

**Analyzing Charlottesville Transit: Investigating Modes of Public Transit in Charlottesville  
and Their Effect on Resident Mobility**

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On my honor as a University Student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments

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## STS Research Paper

### Framework

This study was heavily reliant on the Social Construction of Technology (SCOT) framework in order to first understand how the community's needs should shape the potential implementation of any solution. The SCOT framework relates technology to society by analyzing the social implications of the technology in question. The core concepts of the SCOT framework that this study explored when analyzing the technological frame of the artifact in question are relevant social group, interpretive flexibility, design flexibility, closure, and inclusion (Bijker, 2001).

This study utilized the SCOT framework to analyze multiple aspects of community interaction with current transportation systems in the Charlottesville area. Additionally, this framework was used to analyze the interactions that comparable communities have and unique solutions that might be beneficial to the Charlottesville area. Using the city of Charlottesville's public transit system as a technical artifact, this study breaks down how the components of the transit system, such as the transportation services, routes, and special community programs and offers, fit the population's needs. The residents of Charlottesville, both affiliates and nonaffiliates of the University of Virginia, were identified as the relevant social group of this study.

The design flexibility of this artifact, which can be described as the built-in versatility of a given technological artifact, was analyzed by evaluating of the usage and route options offered to the area residents. The interpretive flexibility of the technological artifact was analyzed by identifying the various responses to the transit system by different key demographics in the rider

population. By exploring these flexibilities, this study gives insight into whether or not the technological artifact is truly inclusive of the entire population it was meant to serve.

Finally, by assuming the key problem leading to the development of a regional public transit system is the need for residents to travel about the area, this study redefines the problem that must be addressed, explores potential solutions, and suggests further studies to support the validity of the new problem. By redefining the baseline transportation problem to fit the current community need, an avenue for closure will be opened for the analysis and repair of the social construction of this artifact.

Ultimately, the goal of using the SCOT framework in this study was to facilitate a proper investigation into the problems occurring with the mobility of Charlottesville residents and lay the foundation for the development of a true bottom-up solution tailored for the community.

## **Introduction**

### *Declining Transit Ridership*

In the past five years, Charlottesville Area Transit (CAT) ridership has plummeted by roughly 25% from the 2.4 million passengers who used the system in 2014. By the end of Fiscal Year 2019, ridership is expected to report a drop of an additional 100,000 passengers, another 4.2% (Progress, 2019). In the past year alone CAT has altered and discontinued routes, reduced services, and have dealt with revenue discrepancies stemming from a fare collection system

introduced in 2014 that has not performed as efficiently as expected (Bayne, 2014). Of the 13 routes that CAT operates in the Charlottesville area, only one route experienced an uptick in ridership between 2018 and 2019. Additionally, the Charlottesville area has also seen an uptick in service and ridership from the ride-by-request bus service, JAUNT. Between the 2017 and 2019, JAUNT has experienced a ridership decline much similar to that of CAT in most of the regions it services. However, rural Albemarle County was the lone region in area that experienced any increase in ridership. Not only did this region differ from the trend of decreasing ridership in most other areas in and surrounding Charlottesville, but the increase itself was drastic and worth noting. Between 2018 and 2019 alone, Albemarle County experienced a 72.3% increase in ridership. This regional outlier is the sole reason why JAUNT still posted a nearly 5% ridership increase between the fiscal years of 2018 and 2019 (*Mar-2019-Transit-Ridership-Report.Pdf*, n.d.).

### *Comparing and Contrasting Charlottesville and Nashville Public Transit*

As Charlottesville's population increases in both residents and students at the University of Virginia, the potential for unique interactions and successful engagements with students, faculty, and organizations between UVA and the Charlottesville community continues to build as well. However, the potential for these types of engagements is limited by the lack of access students have to the community and vice versa. The University of Virginia has its own internal transit service. However, this University Transit Service (UTS) is mostly limited to transporting students around Grounds. This system starkly contrasts the university and city interactions between other colleges, such as Vanderbilt, where the university's public transportation system is coordinated with that of the Nashville area (*Transportation Services*, n.d.). In fact, despite having

a substantially larger community to service, the Nashville Metropolitan Transit Authority (MTA) seems to provide more services to the region than CAT with Charlottesville. In 2014, MTA debuted their youth transit program, StrIDe, which allows high school students attending Metro Nashville Public Schools to utilize MTA transit services free of charge. In the year following the inception of this program, MTA experienced a 11% uptick in youth ridership which currently accounts for over 20% of total MTA ridership. In the following year, the StrIDe program itself experienced a 26% increase in ridership—boosting the program’s total to over 1 million (Nashville Metropolitan Transit Authority, 2016).

