



RUTGERS UNIVERSITY PHYSICAL MASTER PLAN

RUTGERS 2030

VOLUME 1: NEW BRUNSWICK

JUNE 18, 2015

PREFACE

Rutgers University embarked on Rutgers 2030 in May 2013, the first comprehensive master plan in over a decade, and the first to incorporate Rutgers Biomedical and Health Sciences (RBHS), created from the integration of the University of Medicine and Dentistry of New Jersey (UMDNJ) with Rutgers University in July 2013. The physical master plan complements the Rutgers University Strategic Plan, prepared in conjunction with the Boston Consulting Group, and approved by the Board of Governors in February 2014, and the strategic plans of each of Rutgers' component institutions.

Rutgers 2030 envisions development at Rutgers over a 15-year time frame, 2015 to 2030, and is comprehensive in its scope; taking into account buildings, the natural and constructed landscape, transportation, and infrastructure. The report consists of three volumes:

- Volume 1: Rutgers University–New Brunswick
- Volume 2: Rutgers University–Newark
- Volume 3: Rutgers University–Camden

RBHS is considered primarily within Volume 1 although constituent elements are found across Rutgers.

The scope of input was broad, involving survey responses from approximately 8,000 members of the community, over thirty presentations and town hall meetings, and meetings with many administrators, faculty, and student groups.

This study would not have been possible without the leadership of Rutgers University President Robert L. Barchi and support of Chancellors Nancy Cantor, Richard Edwards, Phoebe Haddon, and Brian Strom. In addition, the Physical Master Plan Executive Steering Committee, Rutgers University Facilities and Capital Planning members, Deans, staff, faculty and students contributed invaluable insight to the development of the project.

The master plan consulting team included Robert A.M. Stern Architects, Sasaki Associates, VHB, Buro Happold, and Toscano Clements Taylor.

Volume 1: New Brunswick

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PLANNING CONTEXT

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Introduction

With over 40,000 students, 20 million square feet of buildings and set on 2,677 acres, Rutgers University–New Brunswick is a complex campus environment – comparable in physical size to the University of Michigan, but over a less contiguous area of land. Whereas the University of Michigan is completely contained within the City of Ann Arbor, Rutgers University–New Brunswick has land in six cities and municipalities: New Brunswick, North Brunswick, East Brunswick, Piscataway, Edison, and Highland Park. This physical context, in combination with the resulting operational context, comprises a foundation for analysis – campus organization and development, space needs, future growth, inter-district travel, and natural systems – that informs the master plan vision and principles, as well as future decision-making. Components of the physical context analysis include:

- **2.1 Open Space and Natural Systems:** Natural resources on campus, topography and hydrology, regional resources
- **2.2 Land Use:** Campus history and land use patterns, space utilization, and the need to travel
- **2.3 Mobility:** Campus connectivity, regional transportation context

The analyses in this chapter establish existing conditions for Rutgers University–New Brunswick; their conclusions provide a foundation for the master plan vision and principles, revealing opportunities to improve the physical environment at Rutgers and consequently, the student experience, and the campus experience for the greater community.

2.1 OPEN SPACE AND NATURAL SYSTEMS

The characteristics of the natural environment are significant components of the planning context, providing the fundamental context in developing a sustainable master plan. This section surveys the following:

Hydrological Context: an analysis of stream corridors, topography, and hydrological connections to the Raritan River and its floodplains; and,

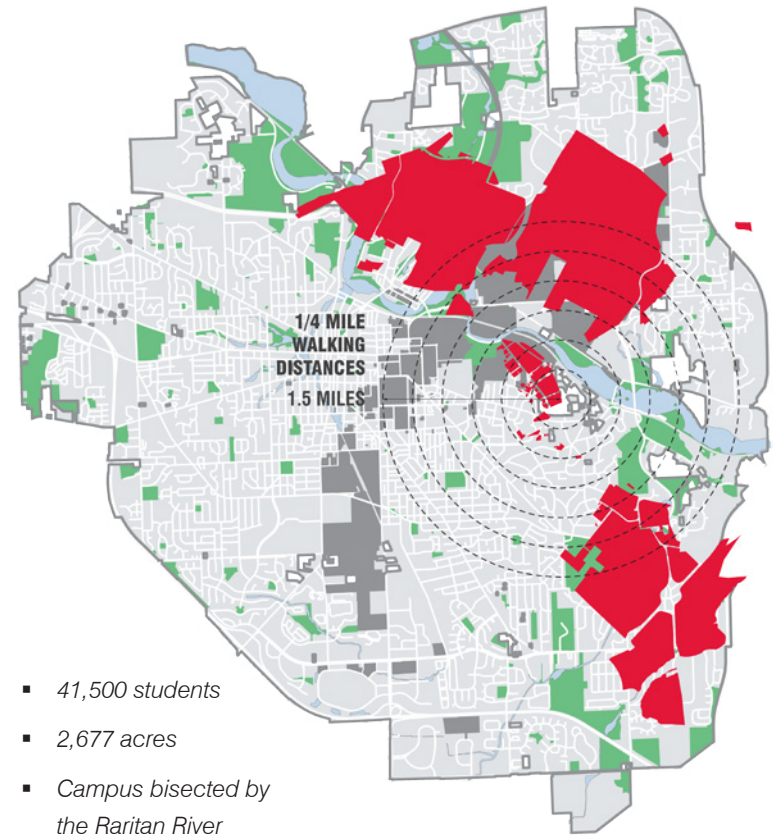
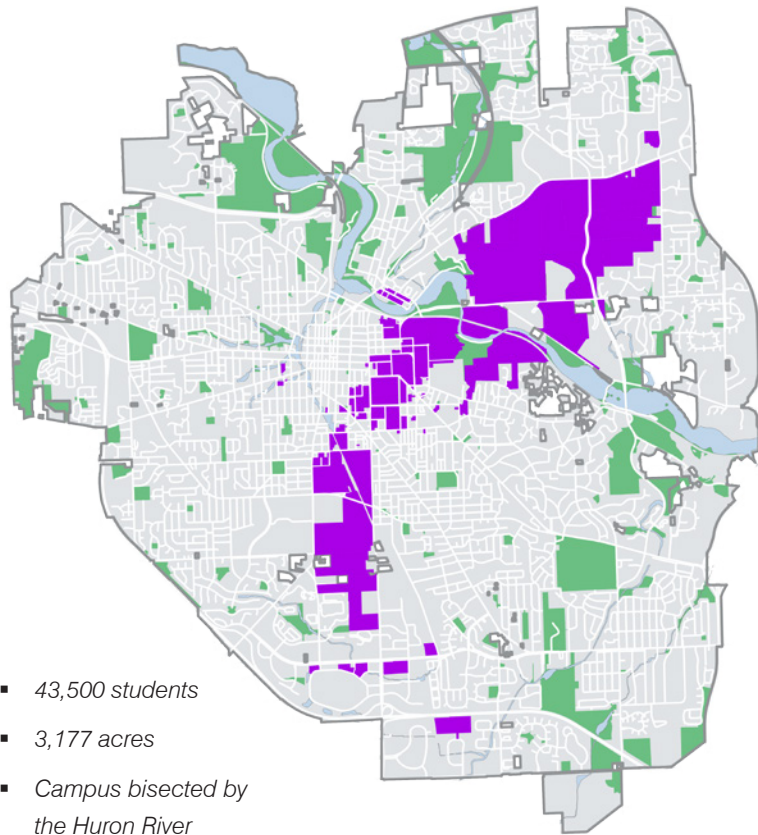
Natural Systems on Campus: a history of existing forested areas and resources on and off campus, as well as other pervious surfaces and stormwater management initiatives.

Rutgers University–New Brunswick is unique in its combination of urban and natural environments, from the urban Voorhees Mall to the natural environment at the Ecological Preserve. This section identifies underutilized resources and opportunities for sustainable growth, given the priority of preserving natural habitats.

2.2 LAND USE

Nearly 250 cumulative years of development, history, and growth have defined the current physical environment at Rutgers, and this context provides an understanding of how it functions today. The complexity of the need to travel between distant districts, and the conditions that contribute to it, are reflected in the breadth of analysis required to comprehensively document its impact on the student experience. This section examines the need to travel and how the Rutgers University–New Brunswick campus has evolved over time, in the following four areas:

Land Use Patterns: an analysis of the current campus environment, as affected by the University’s historical development;



PHYSICAL CAMPUS COMPARISON: RUTGERS UNIVERSITY-NEW BRUNSWICK, UNIVERSITY OF MICHIGAN-ANN ARBOR

Space Utilization Study: a data-driven approach to identifying specific space needs, establishing a baseline for strengthening each district individually, and the campus as a whole;

Core Facilities and the Need to Travel: findings of the MyCampus survey, which reveal patterns of use on and off campus, and how they create the need to travel; and

Class Schedule-Based Transportation Demand: the findings of the “Swarm” analysis, which further reveals the extent of the need to travel.

2.3 MOBILITY

The size of the Rutgers University–New Brunswick campus has necessitated the creation of the Rutgers bus system – a condition that is expected to continue in the long term, even with the increased use of alternative modes of transportation.

Mobility at Rutgers University–New Brunswick extends beyond the campus proper to the larger region. More than 15,000 students live on campus, but the

majority of students commute from the surrounding neighborhoods as well as from greater distances.

This section examines the existing conditions regarding mobility at Rutgers University–New Brunswick, for all members of the campus community, in order to identify where the transportation network is functioning well, and where there are opportunities for improvement:

Bicycle and Pedestrian Networks: an assessment of existing networks, missing links, opportunities, and constraints;

Rutgers Buses: an assessment of the existing bus network and operational context; and

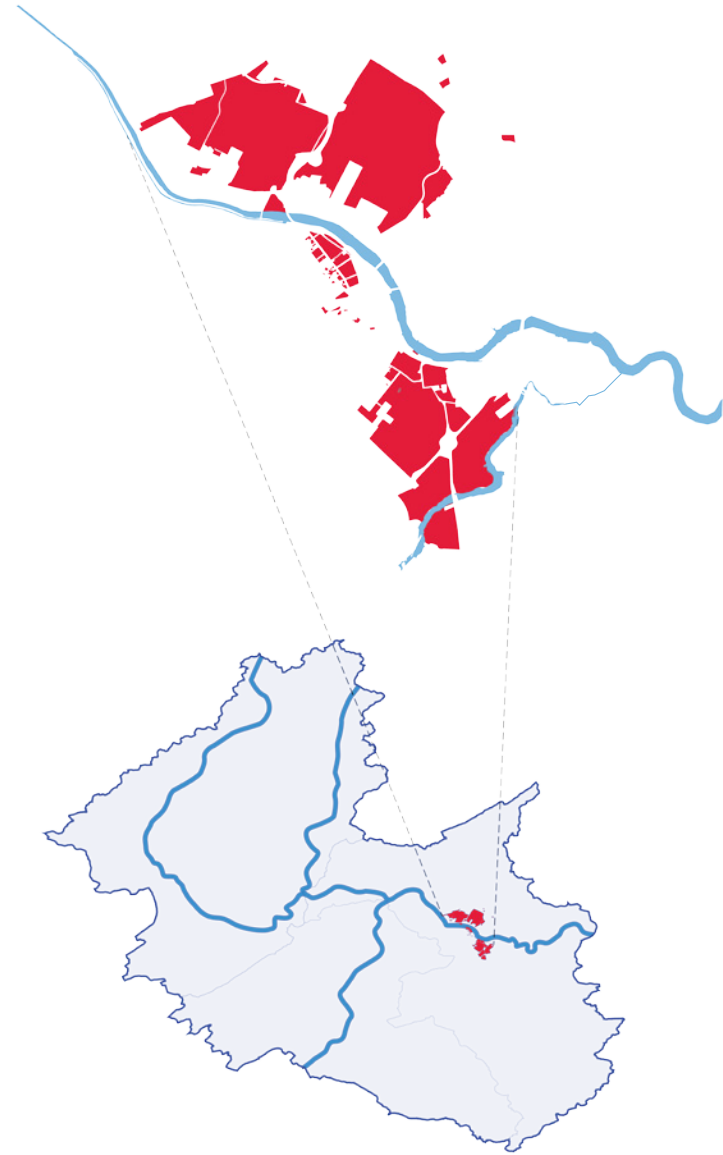
Commuters and Regional Connectivity: an assessment of regional transit and vehicular connections and parking.

The physical separation of the four Rutgers University–New Brunswick districts requires a comprehensive transportation network, encompassing transit, Rutgers bus, bicycle, and pedestrian connections in order to

maximize efficiency and convenience, and minimize vehicular congestion. This section assesses existing networks and reveals opportunities for completing and improving them.



NEW JERSEY AND THE RARITAN



RARITAN RIVER BASIN

2.1 Open Space and Natural Systems

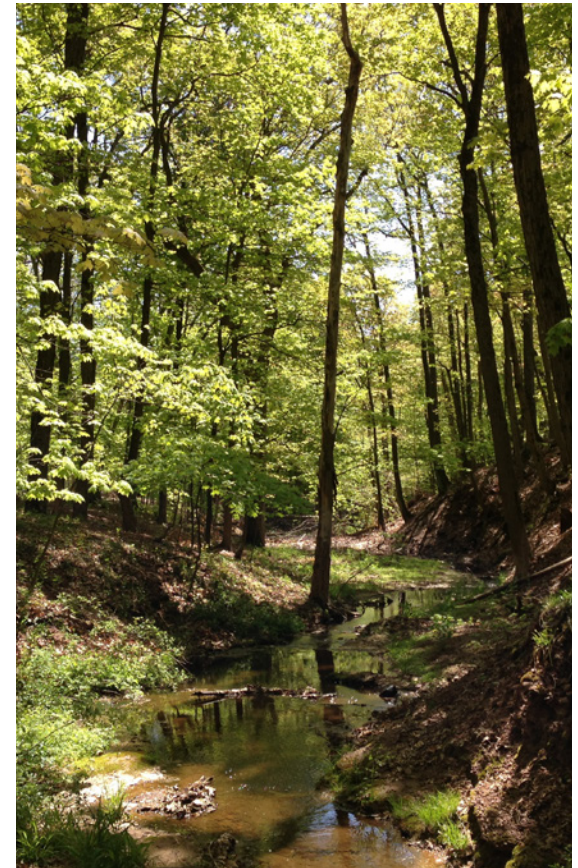
At nearly 2,700 acres, the Rutgers University–New Brunswick campus is one of the largest college campuses in the United States, on par with the University of Michigan - Ann Arbor, and significantly larger than Ohio State University at 1,777 acres. While the campus encompasses 20 million square feet of built space, it is also home to significant natural resources, including the Rutgers Ecological Preserve forested area, Rutgers Gardens, and a system of riparian streams and wetlands. These natural resources are supplemented by campus open space, agricultural research fields, and athletics and recreation facilities including play fields and a golf course.

The Rutgers University–New Brunswick campus is bisected by the Raritan River, one of New Jersey's major rivers. The campus lies within the Lower Raritan River watershed, a part of the 1,100-square-mile Raritan River Basin. The Raritan River Basin is the largest river basin located entirely within the state of New Jersey, and includes parts of seven counties and over a hundred municipalities. The majority of Rutgers University–New Brunswick students come from cities and towns inside the boundary of the basin.¹ The Raritan is a tidal river in the New Brunswick area, and

empties into the Atlantic Ocean from Raritan Bay in South Amboy. Several streams are located at Busch, Livingston, and Cook/Douglass, draining into the Raritan River, including two first-order streams: Buell Brook and Metlars Brook, both located at Livingston.

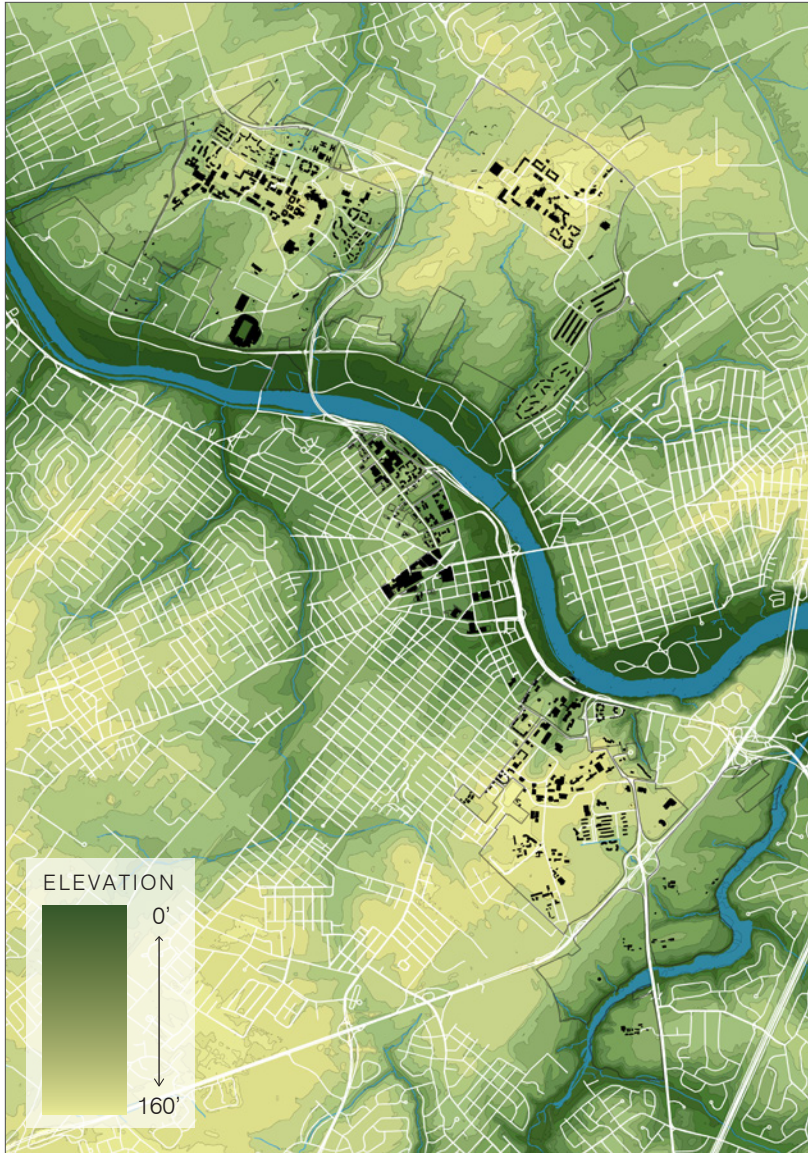
Formerly the primary mode of transportation in colonial New Brunswick, the Raritan is now used for recreational boating. The City of New Brunswick experienced significant growth as a colonial town, due to its proximity to the Raritan River and its location between Philadelphia and New York City. The Delaware and Raritan Canal, located along the southern bank of the river in New Brunswick, provided links between these three cities, before being supplanted by railroads; it is now a state park.

