the holistic system they are. The team repeatedly gathered from key informants that the dynamic between transportation and the built environment has a great impact on how well citizens’ transportation needs are being met. Additionally, this project integrated the use of quantitative and qualitative data, and it was concluded that the socio-demographic factors being considered influence this interaction as well. It is important to realize that any of these three factors can change the influence of the other two on transportation disadvantage.
One of this project’s primary goals was to assess the validity of the maps produced with a set of select variables in predicting which areas are more likely to contain transportation-disadvantaged populations. From the qualitative data gathered in the team’s interviewing process, a number of limitations and opportunities for improvement were brought to light. There are some aspects of the data collected that are missing from census data or are inherently difficult to represent on a map. Though convenient, one of the shortcomings of relying on Census-based data is that underreported populations are misrepresented and undocumented persons are often unaware of the census or unwilling to respond to it. This creates an incomplete picture of a given population, one which often excludes those who may be most in danger of transportation disadvantage. The existence of informal networks among community residents was a significant and recurring theme in the data collected. These interpersonal networks are indefinable and difficult to quantify, but represent an essential option for meeting many individuals’ transportation needs.

However, feasible improvements of the map methodology were identified as well. Firstly, transportation supply is usually tightly correlated with population density. This means that where densities are higher, there are usually more roads, bike and pedestrian facilities, and more transit options. Normalizing by population would partially account for this difference in transportation supply when considering only traditional measures of disadvantage. Both the research team and key informants were concerned that, without incorporating a population-weighted average into the quantitative data, some areas were misrepresented as being disproportionately disadvantaged. Due to the fact that rural areas often have low population density, a small number of residents in a census block can greatly affect the overall rating of that tract. Accounting for population in this way can be easily accomplished using GIS software. A second improvement would be the inclusion of existing transportation infrastructure in the map metrics. Ideally this would include sidewalks, bike lanes, bus routes, and extent of existing on-demand transit services, though these data may not always be readily available.

As a pilot program in collecting qualitative data on transportation disadvantage, this project was also meant to hone an efficient and accurate method to gather this information. One of the primary difficulties in executing data collection was identifying and contacting appropriate subjects for participation in focus groups of non-expert but interested citizens. The team concluded that focus groups should be scheduled for a separate visit after conducting key informant interviews. This would most likely ensure that informants understood the purpose of the focus groups, and could therefore provide the team with information on where to look for focus group subjects.

**Recommendations**
Furthermore, the team recommends that adequate time be allotted for gathering and analyzing data from each site. This specifically includes scheduling sufficient time between site visits, as well as not moving on to a new site until preliminary organization and analysis of data from the current site is finished. Additionally, due to the richness of the data, the team did not initially appreciate the amount of time that would be needed for synthesis and analysis. With this in mind, the team recommends careful management of field work logistics.

Finally, an important consideration for any future research teams reproducing this study is to approach analysis of the data without a preconceived focus on disadvantage. The purpose of this project was to identify transportation-disadvantaged populations; however, researchers should be wary of letting this lead to single-mindedness. Viewing the populations under study through a lens of disadvantage could skew one’s perception of data. Acknowledging the good and functional aspects of an area’s transportation condition is just as important as identifying its shortcomings. Additionally, the opinions of researchers and public servants regarding transportation disadvantaged populations do not always align with how residents view their own circumstances. Researchers should bear this in mind, and appreciate that not everyone with the “disadvantaged” characteristics considered in this project would self-identify as lacking adequate transportation.
Appendices

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Appendix A: Example of map produced by NCSU with threshold symbolization
Appendix B: Example of map produced by NCSU without threshold symbolization
Appendix C: Key informant interview instrument

Transportation deserts and transportation disadvantage

Key informant script and questions

These interviews are part of a project to understand what factors may explain which citizens are at risk of “transportation disadvantage,” meaning that their transportation options do not match well with their needs to travel to work, shopping, services and other activities. For this project, “key informants” are professionals such as planners or local government officials, or other local leaders knowledgeable about the residents of the community and about transportation patterns and options.

We are interested in learning about how easy or difficult it is for residents to get around to important destinations. In addition to interviewing key informants, we are meeting separately with a group of citizens to ask about their travel habits and needs.

Informed Consent

We appreciate your willingness to share your time and knowledge with us. This interview will last about a half-hour. We have taken steps to assure careful handling of the information you share with us. This includes limited access to the audiotapes and transcribed interviews (limited to seven undergraduate students, two graduate students, and three faculty advisors). You may choose not to answer any questions that you do not wish to answer. You may end this interview at any time for any reason. We will provide you with a transcript of the interview to review for accuracy.