### *Innovative Methods with Design and Interpretive Flexibility*

The last part of this study focused primarily on innovative methods, some beyond the conventional means, that could potentially alleviate the aforementioned transit and mobility issues in Charlottesville. There are currently several studies and projects ongoing at the University of Virginia that are investigating ways to intuitively manage the bus route system in order to best suit the riders. In one study, researchers at the University of Virginia are developing methods where potential riders can effectively utilize heterogeneous transportation systems under disruptive events. Many urban centers have static responses to disruptive events, such as construction, weather, and natural disaster. Homogenous methods of responding to disruptive events are extremely inefficient given the lack of real-time data utilized to act appropriately (Yuan et al., 2018). A homogenous method, known as eRouting, was developed and tested in a major metropolitan area to aid the transit system’s responsiveness to such disruptive events. The testing of the eRoute system found that in a metropolitan with a bus system with 13,000 buses, a subway system with 127 subway stations, an automatic fare collection system with a total of

16,840 readers and 8 million card users, the transit system was able to increase the ratio of served passengers by a factor of nearly 12 and decrease the average travel time during a disruption by up to 82.1%. As Charlottesville progresses towards its smart city goals, especially with the expansion of the University of Virginia and constant construction in the city itself, it is reasonable to question whether CAT responses to disruptive events have been detrimental to the service itself.

Another study recently focuses on how other smart cities in the United States utilize smart routing technologies to assist in guiding them to their destination. These smart routing technologies are widely available through apps like Google Maps and can perform basic routing operations such as avoiding disruptive events, much like the eRoute system. However, these smart routing technologies can also guide commuters to their destination by mapping out their path utilizing combinations of transit methods. Though, smart routing capabilities are not only limited to finding the shortest path. The broad spectrum of what smart routing technology could consider when guiding a user can include safety, special attractions, services, disruptions, social proximity to other destinations, familiarity with neighborhoods, and other factors (Hendawi et al., 2017). The system in this study, coined preGo, allows users to adjust preferences, plan their trip based on factors such as start time, or estimated trip time, and automatically make adjustments to routing based on road conditions. User evaluation of this system found that the shortest path by time was not the greatest indicator of the preferred path by users. During the daily work commute, users did indeed prefer the system to find the fastest route to their destination—likely work or school. However, during night hours the preference skewed towards taking routes with less congestion, construction, or with the least extensive history of accidents.

On weekends, users preferred to take the scenic and more heavily serviced paths over any other to their destination (Hendawi et al., 2017).

### *Study Objectives*

In getting a better understanding of the extent to which ridership of public transit is decreasing in the Charlottesville area and where, we have a better chance at knowing if the social construction of the route systems is viable and sustainable for the Charlottesville area. By using Nashville as a model city, we see how an efficient transit system in a metro in close proximity to a traditional college campus operates. Given the similarities in the city-school structure, there is potential for Charlottesville to effectively model many characteristics of the Nashville transit system and its ability to cater to the city population as well as the Vanderbilt University population. Finally, by utilizing smart city mass transit projects as case studies like those mentioned above, a new framework for smart and community-focused technologies could be developed to further benefit the Charlottesville community. As the world progresses further into the digital age, these case studies demonstrate the effectiveness of designing routing systems dynamically to suit the environment while also ensuring users are able to utilize the transit system the way they desire.

### **Methods**

This study investigated trends in critical ridership information regarding total ridership by region and route usage by residents of Charlottesville. In 2017, 7.7% of Charlottesville commuters reported they utilized public transit as their main mode of transportation. This figure is surprisingly comparable to counties in Northern Virginia with higher population densities and

closer proximity to dense urban centers, such as the District of Columbia (Hudson, 2017). It is evident that, as recently as 2017, Charlottesville residents were utilizing public transit with more than double the frequency as mid-sized metropolitan areas with fewer than 1,000,000 such as Nashville and Charlotte. This study investigates if these figures demonstrate any trends or fluctuation over the past decade and how that might correlate with the recent decline in CAT ridership.