Today, the Raritan River is one of central New Jersey's sources of drinking water, with two water treatment plants located at the nexus between the Raritan and the Millstone Rivers. However, numerous contaminated sites are adjacent to the lower Raritan River, or drain into the river, despite continuing efforts over the past two decades to improve water quality.



Buell Brook at Livingston

1. *Rutgers University Fact Book 2012-2013*: p 29.



ELEVATIONS



RARITAN RIVER BASIN FLOODPLAIN

2.1.1 HYDROLOGICAL CONTEXT

In general, water drains to the Raritan River from the Rutgers University–New Brunswick campus, aided by streams and wetlands on Busch, Livingston, and Cook/Douglass. Situated in the lower foothills of the Raritan Valley, the campus is relatively flat, with significant elevation changes at the edges of the river's floodplain – for example, at the football stadium, and at the river dorms. These steep slopes affect access to the system of City and county riverfront parks, which is currently primarily by car, or by circuitous pedestrian routes. Cook/Douglass is also defined topographically by a ridge running generally along Dudley Road; water drains towards the river on either side of the ridge.

Stream corridors in the less-developed areas of Busch and Livingston drain to the river; these areas include the Ecological Preserve and campus golf course. At Cook/Douglass, the ravine running along the edge of the Mason Gross School of the Arts buildings also drains to the river. According to an assessment completed by Biohabitats in 2010, first-order streams have been degraded by stormwater runoff from the campus buildings and Route 18.² Other streams are in good condition, but have narrow buffers that increase the impact of stormwater runoff.

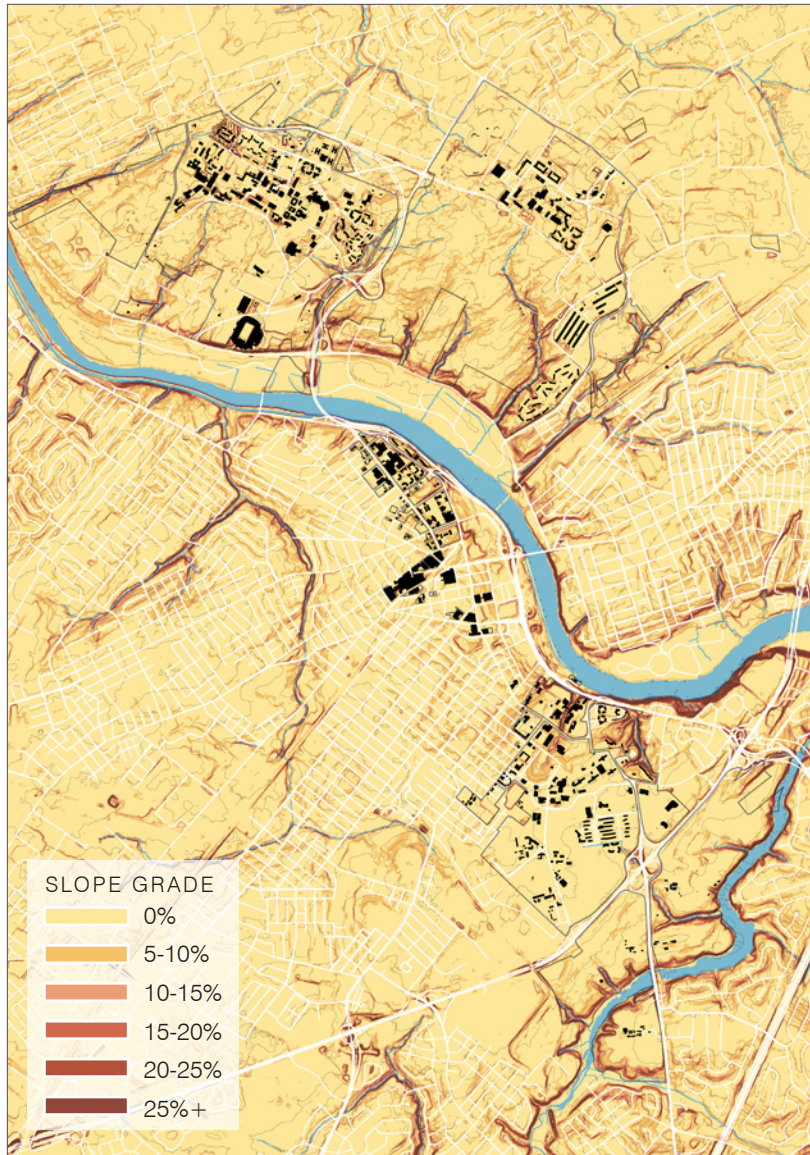
The Raritan River floods during major storms with high levels of rainfall; however, nearly all of Rutgers University–New Brunswick falls outside the boundaries of the floodplain, which is primarily occupied by the

riverfront parks that provide a buffer between the river and developed areas. The river was dredged in 2003 and 2013 as part of a flood mitigation program.

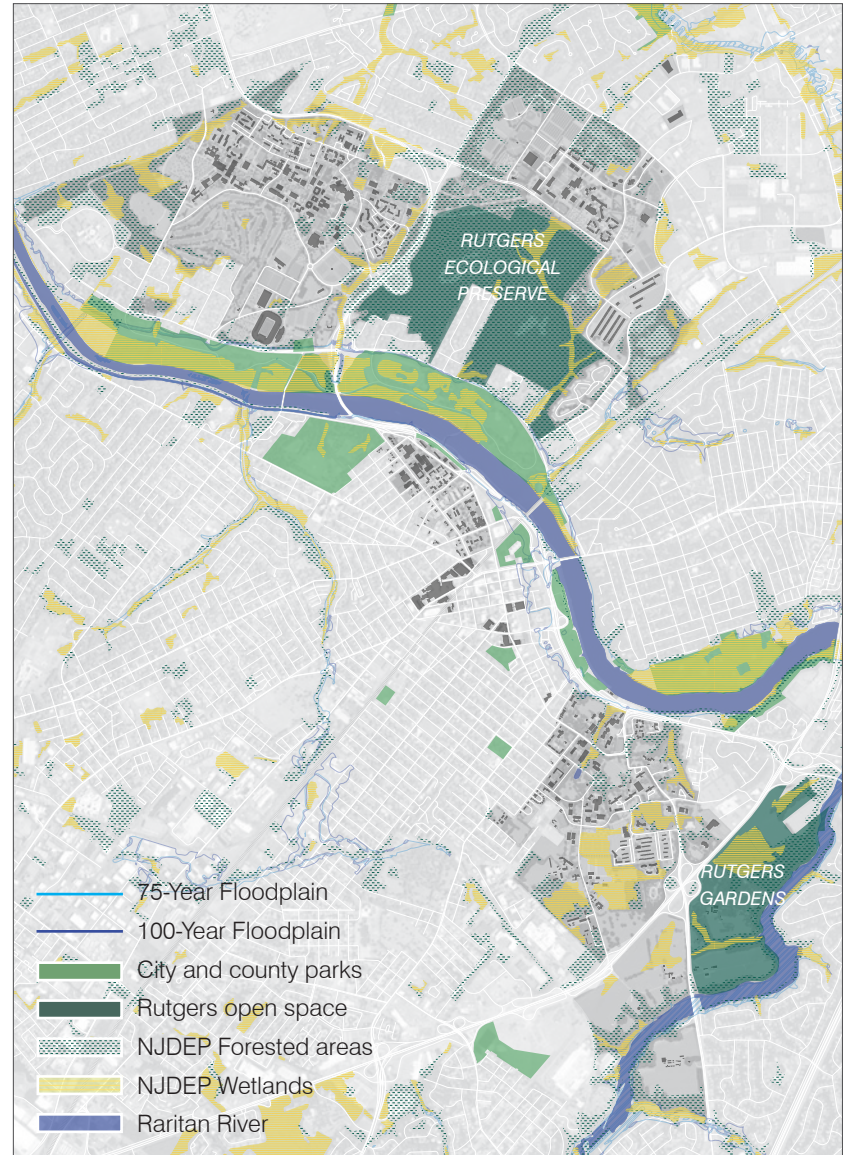


Flooding in New Brunswick after Tropical Storm Irene in 2011

2. *Stormwater & Landscape Management Master Plan*, Biohabitats, 2010: p C-13.



STEEP SLOPES



OPEN SPACE + WETLANDS

2.1.2 NATURAL SYSTEMS ON CAMPUS

NATURAL RESOURCES

Forested areas on campus boost the ability of the natural environment to manage stormwater runoff and groundwater recharge, thus providing protection in flood conditions. The Ecological Preserve, located at Livingston, is one of the last remaining areas of undeveloped, forested land in Middlesex County. Currently used for recreation and occasional research, the use of the Preserve has been limited by a lack of resources. Formerly owned by the members of the Johnson and Johnson family, the Ecological Preserve was created in 1976 by the Rutgers Board of Governors, and encompasses 316 acres of upland forest, woodlands, wetlands, and meadows. The intent of the Board of Governors at the time of the transfer of ownership to Rutgers was to preserve the land's natural ecology, and use it as an outdoor teaching resource.

Although the Eco Preserve is currently a forested habitat, it was farm land in the 1700s and early 1800s. Some of the pin oak, maple, and cherry trees that formed hedgerows between fields are still present in the Eco Preserve. In the northeastern part

of the Preserve, the Kilmer Woods were reforested in the mid 1800s, with various species of cedar, oak, beech, maple, and hickory trees. The Kilmer Woods attract several species of warblers and other birds.

The area of the Eco Preserve near Ross Hall was a golf course in the early 1900s, but was abandoned after the Depression. The Eco Preserve has been used infrequently as a teaching resource in the past,



Forested area in the Eco Preserve



Bioswales were included in the Livingston Apartments landscape as a stormwater management strategy

although these requests are increasing, primarily for classes in mapping and ecology.

A primary concern in the Eco Preserve is the encroachment of invasive species. A large population of deer – estimated at over 100 deer per square mile² – currently occupies the Eco Preserve. This overpopulation led to the development of a Deer Damage Management Plan in 2012. The plan is modeled after the plan used on other New Jersey Agricultural Experiment Lands; its primary strategy is to reduce the population through bow hunting. The plan is a collaborative effort between the RU Police Department, Office of Risk Management, Facilities Management, RU Ecological Preserve Advisory Committee, and Dean of the School of Environmental and Biological Sciences.

CONSTRUCTED OPEN SPACES

In addition to its natural environments, each district has a network of constructed open spaces, anchored by a major open space. These include Voorhees Mall at College Avenue; Passion Puddle and Woodlawn at Cook/Douglass; the Mall at Busch; and the Quad at

Livingston. These large, central open spaces are tied to the history of the University, particularly at College Avenue and Cook/Douglass, where original buildings surround these open spaces. The open space network provides essential connective tissue between buildings, in addition to acting as a wayfinding aid and a venue for informal gathering and interaction for students, faculty, and staff. Currently, the linkages between open spaces are not always clear and consistent, leading to underutilization. The open space network should also be coordinated with new development, in order to align programmatic uses between buildings and open spaces.

The open space networks in the district cores is supplemented by Rutgers Gardens, which comprise a series of display gardens and horticultural facilities. Located at the southeastern edge of Cook, Rutgers Gardens was established in 1927 and is a campus and teaching asset, in addition to a regional community resource. Rutgers Gardens is in the process of planning for its future, with a focus on raising its profile on campus and in the region, and on enhancing its existing facilities.

STORMWATER MANAGEMENT

Since the completion of the Stormwater & Landscape Master Plan by Biohabitats in 2010 for Busch and Livingston, the University has implemented several projects that follow recommended stormwater best management practices. Bioswales and rain gardens have been integrated into the landscape at the Livingston Apartments, the quad surrounding the Livingston Student Center, and in the area behind the Livingston Dining Commons. At Busch, the new Chemistry & Chemical Biology building design includes a rain garden in the plaza in front of the building.

The University has also limited the creation of additional lawn space in favor of native plants that require less water and maintenance. The continuing incorporation of green infrastructure – bioswales, rain gardens, native plantings, stormwater detention areas, etc – into new building projects is one of the University's goals in future development. Biohabitats is currently in the process of completing a Stormwater & Landscape Master Plan for Cook/Douglass.

2. *Deer Damage Management Plan for Rutgers Ecological Preserve FAQ*, Rutgers University, 2013: p2.



- 1808 Old Queens
- 1864 Rutgers Scientific School (land grant)
- 1914 College of Engineering
- 1918 New Jersey College for Women
- 1921 College of Agriculture
- 1924 School of Education
- 1939 Construction of Rutgers stadium
- 1945 Designated as State University University College
- 1963 Creation of federated college system
- 1969 Livingston College
- 1970 Rutgers Medical School
- 1971 Rutgers Medical School becomes UMDNJ
- 1982 Residential colleges centralized
- 2003 Physical Master Plan
- 2006 School of Arts and Sciences
- 2013 Integration with UMDNJ

HISTORICAL MAP OF RUTGERS IN 1939

HISTORICAL CONTEXT

2.2 Land Use

Rutgers University was originally chartered in New Brunswick as Queen's College in 1766, named in honor of King George II's Queen consort. Established to train future ministers in the Dutch Reformed Church, classes were held at the Sign of the Red Lion tavern and in private homes until Old Queens was built in 1808. Queen's College shared Old Queens with Queen's College Grammar School (now Rutgers Preparatory School) and New Brunswick Theological Seminary until these institutions moved in 1830 and 1856, respectively.

Queen's College was renamed after the War of 1812 as Rutgers College, in honor of Colonel Henry Rutgers. In 1864, Rutgers College expanded as New Jersey's land-grant college, establishing Rutgers Scientific School on what is now the Cook district.

From 1914 to 1993, Rutgers experienced two periods of major growth, adding nearly 15 million square feet. In the first, from 1914 to 1963, four new colleges were founded: the College of Engineering in Piscataway (Busch), the New Jersey College for Women (Douglass), University College (for part-time and commuter students), and the School of Education.

Rutgers Scientific School was also re-established as the College of Agriculture. The University also expanded its residential facilities, adding seven new residence halls.

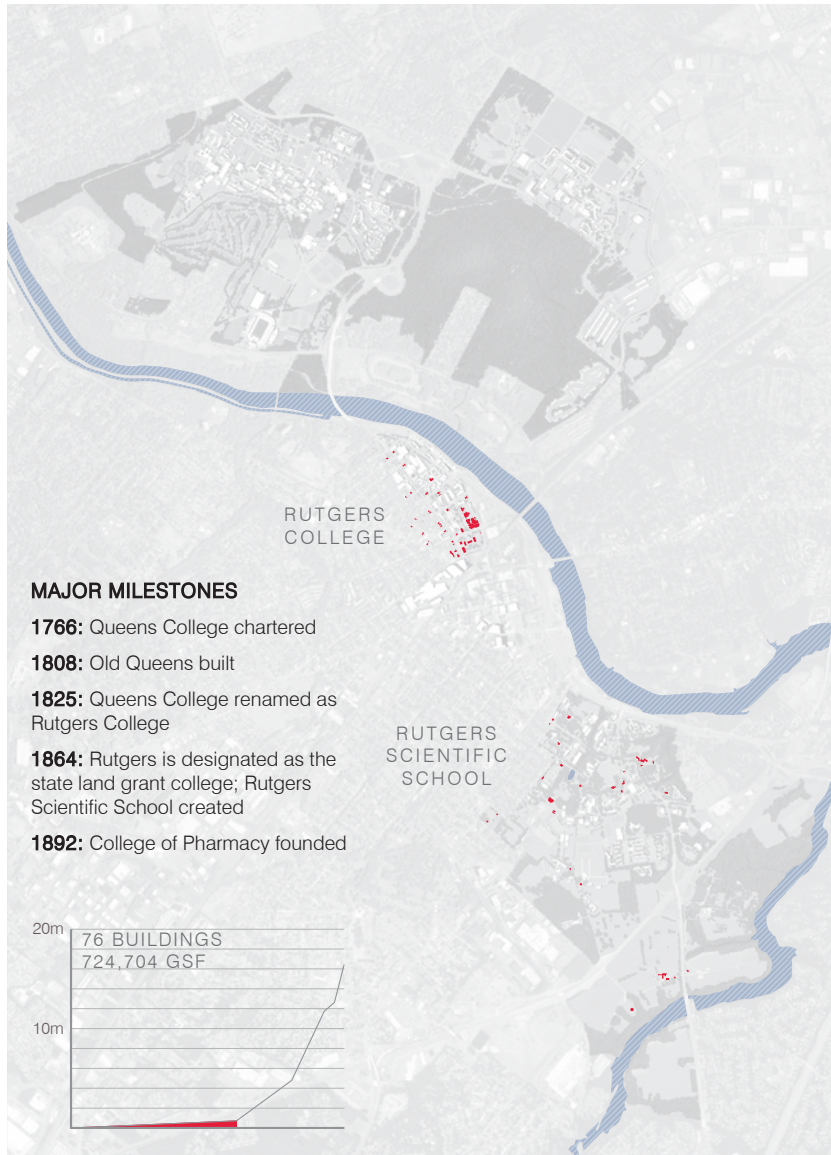
In the second period of growth from 1964-1993, nearly 10 million square feet was added. One new school was established at the former Camp Kilmer military base - Livingston College. Beyond the new college and general academic expansion, the majority of the University's residence halls, dining facilities, and student centers were built during this period. Rutgers Medical School was also established, in 1970. It became a separate institution in 1971 as part of the College of Medicine and Dentistry of New Jersey (later renamed in 1981 as the University of Medicine and Dentistry of New Jersey, UMDNJ).

