Brown University Institutional Master Plan

submitted May 2011

BROWN

“The mission of Brown University is to serve the community, the nation, and the world by discovering, communicating, and preserving knowledge and understanding in a spirit of free inquiry, and by educating and preparing students to discharge the offices of life with usefulness and reputation. We do this through a partnership of students and teachers in a unified community known as a university-college.”

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Executive Summary

In 2003, the Brown University Corporation adopted the *Strategic Framework for Physical Planning*. This document and subsequent area master planning studies continue to be the foundation for the development of the campus and more specifically the projects contained within this Institutional Master Plan. Because of this planning and the strategic vision articulated in the *Plan for Academic Enrichment*, Brown is a much different place than it was 5 years ago. The faculty is 25% larger. Significant financial aid is provided to over 40% of the students. Student loans have been eliminated for families earning less than $60,000. Approximately $700 million of construction work has been completed, including approximately two miles of improved public streetscapes, improvements to the campus utilities system, adaptive reuse of nearly 500,000 square feet of historic buildings, construction of over 125,000 square feet of new buildings, and a new medical school in the Jewelry District. During this period, Brown has created over 5,000 person-years of employment in construction related jobs and has established itself as one of the important economic engines in Providence (see page 30). With its growing presence in the Jewelry District, an international reputation for excellence and a focus on expanding research and technology transfer, it is clear that Brown's success and the success of Providence are directly connected

Now more than ever, Brown's planning efforts need to be carefully coordinated with the City, other institutions, and public agencies to ensure that the whole is greater than the sum of the parts. To facilitate this, Brown University is submitting the following Institutional Master Plan, which outlines the University's plans for physical development over the next 5-10 years.

However, it should be noted that planning for Brown's evolving campus does not stop. Several planning efforts are underway that have not yet coalesced into specific projects, but they are expected to within this time period. For example, the University has identified the need for additional research space to support thriving activities such as the recently created School of Engineering and Brown's Institute for Brain Science. The University is also evaluating plans for new residence halls and exploring the need for graduate student housing. As these plans evolve into specific proposals, they will be added to this plan as amendments.

Many of the projects listed in this plan require complex multi-year efforts, including planning and design, phased construction, and fundraising, all of which are subject to change. The intent is to provide a general overview of significant changes being proposed, including improvements in the public right-of-way, new buildings, renovation projects that alter the use, demolitions, and changes in real estate holdings. It is not the intent of this plan to provide a detailed list of all projects the University will undertake. Typically, the University performs nearly 200 small construction projects each year, including maintenance projects and fit-out projects required to accommodate the needs of certain academic or administrative units. These projects are not included in this Institutional Master Plan, as they typically do not affect the overall character of the campus. The projects that are listed in this plan include:

Transportation & Parking

- Improved pedestrian amenities
- Improved shuttle service
- Continued RIPTA UPass
- Expansion of Zip Car program
- Piloting a Bike Share program
- Increased parking fees
- Increased parking capacity
- Continued off-street parking for contractors for major projects

Changes in Real Estate Holdings:

- 43 Elm Street Acquisition
- 60 Clifford Street Acquisition
- 198 Dyer Street Acquisition
- Sale of 1128 North Main Street
- Sale of 240 Bowen Street
- Expansion of Brown to Brown Home Ownership Program (see page 25)

Proposed City Council/Zoning Board Actions

- Special Use Permit for 198 Dyer Street

Executive Summary

Proposed Construction Projects

- Renovation of Hunter Lab
- Conversion of 315 Thayer
- Conversion of the Saunders Inn
- Conversion of Wayland Hall
- Renovation of Miller / Metcalf / Andrews
- Renovation of Emery / Wooley Complex
- Renovation of Keeney Quadrangle
- Renovation of The Minden
- Renovation of the Grad Center
- Renovation of Perkins Hall
- Renovation of Verney Woolley Dining
- Renovation of Sharpe Refectory
- Expansion of the Brown to Brown Home Ownership Program
- Stevenson Field Stadium & Parking Garage
- Addition to Library Annex
- Renovation of 198 Dyer Street

