SUSTAINABLE **TRANSPORTATION** STRATEGIES

& THEIR APPLICATIONS IN **UNIVERSITY** DESIGN

A RUTGERS UNIVERSITY UNDERGRADUATE
LANDSCAPE ARCHITECTURE THESIS
WRITTEN & ILLUSTRATED BY
JESSIE WOODS

SUSTAINABLE TRANSPORTATION STRATEGIES AND THEIR APPLICATION IN UNIVERSITY DESIGN AT THE COOK/DOUGLASS CAMPUS

BY
JESSIE WOODS

PRESENTED TO THE HONORS COMMITTEE
FOR PARTIAL FULFILLMENT OF A
GEORGE H. COOK SCHOLARS PROJECT

WRITTEN UNDER THE DIRECTION OF
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AT THE COOK/DOUGLASS CAMPUS

I HAVE REVIEWED THE PROJECT CONDUCTED BY JESSIE WOODS
AND I ENDORSE ITS CONSIDERATION FOR THE
GEORGE H. COOK SCHOLAR AWARD.

HOLLY NELSON, PROJECT ADVISOR
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PROJECT OVERVIEW

DESIGN RESEARCH

The more environmental and science based realms of landscape architecture are based on quantitative and qualitative facts, numbers, and systems that are produced by standard scientific research. Public space and system design requires an entirely different form of investigation.

Because landscape architects are responsible for designing the space that people use, it is crucial to understand how the people use the space. It is because of this fundamental concept that landscape architectural research is a highly observational and experiential analysis of what physically exists, how it functions socially, and the implications and opportunities for change that lie within the two. These concepts are in the field that is known as ‘environmental-behavioral research’.

Furthermore, designers learn and gather new conclusions through the process of design itself. By figuring out what works, what doesn’t work, and how it works, new ideas, solutions and discussions are generated. This project utilizes this theory of observational and environmental-behavioral research and test design to investigate the role of sustainable transportation in the campus environment.

THE **QUESTION**

Can network connectivity and sustainable infrastructure be designed in such a way that encourages bicycling and gives the power back to the pedestrian on the Rutgers’ Cook/Douglass campus?

THE **GOAL**

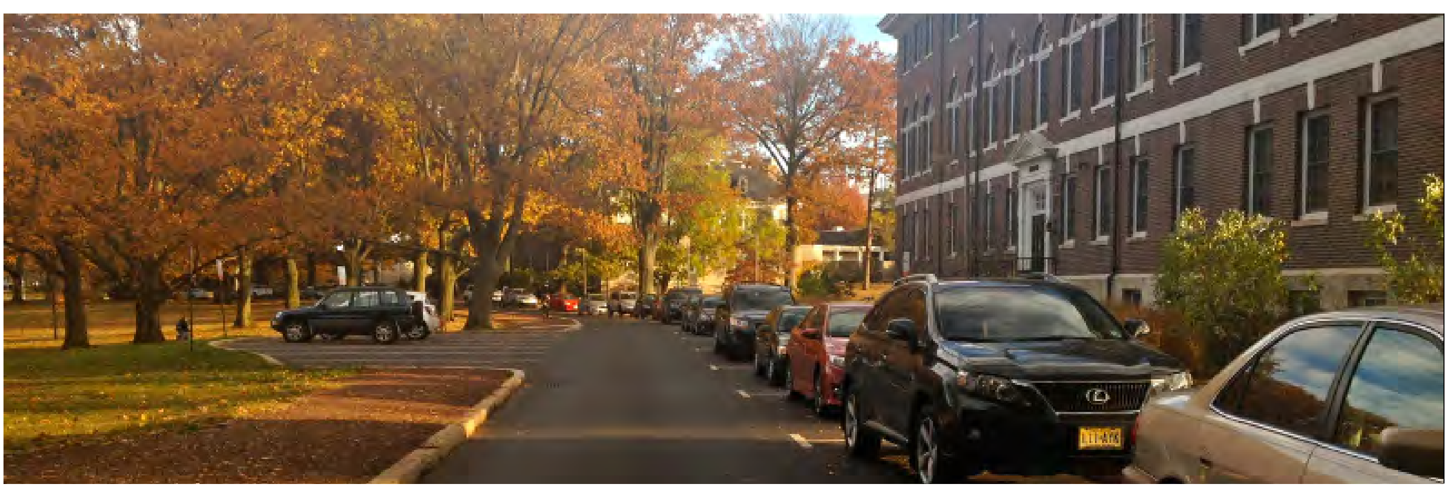
In the fast-paced lifestyle of today's society, vehicles undoubtedly rule the roads. What many people fail to realize is that our current road and highway system design is equally to blame for this automobile dominance as is the population's reluctance to change to different modes of transportation. In the past, the design of transportation infrastructure has been primarily focused on getting vehicles from point A to point B as quickly and efficiently as possible. As a result, pedestrians, bicyclists, and other travelers are struggling to compete for the roads and more often than not, the conditions for these users are less than ideal. When walking or biking isn't safe, enjoyable, or fun, who can blame people for just jumping in their car and getting to the destination faster? If we, as a society, want to make the shift to more sustainable methods of travel, we need to redesign our current roads and systems with a completely new mindset.

Complete streets or 'sustainable streetscapes' are designed, livable streets that aim to eliminate vehicular dependence by "making streets safe, [attractive], and accessible for non-motorized travelers who [have] previously been left out of the equation" (Lee et. al, 2005). This theory of transportation reform stimulates a shift from conventional automobile-dominated ideologies to a new principle that places a large emphasis on improving pedestrian, bicycle, and public transit conditions while also increasing the potential for environmentally sustainable interventions- thus providing numerous environmental, health, safety, social, and economic benefits. When streetscapes function efficiently, accommodate all users, and become beautiful landscape corridors, people are compelled to take alternative modes of transportation and as a result, decrease the priority of vehicular traveling. Although the primary objective of sustainable streetscapes is to change the way we move, they also end up changing the way we live. Traveling transforms from a daily inconvenience to an enjoyable activity, and streets transform from places we avoid to places we are drawn to.

This project aims to retrofit, revitalize, and ultimately change the culture of the current road and transportation system on the Rutgers University Cook/Douglass Campus in order to make the shift to a more pedestrian and bike friendly environment that promotes the use of alternative methods of travel.

College campuses are unique environments— microcosms of society in which the student body shapes and defines the land and its functions. While the rest of the population may have more reluctance and fewer resources to change, the forward-thinking nature of Rutgers University and its students provide the opportunity for the Cook/Douglass Campus to become a catalyst for community-based complete streets and environmental sustainability. A sustainable streetscape strategy for the Cook/Douglass Campus seizes the unmet opportunity for the campus to become a laboratory for sustainable environmental design, transforming Rutgers University into a precedent for the public to permanently change the way we think about transportation.

This project is conceived as an individual part of a collective sustainable plan of action for the Rutgers University Cook/Douglass Campus. While Sustainable Streetscape Strategies is in itself a complete and comprehensive research exploration, it has an exponentially greater potential to have an influence beyond campus boundaries when integrated with additional sustainable strategies. Utilizing the design methods and processes taught in the Department of Landscape Architecture curriculum, I worked collaboratively with two George H. Cook Scholars, Michelle Hartmann "*Sustainable Social Space*" and Rebecca Cook "*Sustainable Stormwater Management Practices*", to generate new hypotheses and draw conclusions that will later be synthesized in certain areas to form a cohesive analysis for the Cook/Douglass Campus.



SUSTAINABILITY DEFINED

Source: *Globe in the grass.*

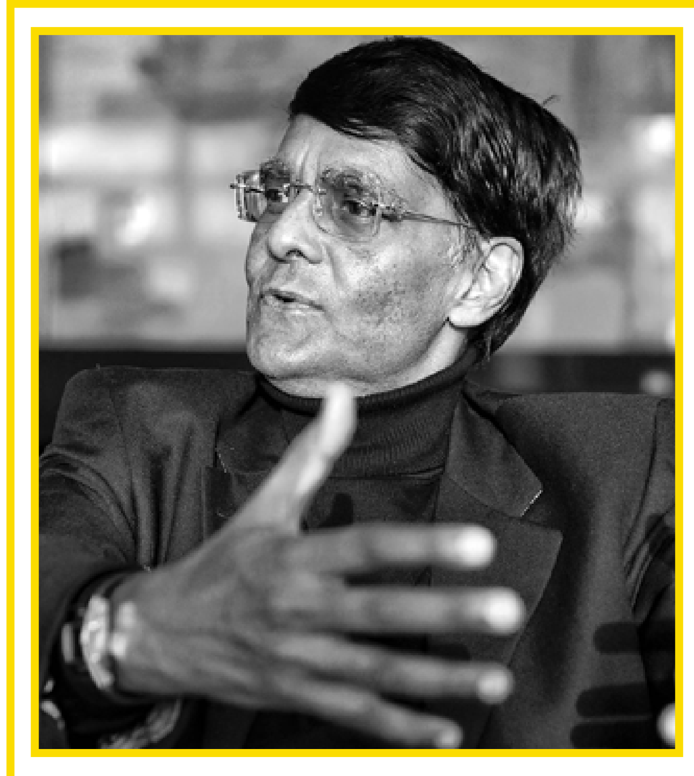
"A **SUSTAINABILITY** is commonly defined as the ability to **MEET THE NEEDS** of the present without compromising **THE ABILITY OF FUTURE** generations to meet their needs. Beyond some sufficient level of continuous functioning, however, sustainability represents **MORE** than just the mere ability to survive and get by, but **TO THRIVE**."

- Mission Statement of the Office of Environmental Sustainability, Oberlin College

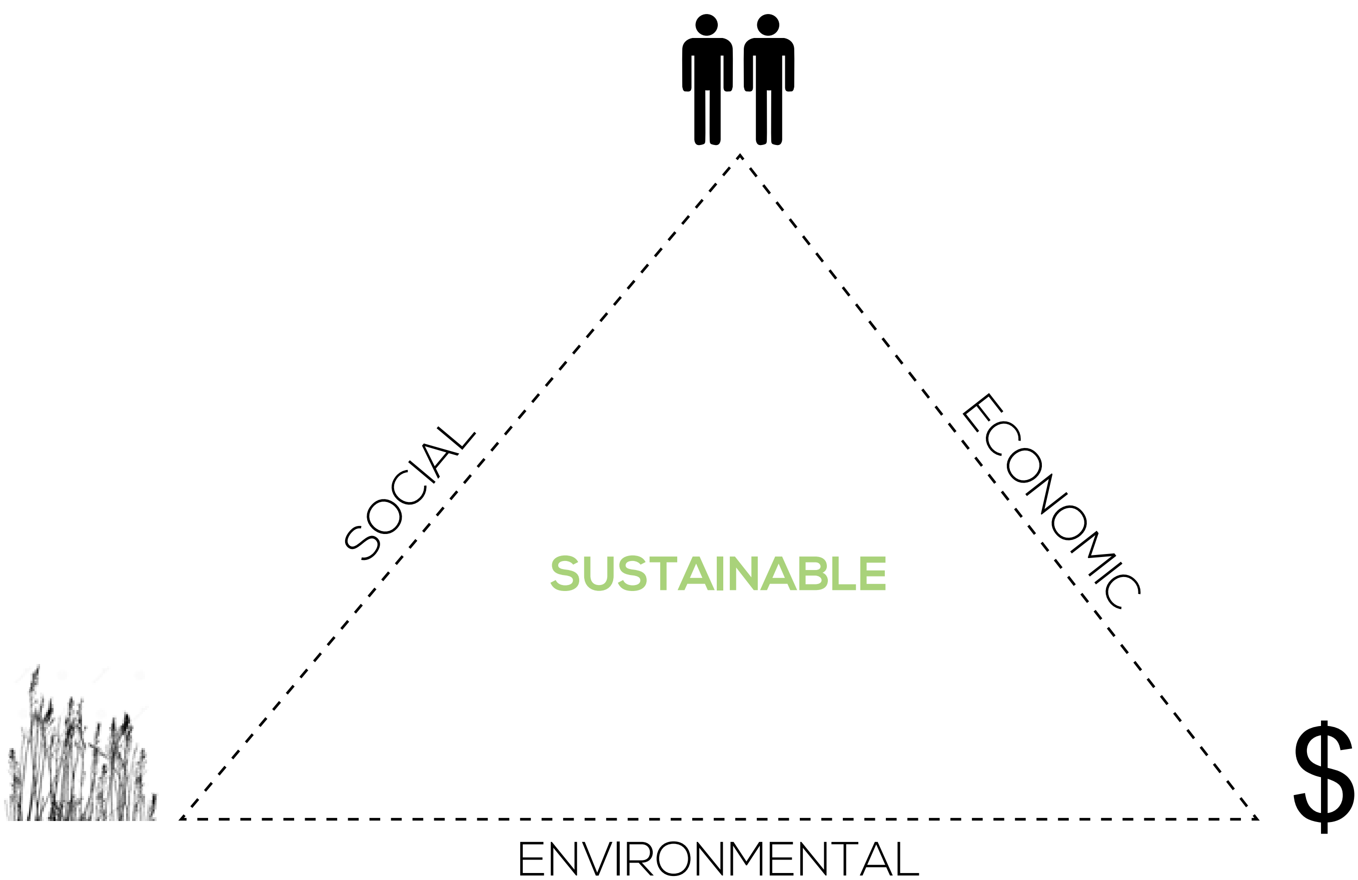
THE **REAL** MEANING

The word 'sustanaibility' is used thousands of times a day and in a variety of contexts. It has become a buzzword of sorts, like 'green' and 'organic', that starts to develop diluted definitions the more it is tossed around. So what exactly does sustainability mean? My first step in this project was to define and adopt a definition of sustainability that coincides with my own beliefs and objectives so that I could move forward with clarity in my research and design. The most widely recognized definition was released in 1987 by the United Nations World Commission on Environment and Development, stating that sustainable development is "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (United Nations, 1987). To me, sustainability expands beyond this definition and encompasses an even more innovative and resourceful way of thinking that aims to flourish, not just endure. The goal is bigger than simply balancing what we need with what we use and living within our means, but to design and develop things and ideas that restore the environment to a greater condition than which we found it. The Office of Environmental Sustainability at Oberlin College captured this concept clearly and succinctly (*above*).

Sustainability is all about balance. When the needs of the present are met without compromising the needs of the future, there is an equilibrium between all of different factors. It is important to consider what factors are involved and how the relationships between them function to be able to steer towards sustainability. According to Professor Mohan Munasinghe (*right*) who created the sustainable development triangle theory, a society is sustainable in the overall sense of the word when economic, environmental, and social factors are in harmony. Sustainability incorporates the mutual interests of all three domains (i.e. growth, stability, resilience, resources, governance, etc.) in order to function at the highest collaborative efficiency. Understanding the theory of sustainability at the larger scale provides me with the concepts and tools necessary to analyze what exactly sustainable transportation entails, how it works, and how to apply it to the Cook/Douglass campus.