The ten-year period from 1994 to 2003 was marked by a slower pace of growth. More than half of the space acquired during this period is comprised in three major projects: the University Center apartments, Civic Square in downtown New Brunswick, and Foran Hall on Cook. The balance of space was largely administrative and support facilities.

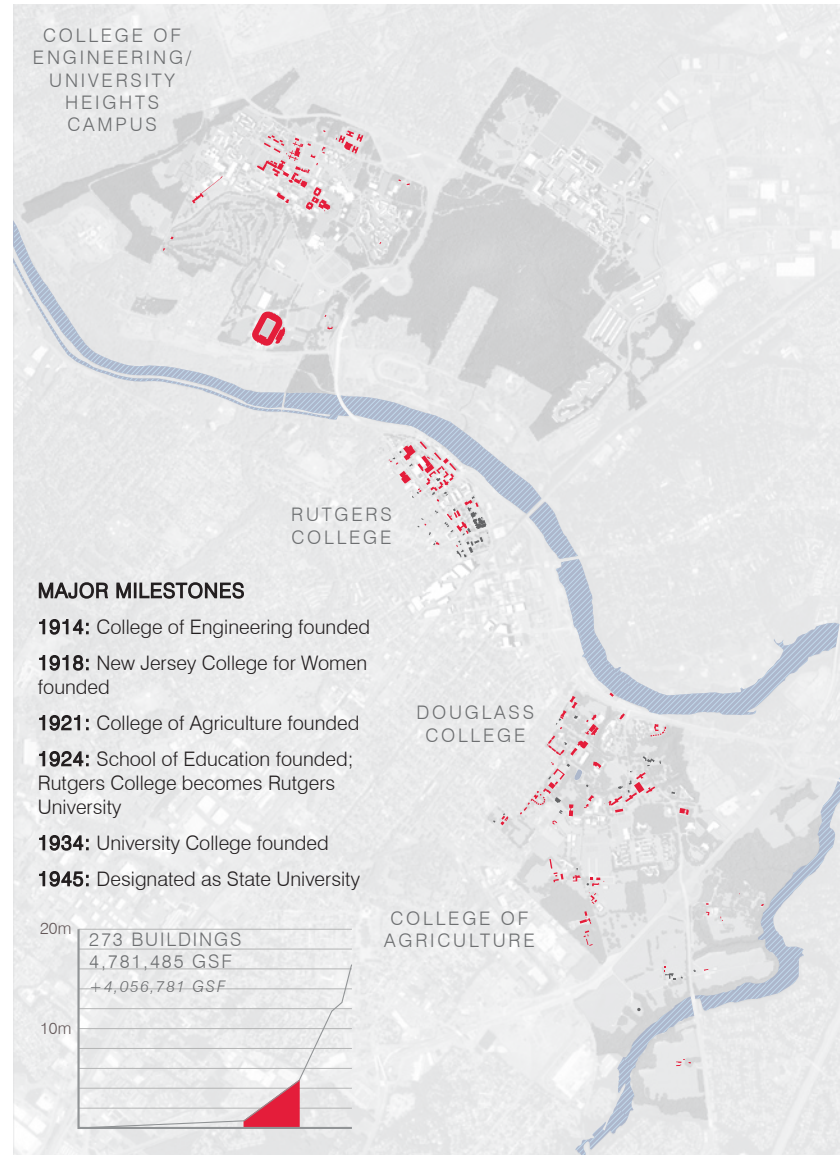
RECENT DEVELOPMENT: 2004-2013

The 2003 Physical Master Plan signaled a new capital campaign for Rutgers under previous president Richard L. McCormick, with over twice as much growth as in the previous decade, not including the addition of UMDNJ facilities. More than half of this growth has occurred at Livingston, where development has transformed the district with the construction of the dining commons, 1,600 new beds, a new building for Rutgers Business School, and the partial renovation of Tillett Hall. In addition to this new construction at Livingston, the student center has been recently renovated. The cumulative improvements to the Livingston district have made it one of Rutgers' most popular destinations among students.

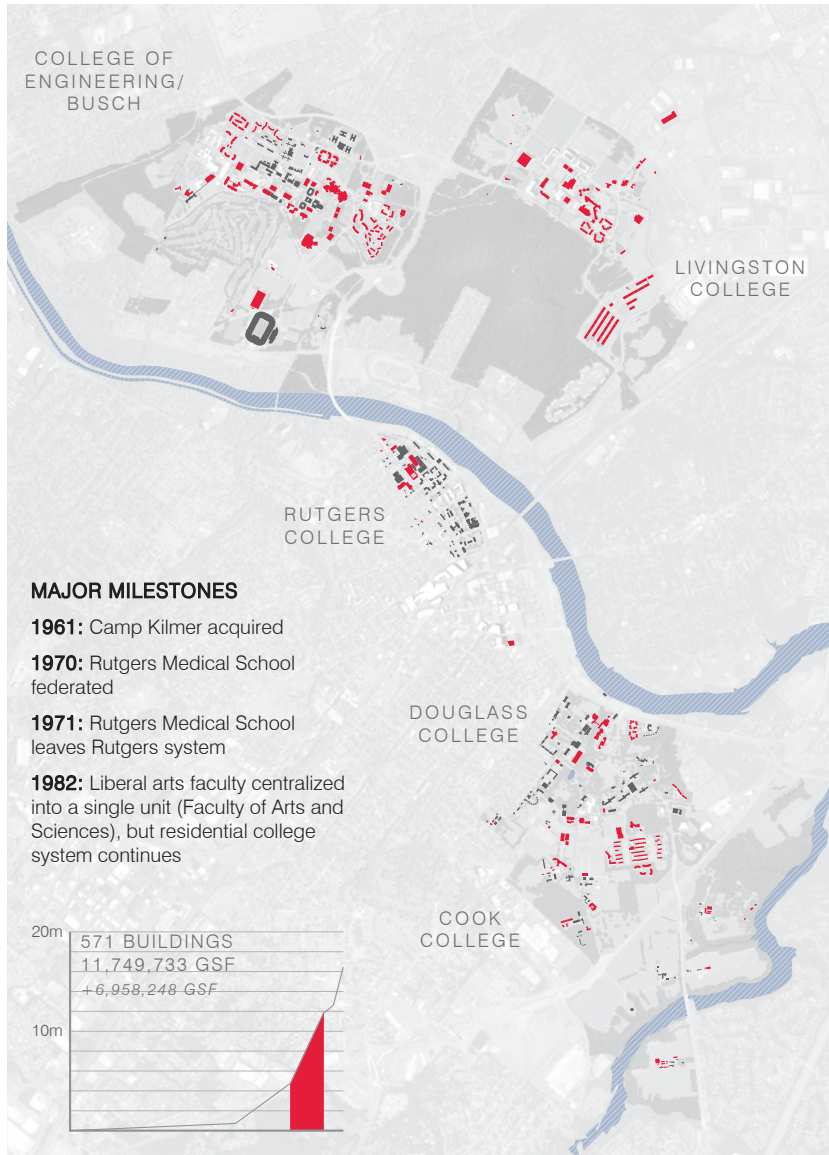
A significant amount of growth has also occurred at Busch, though at a slower pace than Livingston. The addition of the Life Sciences Building, the Biomedical Engineering Building, and the Center for Integrative Proteomics Research have improved research facilities in science and engineering. Busch Engineering, Science & Technology Hall has added a 500-bed living-learning community, targeted at



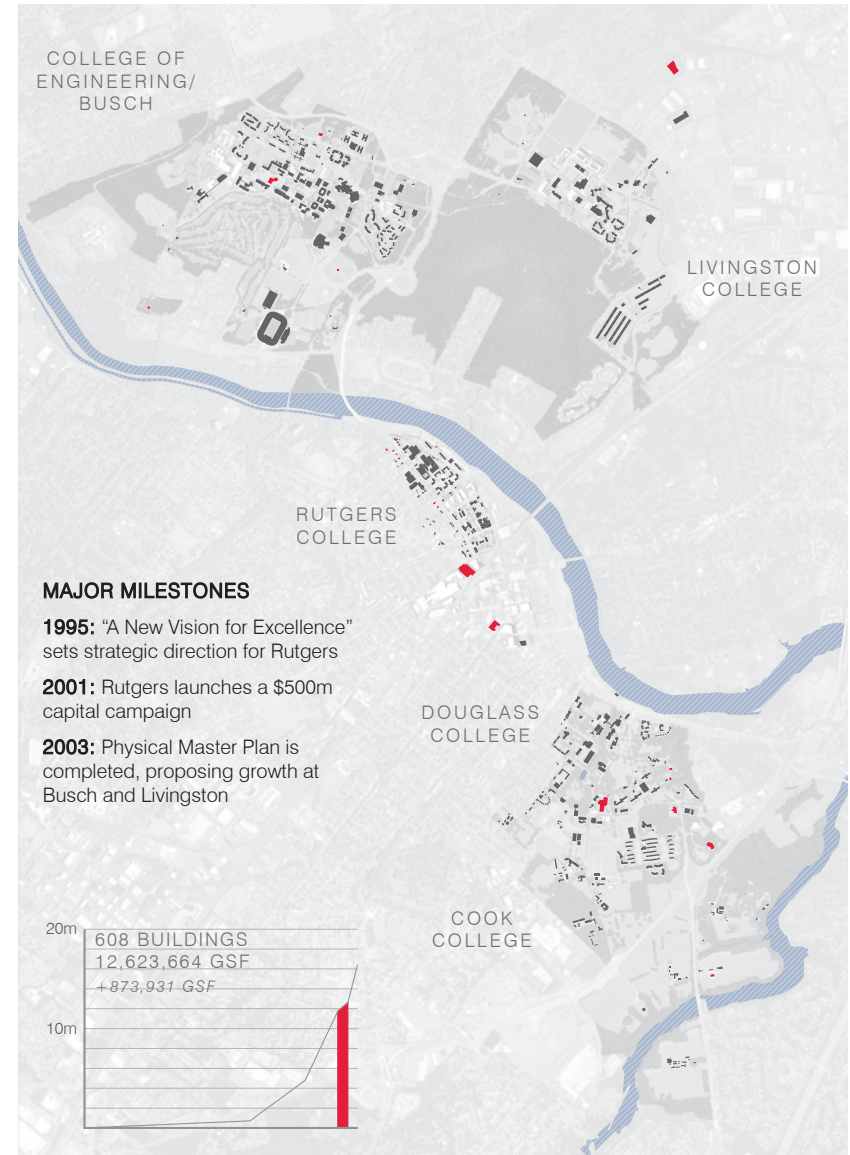
1766-1913: FOUNDING + ORIGINS



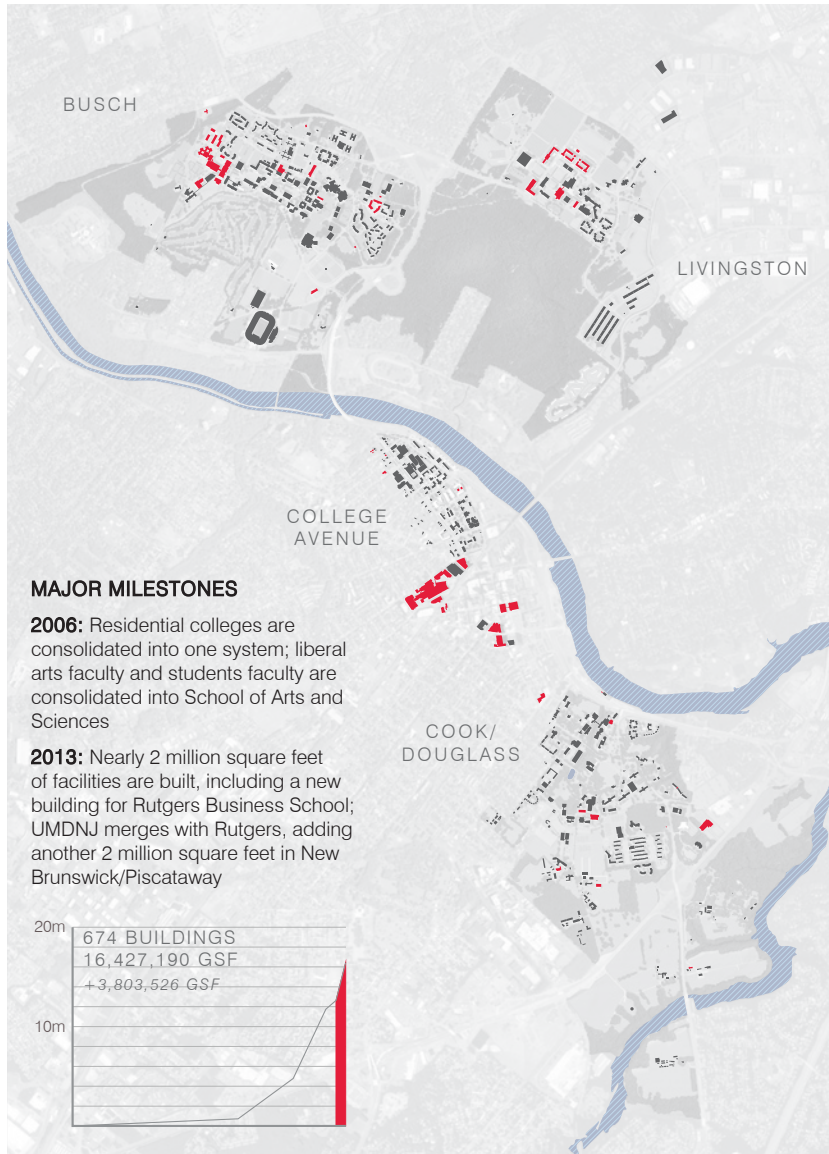
1914-1963: ACADEMIC EXPANSION



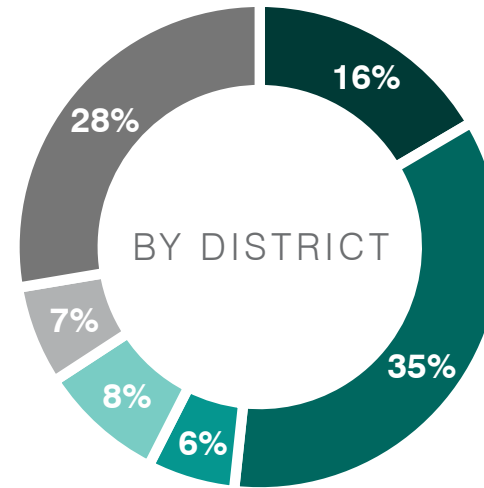
1964-1993: POSTWAR GROWTH



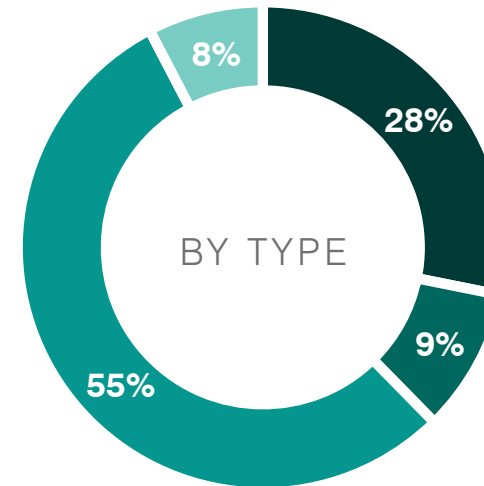
1994-2003: NEW STRATEGIC DIRECTION



2004-2013: SIGNIFICANT GROWTH



- Busch
- Livingston
- College Avenue
- Cook/Douglass



- Academic
- Research
- Residential
- Admin/Student Life

GSF BUILT FROM 2004-2013

improving student life. The football stadium was also expanded in 2009.

While less investment has been dedicated to College Avenue and Cook/Douglass in the past decade, there has been some growth. College Avenue has seen limited growth in academic and student life space, with the Institute for Health, Health Care Policy and Aging Research, and the relocation of the bookstore to Gateway Transit Village. At Cook/Douglass, the School of Environmental & Biological Sciences has a new building currently under construction – the Institute for Food Nutrition and Health in the Cook academic core. The Mortensen Hall Performing Arts Wing, an addition to Nicholas Music Center, opened in Fall 2013, and included classrooms, practice space, and a cafe on the ground floor.

The merger of UMDNJ with Rutgers has also added a significant amount of space to Busch and College Avenue in Piscataway and New Brunswick, respectively. UMDNJ brings research, clinical, health care, instructional, and administrative space to Rutgers. UMDNJ is reorganized at Rutgers as the Rutgers Biomedical and Health Sciences (RBHS) and

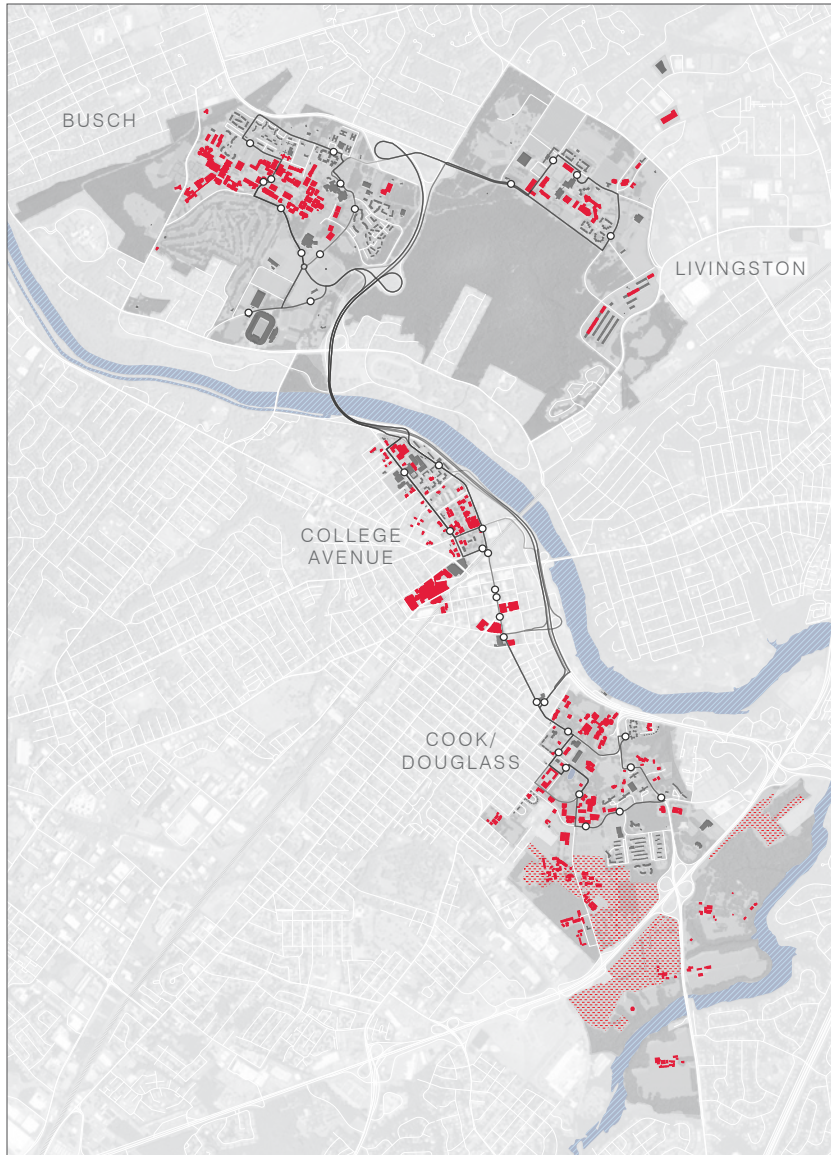
a long-term vision and strategy for RBHS is currently being developed by the University.