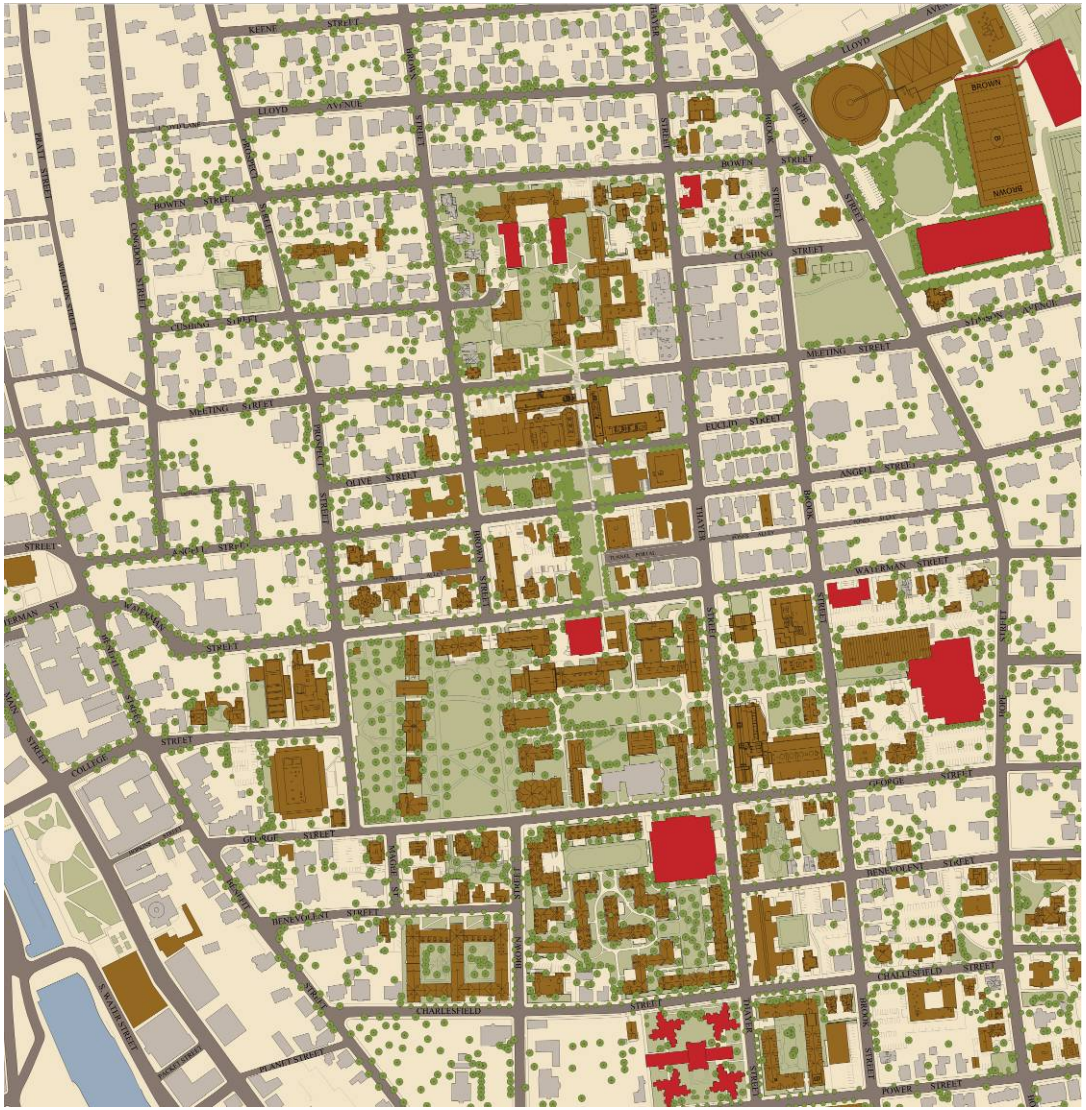
Proposed Demolitions / Relocation

- Plant Environmental Center
- 89 Benevolent Street
- 1128 North Main Street

Expanding Research

- Applied Science and Engineering
- Brown Institute for Brain Sciences

Campus Map at right shows major projects in red



Planning Context

Plan for Academic Enrichment

In February 2004, the Corporation of Brown University adopted the *Plan for Academic Enrichment*, which established a far-reaching set of goals that will enhance the quality of our academic and campus environment. This plan is constantly monitored and adjusted, and it continues to focus the University's efforts in its pursuit of excellence. A complete version of the *Plan for Academic Enrichment* and recent status reports can be found at:

http://brown.edu/web/pae/

Strategic Framework for Physical Planning

In October 2003, the Brown University Corporation adopted the *Strategic Framework for Physical Planning at Brown University*, prepared by R.M. Kliment & Frances Halsband Architects. This framework serves as a guide for all decisions about campus planning and design. The framework focuses on three interdependent planning principles to form the basis of the recommendations:

1. *Develop circulation infrastructure to foster community, unify and enhance the campus and its surroundings*
2. *Consolidate the Core*
3. *Move Beyond College Hill*

These planning principles continue to guide the University in all of its physical planning, so much so that the Institutional Master Plan is organized around these principles.