We will not identify you or use any information that would make it possible for anyone to identify you in any presentation or written reports about this study. However, we note that you are a key informant with exposure in your community, and as such your views already may be well-known and your identity guessed by readers. There is no known potential harm to you for participating in this interview. There is no compensation for your participation. We will ask for your oral consent to be interviewed and recorded before we begin asking questions.

All research on human volunteers is reviewed by a committee that works to protect your rights and welfare. If you have questions or concerns about your rights as a research subject, or if you would like to obtain information or offer input, you may contact the Institutional Review Board at 919-966-3113 or by email to IRB_subjects@unc.edu. This project is IRB study #13-1531.

This work is part of a project being conducted at the University of North Carolina—Chapel Hill, by researchers at the Institute for the Environment.

You may direct questions to Dr. David Salvesen at dsalv@unc.edu or 919-962-7045, or to Dr. Elizabeth Shay at eshay@unc.edu or 919-966-0581.
Interview Questions

Thank you for taking the time to meet with us today. I’m [name], and this is my colleague [name].

We are here in [Chatham Co] today as part of a project to understand the factors that may help explain which people are at risk of experiencing “transportation disadvantage,” meaning that their need to travel to get to goods, services, and activities they value does not match well with their available transportation options.

We’d like to audiotape this conversation, so that we can refer back to it for accuracy. Is that ok with you? If so, we’ll start taping now.

1. Can you tell me about your work? Particularly, how is it involved with transportation?
2. Using this map, will you help us identify places in [Chatham County] that you would consider to be transportation deserts? By this, we mean places where transportation services and land use patterns don’t fit well with the needs of the residents.
3. What are some of the biggest challenges transportation-disadvantaged people face in getting where they need to go, such as to jobs, school, health care, social activities, groceries?
4a. Pittsboro is served by [regular transit to Chapel Hill, limited scheduled service to Siler City, and para-transit county-wide]. Can you show [map] where the greatest demand is for service?
4b. Are there areas not served by public transportation? [probe for location on the map]
5a. Do you know, roughly, what percentage of [county or city] population uses transit for any purpose? [% of population transit-dependent for some/all trips, NOT % trips made by transit]
5b. What would make transit a better option for people? [Probe: more frequent/better schedule]
6. Chatham’s population has experienced very rapid growth in population [~30% growth since 2000]. How do you kept up with changing demand for transport services? [and/or housing]
7a. Do you know what percentage of people in [county or city] walk or bicycle for transportation? [% of population, not % of trips]
7b. What policies or programs would make walking or bicycling a more viable transportation option in the community?
8. Do a lot of your residents drive very long distances to get to work or basic services? If so, why do you think that is?
9. One of the goals of this study is to determine whether we can use census data to identify places where people are likely to be transportation-disadvantaged. So, we used census data to make our own map of [Chatham County]. Would you mind looking at our map and seeing if you think we got it right? Are there places we missed, or places we identified that aren’t actually disadvantaged, in your opinion? We are trying to determine how useful this kind of data is in identifying the location of transportation disadvantaged populations?
10. Is there anything else you’d like to tell us about transportation, travel conditions, or the locations of housing and important destinations for the residents of [Chatham Co.]
11. Finally, can you advise us on convening a focus group of interested but non-expert citizens?

Thank you for your time and helpful information. If you have any questions or comments, please feel free to follow up with us at [contact info—business cards].
Appendix D: Focus group instrument

Transportation deserts and transportation poverty

Focus group—mapping exercise and discussion

Mapping exercise
Thank you for taking time to meet with us this [afternoon or evening]. My name is [name], and I’m here with my co-workers [name] and [name]. We are here [in county or city] today as part of a project to understand what factors may explain which citizens are at risk of “transportation disadvantage,” meaning that their transportation options do not match well with their needs to travel to work, shopping, services and other activities. We’d like to do quick introductions, just going around the room: your first name [and, if appropriate, city of residence, or other item].

We are interested in learning about how easy or difficult it is for you here in [county or city] to get around to important destinations. We want to start by spending 10 minutes on individual maps of [county or city], then have a discussion about your daily lives and routines and your travel options.

You each have a map of [county or city and nearby region], showing roads and major features [provide some map-reading hints, like: “here’s the intersection of Columbia and Franklin; here’s the municipal parking deck; and here’s MLK heading north toward Timberlyne”].

We don’t need your name or address; the maps will be kept anonymous. But please write down the number of children and adults in your household here [hold up map and show blank lines] and how many cars your have, if any. We’d also like to know your age, ethnicity, and your first or main language. This may be useful context as we learn about why residents of some areas find it easier or harder to get around and meet their routine household needs and participate in various activities.