Source: *Professor Mohan Munasinghe*



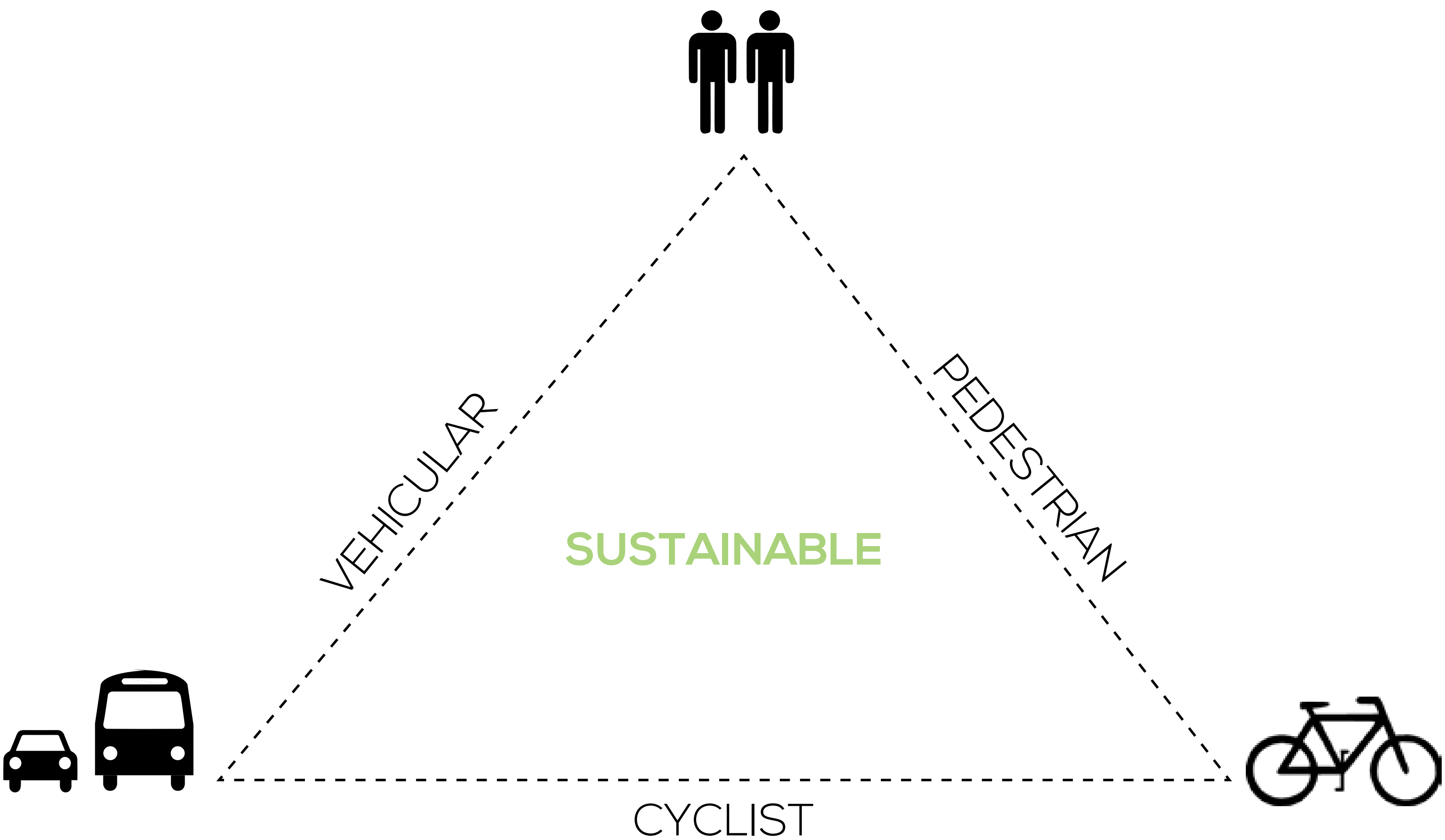
"A **SUSTAINABLE TRANSPORTATION SYSTEM** is one that:

allows the basic needs of individuals and societies to be met **SAFELY** and in a manner that is consistent with **HUMAN** and **ECOSYSTEM HEALTH**,

is **AFFORDABLE**, operates efficiently, offers **CHOICE** of transport mode, and supports a vibrant **ECONOMY**,

LIMITS emissions and waste within the planet's ability to absorb them, **MINIMIZES** consumption of non-renewable resources, reuses and **RECYCLES** it's components, and minimizes the use of **LAND** and the production of **NOISE**."

- The University of Plymouth Centre for Sustainable Transport

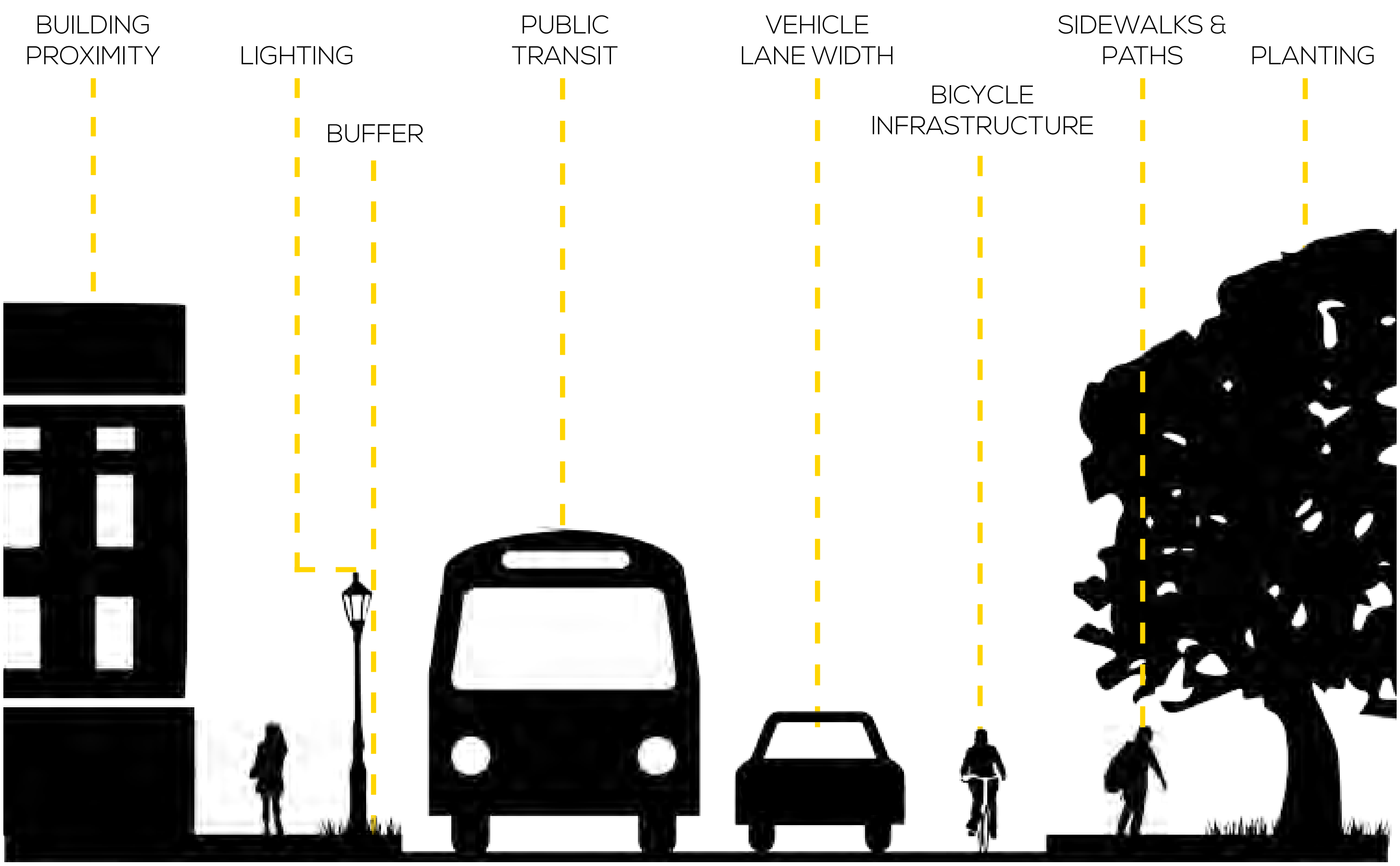


Sustainable transportation is often though of in terms of alternative forms of fuel, emissions reductions, and new 'green' car models. While these are valid long-term goals, they are such vast, complex problems that require years and years of research and thus seem almost unattainable. The reality of sustainable transportation is far more fundamental and realistic than this. The definition from the University of Plymouth Center for Sustainable Transport represents the culminating ideal of what a sustainable transportation system achieves (*left*).

What I have gained from my research is that there are two main short-term goals that are the most important to achieving a sustainable transportation system: a cultural shift in the way that people perceive day to day travel methods, and an improvement in or creation of infrastructure that stimulates this shift. To achieve this, the answer is more feasible than ground-breaking technology and research. In redesigning the roads, networks, and paths that exist, there are simple components of the urban street fabric that can be modified to move towards achieving this balance (*below*).

The balance and priority of all three user groups is dependent upon the context of which the system is within. For example, a highway streetscape will inevitably put the dominant focus on vehicles because the speeds that are permitted do not create a suitable environment for pedestrians and cyclists. In order to achieve such a large change, it is important to be realistic in the sense that achieving the perfect balance between all users is the ideal, but sometimes slightly impractical. It is in this frame of mind that the university context provides a unique urban opportunity. The amount of people that are traveling for often and for short periods of time to short distances combined with the sheer number of students and other people within a university emphasizes that the focus should be at the human movement scale; that the pedestrians and bicyclists should take larger priority in certain areas. Unlike other urban areas where it really is all about accommodating the entire spectrum of users all at once, and where standard regulations have more hold, Rutgers University has the opportunity to become a laboratory for transportation system and streetscape designs that are heavily weighted towards people rather than vehicles.

STREETSCAPE DESIGN: WHAT TO CONSIDER



OBSERVATIONAL **ANALYSIS**

SITE INTROUCTION

Red Oak Lane, Cook Campus. *Photograph by author.*

Located on the banks of the Raritan River, the Cook/Douglass campus is the vegetated, open heart within he rapidly urbanizing city of New Brunswick, New Jersey. The campus maintains the true identity of Rutgers University as a land-grant college with its green lawns, tree-lined streets, and fields. The character of Cook's agricultural farmland beginnings and Douglass's Georgian-style architecture are prevalent today.

Historically and logistically speaking, Rutgers designates Cook and Douglass campuses as separate entities. Each is home to a different school within the university; Cook campus is the home base for the School of Environmental and Biological Sciences and the New Jersey Agricultural Experiment Station and Douglass is home to the Douglass Residential College.

Although Rutgers still distinguishes between the two, they are often referred to as one joint campus and the boundary between them is not clear cut. For the purposes of this thesis, the Cook and Douglass campuses are investigated as a single entity.

Despite it's green interior, the campus is surrounded by major thoroughfares and roadways. As seen by the disjointed campus boundaries on the context map (*right*), it is fragmented by highly trafficked roads like George Street, Ryders Lane, and Route 1. For this reason, the Cook/Douglass campus is an interesting and challenging site for the exploration of sustainable transportation dealing with not only a large student body but constantly increasing influxes of traffic and congestion.

CONTEXT MAP

TO COLLEGE
AVENUE CAMPUS
HIGHLAND
PARK
RARITAN RIVER
DOWNTOWN
NEW BRUNSWICK
RT. 18
RT. 1
RUTGERS
COOK/DOUGLASS
CAMPUS
WESTONS MILL POND
MILLTOWN
0
0.25
0.5 MI
N

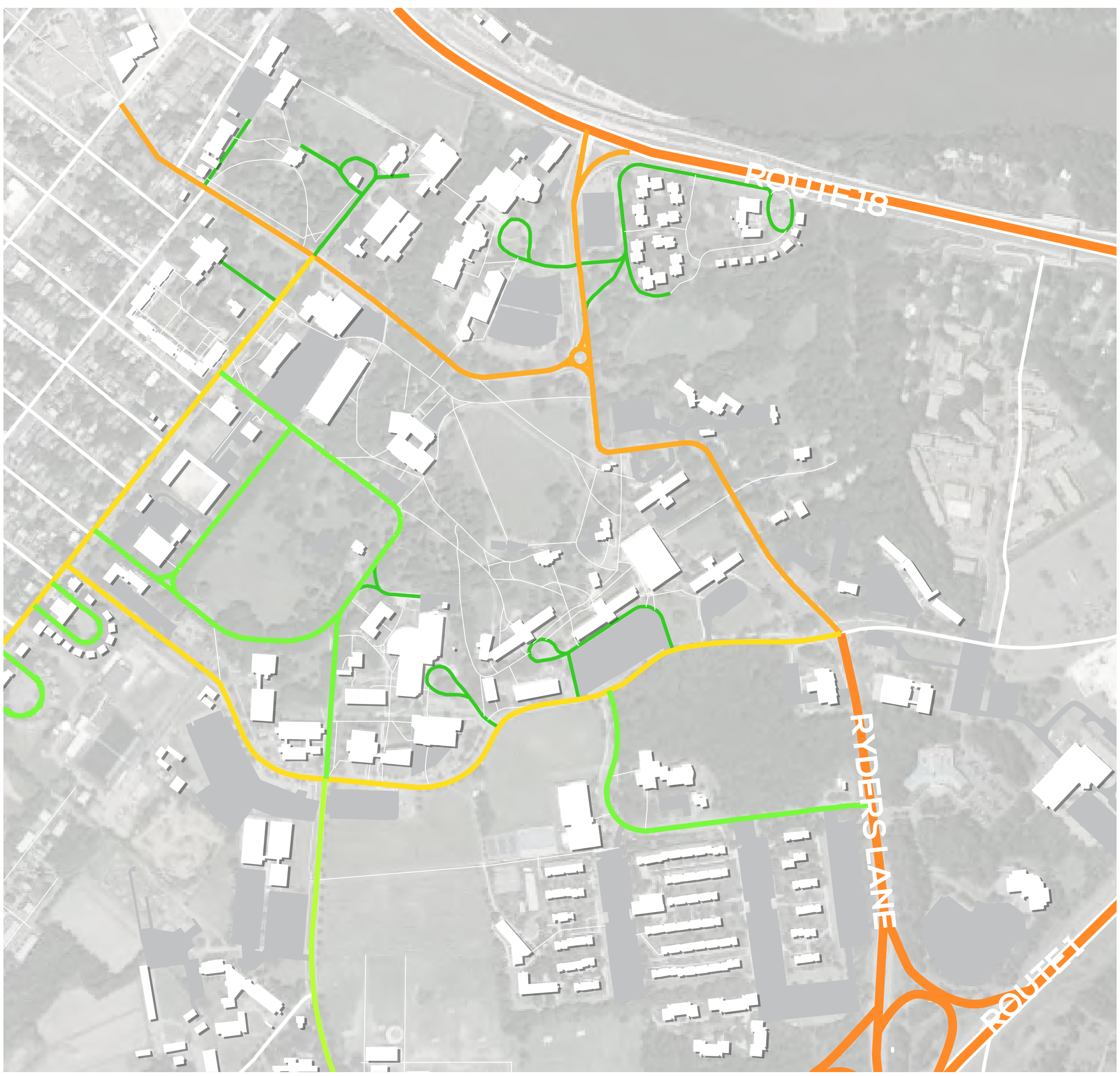
Why is Cook/Douglass such a heavily vehicle reliant campus when it has the potential to be a pedestrian and bicycle oriented community?