CURRENT PROJECTS

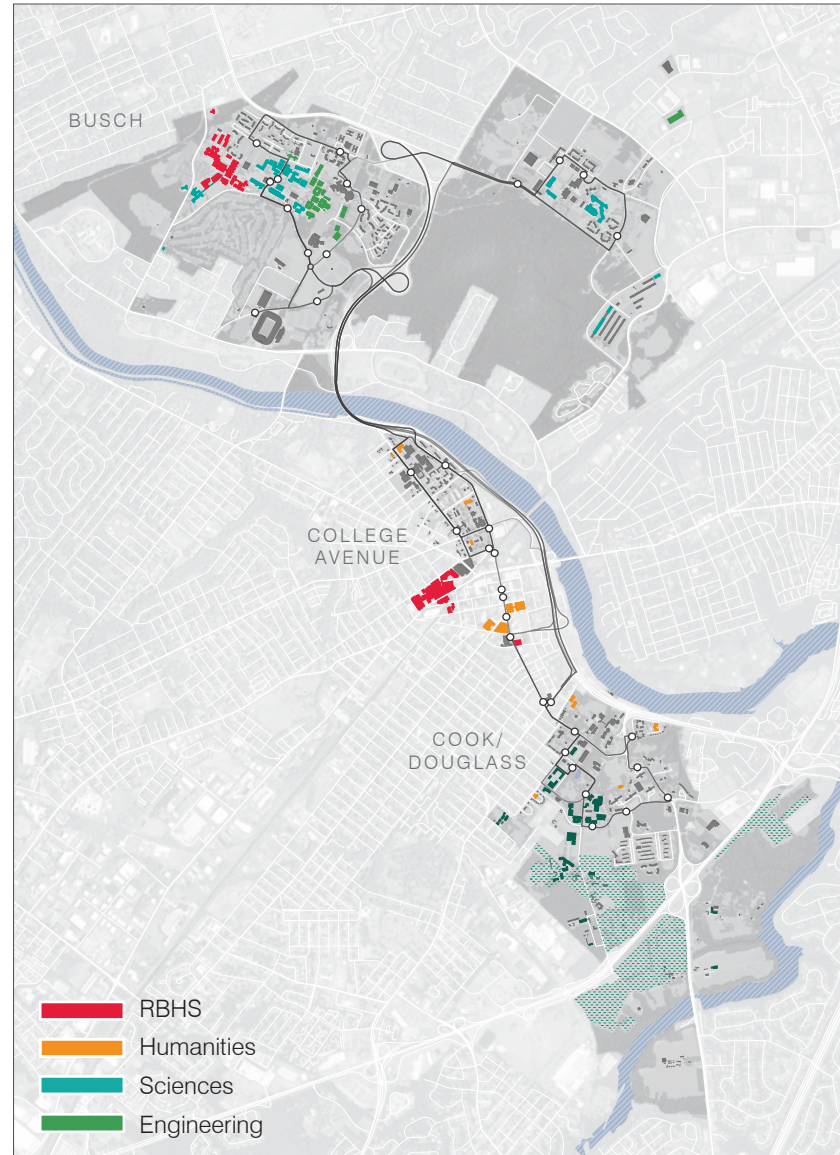
The University currently has several projects in the pipeline, including those in planning, in design, and under construction. Those projects include:

- Chemistry & Chemical Biology Building at Busch, under construction
- Ernest Mario School of Pharmacy expansion at Busch, in design
- School of Engineering building at Busch, in design
- Honors College at College Avenue (with DEVCO), under construction
- Academic Building at College Avenue (with DEVCO), under construction
- Lot 8 Housing at College Avenue (with DEVCO), under construction
- Busch-Livingston Power Plant replacement at Busch, in planning

- College Avenue Power Plant replacement at College Avenue, in planning



EXISTING ACADEMIC FACILITIES



EXISTING RESEARCH FACILITIES

2.2.1 LAND USE PATTERNS

Land use patterns at Rutgers University–New Brunswick have developed over a long period of time. The opportunities and inefficiencies revealed by current land use patterns lay a foundation for many of the master plan strategies in this report. Patterns that have significant impacts on the master plan are summarized in this section.

ACADEMIC FACILITIES

Rutgers University–New Brunswick’s academic schools are split between the districts, based on the origins and history of each former college:

- **College Avenue (humanities):** Arts and Sciences - Arts, Communication & Information, Social Work, Planning & Public Policy, Education, RBHS
- **Cook/Douglass (women’s college, agriculture):** Douglass Residential College, Management & Labor Relations, Environmental & Biological Sciences, Arts and Science, Mason Gross Performing Arts
- **Busch (engineering):** Engineering, Arts and Sciences - Sciences, Applied & Professional Psychology, RBHS, Pharmacy

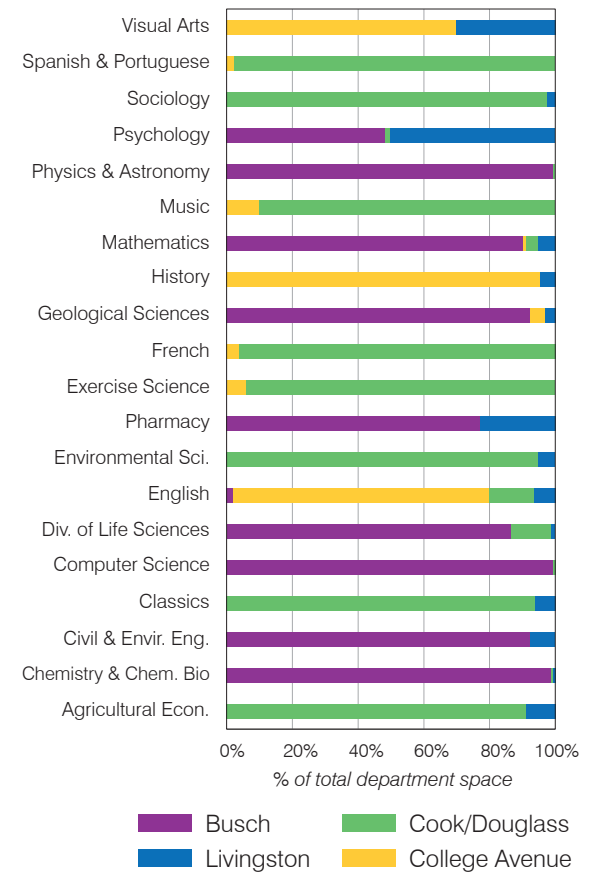
- **Livingston (professional schools):** Rutgers Business School, Arts & Sciences

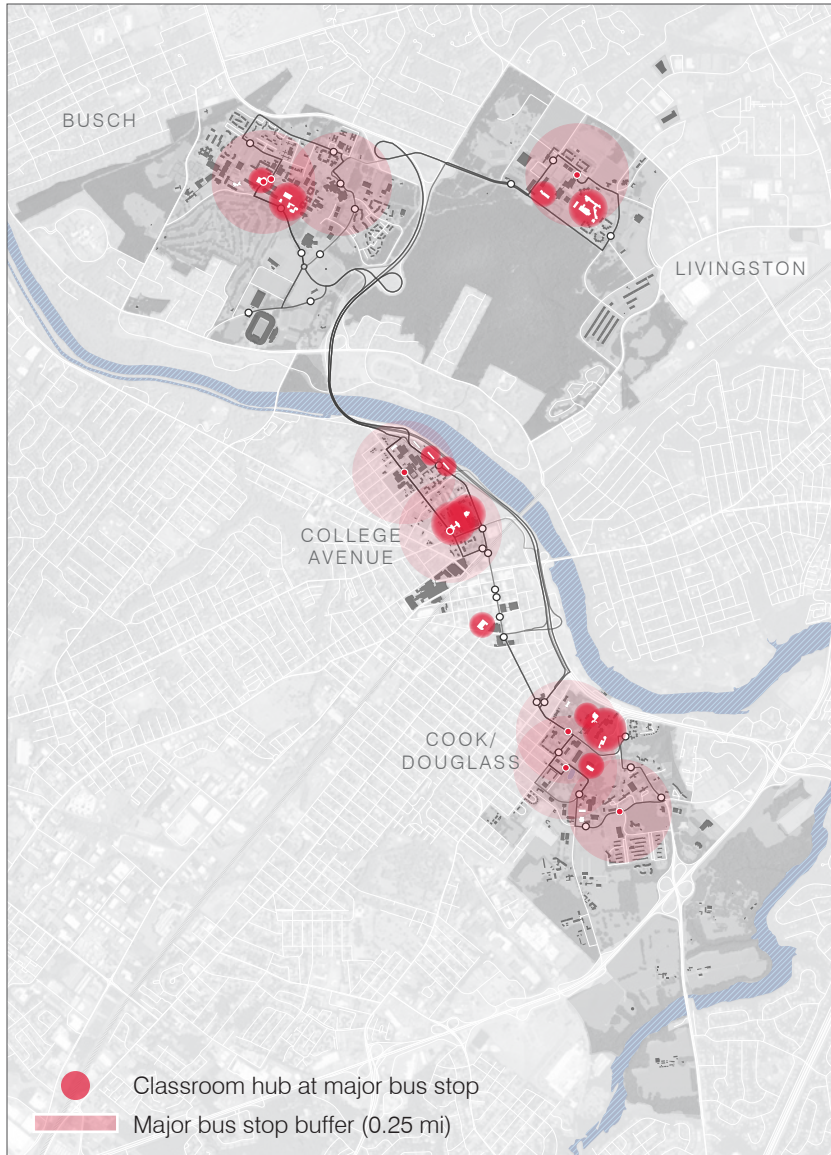
Academic facilities dedicated to these schools are dispersed not only across the four districts, but also within each district. A pattern of sprawl and lack of organization makes it difficult to navigate the campus. Facilities over spread over a large area. Several departments are located on more than one district. This may accommodate faculty who teach large introductory lecture classes with sections in all districts. Other departments have multiple locations due to a lack of available space, and may have a preference for consolidation in order to increase academic interaction and administrative efficiencies.

RESEARCH FACILITIES

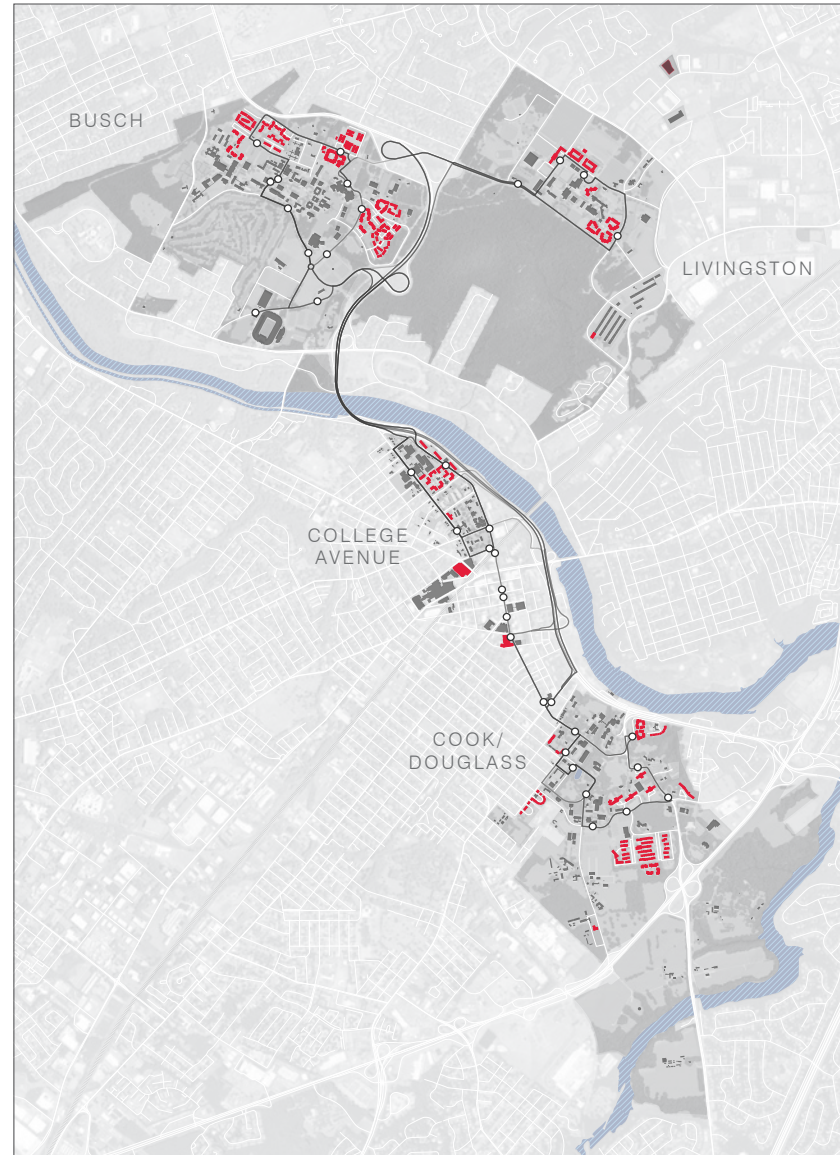
Research facilities are also dispersed across the campus. Shared core facilities are an essential component of any research institution and their efficacy can be impacted by dispersion. The integration of UMDNJ facilities has also added research space at Busch and College Avenue. As UMDNJ’s research operations are integrated, departmental synergies should be considered.

FIGURE 2.2.1 Departments located in multiple districts





EXISTING CLASSROOM HUBS



EXISTING RESIDENCE HALLS

CLASSROOM HUBS

As is the case with academic departments, instructional space is dispersed across the campus. Each district has one or two major classroom hubs, with a high concentration of classroom seats:

- **College Avenue:** Scott Hall/Murray Hall (2,688 seats), River dorms (1,358 seats)
- **Cook/Douglass:** Hickman Hall (1,734 seats), Loree Classroom-Office Building (596 seats), Ruth M. Adams Building (584 seats)
- **Busch:** Allison Road Classroom Building (942 seats), Hill Center/SERC (2,062 seats)
- **Livingston:** Lucy Stone Hall/Tillett Hall (1,874 seats), Beck Hall (1,071 seats)

Although bus stops are located near each classroom hub, the distance between district hubs is reflected in the class change durations, which, at twenty minutes, are longer than typical for a university. Staggered schedules between Busch-Livingston, College Avenue, and Cook/Douglass accommodate students who need to travel to another district for their next class. In general, facilities at the outer limits of the academic

core on all districts tend to be instructional labs located within departments. However, facilities that are farther from transit become increasingly difficult to reach for students, and they may forgo enrolling in a class because of its location. This is a particular concern at Cook/Douglass, where classroom seats are the most dispersed. Rutgers has also built two temporary classroom facilities to meet increased demand - the Livingston Classroom Building and the Cook/Douglass Lecture Hall; these facilities are nearing the end of their useful life.