Please mark your own key locations, like home, work, school, recreation or other common destinations. Then draw in your connections from home to major regular destinations, and write down how you travel, for example, walk, bus, drive, or carpool. Please also note travel conditions, such as heavy traffic or congestion, good or bad sidewalks, shade or sun, or steep slopes. We don’t need to know your actual route, although drawing it out may help you remember where you go.

Here’s an example, with this person’s home, school, job, park, and grocery store marked on the map. She drew a line from home to these locations and wrote down how she usually travels: walk to the grocery store and elementary school, both along decent sidewalks, and bus to work.

If you have any questions, just flag down one of us wearing names tags. [~10 min for map work]

Discussion
Thank you for taking time to map out your routine travel. After our discussion, we’ll return to the maps, and ask for some additional comments. We’d like to ask a few questions about your transportation options and whether it is easy or difficult for you to get around to your important destinations. We’ll write down answers and
comments on this easel, and also take notes on a laptop. But you may also give comments to any of the team members who are here, and we’ll make a note of it. A few ground rules: one person talking at a time, and everyone gets a turn—or turns—if they want to speak up.

1) Where do you travel on a routine basis? To get a sense for major destinations, would some of you briefly share what you drew on your maps?
   1a) How about weekend travel? Are your destinations and travel different from weekdays?
   1b) What about rare but important destinations: airport or hospital? How would you get there?

2) [For the whole group] Do you ever use the bus? If no, why not? If yes, how often?
   Where do you typically go on the bus?

3) What works well with your public transportation? What would you like to see improved?

4) Is public transit reliable enough to use for important trips, like getting to work or school?

5) How often do you walk or bike somewhere? Is it safe? Are there times you can’t walk or bike? Why? [probe shelters, crosswalks, sidewalks, lights, facilities, traffic, crime, etc.]
   Would you let your children walk or bike? Where? Under what conditions? [alone, with adult]

6) Can you recall a situation when you had trouble getting to work, school, or some other place because of a lack of adequate transportation? [If yes, ask some to tell the group about their particular situation] How often does this happen?
   6a) Can you describe trips that work well for you, that is, where it’s easy, affordable, and convenient for you to get where you need to go?

7) For those of you with a car: Could you get around reasonably well without it? Do you spend more, less, or about the same amount of time driving as most people in [county or city]?
   7a) For those of you without a car: In what situations would access to a car be most helpful?

8) Are there places you would like to go to, but can’t reach? Where?

Back-of-the-map questions
Thank you for all this useful information. This discussion has raised a lot of interesting points, and ties in to some questions on the back of your maps. We’d like to take some time now for you to return to those maps, and have you answer some questions on the back. Specifically:

1) Are there any trips you would take or places you would like to go to, but don’t? If so, what is keeping you from making those trips? [some controlled responses, plus “other”]

2) Do you ever carpool? Where to? With whom do you carpool? [family, neighbors, co-workers]

3) Where do you get your infor regarding public transit? [smart phone, website, maps, etc.] Do you have suggestions for improvements? [other languages, simpler, routes, bus stops, etc.]

4) Are there any things about your regular travel that you would like to change? If so, what changes would you make?

5) Do you have any other comments you think would help us understand why residents of some areas may find it easier or harder to get around to important destinations?

Wrap-up
Thank you for taking time to meet and talk with us. We can’t make any direct changes in your community, for example, changing your bus service. But we will share what we learn with some of your community leaders, and we hope it will contribute to more and better travel options for you. We’ll leave these maps on the tables, if you want to linger and see what people drew and said. You may reach us at [point to 1-pager with contact info]
Appendix E: Focus group consent form

Transportation deserts and transportation disadvantage

Beaufort County focus group
Thursday, March 21, 2013, 4:30pm
Skills Center, Beaufort County Industrial Park Conference Room
705 Page Road, Washington, NC

Focus group—recruitment and consent
Thank you for taking time to meet with us today. We are here as part of a project to understand what factors may explain which citizens are at risk of “transportation disadvantage,” meaning that their transportation options do not match well with their need to travel to work, shopping, services and activities. We are interested in learning about how easy or difficult it is for you to get around to important destinations. You were invited because you are a resident of Beaufort County, and may have insights into travel conditions and transportation options for you and other residents.

We will ask you to describe your major destinations and how you travel to them. During an open discussion with this group of about a dozen residents, we’ll take notes on an easel, and also make a note of any comments you want to share with us one-on-one, that is, if you don’t want to speak up publicly during the discussion.