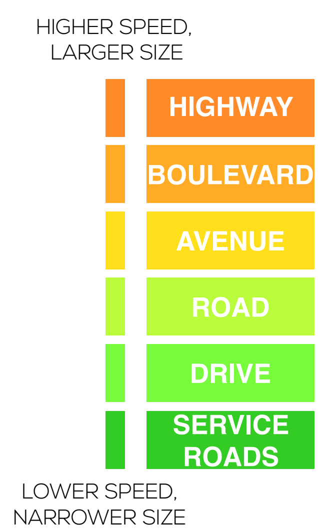
In order to understand how the campus is navigated, the function and identity of the current road and pathway system must be understood. The most commonly used standard system to classify streets and highways is the Federal Highway Administration's Functional Classification System, which groups roads into three overarching categories: arterial, collector, and local roads. Arterial roads "provide the highest level of service at the greatest speed for the longest uninterrupted distance, with some degree of access control", collector roads "provide a less highly developed level of service at a lower speed for shorter distances by collecting traffic from local roads and connecting them with arterials", and local roads "consist of all roads not defined as arterials or collectors [that] primarily provide access to land with little or no through movement" ("Flexibility in Highway Design: Functional Classification System," 2012).

While the Functional Classification System is widely accepted and used, I believe that these categories are too broad and general to properly classify the types of roads and paths on the small scale of the Cook/Douglass campus. The system fails to specify some of the most important identifying characteristics of smaller roadways, such as surrounding building context, landscape, users, and method of travel that are vital to understanding the intricate but intimate network on campus.

The American Institute of Architects' Street Classification System successfully takes these as well as additional factors into account and simplifies them into ten comprehensive categories that are listed in Figure 1 (*right*).

CAMPUS ROAD CLASSIFICATION



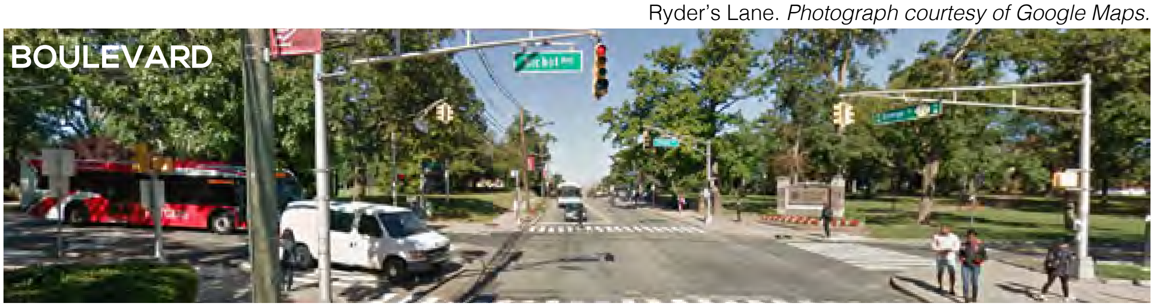


AIA STREET CLASSIFICATION SYSTEM

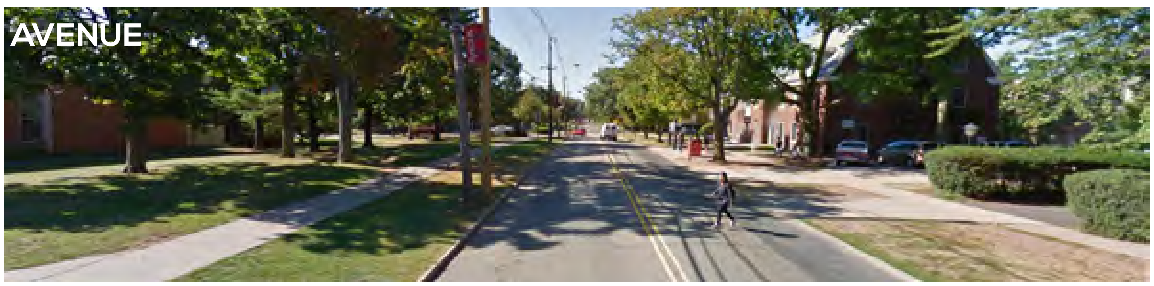
HIGHWAY	Long-distance, medium speed vehicular corridor that traverses open country. A highway should be relatively free of intersections, driveways and adjacent buildings; otherwise it becomes a strip, which interferes with traffic flow.
BOULEVARD	A long-distance, medium speed vehicular corridor that traverses an urbanized area. It is usually lined by parallel parking, wide sidewalks, or side medians planted with trees. Buildings uniformly line the edges.
AVENUE	A short-distance, medium speed connector that traverses an urban area. Unlike a boulevard, its axis is terminated by a civic building or monument. An avenue may be conceived as an extremely elongated square.
DRIVE	An edge between an urban and a natural corridor, usually along a waterfront, park or promontory. One side of the drive has the urban character of a boulevard, with sidewalk and buildings, while the other has the qualities of a parkway, with naturalistic planting and rural detailing.
STREET	A small-scale, low speed connector. Streets provide frontage for higher-density buildings such as offices, shops, apartment buildings, and rowhouses. A street is urban is character, with raised curbs, closed drainage, wide sidewalks, parallel parking, trees in individual planting areas, and buildings aligned on short setbacks.
ROAD	A small-scale, low speed connector. Roads provide frontage for low-density buildings such as houses. A road tends to be rural in character with open curbs, optional parking, continuous planting, narrow sidewalks, and buildings well set back. The rural road has no curbs and is lined with pathways, irregular tree planting and uncoordinated building setbacks.
ALLEY	A narrow access route servicing the rear of buildings on a street. Alleys have no sidewalks, landscaping, or building setbacks. Alleys are used by trucks and must accommodate dumpsters. Alleys are usually paved to their edges, with center drainage via an inverted crown.
LANE	A narrow access route behind houses on a road. Lanes are rural in character, with a narrow strip of paving at the center or no paving. While lanes may not be necessary with front loading garages, they are still useful for accommodating utility runs, enhancing the privacy of rear yards, and providing play areas for children.
PASSAGE	A very narrow, pedestrian-only connector cutting between buildings. Passages provide shortcuts through long blocks or connect rear parking areas with street frontages. Passages may be roofed over and lined by shop fronts.
PATH	A very narrow pedestrian and bicycle connector traversing a park or the open country. Paths should emerge from the sidewalk network. Bicycle paths are necessary along highways but are not required to supplement boulevards, streets, and roads, where slower traffic allows sharing of the vehicular lanes.

Figure 1. *(Source: American Institute of Architects,1998))*

Ryder's Lane. *Photograph courtesy of Google Maps.*



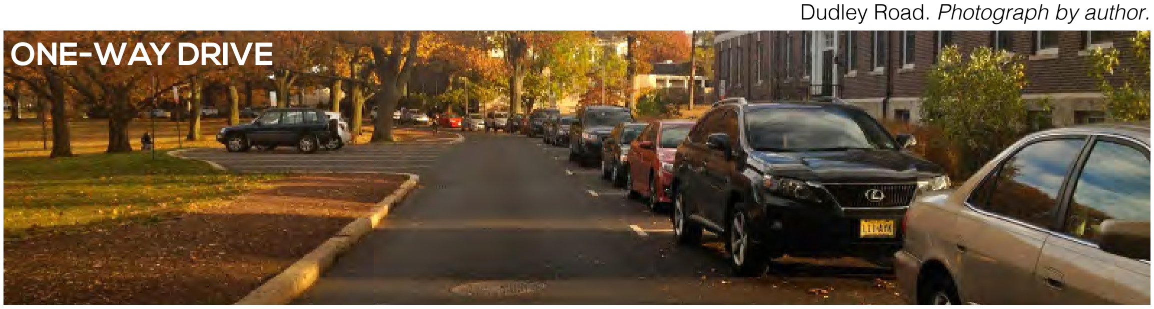
George Street. *Photograph courtesy of Google Maps.*



Nichol Avenue. *Photograph courtesy of Google Maps.*

College Farm Road *Photograph courtesy of Google Maps.*

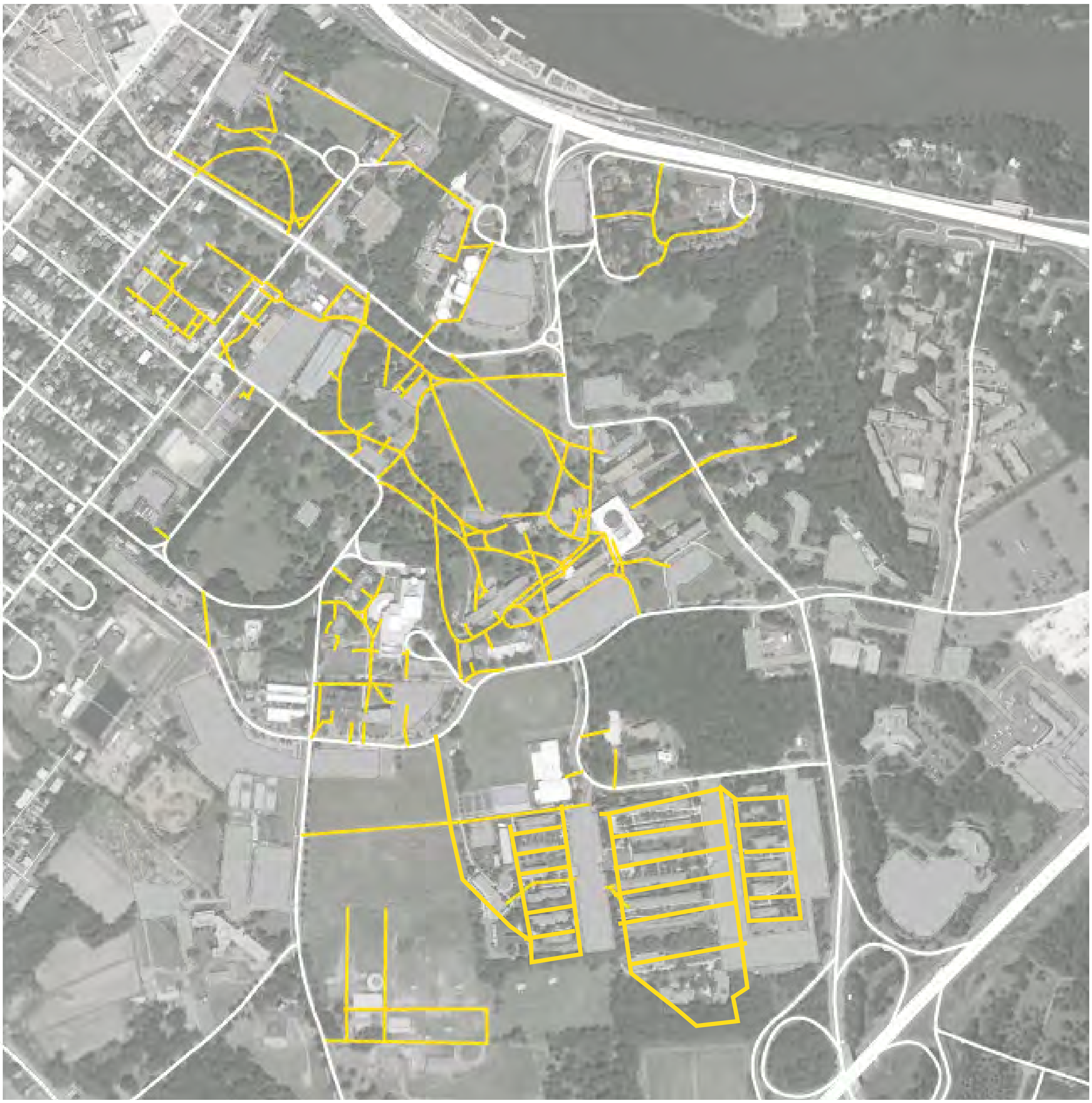
Dudley Road. *Photograph by author.*



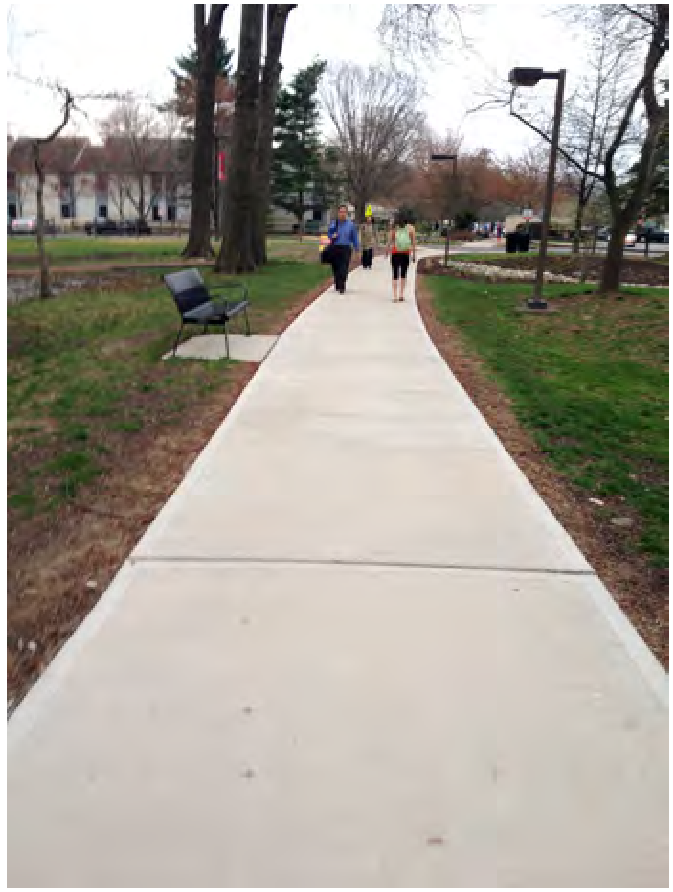
Lipman Drive. *Photograph by author.*

HIGHER SPEED, LARGER SIZE

LOWER SPEED, NARROWER SIZE



PATH CHARACTER



HARDSCAPE ANALYSIS

Roadways and paths are clearly at the forefront of site analysis for transportation and streetscape design explorations with regards to movement and location, but this network also requires connection to 'hardscape' infrastructure that is not sustainable. In the practice of landscape architecture and related fields, the term hardscape is used to refer to paved areas that are typically of a similar materiality (concrete, asphalt, stone, etc) that are typically impervious and do not allow stormwater to infiltrate into the ground. While hardscape materials are undeniably necessary for functions of heavy and frequent use (roads, select sidewalks), they are not the only options for others (paths, select parking lots).

On the Cook/Douglass campus, there is a staggering amount of hardscape coverage in an area that is considered to be the 'green heart' of the city. In addition to roadways, it is interesting to assess and calculate how much of the campus is devoted to hardscaped paths and parking lots. It would be an interesting opportunity to see how much parking and path hardscape could be reduced via changes in transportation habits to increase sustainability.