In order to gain a better understanding of the user perspective with regards to transportation in the Charlottesville area, individuals from two key populations were interviewed about their interactions with transit in the Charlottesville area.

The first population interviewed consisted of University of Virginia students. These students, however, were select individuals who regularly participate in activities, clubs, and work that require them to travel beyond Grounds frequently. This key characteristic of this target population makes the selected students more familiar with the greater Charlottesville area and the public transportation system than the average UVA student. In speaking with leaders of various Contracted Independent Organizations (CIO) at UVA who often engage with the Charlottesville community, I gained a better idea of how students feel about their ability to engage with the city. Few of the students I spoke with spent a significant amount of time during their undergraduate careers away from Grounds for purposes other than organizational work. Many cited a lack of reliable accessibility to the Charlottesville area early on as a main reason as to why they never felt inclined to engage with the city more. Since first-year students are not



permitted to have cars on Grounds, students are completely reliant on other modes of transportation to get around Grounds and Charlottesville. Once the habit of remaining entirely on Grounds is established, these students expressed how they felt less inclined to change even when they had their own vehicles following their first year. These students also expressed similar concerns with regards to CIOs they were a part of. With larger groups, coordinating community work or engagement is often difficult for UVA students, who often times find the crossover between using public transit at UVA and in the greater Charlottesville area unreliable and confusing.

The second target population consisted of users of public transit in the Charlottesville community. Although this study intended to poll several users from this population, much like the first population listed, nation-wide shutdowns of non-essential businesses and discouragement of unnecessary travel and in-person communication due to the COVID-19 virus hindered the ability to do so in this research. Instead, a social experiment conducted by Charlottesville environmentalist Sean Tubbs was utilized as a case study to gain insights into the rider experience for the average Charlottesville resident (Tubbs, 2019).

Further analysis of colleges and Universities with alternate transit setups, such as Vanderbilt, was also necessary to better understand if student interactions with the host city of their college/university are scarce nationally or if the issue is unique to UVA. By investigating Nashville city ridership, population car usage, and overall mobility, the study gained a baseline urban comparison to use as a reference to Charlottesville's transportation utilization.

## **Discussion**

The common denominator to the several issues that plague Charlottesville's transportation system is the lack of intuitiveness in the social construction of the transit system. Ridership continues to plummet in the region due to an overall lack of convenience to riders. Those who have vehicles often find their commutes are much more efficient using them as opposed to utilizing the CAT or JAUNT bus systems. In the social experiment conducted by Sean Tubbs, a Charlottesville resident and environmentalist, commutes were found to at times take up to three times longer using public transit as opposed to using a personal vehicle. Another major issue the Charlottesville community experienced was the lack of coordination in routing between the various bus systems available. Around the central UVA campus area, there is a great deal of overlap with the various public transit options. This has contributed to confusion and dissatisfaction among riders. Charlottesville area transit experienced its downward trend in ridership following the unveiling of their re-designed routes in 2013. Some Charlottesville residents cited a major issue was bus routing which that loops into the UVA campus unnecessarily, creating delays in their commute. However, service outside of central UVA becomes much scarcer. This suggests an unintuitive current routing system shared by both CAT and JAUNT that are failing to take advantage of the potential for ridership outside of central Charlottesville while overserving the UVA and central Charlottesville region. An in-depth surveying project of the Charlottesville and Albemarle region is likely necessary in order to construct a routing system that reduces overlap and appropriately serves the current needs of the area residents.

In addition to routing needs, public transportation in Charlottesville is severely lacking innovative technologies and programs available to the public to encourage ridership and interaction with the system. In Nashville, the StrIDe program serves as evidence that the transportation system was intuitively designed with social needs of the population taken into heavy consideration. The implementation of the program alone increased ridership significantly while catering to a select group of riders identified as a major rider demographic. In Charlottesville, CAT caters to University of Virginia students by offering free transit to students who present a student ID. CAT additionally caters to individuals under the age of 18 by offering free transit—an even more generous program than the StrIDe program that Nashville MTA has in place. However, students must apply for a special identification card to receive from CAT in order to reap the benefits of this youth program. The design of the program itself indicates a lack of coordination with the Charlottesville school systems. Compare this to StrIDe which saves the transportation system money and resources while also saving students the extra hassle of needing to apply to obtain access to the program by allowing the public school identification they already own to suffice for usage.