This focus group will last about 90 minutes. There is no known risk to you, nor is there any incentive or payment provided to you. We are not writing down any personal identifying information, including names or addresses. We are not recording any audio or video during this event. Because we are not writing down any personal identifying information, we also will not request written consent from you.

You are free to decline to answer any particular question, and to stop participating at any time.

This work is part of a project being conducted at the University of North Carolina—Chapel Hill, by researchers at the Institute for the Environment.

You may direct questions to Dr. David Salvesen at dsalv@unc.edu or 919-962-7045, or to Dr. Elizabeth Shay at eshay@unc.edu or 919-966-0581.
Identifying Transportation-Disadvantaged Populations

UNC-CH Capstone, Spring 2013

Appendix F: Map for focus group exercise

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<tr>
<th># Adults</th>
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Are there any trips you would take or places you would like to go to, but don’t? If so, what is keeping you from making those trips?
- It’s too expensive to get there
- It takes too long to get there
- It’s too complicated to get there
- Travel conditions are too dangerous
- The buses don’t go there
- It’s too far away to walk or bike there
- Other _______________________________________________________________________

Do you ever carpool? Where to? With whom do you carpool?
- Family members
- Neighbors
- Co-workers
- Formal/arranged carpool
- Other _______________________________________________________________________

Where do you get your information regarding public transit? Sources might include paper schedules or brochures, paper maps, website, smart phone, electronic billboard, or others
______________________________________________________________________________

Do you have suggestions for better information about transportation options? These might include other languages, more readable information, additional information about routes or bus stops, or others
______________________________________________________________________________

Are there aspects of your regular travel you would like to change? These might include number of trips, route, time you travel, or how you travel (car, walk, bus). What changes would you make?
______________________________________________________________________________

Do you have any other comments you think would help us understand why residents of some areas may find it easier or harder to get around to important destinations?
______________________________________________________________________________
Appendix G: Example of coded transcript

Example Reconciled Coded Transcript

Mi-Oh, great,
I3- So I work with them very closely, and we are, the bike ped board is, tasked to implement the bike plan that we have actively on the shelf, and, as far as policy goes, I don’t know.
I1- I think bike routes, we’ve required bike routes with any new development.
I1- And we’ve noticed they’re getting used at some of the establishments, like Olive Garden it’s probably like a kitchen staff person or something you know there’s a bike, the new Golden Corral, ya, so there’s certainly industry type use.
I3- It is isolated work, and it is nice to see it, because it is sort of breaking ground on that level.
M1- Is that mostly in the downtown area of Wilson, or just throughout the city of Wilson?
I3- Well the bike racks would be any new development.
M1- In the city. Okay.
I3- Ya, the bike racks or any new development in the city, the bike routes are, have yet to be really formally established. We have, a large community of bike users, along with the car, if they don’t have a car, their second mode of transportation would probably be a car, versus the transit.
So we do have a large user group for bicycles, it’s the routes we need to establish that’s the safer use of the routes, and the connectivity, we’ve implemented some sharrows on at least one segment of road that is a stencil on the ground of the little bicycle with the Chevron.

Aa & Mi- Mmm.
I3- To bring awareness, to motor vehicles that this is a chosen route for bicycles to use, so just share the road, sharrows, and we’re going to continue to implement those and hopefully make more connectivity from the center city and out, bike lanes. umm, formally no bike lanes, we have wind of a project coming on Corbit one leg of our roads that shoulders are going to be widened and bike lanes are going to be put on that segment, that is, I wouldn’t say that’s more of a commuter bike, it’s leading you out of the city, so a lot of recreational people who ride their bikes along the distance to get out of the cities to ride the country roads and what not. So for intra-city bike use, we can certainly spend more efforts into getting that more and more established, and funding is of course an issue.
M1- So for the bike routes, you’re looking at the difference between recreational and possible commute routes?
I3- Ya, we have proposed greenway.
I3- Ya, we have proposed greenway that we’re hoping to make more of a recreation multi-modal at some segments but also perhaps that can facilitate more commuting as well. The greenway is in its very beginning stages of planning and the folks that we using bikes right now are just willy nilly all over the place, and oftentimes it’s a safety concern for everyone involved and I worry especially for the bicyclists.
Mi & Aa- Ya.
I2- Like riding against traffic.
I3- Ya, there’s an educational component that really needs to be enforced, or make aware of from the community and the bike ped board would be a good use for that as far as getting educational and awareness out to the general community. that literally they are supposed to operate as a vehicle on the road. You can walk as a pedestrian, but...