HARDSCAPE FIGURE GROUND DIAGRAM

TOTAL ROADWAY*

3.7 MILES

TOTAL PARKING LOT COVERAGE*

28 ACRES

** VALUES ARE APPROXIMATED.*

MODES OF TRAVEL

Rutgers is a unique campus in its structure and design- four large and distinctive campuses linked together by one of the largest collegiate bus systems in the United States. In terms of intercampus travel, the buses are the most used method of transportation. It is to no surprise that all four Rutgers campuses have been largely defined by their prominent transportation systems. In the effort to get from one place to another as quickly as possible, the once rural landscape of the Cook/Douglass campus is being developed to accommodate the high level of activity- but not necessarily in the most sustainable way possible.

With a constant influx of buses and cars navigating throughout Cook campus, pedestrian and bicycle circulation has fallen by the wayside along many of these main routes and in some areas, safety is an escalating concern.

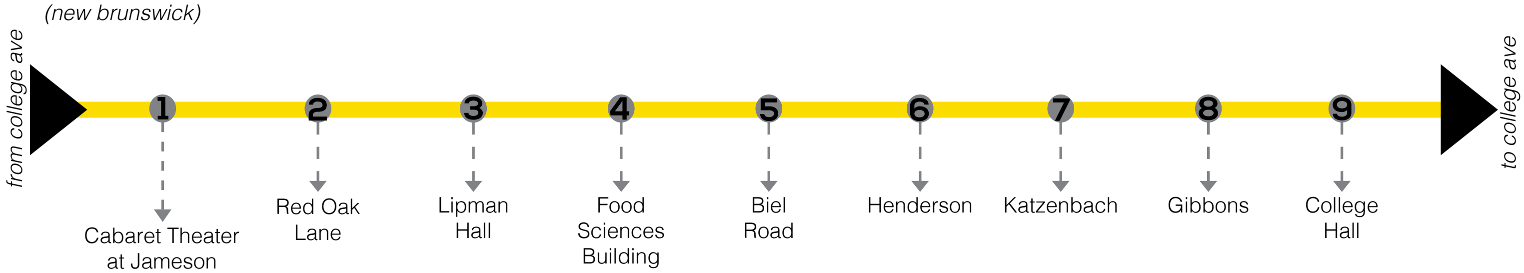
While the existing campus transportation is meeting the elementary needs of its users and provides a choice of transport mode, the system could be vastly improved to boost efficiency, safety, health and well-being, aesthetics, and the appeal of alternative modes of transportation in order to reduce the priority that is currently placed on bus and personal vehicle transportation. The following research is a thorough investigation of the Cook/Douglass segment of the Rutgers transportation system in terms of functionality, usage, and character.

What kind of insight can the first-person student perspective offer as both a user and a designer in this applied research?

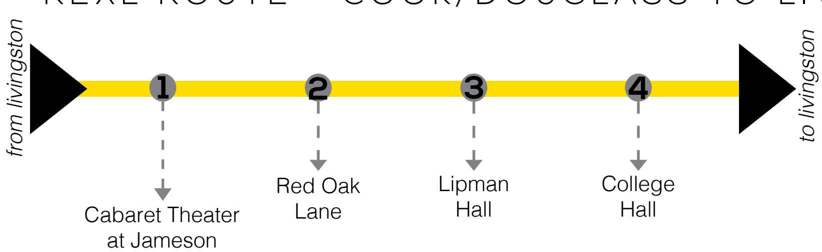
BUS STOP **SEQUENCE**

EE AND F ROUTES - COOK/DOUGLASS TO COLLEGE AVENUE CAMPUS

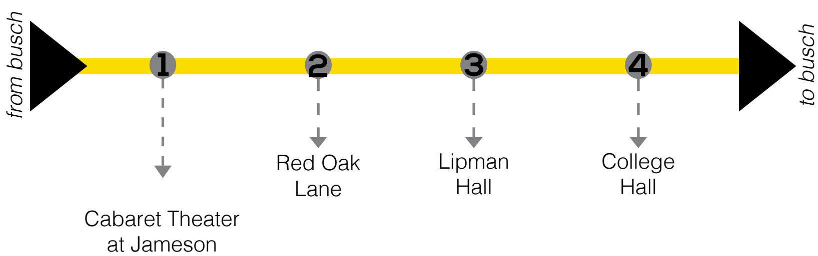
(new brunswick)



REXL ROUTE - COOK/DOUGLASS TO LIVINGSTON CAMPUS *(piscataway)*



REXB ROUTE - COOK/DOUGLASS TO BUSCH CAMPUS *(piscataway)*



ROUTE MAP

Photograph courtesy of BikeRu.

Photograph by author.

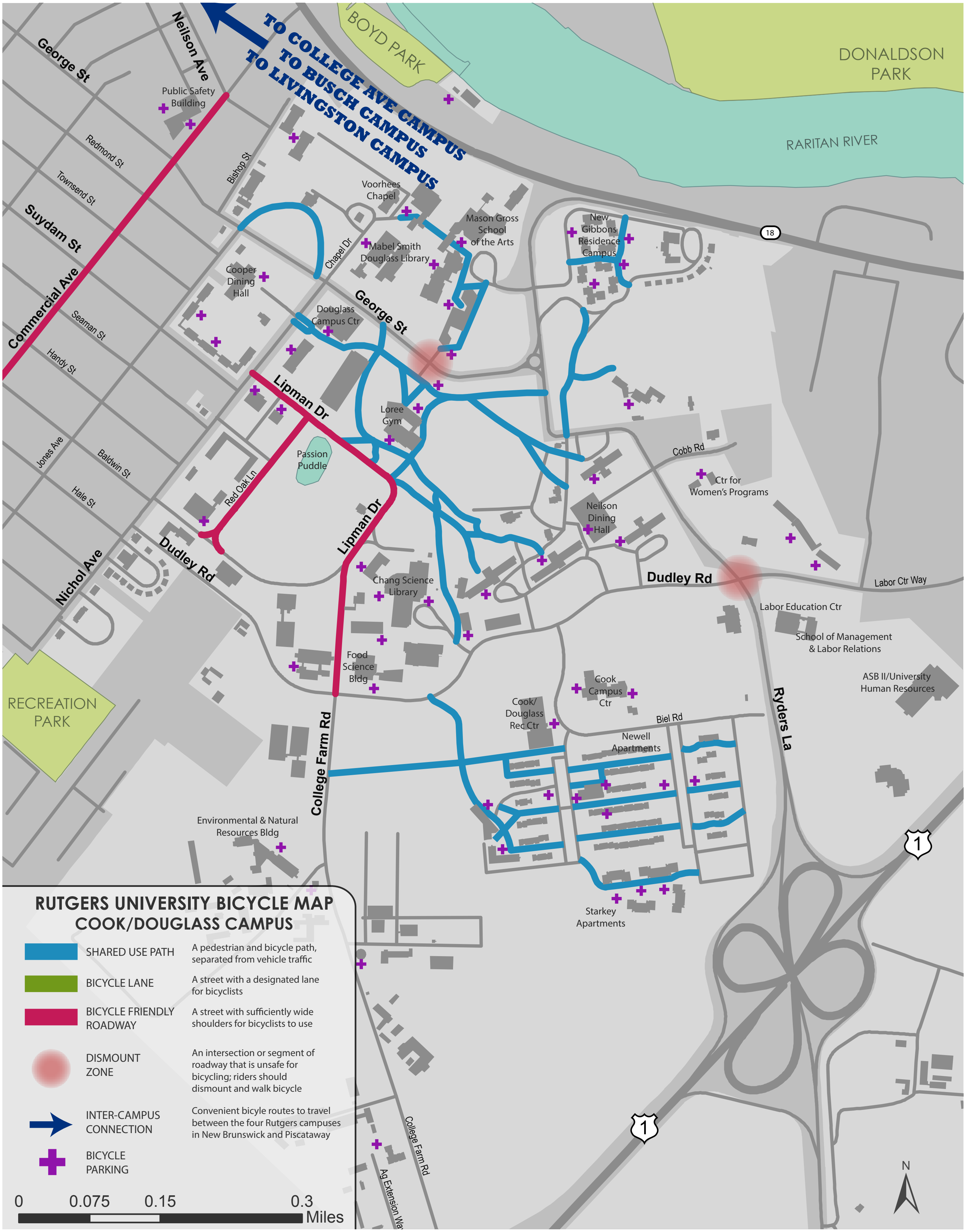
With sponsorship from the Rutgers Energy Institute, the Rutgers Green Purchasing Program and the Rutgers University Department of Transportations Services (RUDOTS) launched a bicycle rental pilot program that gives students the opportunity to rent bicycles for a specified length of time in order to encourage biking as a primary mode of transportation to and from class. The program initially started with 150 bikes available for rental at different pick-up locations on all four New Brunswick campuses. In its third year of operation, student interest in the program is on a steady incline, but to those students who are unaware of BikeRU's existence and procedure, attaining a bicycle is much more difficult. Still, BikeRU is steadily growing. Through personal experience, social media research, and interviews with the RUDOTS senior transportation planner and the manager of transportation planning, Dorothy Le and Jenn Stuart, I concluded that major hindrances to the program's growth lie in safety and aesthetic issues from deteriorating infrastructure, competition with vehicles, and availability of bikes.

While the program is becoming well-known, there is a large discrepancy between the number of rentals and the number of 'unique' rentals that shows that nearly half of the bikes rented are rented by the same group of users; this alludes to the assumption that there is a much higher margin of students interested in utilizing the program than there are bikes to rent. This data supports that expanding the program is a viable option.

In order to "shift gears", Rutgers has been working towards connecting campuses via designated bike routes. It's easy to draw a line connecting routes and areas in plan view, but how do these really function for the everyday user? The RUDOTS current bike map is slightly misleading with the network that it has drawn for the Cook/Douglass campus. The map does a very good job of discerning between different bike path typologies as well as beginning to identify areas of hazard that require dismounting. However, the current highlighted routes are fragmented and disjointed and often do not connect in addition to the fact that there are many more hazardous zones and intersections that require dismount. While the map is a good starting point, it needs ground-based user verification and feedback to start point out issues and areas that need to be addressed.

Photograph courtesy of BikeRu.

EXISTING COOK/DOUGLASS BIKE MAP



Source: Rutgers Department of Transportation

PRINCETON UNIVERSITY

?

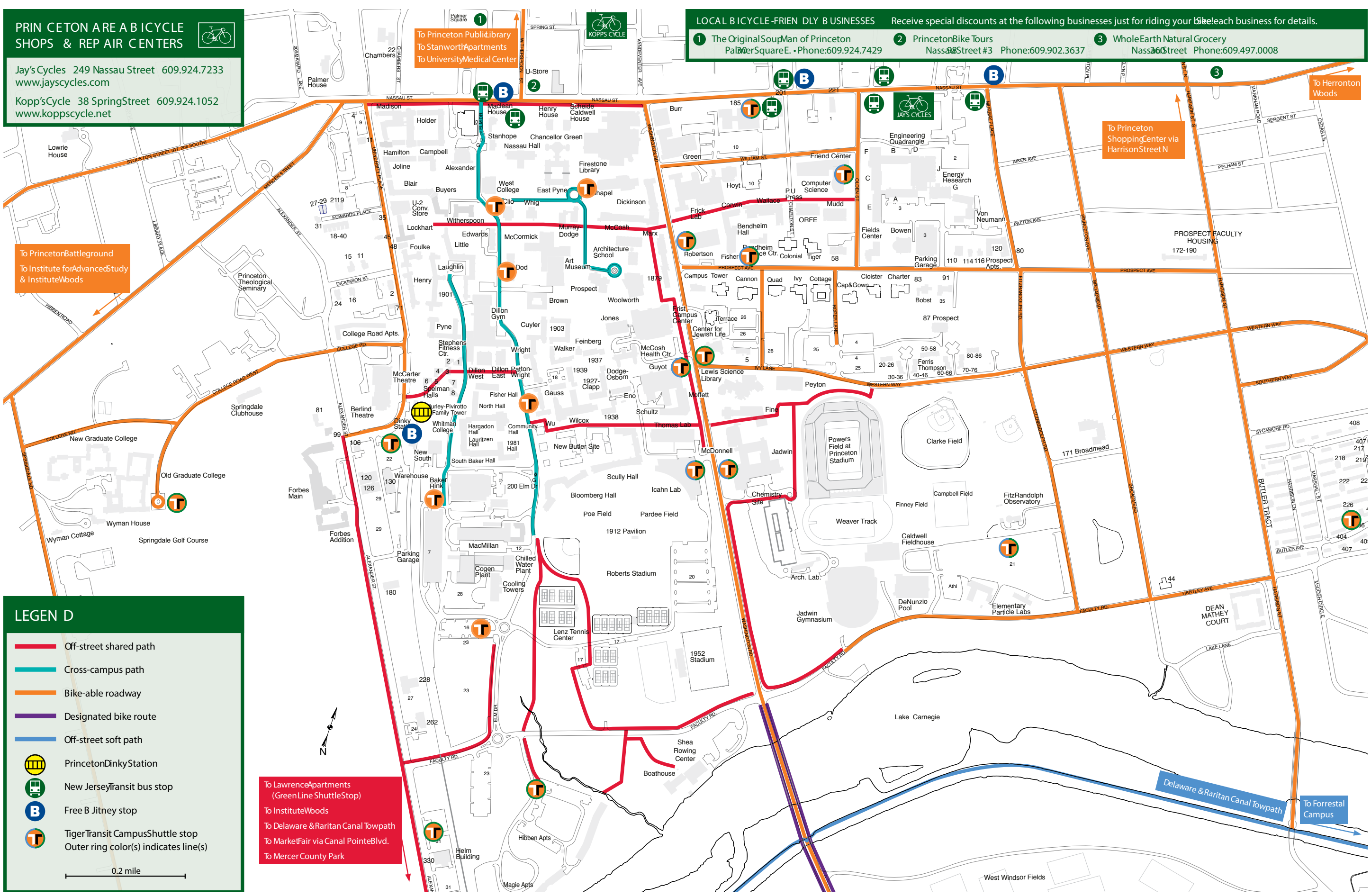
What makes a campus bike path system successful?

In order to answer this question, it is important to look at university leaders in campus biking to analyze how they go about creating their programs, how they encourage biking among their student culture, and how well they function. Through researching a series of university bike progras, I highlighted the following case studies that had programs and strategies that provided interesting comparisons to the Cook/Douglass Campus. Whether or not they fit in with the campus context, these case studies highlighted some of the factors and areas of focus that need to be addressed moving forward.

The map of the Princeton University bike system below provides a good model for analyzing the current Cook/Douglass bike path map. Both maps differentiate between path usage, but the Princeton map delinates where the designated bike path is (purple) as opposed to the shared roadways and pedestrian paths, which gives riders a further layer of understanding that not all listed routes are specific parts of the official bike route.

Additionally, the Princeton map does a good job of connecting its network to the surrounding context by listing the stops and routes of other forms of transportation, as well as bicycle-friendly businesses nearby. As a rider, this connection to other systems and to destinations within the area would definitely allow me to have a better understanding of the area and probably be more inclined to bike around.

The BikeRU maps could benefit greatly from revamping their current mapping system to be more like that of Princeton University and strive to be a little truer to the existing path conditions of the Cook/Douglass campus- even if they are not as desireable as they should be.