Finally, the technological mediums which the current transit systems use to operate are in need of a major redesign for both riders and the transit systems themselves. Currently, no Charlottesville public transportation systems utilizes dynamic routing techniques in response to heavy traffic or traffic disturbances. Given the frequent construction occurring in the Charlottesville area and the current routing system, which is heavily centered around central UVA, the lack of dynamic routing is seemingly a major source of inefficiency in the system. The first case study demonstrated how dynamic routing can drastically reduce transit times. Dynamic

routing also is inherently designed to avoid traffic disruptions and hazards, creating safer transits for riders. In the second study, riders valued safety above timeliness during all commutes outside of morning and evening rush hour. The second study also demonstrated how user-friendly mediums for riders to interact with are vital to their overall experience and willingness to utilize public transit in the digital age. Although CAT, JAUNT, and UTS all utilize apps that are accessible on mobile devices to riders, the functionality across the apps used by these three services varies. CAT in particular is noted in Tubbs' social experiment to be late or inaccurate in its route reporting, leading to missed busses and long wait times. Students of UVA also expressed frustration and confusion with needing to utilize multiple applications in order to navigate downtown by using a combination of CAT and UTS buses. These studies suggest the potential technological solution to Charlottesville's transportation problem is two-fold and must be constructed intuitively with both the city and the users themselves in mind. On one hand, the transit system itself must be designed to be efficient and navigate the city for its riders in a safe and timely manner. On the other hand, the rider population is not homogenous and the transit system must also account for the various social needs and objectives of its users.

The second study also makes a case for the integration of new technological takes on currently existing map and routing apps. Every year, thousands of new students enter the University of Virginia, the vast majority of whom are not familiar with the Charlottesville region. Without access to their own vehicles, they are reliant on the aforementioned transit systems in the city to travel about the Charlottesville area. A system like *preGo* could be shaped to greatly aid students in utilizing public transit to explore and familiarize themselves with the Charlottesville area safely and efficiently. By coordinating between the various transit services available and

constructing such a system to be tailored to the Charlottesville area, the number of students interacting with the community could increase, thus increasing overall transit ridership in the region. Given the concerns expressed by UVA students regarding how confusing transportation can be in Charlottesville, personalized routing could not only increase CAT ridership, but also encourage student interactions with the city of Charlottesville.

## **Conclusion**

The public transit system in Charlottesville is unideal and lacks the proper social construction to effectively serve the regional population. City residents have expressed dissatisfaction with the inconsistent routing throughout the area for all three major transit services and the disproportionate amount of attention that the University of Virginia area receives. Personal vehicles are preferred overwhelmingly over other modes of transportation in the Charlottesville region by those with access to them. Even amongst University of Virginia students, who arguably have the greatest ease of access to public transportation services in Albemarle County, privately owned vehicles are a popular transportation medium for non-first-year students. For these students confusing route systems, lack of synchronization between the available transportation services, and inaccurate reports of wait times on apps were the main cause of dissatisfaction. The lack of catering to potential riders who are demanding access and the lack of ridership among those with the most access demonstrates how inadequately fit this transportation system is to Charlottesville region. A study of personal vehicle usage by University of Virginia students in comparison to similar institutions would be worthwhile in order to gain a quantitative understanding of the efficiency of the transportation systems in place, or lack thereof. Future studies into Charlottesville vehicle emissions compared to similarly sized regions would also be

worthwhile to shed light on the true impact this inefficiency has on the region besides the lack of rider satisfaction.

For those without personal vehicle access, the current setup of the transit system in Charlottesville has left them with few options, but to deal with the unideal circumstances or be isolated. A social study into the effects of the current state of the transportation system on their ability to seek and retain employment, take care of their families, or leave their homes for non-essential purposes such as eating at local restaurants is warranted.

Quantitatively analyzing the effect of Charlottesville's current transportation setup and gathering further insights into its impacts on resident lives will provide further context for the argument that the system is failing area residents. An argument can also be made that the current setup of the regional transportation system adversely affects the economy as well as the environment for the Charlottesville area. Data from further explorations into the aforementioned topics as well as the evidence and arguments provided in this study will prove useful to any effort to persuade decision makers in Charlottesville to alter the social construction of the regional public transit system to better suit the population.

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