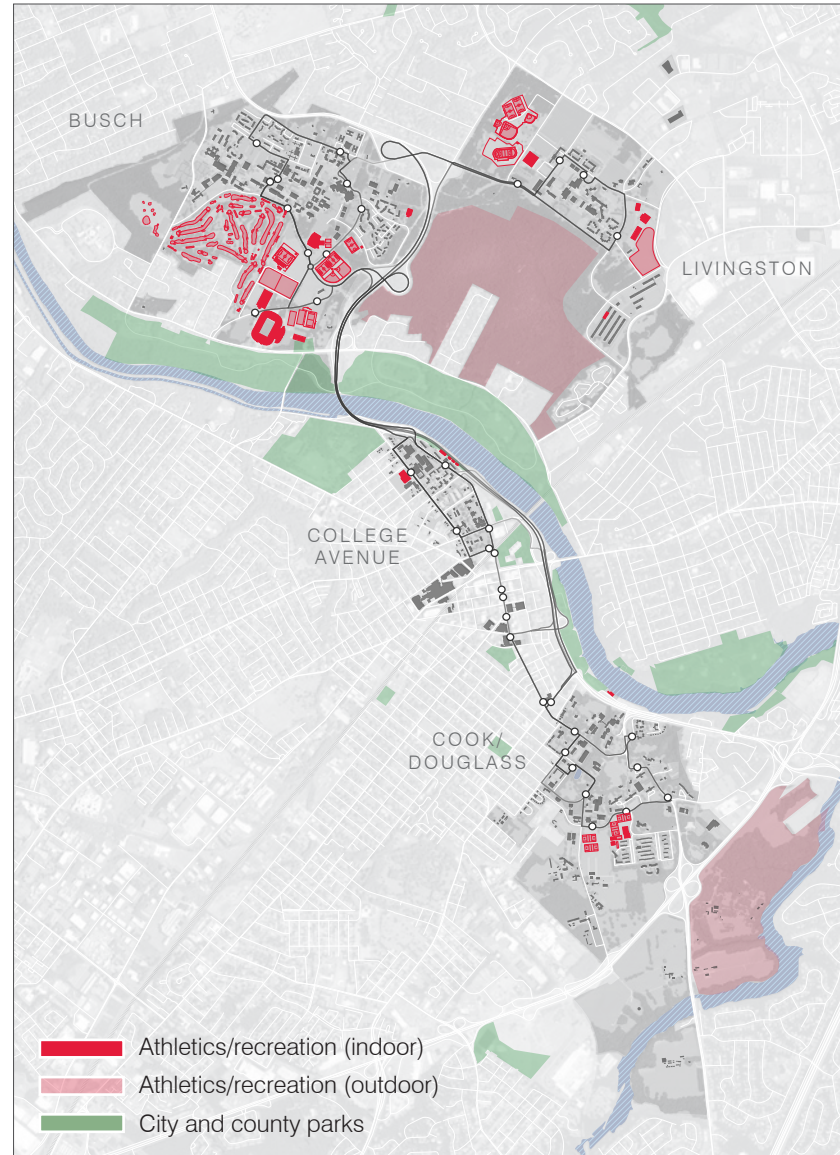
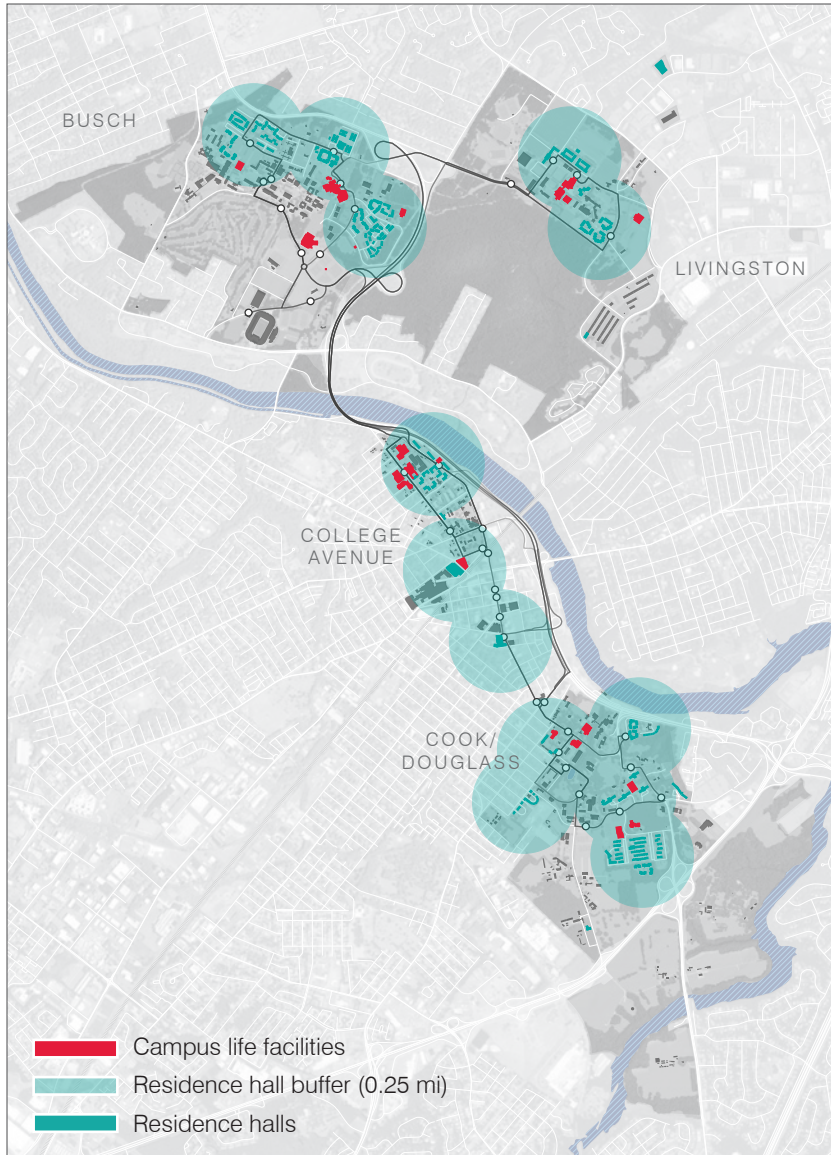
RESIDENCE HALLS

Rutgers University–New Brunswick is home to the largest residential system in the country, with over 15,000 beds. Built primarily in the 1960s, 1970s, and 1980s, the housing portfolio is split mostly between traditional residence halls (50%) and apartment-style units (40%), with a small proportion of suite-style housing (10%). Freshmen live in traditional residence halls, while upperclassmen live primarily in apartments and suites; housing is guaranteed only for first-year students. The majority of the University's residence halls were built prior to the reorganization

of the individual colleges into a single institution. At Cook/Douglass, this is particularly visible, with dispersed housing clusters on Cook and on Douglass.

Residence halls are inconsistently located in relation to student amenities and classrooms. For example, the Nichols and Richardson Apartments were built at the western edge of Busch – remote from most undergraduate housing, the student center, the dining hall, and the recreation center. With its urban, compact pattern of development, College Avenue is most successful at clustering housing near popular destinations. The Livingston Apartments were also designed as an urban context, located across from the student center, with retail on the ground floor of the residence halls.

Transportation to the residence halls is tailored to the dispersed nature of their locations, with some bus stops located to serve residents. For example, the Quads, Nichols Apartments, and Old Gibbons stops are intended to serve large concentrations of residents who are located at a distance from major bus stops and amenities. However, students who live in larger residential districts with only one bus stop are



EXISTING CAMPUS LIFE

EXISTING ATHLETICS AND RECREATION

underserved, including the eastern part of Busch, and the Newell Apartments at Cook/Douglass. Because the bus system is currently running at capacity with respect to the existing stops, investment in more centrally located housing is desirable.

CAMPUS LIFE

Student amenities like campus centers, dining halls, libraries, and recreation centers are hubs of activity, and are often clustered for ease of access. At Rutgers, student facilities have been built with more emphasis on available land than connectivity. At College Avenue, the compact district reduces the effect of these dispersed cores. At Livingston, the student center, dining hall, and library are all located adjacent to each other, but the recreation center is on the periphery of the district. Busch and Cook/Douglass are particularly spread out, and as a result, students must travel farther on these districts.

Student amenities are also located at distance from many residence halls. Two exceptions include the River Dorms and Bishop Quad dorms at College Avenue, and the Livingston Apartments. In some cases, other

barriers impede access to otherwise nearby facilities. Students who live in the eastern part of Busch, for example, live in close proximity to the student center and dining hall, but must cross Bartholomew Road to get there. Vehicular traffic frequently disregards the posted speed limits along Bartholomew, making the road a hazard for students crossing the road.

Student services – financial aid, the registrar, residence life, health centers – are also located in a dispersed manner. Most, but not all of these services are located within ten minutes' walk from a bus stop. Given that students have reported that they make a trip to one office, only to be directed to another office that may be located on a different district, it would be beneficial to consolidate these functions in a central location.

ATHLETICS AND RECREATION

Athletics facilities are located at Busch and Livingston, although the wrestling, volleyball, and gymnastics teams currently practice outside of the athletics core facilities due to a lack of space. Football, lacrosse, soccer, tennis, and golf facilities are located on Busch, with basketball, track and field, baseball, and softball at Livingston. While Rutgers University–New

Brunswick has only about 700 student-athletes – a small fraction of the total 40,000+ students – students and alumni flock to the stadium en masse on game days. Accordingly, game days have a major impact on both parking and transportation. Parking is at a premium, and is limited; special parking rules are enforced throughout Busch and at the Yellow and Green Lots at Livingston. Rutgers also runs special buses to and from the stadium, and students also walk across the river using the Landing Lane and Route 18 bridges.

As Rutgers has recently joined the Big Ten, the impact of game day on transportation is expected to increase. The University completed a game day traffic study in 2009, which explored three options for transit and parking: “total transit,” “park everyone,” and “balanced offense.” More in-depth study is needed to assess physical needs of the athletics department due to the integration into the Big 10 Conference.

2.2.2 SPACE UTILIZATION STUDY

The Space Utilization Study for Rutgers University–New Brunswick was completed in February 2014, and it establishes a foundation for data-driven planning. The study provides a baseline assessment of existing space, current needs, and future needs based on enrollment projections and Council of Education Facility Planners International (CEFPI) guidelines. The New Brunswick campus is anticipated to experience enrollment growth of approximately 7% in total headcount enrollment between 2011 and 2016. The following section is a summary of the findings; the full report is available from the University.

CEFPI space planning guidelines are widely used to benchmark higher education space needs according to specific categories determined by the Facilities Inventory and Classification Manual (FICM) codes published by the US Department of Education. FICM codes (formerly known as Higher Education General Information Survey, or HEGIS) are organized in the following categories:

- **100:** Classroom facilities
- **200:** Laboratory facilities

- **300:** Office facilities for faculty and staff, including conference rooms
- **400:** Library and study facilities
- **500:** Special use spaces including athletics and recreation facilities
- **600:** General use spaces including assembly and exhibition spaces, dining, student life space, and meeting rooms
- **700:** Support facilities
- **800:** Health Care facilities

Consistent with the typical method of CEFPI-based analysis, residential facilities are excluded. The CEFPI guidelines, which focus on indoor space, were supplemented with National Intramural-Recreational Sports Association (NIRSA) guidelines to assess outdoor field space.

The space assessment supports the master planning process, reporting on the University's current portfolio of space and identifying areas of current and future need within the context of campus operations. The study also includes an analysis of instructional space utilization – one of the University's most intensely used

physical resources – providing a baseline for decision making and further action. New teaching pedagogy, as well as changes in the way that students learn and socialize, also affect the University's physical context, and some of the needs identified in this report emphasize the importance of adapting to those changes.

On the New Brunswick campus in particular, the legacy of the individual college system presents a challenge to operating an efficient and connected campus. The distribution of space often contributes to perceived shortages; better connectivity and a more balanced allocation of different types of space will improve access to facilities for teaching and learning and for student life.

The space assessment projects current and future needs, but does not take into account quality of space. The University is in the process of assessing the facility condition and deferred maintenance needs of all University buildings through an independent analysis by ISES. The master plan team recommends that the University complete additional analysis following the completion of the ISES study, comparing

building condition to overall needs. This analysis should include a comprehensive space audit and updated space needs following the completion of the current capital campaign, both within the context of the physical conditions detailed in the ISES study.

Academic space dedicated to departments, including office, research, and instructional labs, should be considered within the context of the next step of the strategic planning process, in which each of Rutgers' schools will develop its own individual strategic plan for growth. More detailed growth projections can be used to refine the space assessment.

OVERVIEW OF FINDINGS

The New Brunswick campus has more than enough total square footage to meet its programmatic needs, both at present and for the near term future; that is one of the primary findings of this study. However, having enough space does not necessarily correlate with having the right space, in the right place.

New trends in teaching and student life continue to emerge, changing the way campuses develop,

operate, and make capital plans. In addition to responding to the changing nature of the college campus, at RU-NB, the legacy of the individual college system continues to affect the campus as a system, and how students access both learning spaces and social environments. This study seeks to identify key areas in which the University can redistribute space to improve the campus experience, not only for students, but also for faculty and staff. Major findings are summarized below, followed by additional detail by space type:

- **At 9,055,675 total asf, the University has sufficient space** — the legacy of the individual college system is apparent in the duplication of facilities on each campus (i.e., dining, recreation, lounge, health care, library). The rationalization of the University's space towards efficient campus operations and a more accessible campus core for students is an important next step.
- **The need for duplicated spaces at each campus is reflected in the distribution of space types across each campus** — the distribution is not always equal, however, creating

local shortages. The rationalization of space should also include a strategy for resolving these shortages, while maintaining efficient utilization.

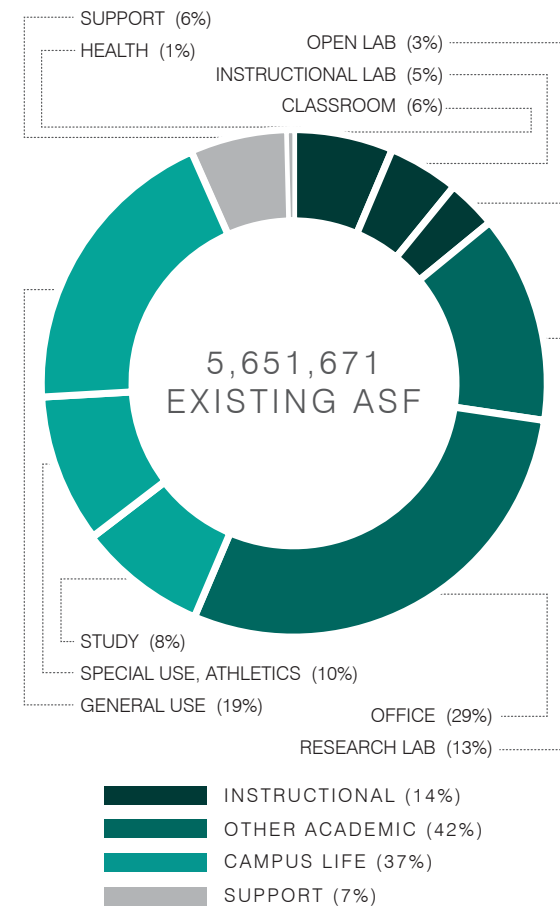
- **Adjusting the classroom inventory will help distribute classroom utilization more evenly.** Overall classroom utilization is above average on all districts for most of the day. In addition, while a number of individual rooms at each district are hyperutilized, with more than 40 weekly room hours (WRH), other classrooms are underutilized. This is due to a number of factors, including: classroom size vs. section size, location, faculty preference, and, in particular, departmental ownership. Departmental ownership frequently limits the number of hours that a classroom is available because unscheduled hours cannot be used by other departments, thus increasing shortages of classroom types and decreasing the efficiency and utilization of the overall inventory. Adjusting the classroom inventory to fit desired section sizes and accommodate the distance between districts, both through technology integration and updating the physical spaces, will help balance utilization and increase efficiency

TABLE 2.2.2 Partial Space Need Summary (ASF)

SPACE TYPE	EXISTING SPACE	CURRENT NEED	FUTURE NEED
LIBRARY + STUDY	779,910	596,935	616,694
Study	418,320	324,794	343,038
Stack	303,539	218,925	218,925
Service	58,051	53,217	54,730
ATHLETIC + PHYSICAL EDUCATION	340,477	598,936	609,969
CAMPUS LIFE	929,213	521,776	550,547
Assembly + Exhibition	133,691	130,596	136,835
Dining	265,212	160,472	169,484
Student Life	530,310	230,708	244,228
Lounge	122,624	74,064	78,224
Merchandising	83,248	74,064	78,224
Recreation	221,300	55,548	58,668
Meeting	103,138	27,032	29,112
Health Care	20,138	12,210	12,834
SUPPORT	276,822	137,006	137,006
TOTAL ASF	2,346,560	1,866,863	1,927,050

Note: Classrooms, instructional labs, and office space are not included in this table; projections of current and future need are under review by the University. Projections of space needs should also be completed at the departmental level as a part of the strategic planning process currently underway.

The chart to the right shows the distribution of space between major types (SuperFICM - i.e., 100, 200, 300, etc). The data excludes residential space, consistent with CEFPI-based space analyses.



across the board. Finally, a significant number of spaces classified as classrooms did not appear in the class schedule, which suggests that these spaces may be in use for other academic functions and should be considered for reclassification.

- **Comprehensive UMDNJ space data was not available**, and space analysis for the former UMDNJ could not be included in this study. A separate study should be undertaken for RBHS, in conjunction with current and future strategic planning efforts.
- **This analysis represents a foundation for department-level strategies and space needs.** The findings of this study should inform a separate study following the development of each school's strategic plan.
- **Maintaining accurate and up-to-date space data should be an institutional priority.** Accurate space data, especially with regards to the space inventory, is essential to comprehensively assess the University's facilities.

In addition to the above summary of findings, the

following section details space needs by type. Looking at space by type, within the context of location, owner, and distribution, provides more nuanced analysis; these findings are discussed below.

CLASSROOMS

Overall, the classroom supply appears to be sufficient across the New Brunswick districts. However, classroom types are not in sync with current teaching pedagogy and the trend towards smaller classrooms—there is high demand for small classrooms (1-25 seats) and a surplus of medium classrooms (26-75 seats). The shortage in small classrooms can have a wide-ranging effect: class sections migrate into larger classrooms after the supply of small classrooms has run out, causing a ripple effect of shortages across the entire inventory. Strategies for resolving this problem include building additional classrooms and subdividing surplus medium-sized classrooms. Better matching classroom and section sizes will also improve individual and overall classroom utilization.

While classroom occupancy is generally within range of its target, pressures on classroom scheduling

reported by University stakeholders may be attributable to a number of hyperutilized classrooms – classrooms scheduled for over 40 WRH. 22% of classrooms at Busch, 47% at Livingston, 44% at College Avenue, and 9% at Cook/Douglass had 40 or more WRH. These hyperutilization of these classrooms, while balanced in overall utilization by underutilized classrooms, increases wear and tear, impacting the scheduled cycle of maintenance and renovation, and, more importantly, the learning experience.

Nearly twenty percent of spaces classified as classrooms are not listed in the Fall 2012 class schedule. In addition, while these spaces represent twenty percent of the total number of classrooms, they only comprise twelve percent of total classroom space in square feet – indicating that some spaces are too small to be classrooms. It is likely that many “unused classrooms” are classified incorrectly; the majority of these rooms are under departmental control and may have been repurposed for other needs. While these rooms were not included in the utilization analysis, they should still be addressed; unused rooms may have potential use as instructional or departmental growth space. A current, up-to-date space inventory,

in addition to ongoing collaboration with departments, will help resolve classification issues.