Source: Princeton University Transportation and Parking Services

OBERLIN COLLEGE

Primarily run by Oberlin College students, the bike-share program has been offering rental, repair, and educaitonal services since 1986. Students can rent bicycles for $15. Additionally, parking lots are strategically located on the outskirts of the campus boundary, creating a bicycle and pedestrian oriented campus within.

In contrast to BikeRU, the fee is slightly less expensive. As seen in the previous road and path inventory maps and hardscape analysis, Cook/Douglass has a whopping 28 acres of parking lots that are scattered throughout campus. As a result of a high commuter population, circulation around campus has developed from parking lot to parking lot as opposed to building to building.

How can a school with such a large commuter population develop its campuses in a way that concentrates parking on the exterior while still accommodating students who travel by car?

Source: Screenshot from Oberlin's Bike Safety video

Source: Fearless and Loathing

UNIVERSITY OF MASSACHUSETTS AMHERST

The UMass Amherst Bikeshare program is similar to the previous bikeshare programs, although this service is available to students free for a one day rental as long as they return the bike within 24 hours at one of the covered bike racks in front of the Student Union.

The short, quick, and easy rental period of this program would largely benefit the Rutgers Bike Share Program. Currently, bikes can be rented for either a one month period or a full semester. Statistics from the Bike Share Program show that the current capacity of the bike fleet is underserving the large group of students who are interested in renting; offering rentals on a day to day basis would allow those who cannot be accommodated to be able to participate in the program.

NuRide is an incentive program established to encourage alternative methods of transportation. Points are earned when you travel by public transportation, bike, foot, carpool, or walk from home, and can be redeemed for rewards.

Would incentive programs such as NuRide increase the desireability of alternative methods of transportation?

Source: UMass Amherst Bike Rental Program

Source: UMass Amherst Bike Rental Program

RIDING THE ROUTE: A STUDENT PERSPECTIVE

As a former resident of Cook Campus and current senior who spends most of the week on Cook/Douglass, I was curious to experience the campus I thought I knew like the back of my hand in a way that I had never done before- on a bicycle. Prior to my research, I was not aware that Rutgers had a bike share program (which is telling in itself). Once I discovered the relatively small but burgeoning culture of BikeRU, I knew that there was no better way to examine this program and network than to hop on and do it myself.

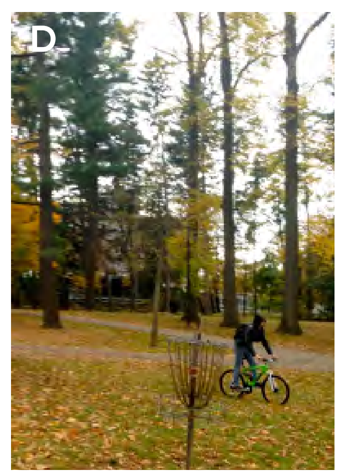
The rental process was a bit of a struggle for me. As a newcomer to the program, I was not aware that the rush of bikes were immediately snagged at the beginning of the semester and therefore had to consistently check the availability database for an opening. Additionally, the date of 'last updated' on the reservation website has been 2012 for quite some time, so without knowledge of the program I assumed that this was a starter program that had either failed or was not active anymore. If I had been a regular student and not an investigator, I most likely would have called it quits and not put in additional effort. However, I was determined to be a part of the Rutgers bike community and after persistent watching, I was able to rent a bike from the Administrative Services Building III on Cook Campus.

The following maps and graphics are a culmination of my personal experience as a cyclist on campus. Although my beginning struggles were due to lack of information on my own part, the major issues I discovered throughout my process were competition for space with other users of the road and paths, poor and unsafe path conditions, and route designation.

EXPERIENTIAL MAPPING

Balancing a digital version of the bike route on my iPhone in one hand and a handlebar in the other, I set out to ride the bike route exactly as it appears on the map. I began at the designated "start" point of the path at the Douglass Campus Center which lacked delineation or signange. Almost immediately I spotted a biker who seemed to be dodging pedestrians; this was one of only two bikers I encountered during my course. Another sign that I was on the right track appeared when I noticed a full bike rack in front of the Hickman Bridge. Approaching a fork in the paths, I was unsure of where to continue before looking down and realizing the suggested route cut through the Loree parking lot. The heap of narrow and confusing 'pretzel' paths in the wooded area next to Loree seemed to be as confusing to a fellow bike rider as they were to me; he had chosen instead to ride straight through on the grass. Disjointed paths of different materials made it difficult to determine which direction the path was intended to go. In front of Nicholas residence hall, I was lead through a parking lot and busy intersection where I realized there was a large vehicle/bike conflict. I continued to follow the path throughout the Newell apartment parking lot until the map's path stopped and I was lead to a dead end. I followed the same route back, this time deviating at Neilson dining hall and going towards the Gibbons residence halls where I encountered the same issue; the path on the map dropped off and I was left at the entrance to Route 18. I heard an F bus turning the corner and realized that hopping on the bus to get home was my best bet.

Pictures correspond with letters on map. Map annotation labels experiences and observations along the route.

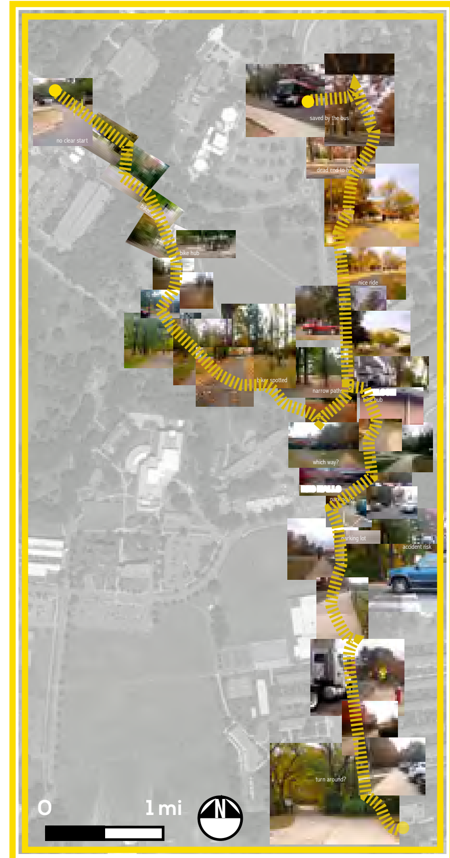


Aerial courtesy of Google Maps.

The graph below illustrates a typology of different issues identified during the bike route experiential investigation. The frequency of each issue is represented vertically while the severity of each issue increases horizontally. This categorization helps to gain insight into certain issues and target areas that will potentially become future focus areas in the design process.

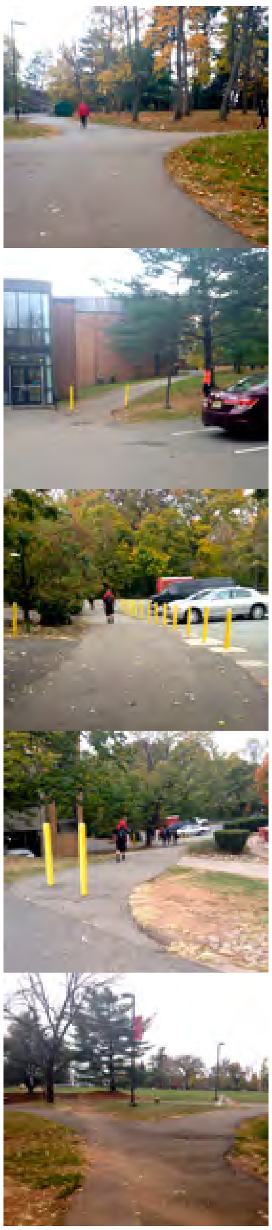
Pictures correspond with letters on map. Map annotation labels experiences and observations along the route.

CONTEXT



VEHICLE CONFLICT

CONFUSING DIRECTION



PEDESTRIAN CONFLICT

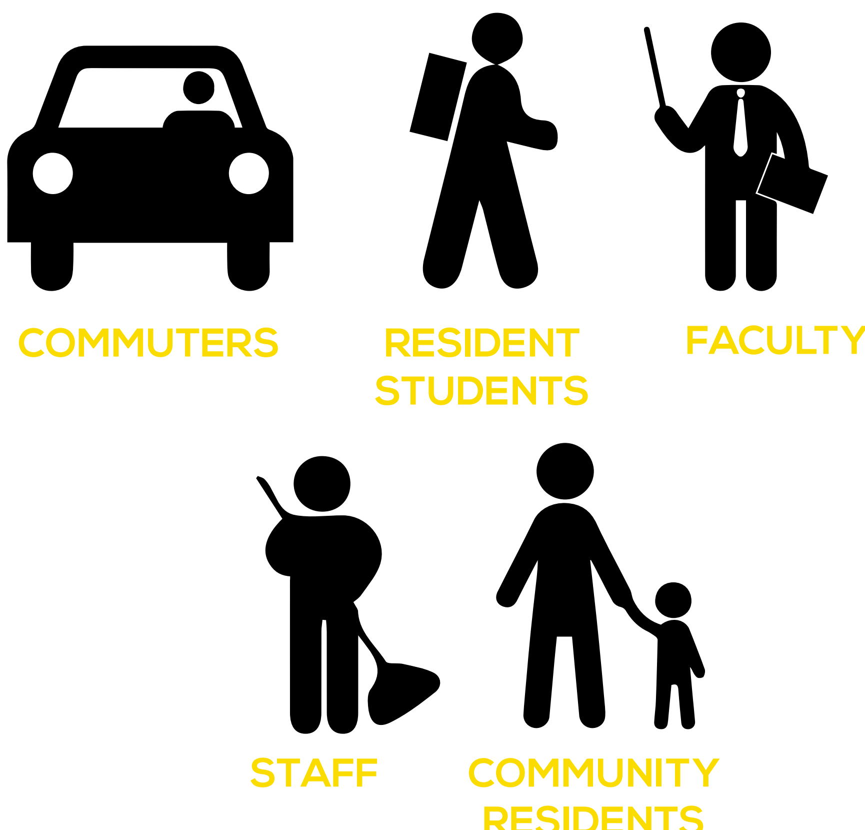
Should the bike route follow existing pedestrian paths or be a completely separate network?

Who is the most prominent user group on campus?

A wide range of users travel to, from, and around the Cook/Douglass campus each day. In order to better design how people travel, it's important to know who is traveling. Between both Cook and Douglass, there are approximately 3,500 student residents that use the area not only to get to class, but to get to dorms, dining halls, and other campus amenities. Between both campuses, there are approximately 3,500 student residents.

Thousands of students commute each day from the College Avenue, Livingston, and Busch campuses in addition to the large majority of students that commute from various locations all over the tri-state area and beyond.

Faculty and staff are often left out of the equation, but are a very important user group when it comes to transportation because they are travel to and from the campus at least once a day. They require a large volume of parking spots throughout the day, but these spaces are vacant in the evening hours. Due to a high commuter population and the needs of Rutgers faculty and staff, parking is one of the largest issues on campus. Local residents of New Brunswick are important members of the user audience as well because they live in the surrounding neighborhoods that border Nichol Avenue and Ryders Lane and consider the campus space an amenity to the broader New Brunswick community as well.



SOCIAL **HOTSPOTS**

A CLASSIFICATION OF BUILDING AND SPACE HIERARCHY

Trying to figure out where people go on a campus with such a large influx of people throughout the day and night seems nearly impossible to do without surveying a good portion of the population. It's important to figure out the buildings and areas that are utilized the most.

In today's technological society, the use of social media has the potential to tell a lot to about people's locational habits and preferences. 'Checking-in' is the concept of geospatially tagging yourself at a location at a certain point in time and is frequently used among the culture of social networks and apps such as Facebook, Twitter, and Instagram. The main powering source behind many of these GPS check-ins is the engine and website known as Foursquare. Foursquare, and the similar check-in engines on other popular social media sites allow you to search places that are within close proximity to your relative coordinates, or to create your own space. Within the social networking culture, check-ins are done at places that people deem important, memorable, and noteworthy based on either frequent daily use or one time 'tourist' visits.

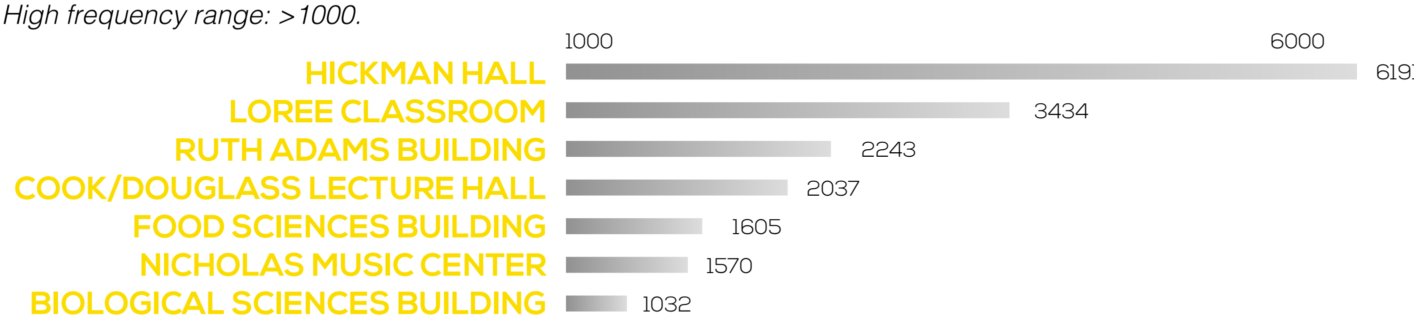
In the college realm, check-ins occur most at places that students are frequently in for class, studying, or other recreational activities. This data can provide unique insight into which places on campus are important to the Cook/Douglass culture that may not come across in a standard inventory of people. By no means is this data scientific, but for the purposes of designing a more relevant network it can help to create a hierarchy of use based on something more social than just numbers.

The following check-in data was gathered from combined counts from Facebook, Twitter, Instagram, and Foursquare that are publicly available. Based on the mean within each category of building/space type, a range was created from high to low frequency of check-ins. Shown below are the top hits that fell into the high frequency range for each category, and thus can be considered social 'hotspots' on campus.

Data taken on February 19th, 2014. Current values may be different.

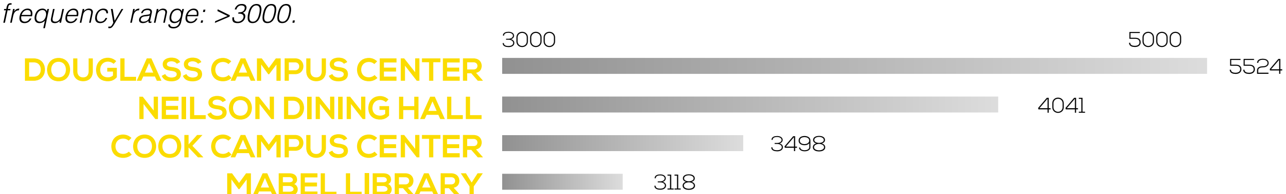
ACADEMIC BUILDINGS

Classrooms and lecture halls used primarily during scheduled 'school day' hours.
High frequency range: >1000.



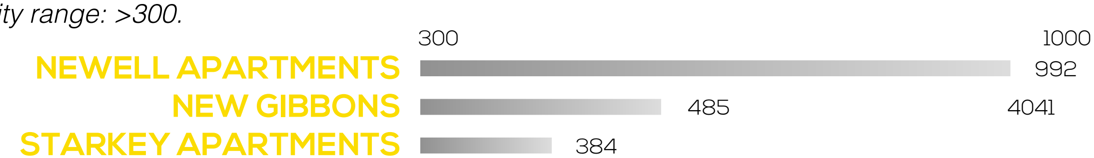
COMMUNITY BUILDINGS & SPACE

that primarily serve the more permanent community.
High frequency range: >3000.



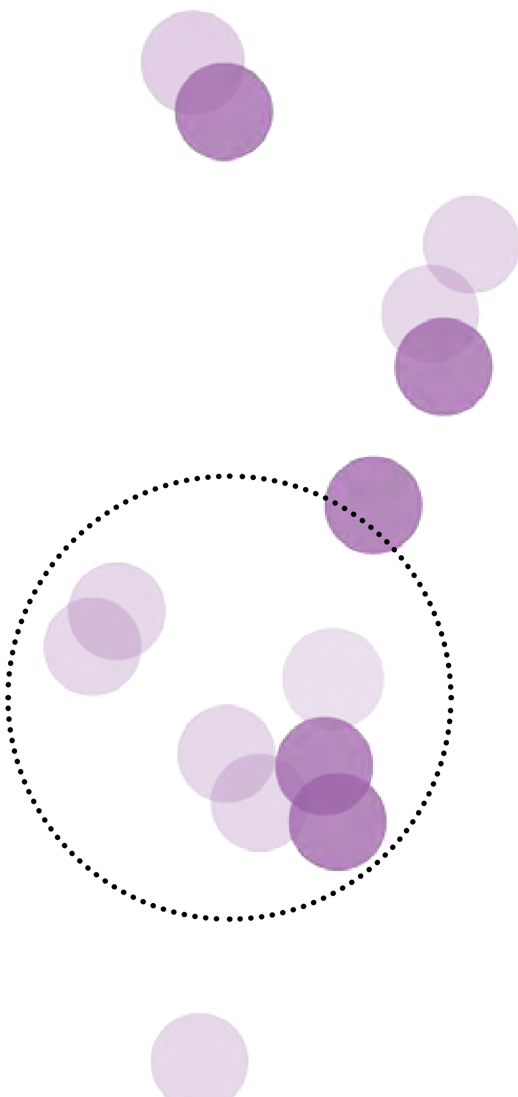
RESIDENTIAL HALLS & APARTMENTS*

High capacity range: >300.



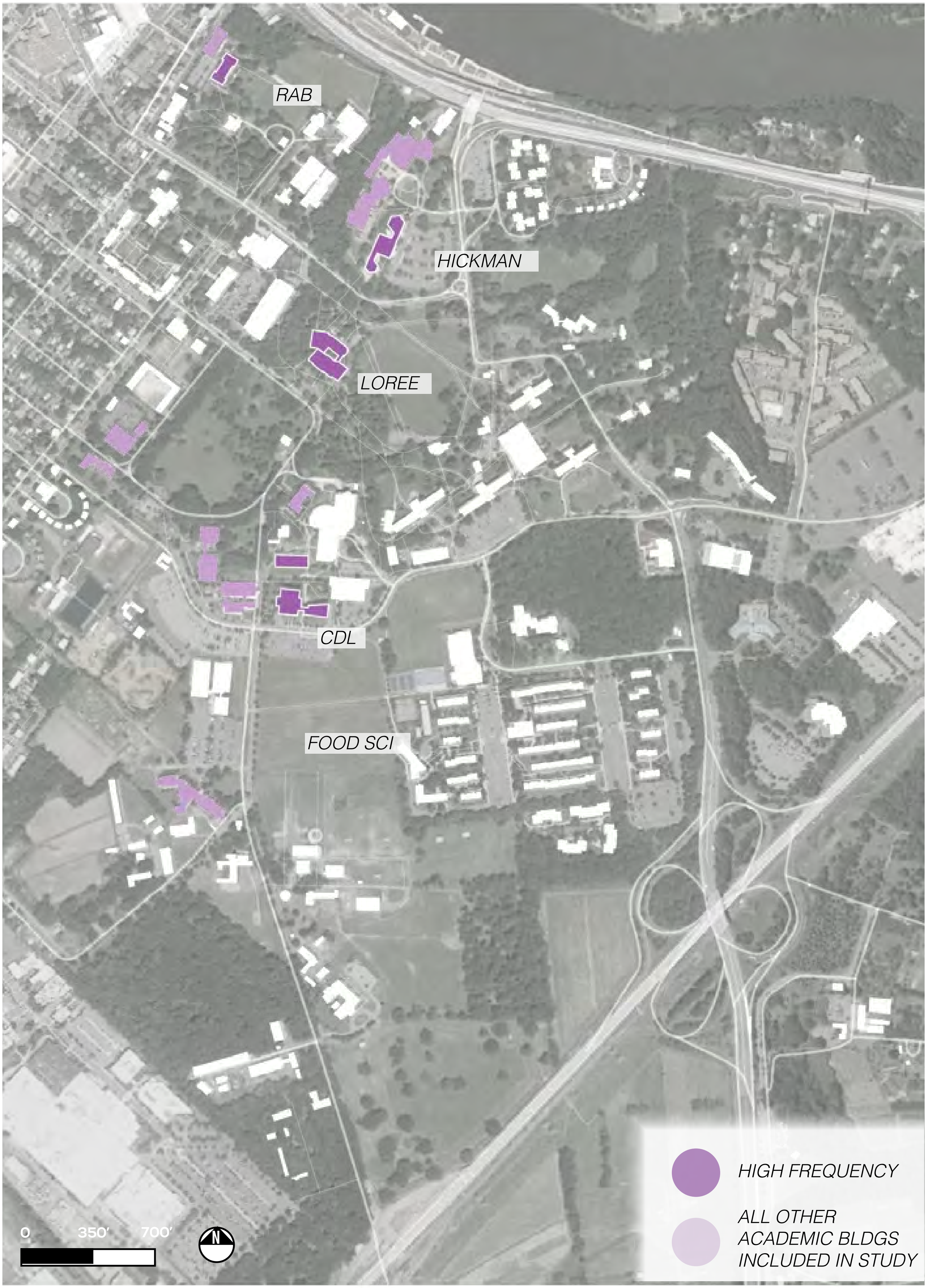
** This data is based off of concrete numbers from Rutgers University Residential Life statistics. Based on my personal behavioral assumptions, people are less likely to check-in at their residence because it is a place they mostly come to rest at; it is under this assumption that social media check-in data would not properly represent the importance of residential buildings on campus and therefore actual resident numbers were obtained.*

ABSTRACT SPATIAL PATTERN



As shown above, the top two hits in the academic category were Hickman Hall and the Loree Classrooms. The map to the right spatializes all of the academic buildings included in the study, with the hotspots shown in darker purple and the rest shown in lighter purple. It is important to note that not all of the academic buildings on campus are shown (although the majority is represented) because some academic buildings were not checked into at all- which is an interesting fact in itself.

The abstract spatial diagram to the left begins to look at how the academic hotspots are located in relation just to each other, absent of context, to see what patterns emerge. The acadeimc hotspot abstract pattern shows a hub of academic buildings, which would be a very important grouping to connect to.


RAB
HICKMAN
LOREE
CDL
FOOD SCI
HIGH FREQUENCY
ALL OTHER ACADEMIC BLDGS INCLUDED IN STUDY
0
350'
700'
N

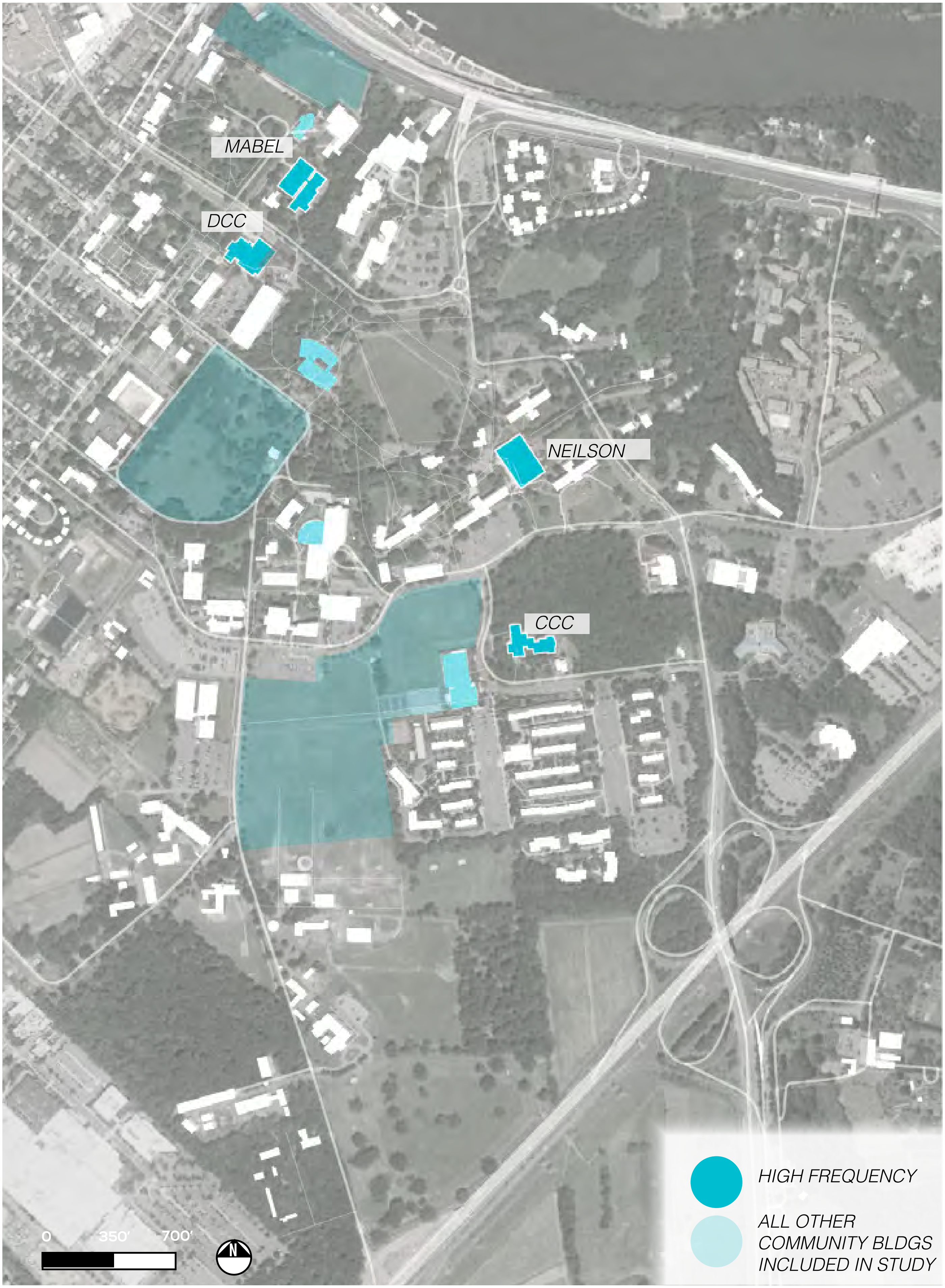
DOUGLASS CAMPUS CENTER


NEILSON DINING HALL

ABSTRACT SPATIAL PATTERN

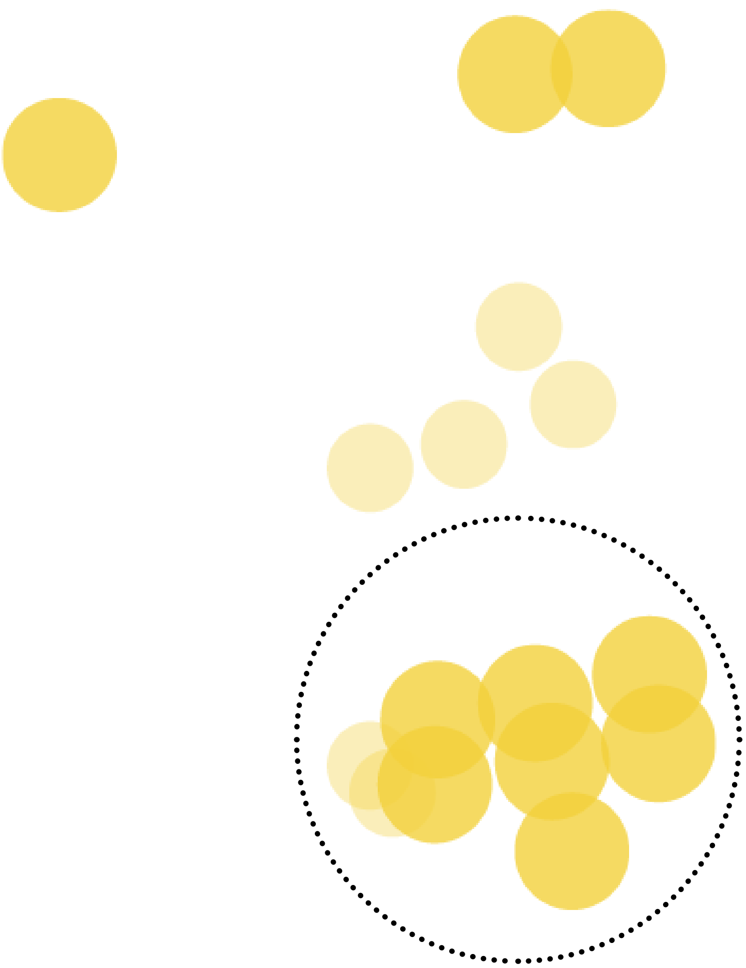
As shown above, the top two hits in the community category were the Douglass Campus Center and the Neilson Dining Hall. As previously mentioned, the community category includes amenities to the campus such as The map to the right spatializes all of the community buildings included in the study, with the hotspots shown in darker blue and the rest shown in lighter blue. Both of these hotspots are heavily used by the Cook/Douglass community as major sources of dining, as the Douglass Campus Center has a large cafe as well as a Dunkin Donuts.

The abstract spatial diagram to the left begins to look at how the community hotspots are located in relation just to each other, absent of context, to see what patterns emerge. The community hotspot abstract pattern shows that most of the community buildings are evenly distributed throughout the campus..