The University has several projects under construction or in planning and design that will impact the supply and scheduling of classrooms and may alleviate some of the pressure on existing classrooms. However, technology strategies, including cutting-edge classroom technology and more robust scheduling software, could help improve efficiency even further, achieving a greater degree of alignment between class sizes, courses, and teaching pedagogy.

INSTRUCTIONAL LABS

Instructional labs are highly variable in occupancy and should be assessed individually – each department uses its instructional labs in a different way. However, on average, instructional labs meet the target WRH of 25. Instructional labs that have low WRH may be reserved for student use outside of class (i.e., painting studios), or might be in need of upgrading – a level of detail that illustrates why it is recommended that instructional labs be assessed in collaboration with the given department. For example, it might be beneficial

to include an assessment of lab space in the strategic planning process at the school level.

Almost half of all spaces classified as instructional labs are not listed in the Fall 2012 course schedule, a finding that indicates that they may be classified incorrectly, similar to unscheduled classrooms. Many of these labs are under departmental control, and belong to engineering or science disciplines. As is the case with classrooms, better space data and ongoing collaboration with the departments are needed.

RESEARCH LABS

With respect to research labs and other research space, traditional space analysis is typically customized based on conversations with the departments. This information was not available for this study, but existing space is summarized in the full findings of the Space Utilization Study for RU–NB. However, the 2014 strategic plan predicts growth in science and engineering, so it is likely that additional research space will be needed, as well as the ongoing modernization of older research space.

OFFICE

Total office space appears to be sufficient. However, office space can be more accurately assessed with station counts, which indicate how many actual offices are needed. Space-based assessments of office space may not take into account variations in office size or large areas of cubicles that might be classified as a single office space. Station counts, the most accurate method of office space accounting, were not available for this study. Current and future office space needs should be assessed at the departmental level, when the data is available.

LIBRARY + STUDY

Library and study space encompasses stacks, study, and library support space. The apparent surplus of space — 779,910 asf existing, compared to 616,694 asf needed according to CEFPI guidelines — masks a need for additional study space. Many open labs, which are traditionally classified as part of study space, are scheduled for class activities. This practice limits their availability to the entire student community, creating a shortage of study space. As libraries move more towards providing collaboration space in

a learning commons model, the University's libraries can be re-envisioned as hubs of active learning.

ATHLETICS

There is a shortfall in athletics space, with 340,477 asf existing, compared to 609,969 asf needed according to the CEFPI guidelines. The 340,477 asf of existing space does not include recreation centers, which were coded in the inventory as athletics space; for this study, space coded as athletics space in the recreation centers has been excluded from athletics space, and added to student recreation space, given the University's entrance into the Big Ten, and the prevalence of separate athletics and recreation facilities at Division I schools. The shortfall of athletics space is evidenced by the use of recreation centers for intercollegiate athletics – wrestling and volleyball practice and compete at the College Avenue Gym, while gymnastics uses the Livingston Recreation Center. The University has just entered the Big Ten, which may provide additional incentive to upgrade existing athletics facilities. Further study to identify specific needs and solutions is recommended as a next step.

GENERAL USE

For the purposes of this study, general use space – open to the entire campus community – has been gathered into three categories: assembly and exhibition, dining, and student life. Student life space, which is space open to all, but generally used by students, has four subcategories: lounge, merchandising, recreation, and meeting.

As is the case with many other categories of space at the University, in general, the total amount of existing space is sufficient for current and future needs. However, especially in the case of general use space, it is the quality and distribution of space where there are remaining unmet needs. Some facilities are in need of modernization or have a significant amount of deferred maintenance. Many students noted Brower Commons as their least favorite dining hall in the MyCampus survey conducted in Fall 2013, and the need to renovate this facility was confirmed in stakeholder interviews. Despite the condition of this facility, it still records a high level activity due to its central location. However, it is likely that if it were modernized, more students would use the facility.

Neilson Dining was also mentioned as a facility in need of renovation.

While the space model suggests a certain proportion of each kind of general use space, those proportions are not the same between campus locations. Perceived shortages, in many cases, might be due to the facilities at one campus location being disproportionately busy, with a corresponding lack of activity at other campus locations. This is especially true of meeting space, which is in high demand at College Avenue.

Assembly and Exhibition

Assembly and exhibition space are adequate for current enrollment, according to CEFPI guidelines. However, assembly spaces are operating close to capacity, and University stakeholders have expressed concern that there is no indoor venue at the New Brunswick campus that is large enough to accommodate campuswide concerts and events with special speakers. Many assembly spaces are under departmental control, further decreasing the availability of existing spaces.

Exhibition

Exhibition space is currently sufficient according to CEFPI guidelines, but is located primarily in large venues, including the Voorhees Zimmerli Art Museum. One other such venue, the New Jersey Museum of Agriculture, is currently closed, although the School of Environmental and Biological Sciences (SEBS) is developing a plan for this space. In the interim, additional exhibition space, especially informal exhibition space to showcase research or student work, is a potential need.

Dining

Dining space is more than sufficient, with nearly 100,000 asf more than future need, according to CEFPI guidelines. Some of this surplus is due to the duplication of facilities that is required to serve each campus location. However, some dining facilities are in need of renovation, particularly Brower Commons at College Avenue and Neilson Dining at Cook-Douglass. Students cite the dining facilities at Livingston as their preference due to its recent modernization, as well as its wide range of retail options. A campuswide vision for dining facilities is needed.

STUDENT LIFE - LOUNGE

Lounge space currently exceeds current and future need, with 122,625 asf existing, compared to 78,224 asf needed. Stakeholder interviews noted a lack of lounge space in student centers; this was echoed by student responses to the MyCampus survey, which noted that lounges at the student centers can be crowded and that lounge space for commuters is insufficient. This localized, high-intensity use of lounge space in student centers may indicate a need to redistribute lounge space to the student centers, and should be studied further with Rutgers Student Life. Surplus lounge space that may exist outside of the student centers could also be repurposed as flexible multi-purpose space, a need identified by students and staff.

STUDENT LIFE - MERCHANDISING

Merchandising space appears to be sufficient, with 83,248 asf existing, compared to 78,224 asf needed. There is some variation in the distribution of merchandising space between campus locations, but the lower proportion of space at Livingston is likely filled by the additional retail dining options located

on the ground floor of the Livingston Apartments residence hall.

STUDENT LIFE - RECREATION

Recreation centers are another area where quality is the primary need, rather than additional square footage. Some of the existing space beyond current and future need is due to the duplication of facilities at each campus location; the facilities at each location are likely to remain in use. Recreation space is often ad hoc from institution to institution, and policies towards recreation space affect space needs beyond what is projected by CEFPI guidelines.

As is the case with dining space, local shortages can occur when users show a clear preference for the facilities at a specific location. The Werblin Center at Busch is most frequently chosen over the facilities at other campus locations, because it is the most modern of facilities, while the College Avenue Gym was highlighted as being in need of renovation. The allocation of program within a given recreational facility may also need rethinking, as new trends emerge in recreational activities. According to National

Intramural-Recreational Sports Association (NIRSA) guidelines, there is a significant need for additional outdoor field space. The findings of this study, in addition to the 2012 recreation master plan, should be considered in creating an overall vision for recreation.

STUDENT LIFE - MEETING

As is the case with classrooms, meeting space is characterized by having an outdated range of room sizes. The mismatch between room size and event attendance can push events into rooms that are not suited for the event, which also puts pressure on the high-demand larger meeting rooms. Although the amount of meeting space is far more than adequate according to CEFPI guidelines, with 103,138 asf existing and 29,112 asf needed, student organizations are very active at RU–NB and generate above average use of available meeting rooms. Academic departments, as the second largest user, primarily use meeting rooms for student-related programming, such as workshops, lectures, and career fairs. In FY13, over 20,000 reservations were booked into not only the inventory of meeting rooms, but also available classrooms—classroom use accounted for

nearly 6,000 reservations. Location also plays a role in the shortage of meeting space, with College Avenue representing 42% of all reservations. Clearly, further study, involving the Department of Student Life, is needed to identify specific needs with regards to room size, quantity of rooms, and location.

SUPPORT

Support space is currently more than adequate, with 276,822 asf existing, compared to 137,006 asf needed. A large majority of this space is dedicated to central storage (45%), facilities shops (30%), and computer and telecom space (20%). No shortages in space were reported in stakeholder interviews. The University might consider conducting an inventory of its central storage.

OTHER FINDINGS

This study provides a baseline snapshot of the current portfolio of space based on the data provided by the University. However, the University has several projects under construction, or in planning, for which data was not available, and thus could not be included in this

study. Once the current round of capital construction and the Sightlines facilities assessment are completed, a future assessment should be undertaken in order to provide a more comprehensive view of campus space needs. This proposed study would reassess space needs, and rationalize the entire portfolio of space towards balancing efficient use and necessary duplication at each campus location. Specific departmental space needs can be identified as the University completes the New Brunswick strategic plan.

Better data translates directly to better analysis; this study was affected by gaps in data, including employee station counts, that would have enabled a more detailed analysis. An audit of the current space inventory is also recommended, as more consistent data will allow for the most accurate analysis. For example, recreation centers were coded as athletics space, although there is a FICM code for indoor recreation space; some classroom spaces are too small to be used for teaching, and might be better coded as classroom service. Many institutions perform an annual audit of their space, in order to maintain a current inventory as space goes inactive,

new space is added or modified, or the actual use of the space is changed by its user. Coordination with other administrative departments on consistent data collection, including the Registrar and Human Resources, will also aid future analysis efforts.

Maintaining a current inventory of space with consistent FICM codes, as well as associated datasets – such as station counts, dining information, and class schedules – will help the University operate as efficiently as possible. In addition to efficiency, better data will improve access to space, help the University plan for future growth, and provide more accurate reporting for University initiatives such as indirect cost recovery.

2.2.3 CORE FACILITIES AND THE NEED TO TRAVEL

With over 65,000 students, 9,000 faculty, and 15,000 staff across three campuses, Rutgers University comprises a large community of stakeholders. The master plan team used web-based technology to maximize participation from the Rutgers community in the planning process, customizing Sasaki's interactive MyCampus survey to gather feedback on aspects of the physical campus, from the best classrooms to popular places to study and eat, and how students, faculty, and staff get around and between the districts. The survey extended the team's outreach efforts beyond the initial round of stakeholder interviews, allowing a larger proportion of the community to provide their feedback on the feel and function of the campus. Approximately 8,000 students, faculty, and staff completed the survey across all three Rutgers campuses, with the majority coming from the New Brunswick/Piscataway campus. The primary findings are summarized below.

CORE CAMPUS FACILITIES

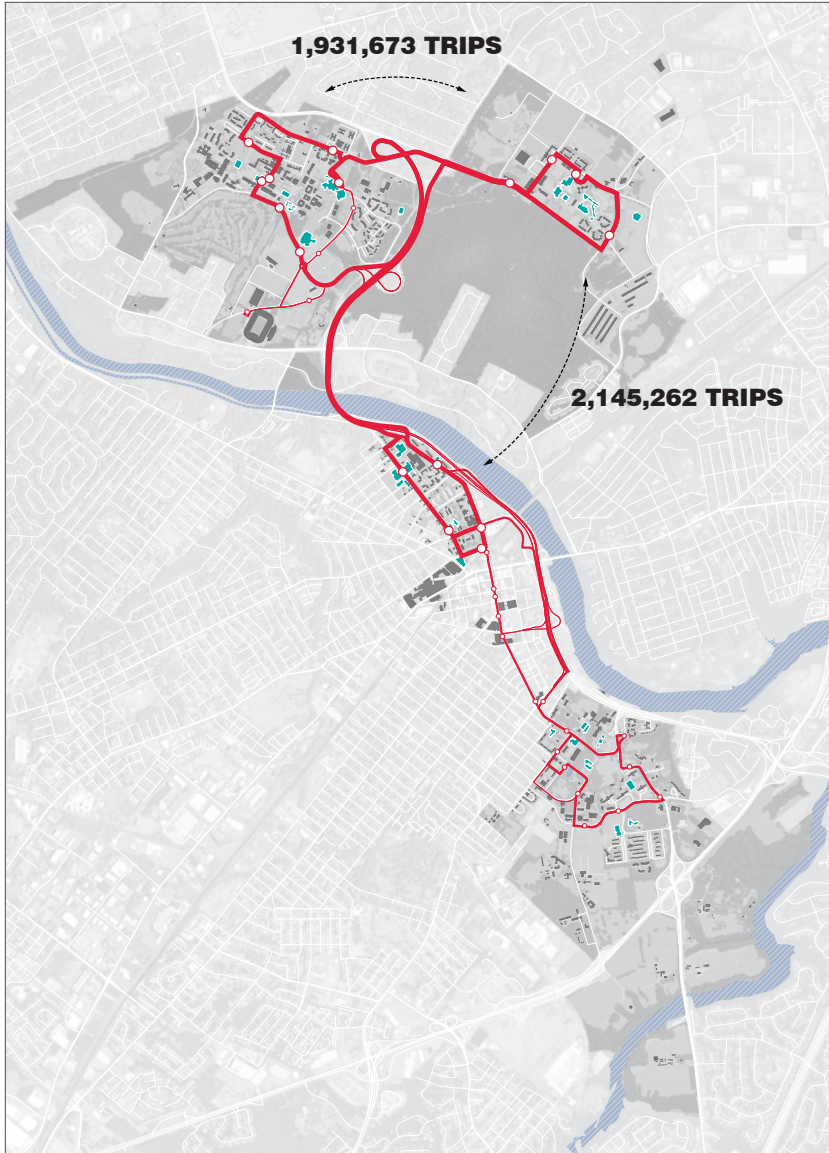
The survey confirmed that the most important campus spaces are student centers, dining halls, major classroom buildings, libraries, recreation centers, and

residence halls. These facilities serve as formal and informal learning environments, social spaces, and meeting spaces for the entire Rutgers community. Students, in particular, travel between these facilities on all of the districts to attend class, meet friends for meals or to study, work out, and go to student organization meetings and events. The core facilities are also the most frequented by first- and second-year students – more so than juniors and seniors, who also socialize and study with friends in Highland Park, along Easton Avenue, and within their academic departments. Similarly, commuter students were more likely to use off-campus resources like Johnson Park, while resident students typically stayed on campus.

Faculty and staff use many of the same core facilities as students, especially dining and student centers. While these spaces primarily serve students, they do not always accommodate faculty and staff as easily; this part of the community was concerned with their needs being addressed by the master plan. The need for faculty and staff-specific spaces is reflected in requests for dedicated lounge and dining space, where faculty and staff can relax in a quieter environment, or where they can bring guests.

The primary factors in the popularity of different core facilities are quality and location. For example, while many students described Brower Commons as an outdated facility, they still ate meals there because of its central location. Still, a shift towards the newer facilities at the Livingston Student Center and Dining Commons is apparent from the University's trip data for the Rutgers buses: College Avenue-Livingston was the connection with the highest number of trips, followed by Busch-Livingston. Investment in the core facilities, as evidenced by Livingston, clearly benefits the entire campus community. However, the higher level of activity at the most popular facilities can result in localized crowding, due to the range in quality of the facilities across all of the districts.

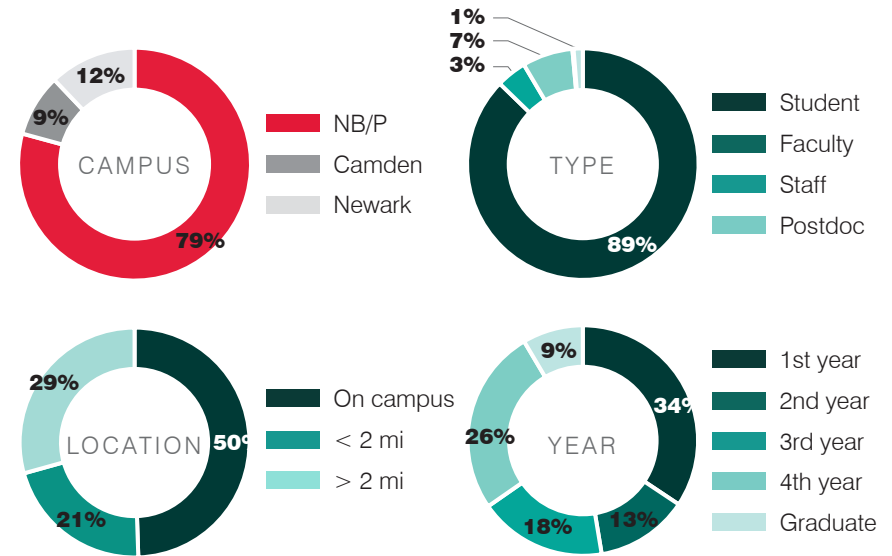
Another finding revealed by the survey is that students view the variety of the facilities on different campuses as a benefit – for example, when they tire of the dining hall on their campus, they can take a bus to a different campus with alternate dining selections. Similarly, each campus has distinctive recreation facilities, defined by its natural resources and pattern of development, which contributes further to their specific identities and sense of place. The distinctive nature of each campus



MOST POPULAR BUS ROUTES

TABLE 2.3 Rutgers Bus Ridership on Major Routes (AY2012-2013)

	RIDERSHIP	CAMPUSES	TRIP TIME	PEAK HOURS
A	1,175,096	CAC-B	35 MIN	11am-10pm
B	1,931,673	B-L	30 MIN	1pm-9pm
C	177,238	WEST LOT-BCC	12 MIN	
EE	1,391,804	CAC-C/D (local)	45 MIN	11am-9pm
F	1,488,225	CAC-C/D (Rte 18)	35-40 MIN	12pm-9pm
H	1,158,741	CAC-B	35 MIN	10am-10pm
LX	2,145,262	CAC-L	30 MIN	11am-9pm
XB	762,355	B-C/D	36 MIN	12pm-10pm
XL	879,690	L-C/D	36 MIN	1pm-8pm
WK1	467,744	ALL	60-70 MIN	
WK2	436,939	ALL	60 MIN	



MYCAMPUS RESPONSES

is a quality that is clearly important for the University to nurture and enhance, while simultaneously creating a cohesive New Brunswick/Piscataway campus overall.