MABEL
DCC
NEILSON
CCC
HIGH FREQUENCY
ALL OTHER COMMUNITY BLDGS INCLUDED IN STUDY
0
350'
700'
N

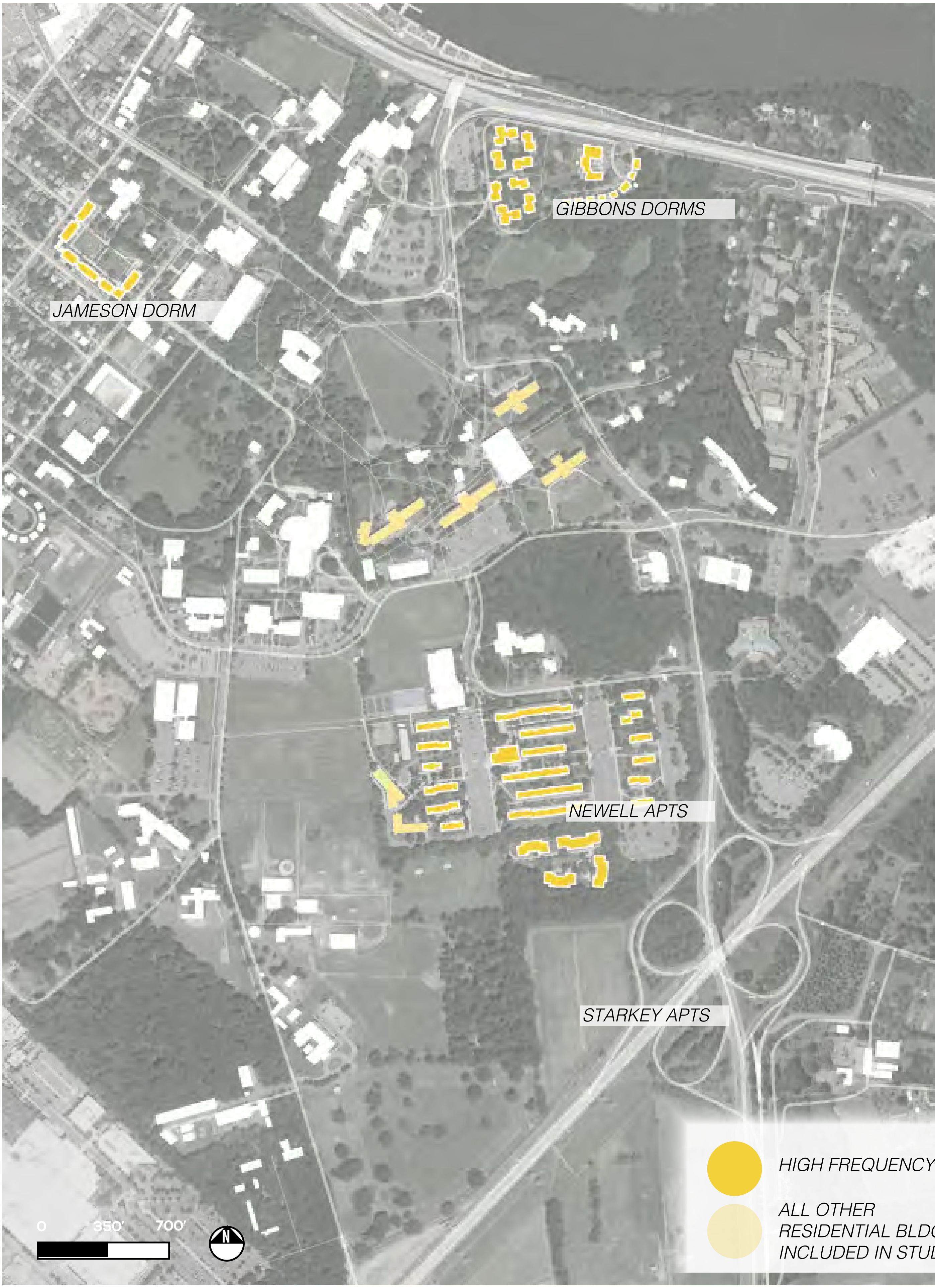
RESIDENTIAL HOTSPOTS

ABSTRACT SPATIAL PATTERN



As shown above, the top two hotspots in the residential category were the Newell Apartments and the Gibbons dorms. It is important to note that this data is based off of concrete numbers from Rutgers University Residential Life statistics. Based on my personal behavioral assumptions, people are less likely to check-in at their residence because it is a place they mostly come to rest at; it is under this assumption that social media check-in data would not properly represent the importance of residential buildings on campus and therefore actual resident numbers were obtained.

The abstract spatial diagram to the left begins to look at how the residential hotspots are located in relation just to each other, absent of context, to see what patterns emerge. The residential hotspot abstract pattern shows that most of the housing is located on the perimeters of campus, with the densest grouping of residents located in the south eastern corner.

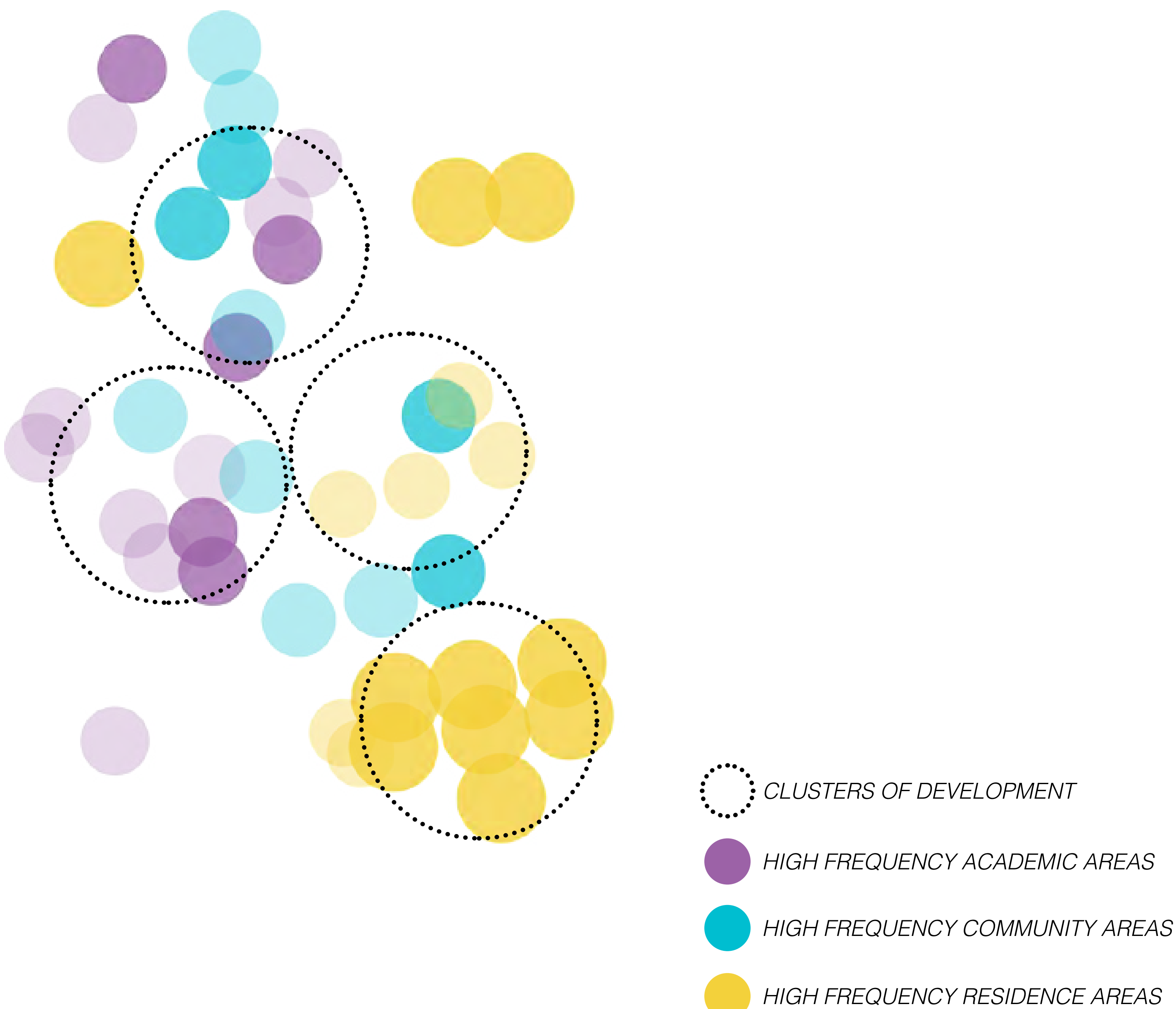

GIBBONS DORMS
JAMESON DORM
NEWELL APTS
STARKEY APTS
HIGH FREQUENCY
ALL OTHER
RESIDENTIAL BLDGS
INCLUDED IN STUDY
0
350'
700'
N

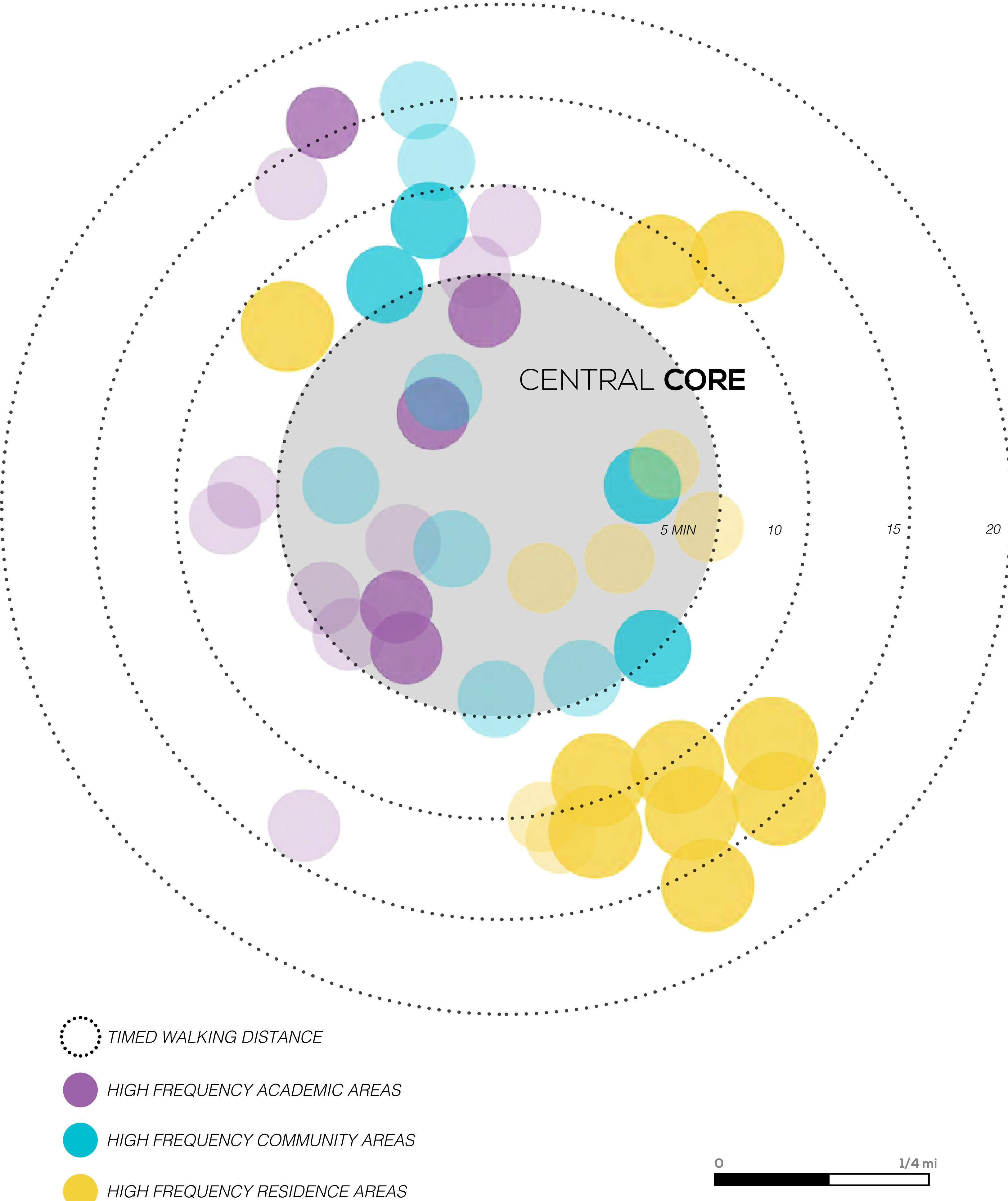
The diagram below is another interation of the abstract spatial pattern, but this time looking at all of the hotspot categories together. Of all of the hotspot exercises, this was the most influential to my thought process because through this diagram, I was looking at all of the places that people are traveling to and using all at once and in relation to each other and only each other.

Within the circled areas of development below, four important intersections to note appeared. There is a gathering of community and academic buildings at the start of campus, an almost strictly academic node, an area in which residential and community hotspots combine, and a strictly residential node.

In order to put these abstract groupings into a "scale" of sorts, the average timed distance that it takes to walk a 5 minute, 10 minute, 15 minute, and 20 minute walk were overlayed. This reinforces the concept that Cook/ Douglass is a very walkable campus, as a large majority of the most important buildings can be reached within a 5 minute walk. Furthermore, the entire campus can be traversed in 20 minutes. When everything is reachable within such short times, is there *really* a need for vehicles within this central core of activity?

ABSTRACT SPATIAL PATTERN




CENTRAL CORE
5 MIN
10
15
20
TIMED WALKING DISTANCE
HIGH FREQUENCY ACADEMIC AREAS
HIGH FREQUENCY COMMUNITY AREAS
HIGH FREQUENCY RESIDENCE AREAS
0
1/4 mi

PLANNING & DESIGN

NETWORK EXPLORATION

The culmination of the information gained from the analyses and studies performed provide evidence to support the claim that the Cook/Douglass campus requires a large retrofitting and possible redesign of its path and roadway network at the campus-wide scale. Through this redesigned network, transportation on campus will be better oriented to the buildings, space, and areas that people need to access.

In order to explore possible connections, it's important to think about which factors of the campus will take priority in the design. A large majority of the previous analysis was based largely on 'the experience'- how people actually use the campus and its amenities. Therefore, it can be concluded that the master plan or overall network redesign must fuse both sustainable transportation goals and well as sustainable social goals.

In the network connectivity exercise (*right*), the social hotspot buildings and areas delineated in the previous data and maps were overlayed with existing and proposed campus social spaces identified by fellow Cook Scholar Michelle Hartmann in her study, "*Sustainable Social Space: The Understanding and Application of Social Space at Rutgers University*". Vital transitory (*yellow*) and social spaces (*green*) were pinned on the map. The diagrams to the right illustrate the exploration of connecting these vitals together based on four different sets of priorities which are explained below. This exercise provided a set of objective connection options that are not clouded by existing roads and pathways and truly represent ideal connections to the social priority spaces on campus.

Based on the observations and analyses in the previous chapter, the ideal connectivity network for the Cook/Douglass campus is a model similar to Network 2. A model that places equal priority on the social hotspot buildings of campus as well as the transitory spaces such as bus stops but reaches the outer spaces allows for the centralizing of pedestrian and bicycle traffic within the inner core of the campus and provides the opportunity to reduce or relocate vehicular traffic to the outskirts of the campus.

NETWORK 1

This connection system is connected with high priority on bus stop locations and therefore begins from Route 18. It was connected sequentially from vital spaces in a left to right movement that echoes the movement of the bus routes.

NETWORK 2

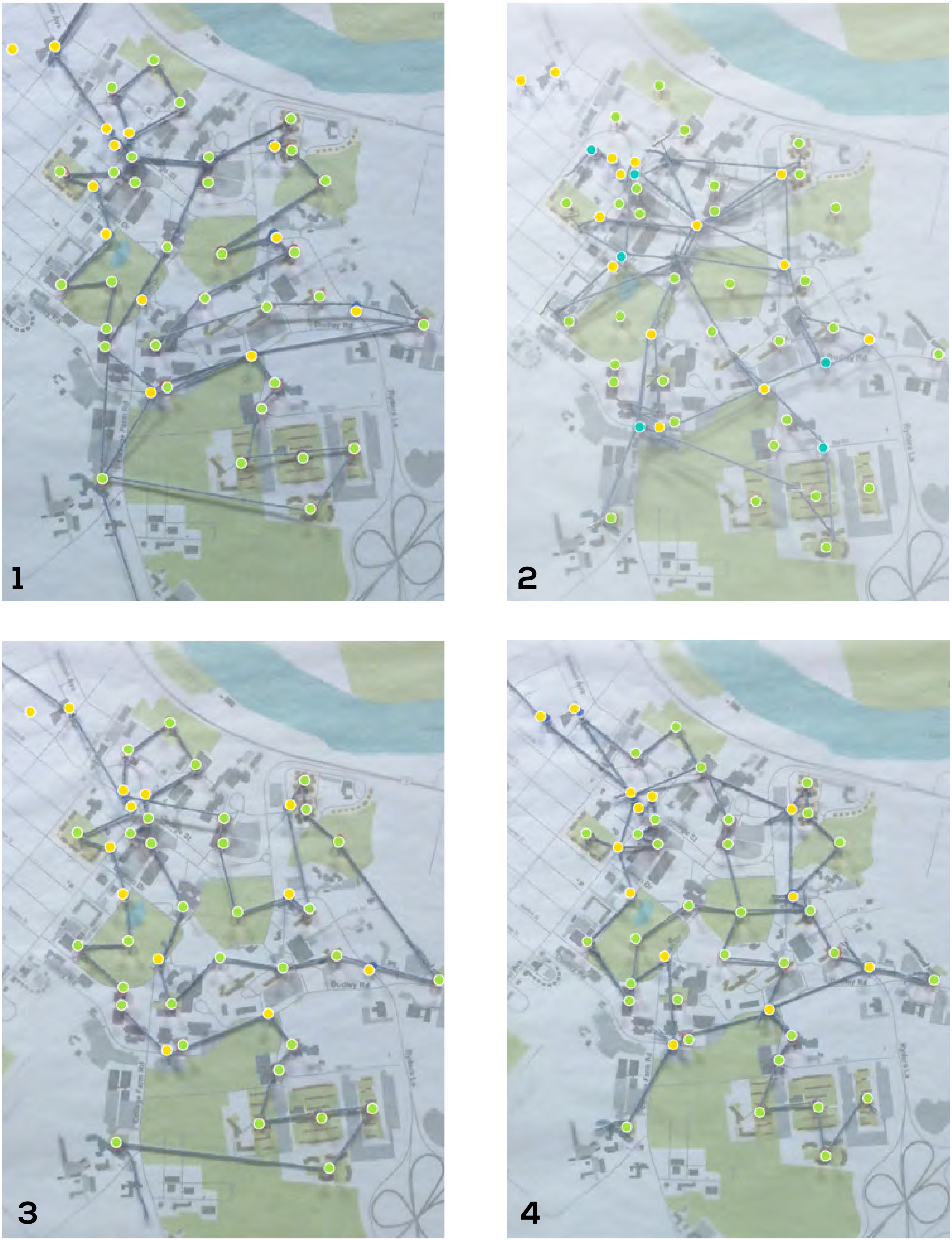
This network began to examine the concept of campus 'thresholds' (*blue*). Thresholds, in this sense, are areas that signify a conceptual exit or entrance to different sectors of the campus. It first connects all of the main social hotspot buildings and then either connects inward or outward to spaces that lie outside this hotspot zone.

NETWORK 3

This system connects transitory spaces to social spaces in a relatively linear fashion beginning from the George Street entrance of campus and continues in the relative direction of the existing bus routes.

NETWORK 4

The main idea behind this system was to hit every point once. It is connected via an 'circuit' or continuous ring that aims to first connect the social and transitory spaces within the 'inner core' of the campus and then spiders off to farther spaces.

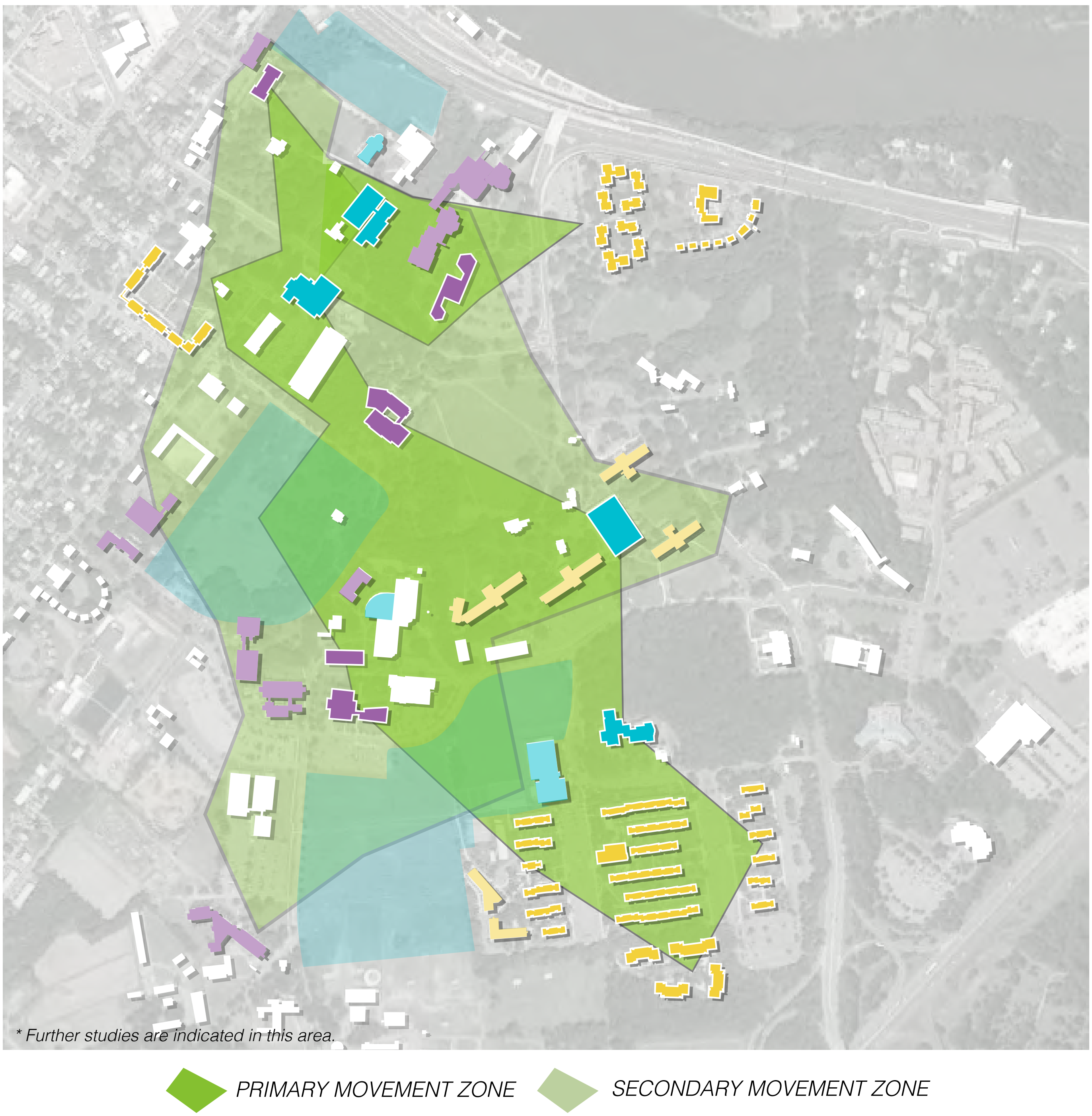


Connectivity network map produced in collaboration with Michelle Hartmann.

MOVEMENT ZONES

The networking exercises were an important step in identifying the main zones of campus where most movement is occuring. One of the interesting methods used during the previous exercise was the way in which it was conducted. Pins were placed in the social and transitory spaces in addition to the hotspot buildings. Yarn was wrapped around each pin in order to create the route from one pin to the other. The network path always had to be a continuous connection due to the material used; there was no other option because otherwise, the yarn would need to be cut. Although these networks are not intended to be the locations of specific paths and routes, they do show the general pattern of movement.

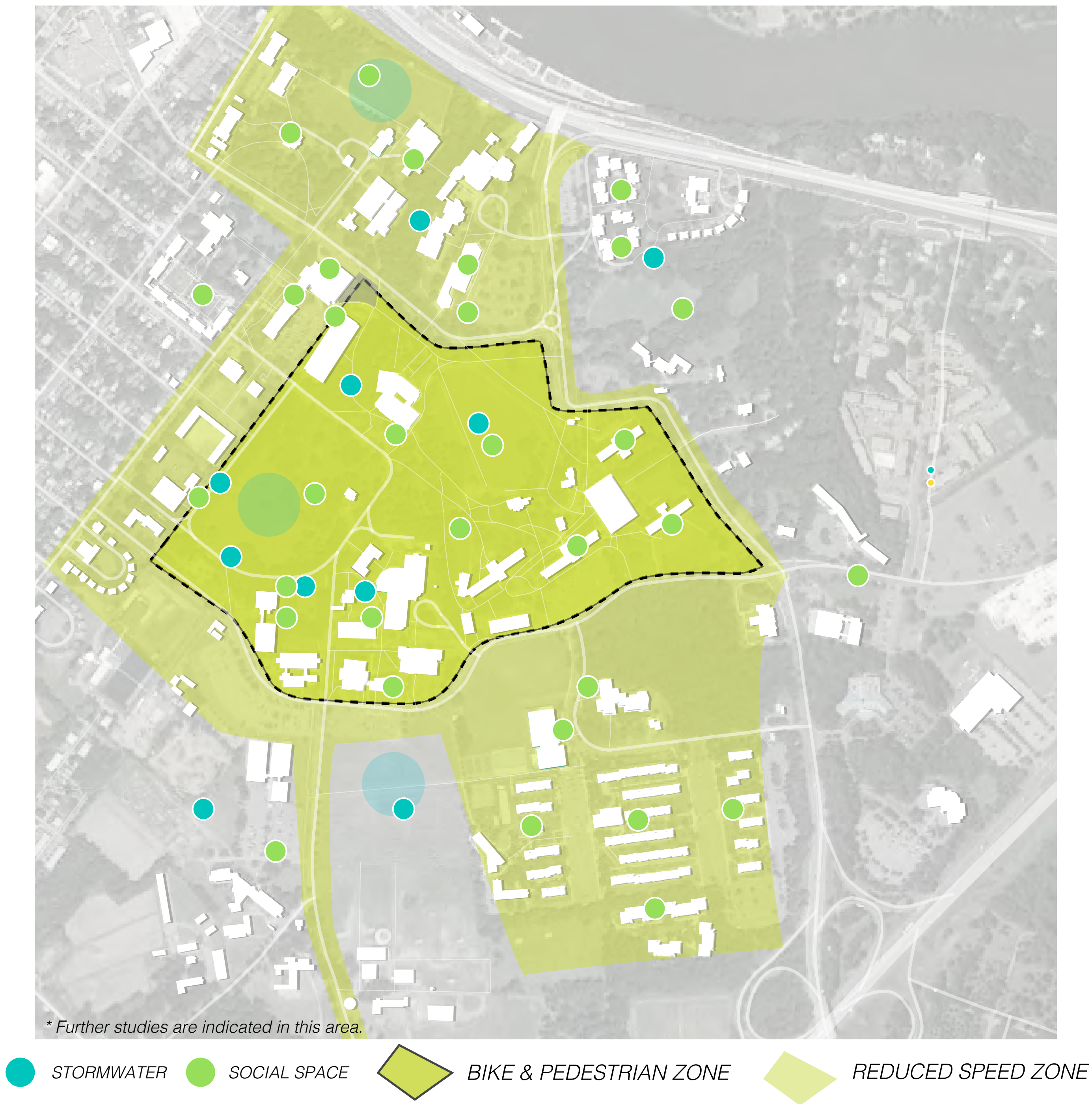
Based on the research and experiences elaborated upon in chapter 3, I personally concluded that indivudal pathways on campus need to be looked at within a scale that is smaller than that of the entire campus. The diagram below starts to look at the Cook/Douglass movement patterns and delinate the main zones of focus where achieveable interventions could be implemented that would start to change the overall transportation system on campus.



ACHIEVABLE INTERVENTIONS

This research has led me to the conclusion that sustainable transportation on the Rutgers Cook/Douglass campus can only happen through a *cultural shift*. The college campus is a unique environment where things can be experimented and tested to truly see if they will be successful and if not, gain insight on how to modify them so that they will be. The following implementations and suggestions are achievable ways that Cook/Douglass could begin to encourage the shift to sustainable transportaiton.

The counter argument to bicycle and pedestrian priority comes from vehicle commuters who are trying to get to where they need to be as quickly as possible. Often, it is argued that most bike and pedestrian friendly policies and designs severely hinder the traffic flow of cars. While there are validity behind these claims, it really all comes down to the point of view from which you are thinking about transportation. In some areas, vehicles do take precedence and rightfully so. In other areas, specifically such as campuses, there is the constant volume of bikers and pedestrians that provides the grounds on which to declare that a priority to these travelers is necessary. To those who do not wish to drive slow in such areas, there are alternative routes available. The most sustainable ways are not always the fastest, but that is a decision the Cook/Douglass community has to accept in order to make the shift towards sustainability.



SPEED AND **SAFETY**

The following pictures illustrate how the average person's cone of vision narrows with just a small five mile per hour increase in speed. As you can see, even at only 30 MPH it is difficult to focus on the pedestrians and bikes in the peripheral. These diagrams serve to prove that the reduced speed zone around campus is absolutely necessary.

CONE OF VISION

Measurement Source: NATCO

As previously mentioned, sustainable transportation on the Rutgers Cook/Douglass campus starts with achievable interventions- things that can be experimented with to begin to inspire the necessary cultural shift. Pop-up bike lanes would be a relatively inexpensive way to do this. The idea is that the lanes are put in for temporary periods of time on a specific road or path to see if people will actually use them (as opposed to spending a large amount of money on a permanent bike lane that no one may use anyway). Through this 'experiment', roads that have successful amounts of use with the bike lane would make them permanent and those that do not would show that they are not necessary in that particular location.

The demonstration shown below was an implementation done by the Minneapolis Bicycle Coalition for a low budget of $600 and was a great success. A similar type of design for the Cook/Douglass campus could be envisioned on busier streets such as George Street, shown to the right.

** Further studies are indicated in this area.*

POP UP BIKE LANES

SOURCE: KNOWBLE MEDIA, MINNEAPOLIS BICYCLE COALITION


RUTGERS
20

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