INTER-DISTRICT TRAVEL

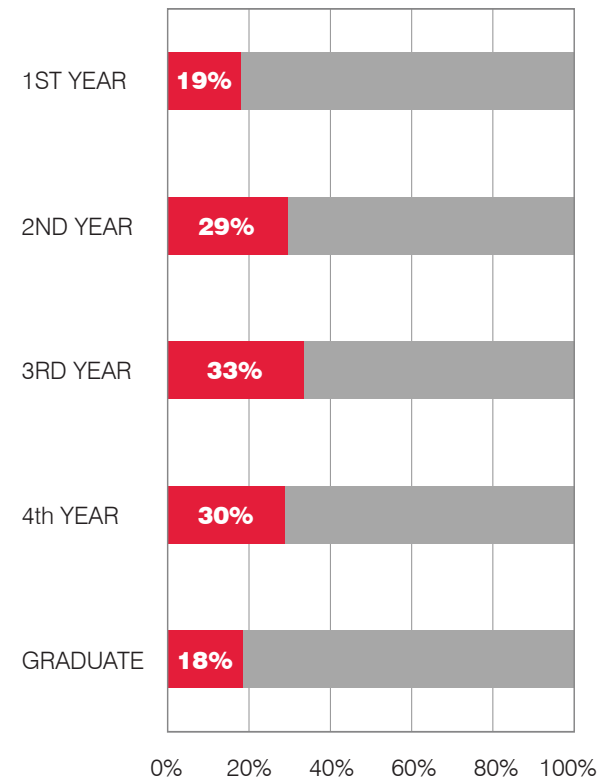
The transportation section of the survey also confirmed that students spend a significant amount of time on Rutgers buses, for both academic and social activities. For example, because the most popular facilities are generally dispersed between different campuses – dining at Livingston, library at College Avenue, recreation at Busch, etc – students frequently use Rutgers buses to travel between them. Students are the primary users of the bus; faculty and staff drive to avoid delays and because it is generally more convenient to them than taking the bus. The effectiveness of core facilities and, consequently, the student experience, are thus firmly intertwined with the experience of riding the bus.

While students were generally satisfied with the buses, the majority of student survey respondents, including those who were satisfied with the service, thought that buses were overcrowded. NextBus, while a positive

addition to the bus service, was seen as sometimes inadequate, as it does not account for unpredictable wait times at high-volume bus stops. The limitations of intercampus travel sometimes prevent students from taking classes they might otherwise enroll in, although they generally feel that they still receive a high-quality education. In some cases, transportation-related constraints can delay graduation if a required class does not fit within a student’s schedule.

Some specific improvements were cited by survey respondents. For example, better service between Busch and Livingston is desired; both campuses are on the same block schedule, but have a bus route that can exceed the allotted class change time. The former bus stops along Cedar Lane are missed by students, faculty, and staff who live in the Highland Park and Edison area.

FIGURE 2.2.3 *Transportation constraints: Have you ever been unable to take a class because of a tight class change schedule? Is the inability to take this class likely to delay your expected graduation?*





2.2.4 CLASS SCHEDULE-BASED TRANSPORTATION DEMAND

Analysis of current scheduling practices and the resulting impact on student travel demand was carried out during the planning process. The results of this analysis, including the visualization known as the “Swarm,” supports concepts included in the master plan to decrease inter-district travel and to develop software that will help students make better choices and enhance their campus experience. As noted in the introduction to this report, Rutgers University–New Brunswick faces logistical challenges due to the distance between the Busch, Livingston, College Avenue and Cook/Douglass districts. Consequently, the student experience for many is defined by the time spent on the Rutgers bus system.

Analysis of student data revealed the inefficiency of current scheduling practices and confirmed a link between scheduled academic activity, housing choices, and the need to travel between districts. While the existing bus, housing, and class scheduling systems have each been designed to handle activities within their purview, they have not been coordinated with each other to maximize efficiency and convenience.

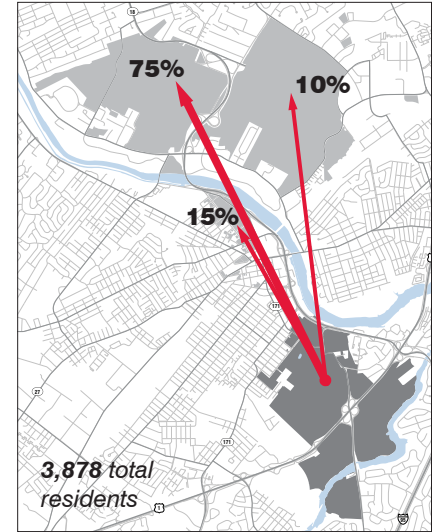
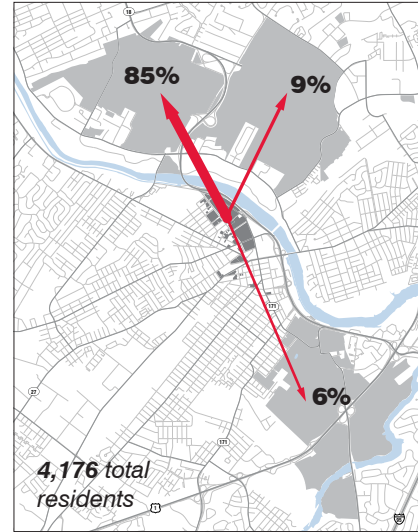
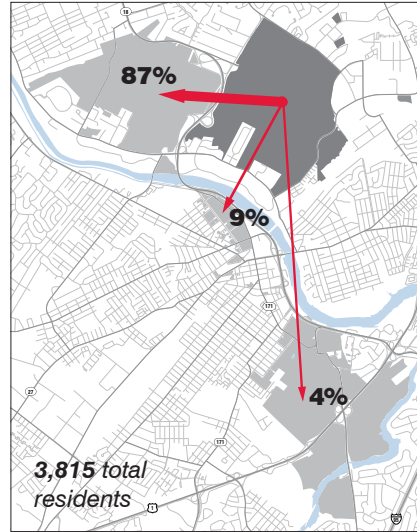
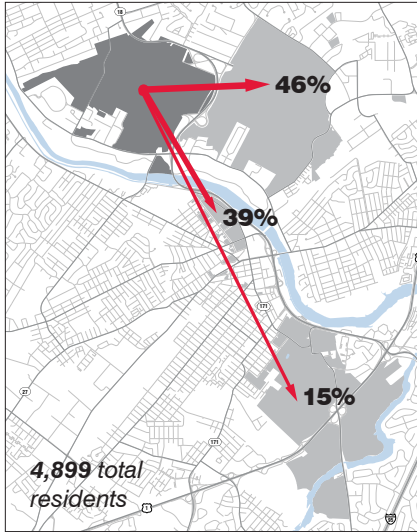
Rutgers is planning to upgrade its scheduling software package; this change presents an opportunity to implement a system that will improve the efficiency of multiple aspects of the student experience. Beyond improving the way that classes are scheduled and managed, the system can provide better coordination with the housing and bus systems. For example, the Rutgers bus system provides efficient and convenient connectivity between districts; however, current scheduling practices require more trips than necessary. Furthermore, the system is sometimes overwhelmed when several large classes end at the same time, in the same building, and students seek to travel to other districts. Housing assignments for resident students further increase the need to travel, since they are made independently of their class schedule. At present, students are not provided with adequate information to understand the travel consequences associated with class scheduling and housing decisions.

EFFICIENCY ANALYSIS

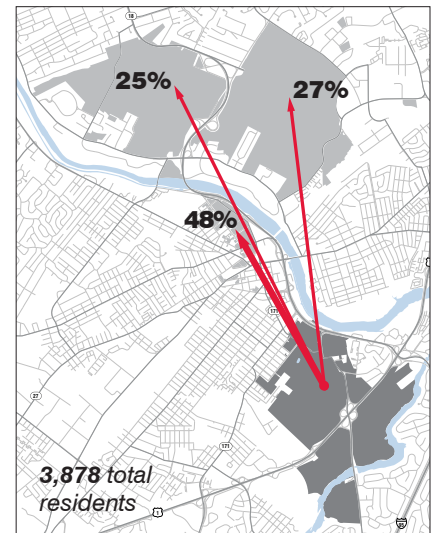
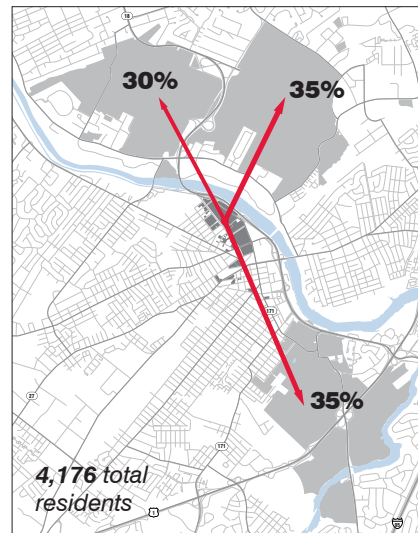
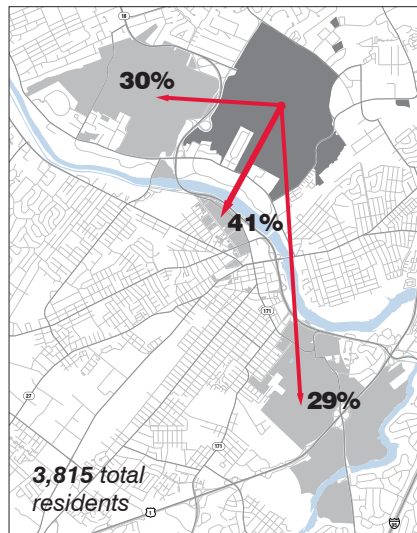
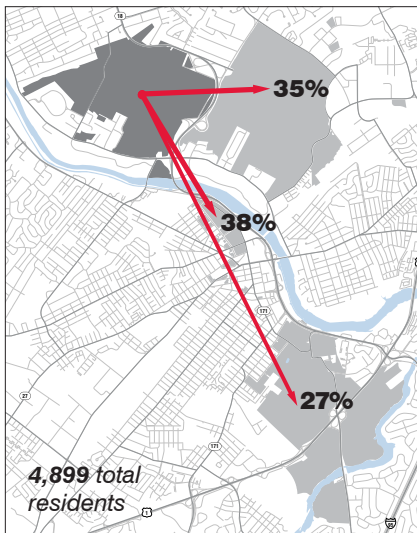
To better understand the inefficiencies of current

class scheduling and housing assignment practices, and the associated need to travel, a series of analyses were performed on the Fall 2012 resident student dataset. The dataset is weighted towards first and second year undergraduates, as they are most likely to live on campus, and are particularly important relative to retention and recruitment. The dataset included 11,651 resident students, representing a majority of the resident Rutgers student population, and 19.8% of the total Rutgers student population.

The efficiency analysis was developed by utilizing a custom data analysis and visualization tool developed for Rutgers to view and synthesize the dataset. Known as the “Swarm”, the tool assisted the master planning team in analyzing the complexity of movement at Rutgers University–New Brunswick – first, by quantifying the number of inter-district movements resulting from the Fall 2012 class schedule; and second, by quantifying the travel associated with current housing choices, and classroom and section selection practices, among other factors. The second quantitative measure reflects the inefficiency of the given combination of factors. The results of the analysis are detailed in the appendices of this report.



Resident students in the School of Engineering travel to other campuses at varying rates over the course of the week to attend their classes. Students living at Livingston, College Avenue, and Cook/Douglass travel to Busch most frequently, while students living at Busch travel to Livingston most frequently.



In comparison to resident students in the School of Engineering, resident SAS students travel to other campuses in relatively equal proportions. The travel associated with taking classes in SAS is due both to large introductory classes, which are offered on all campuses, as well as the dispersed nature of SAS departments and higher level classes.

The analysis revealed the extent to which the class schedule resulted in inter-district movement. Students whose major is in the School of Arts and Sciences and the School of Engineering – the University’s two largest schools – experienced the highest amount of travel, with 8.7 and 6.2 weekly trips per student, respectively. In the aggregate, SAS generates 57,635 weekly trips, while Engineering generates 9,590 trips. The proportions of trips between the districts varied, relative to the location of the school’s facilities; the School of Engineering is concentrated on Busch, while the School of Arts and Sciences has departments located on all districts. Trips between districts for Engineering students were primarily to go to Busch, while for SAS students, trips were spread out throughout the New Brunswick campus. The high number of trips suggests that students are making many trips away from their home district, and that housing could potentially be better coordinated with class schedules.

SAS, with its more dispersed departments, faces particular challenges with respect to inter-district travel. SAS generates 65% of all class schedule-generated trips, in part because it has the most majors, but also

because it offers many of the University’s introductory level subjects, including Expository Writing and General Chemistry. Many of these courses are offered on multiple districts in order to meet demand, maximize convenience to students, and utilize existing facilities. However, in practice, the analysis found that courses offered on multiple districts are generating the most inter-district travel, indicating a need to better understand location in relation to the class schedule.

The potential for developing a data-driven approach to scheduling practices and housing selection – both of which impact the bus system – is highlighted by this analysis. Each part of the efficiency analysis isolated a specific set of practices, to better understand their impact on the need to travel. While the efficiency analysis does not represent fully developed scenarios, it highlights the inefficiency and impact of ongoing practices and decisions. Improving coordination between these systems would have multiple benefits, including more efficient use of classrooms, and a better student transit experience, towards a better overall student experience. These findings imply changes to current student life and academic scheduling practices, facilitated by technological and

data-driven strategies.

TABLE 2.2.4 Top 20 Courses by Trips Generated

COURSE	TRIPS	WSCH	CAMPUS
General Chemistry	4,505	8,029	CA, C/D, L
Expository Writing I	3,333	10,889	B, CA, C/D, L
General Biology	3,321	10,794	B, C/D
General Psychology	3,203	8,120	B, CA, L
Calculus I	3,197	8,425	B, CA, C/D, L
Organic Chemistry	2,565	8,029	CA, C/D, L
Intro to Microecon	1,950	3,979	CA, C/D, L
Precalc College Math	1,590	3,723	B, CA, C/D, L
Abnormal Psychology	1,416	2,699	B, C/D, L
Theater Appreciation	1,406	2,925	CA, C/D
Intro Comm & Info	1,382	2,792	CA, C/D
Multivariable Calculus	1,363	3,180	B, CA, L
General Physics	1,269	2,505	B, C/D
Calculus I Math/Phys	1,266	3,388	B, CA, C/D, L
Intro to Sociology	1,258	2,106	CA, C/D, L
Calculus II Math/Phys	1,257	2,620	B, CA, C/D, L
Social Psychology	1,204	2,368	C/D, L
Qnttv Methd in Psych	1,128	2,080	L
Planet Earth	1,108	3,180	B, CA, C/D, L
Analyt Physics II	1,026	1,650	B

Note: Top 20 courses by Weekly Student Contact Hours (WSCH) are highlighted in light turquoise.



2.3 Mobility and the Need to Travel

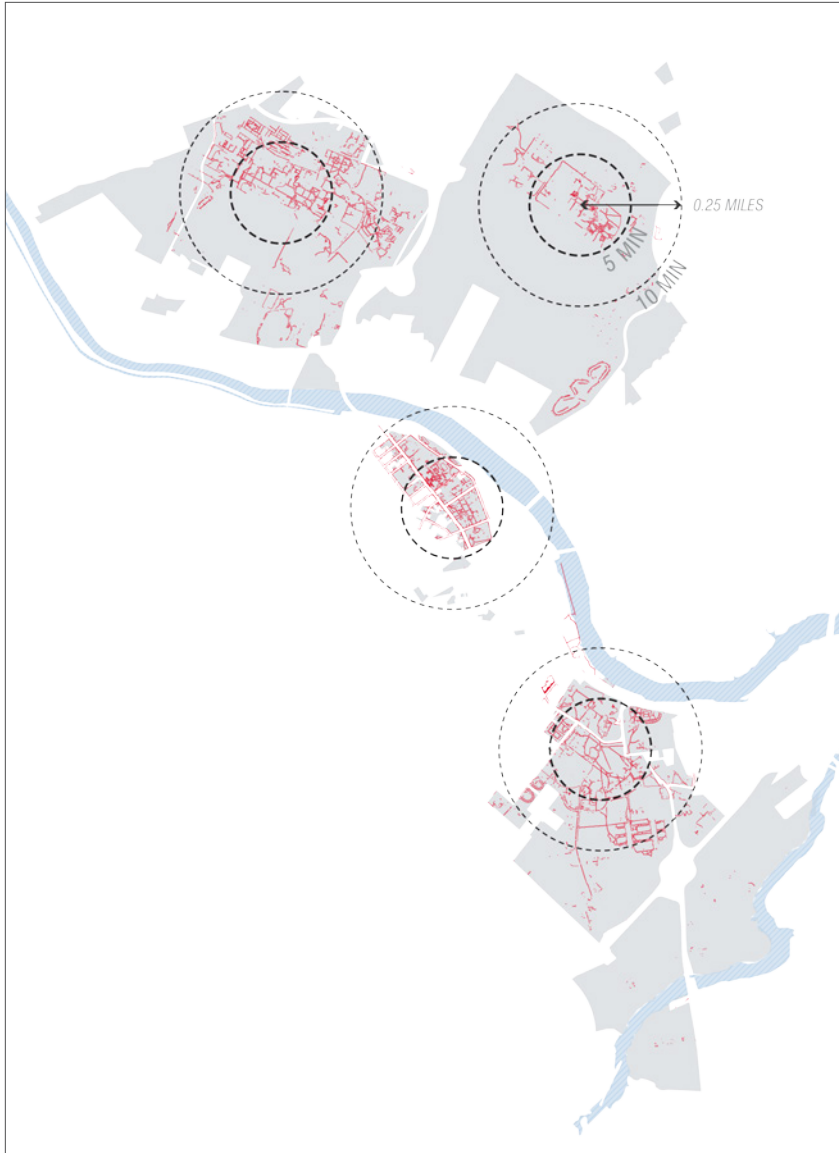
As discussed in the previous section, the distributed layout of Rutgers University–New Brunswick combined with its centralized class scheduling and housing policies has led to a significant transportation challenge. For Rutgers to thrive as a vital institution, convenient access is critical. Historically, this access has in large part, by automobile. However, the nature of its role is changing. Today, the Rutgers bus system is providing a majority of inter-district trips by students, to the point of straining its capacity. As the University and the surrounding region continue to grow and change, the transportation system must also evolve, not merely to remain functional, but to enhance the quality of student life, the environment, and the community.

For many, discussion of campus travel conjures the thought of student and employee commutes to and from campus. While the commute continues to be a substantial component of travel at Rutgers, internal transportation is an increasingly large – and for many, frustrating – element of the Rutgers experience. Rutgers operates the largest university housing operations in the country with additional buildings being planned or under construction. Redevelopment

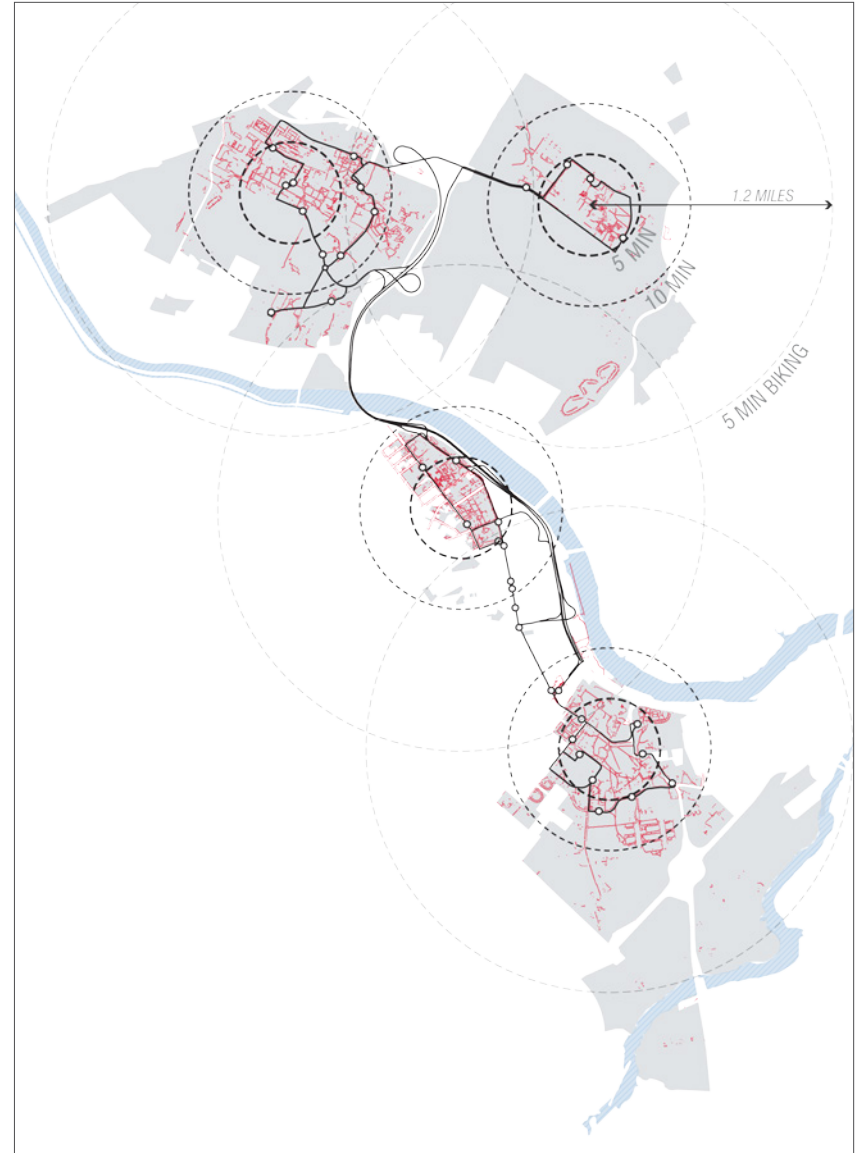
in New Brunswick is providing expanded housing options within walking distance of the University. The communities adjacent to the University are working to expand a network of dedicated bike lanes, enabling more to bike to campus.

Movement within and between districts is a central part of the Rutgers experience. As survey and space analysis show, classes, recreation, and social opportunities are spread throughout New Brunswick and Piscataway. Students and employees need to move across campus to capitalize on the best Rutgers has to offer. The challenge is to improve the quality of experience and, where possible, eliminate the need (but not the opportunity) to travel altogether.





PEDESTRIAN CONNECTIVITY



BICYCLE CONNECTIVITY

2.3.1 PEDESTRIAN AND BICYCLE CONNECTIVITY

Safe, comfortable, and convenient pedestrian connections are essential to the vitality of any campus. Walking is not only important as the most common mode of on-campus travel; it is also critical to the success of transit, and even to the success of travel by automobile. Every trip begins and ends on foot. A pedestrian connection that is perceived as difficult, unpleasant, or unsafe will reduce the attractiveness of the parking lot or bus stop it serves, jeopardizing the success of an otherwise sound facility or service.

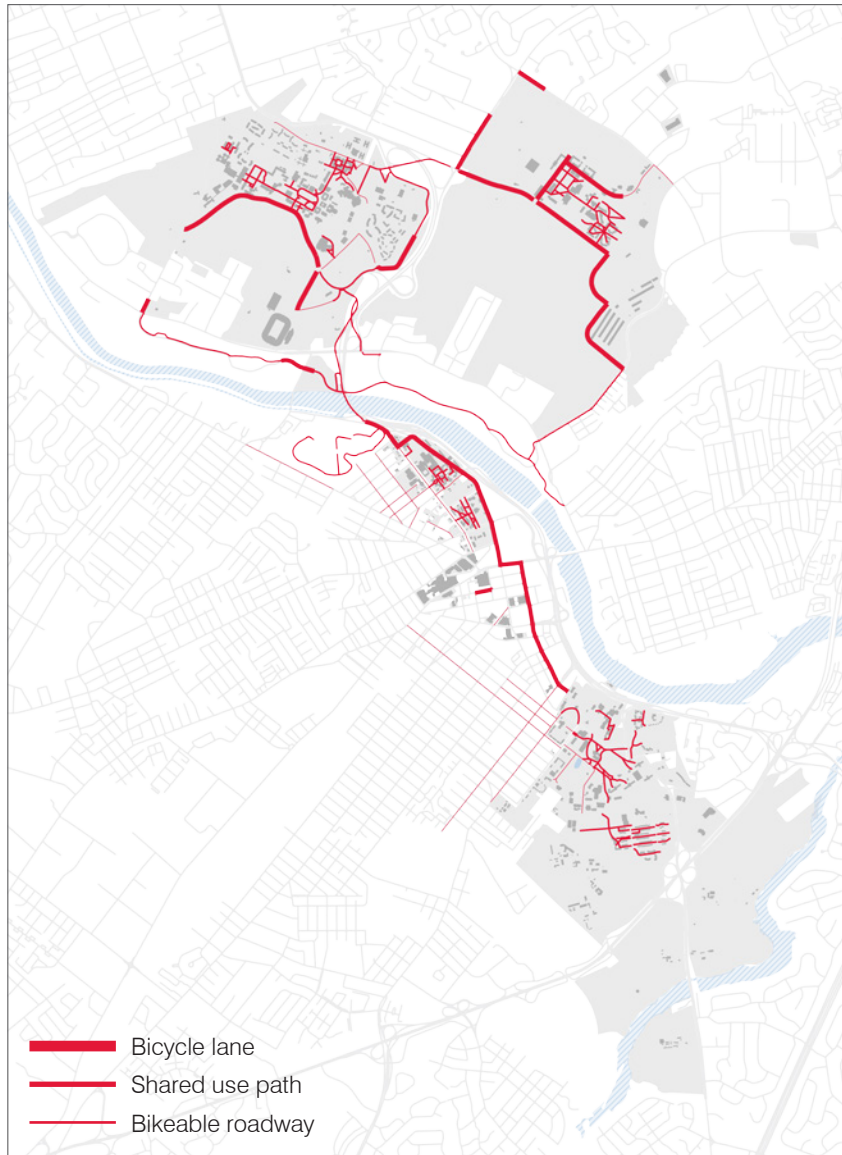
While there are few large gaps in the Rutgers pedestrian network, there are many locations where connections are missing or unclear. At other locations, the connections exist but do not reflect Rutgers' vision of itself a leading educational institution. Enhanced landscaping and wayfinding improve the pedestrian experience. This includes improvements to the quality of walking surfaces, to a landscape palette reflecting unique qualities of campus and districts, to building placement and orientation that reinforces intuitive circulation.

Although some will walk between districts, for most travel on foot is limited to within a district. On the other

hand, Rutgers University–New Brunswick is well-suited to travel by bicycle: the terrain is generally flat and the travel distances are achievable by bicycle. Congestion on city streets between the College Avenue and Cook/Douglass is such that travel by bicycle is often the fastest means of transport between them.

Despite this potential, bicycling is currently a minor form of transport at Rutgers University–New Brunswick. While there are a number of recreational paths, there are some critical missing links and other locations where a route exists, but may parallel or utilize high-volume roadways or otherwise be unsafe. The University and the community have recognized the desirability of increased bicycle use and are working to improve conditions for cyclists. In summer of 2014, the City of New Brunswick began work on its first major bicycle corridor, striping bicycle lanes between Cook/Douglass and College Avenue. The University has developed a number of programs to promote bicycling and support its usage for commuting and campus travel, including long-term bicycle rentals, free bike repair stations, education campaigns, and cycling workshops.

The New Brunswick/Piscataway area has a strong network of recreational paths, particularly focused along the river. While some connections between Rutgers and these paths exist, there are gaps which, if filled, would noticeably enhance the regional trail and path network and provide Rutgers students and staff much-improved access to public recreation opportunities.



EXISTING BICYCLE NETWORK



EXISTING BUS NETWORK

2.3.2 RUTGERS BUSES

Rutgers operates one of the busiest campus bus transit systems in the country, averaging over 70,000 riders on a typical class day or over 12.5 million in a year. Nationally, this makes them roughly the 55th busiest bus operation of any kinds and would be in the top 40 if operated at peak levels year round.

The bus system is designed as a series of express and local routes connecting the four districts. There are nine weekday routes and two weekend routes. The express routes primarily connect Cook/Douglass with the other districts; the other interconnections provide travel both within and between districts. Given the high passenger volume, the system has focused on academic connections, offering limited service to recreation areas and limiting off-campus service. The EE route travels George Street between College Avenue and Cook/Douglass and stops along the way to provide access to Rutgers locations in the City of New Brunswick. At College Avenue, Livingston and Douglass, the student centers serve as bus hubs. At Busch, Allison Road is a classroom hub, complementary to the hub at the Busch Student Center. Cook Campus Center is not directly served by transit.

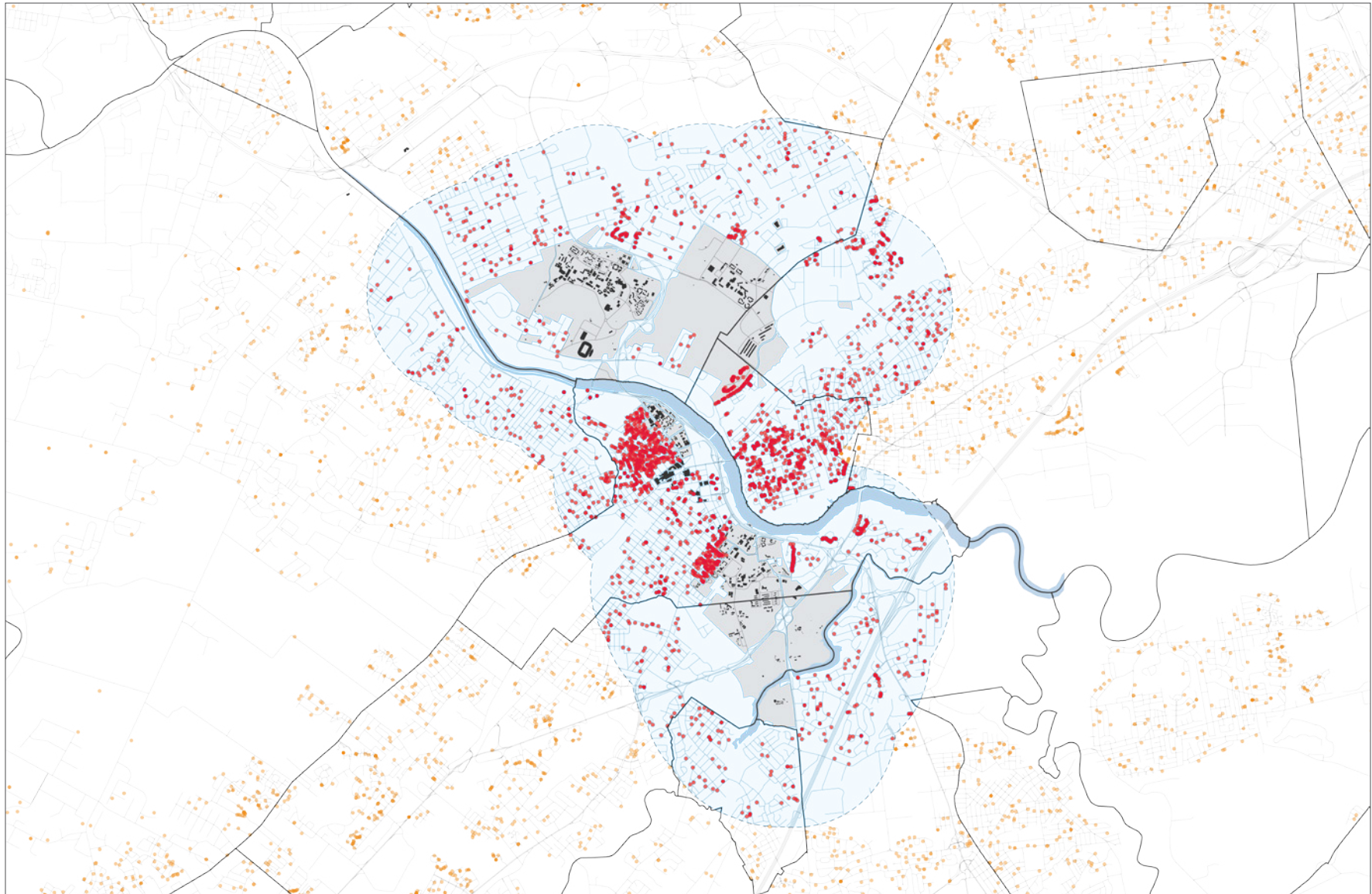
The Rutgers fleet consists of 40-foot and 60-foot buses, the latter being articulated. Most routes run full at class change time. Loading and unloading passengers can be problematic as there can be 100 or more students waiting at the busiest stops. In addition, congestion both on and off the campus slows many of the routes. This is particularly problematic for travel to and from Cook/Douglass as traffic on Route 18 often slows to a crawl in the afternoon and is similarly congested along George Street. Travel time, wait time, and congestion

on the buses are all common complaints about the transit system.

In addition to the Rutgers bus system, Rutgers operates two New BrunsQuick Shuttle routes jointly with the City of New Brunswick to provide improved connections to campus. The routes serve neighborhoods, large apartment complexes, and other key destinations south and west of College Avenue and include a stop in front of the Rutgers Student Center.



Students waiting at the College Hall bus stop at Douglass



COMMUTER LOCATIONS

2.3.3 COMMUTERS AND REGIONAL CONNECTIONS

Rutgers lies at the center of one of the best connected transportation networks in the country. Yet despite of robust capacity of the surrounding networks, there are few direct connections to the University.

The primary vehicle connection to the University is New Jersey Route 18, a four lane controlled-access road extending from north of Busch east to the New Jersey Turnpike and beyond. Route 18 also connects to US 1, a key north-south arterial for central New Jersey providing connections to neighboring townships and boroughs, many of which are home to Rutgers employees and students. There are a number of connections to I-287 to the north, though all are local arterials.

Despite improvements in recent years to Route 18 and other local arterials, roads in the area are frequently congested, particularly in the afternoon and evening. Traffic headed east on Route 18 backs up starting in the mid-afternoon and can extend from the Turnpike all the way to the Raritan River. In an attempt to avoid congestion, many commuters will use George Street and cut through Douglass to Route 18 and Ryders Lane. Much of the congestion along Route 18 is

associated with access to and from the Turnpike; there is currently a project under construction to improve this access with the hope that it will reduce the congestion along Route 18. In addition to the congestion along Route 18 and its associated spillover, traffic generally moves slowly in downtown New Brunswick but the overall speeds and delay are typical of a dense urban area.

Once on campus, there is typically little vehicle congestion. Not all roads into campus are well-marked which can be problematic for visitors. Some of the connections and circulation patterns are convoluted. There can be localized congestion around the entrances and exits to parking lots. Parking on campus is generally sufficient though at peak there is little excess. The biggest concern is spatial allocation in that there is often excess supply on Livingston and portions of Busch and Cook but not at College Avenue, Douglass and the core of Busch. Changes in parking policy and pricing in recent years, in particular for students, have helped to temper demand and avoid a parking crisis. It is not clear, though, how much further student demand can be suppressed, and staff parking pricing is controlled by a labor agreement, limiting the

ability to keep pricing in line with the market.

While the majority commute to campus via automobile, many use other means to travel. The New Brunswick train station has frequent service via NJ Transit, with connections north to Newark and New York City and south to Trenton. While rail service is relatively frequent, reaching the Rutgers districts, for some, is not convenient. The station is an easy walk to College Avenue and the EE route stops a block from the rail station providing direct service to the Cook/Douglass as well as to College Avenue. Commuters headed to Busch and Livingston must transfer however.

In addition to rail connections, there are a number of bus routes which serve New Brunswick, though few enter the campus. NJ Transit operates six routes connecting New Brunswick to its surrounding communities, all of which stop at the train station. Additionally, Middlesex County operates a handful of connector routes serving areas to the south. Commuter bus service provides alternate connections to New York City.

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