The *Strategic Framework for Physical Planning* creates a foundation on which to build with more specific area master plans. The area master plans focus more deeply on specific areas of campus (such as The Walk or the Athletic Complex) or particular subject matters, such as transportation, campus heritage, campus life, utilities, residential life, libraries, etc. A complete version of the *Strategic Framework for Physical Planning at Brown University* and many of the area master plans can be found at:

http://www.brown.edu/Facilities/Building_Brown/resources/

Community Input

The planning process the University has been engaged in for the past nine years has been an open and iterative process with significant community input. Meetings with neighborhood representatives, officials, and adjacent institutions continue to contribute significantly to the development of our plans for physical development.

Likewise, as this Institutional Master Plan was developed Brown sought out opportunities for broader community feedback. The following is a list of meetings with community members and groups dealing specifically with the development of the Institutional Master Plan:

3/22/11	Community Working Group
3/29/11	Wheeler School & Moses Brown
4/1/11	Planning Department Staff
4/5/11	Thayer Street District Management
4/8/11	Campus Planning Board
4/8/11	Brown Community Meeting
4/13/11	PPS – Architectural Review
4/15/11	City Council members
4/27/11	Open Community Meeting
4/29/11	State Representatives
5/10/11	Jewelry District Association
5/12/11	Open Community Meeting
5/17/11	Planning Department Staff
6/21/11	City Plan Commission Meeting

The University hopes to sustain this level of community input even after the Institutional Master Plan approval as the capital projects included in this plan are developed.

Property Taxes

In 2003, the University reached an agreement with the City of Providence by which the University agreed to make voluntary contributions to the City over the next twenty years, based in part on the approximate value of its current landholdings. Currently the University pays approximately $2.2 million in direct property taxes plus $1.1 million in voluntary payments in lieu of taxes. The agreement also stipulates that the University will make voluntary transition payments on any property that is acquired and converted to educational use. These transition payments will be made for a period of fifteen years, stepping down to zero in five-year increments.

Campus History

Brown University and the City of Providence have been woven together almost from the beginning. As a result, it is difficult to adequately describe Brown's history without also talking about Providence's history. The following excerpt from the *Strategic Framework for Physical Planning* describes the history of both the campus and the city:

The city of Providence was founded in 1636 by Roger Williams. The site he selected, in the territory of the Narragansett Indians (land not included in the chartered British colony), was on the Eastern shore of the Providence river at the head of Narragansett Bay, at the junction of the Moshassuck and Woonasquatucket Rivers. The early development of the city did not include the construction of churches or a defined town hall or green. The settlers instead laid out a series of strip house lots, which extended back from what today is Main Street. Houses were built at the front of the lots, while orchards and gardens extended east along the length of the narrow plots up the hill away from the river. Providence was mainly an agricultural community until the 18th century, when trading with other colonies, the West Indies, Africa, and England transformed it into a major seaport. This led to dense city fabric of residences, commercial enterprise and new civic buildings along the edge of the waterfront. The population tripled during this period, and by 1776, one third of the residents of Providence had established their homes across the river on the Western bank, mainly along today's Weybosset, and Westminster Streets.

As colonial life became more prosperous and Providence became a wealthy, more cosmopolitan society, a new awareness about social standing developed. At the same time, a widespread religious revival was enveloping the new world which fostered the growth of burgeoning ideologies, including a new religious sect called Baptists. This nascent social awareness, coupled with the need to educate the day's new religious leaders, led to the founding of the state's first institution of higher learning.

Rhode Island College was begun in Newport, Rhode Island in 1764, with James Manning as its first president. In the search for the college's permanent home, however, Providence, as the birthplace of the colony and the seat of the Baptist Church, prevailed, and in 1770 the Corporation quickly erected University Hall, the institution's first building at the top of what is now known as College Hill. The next building, a dormitory called Hope College, was not added to the campus for almost 50 years.

The campus continued to grow slowly but by 1904 all the buildings around the main green had been constructed. The athletic field to the East of the green, called Lincoln Field, was transformed into a building site for Lyman Gymnasium (1891) and the dormitory, Maxcy Hall (1895). Pembroke College, the companion institution for women (1897) was constructed a few blocks to the North.

In 1901, the Olmsted brothers were engaged by the Corporation to develop a plan for Lincoln Field and areas to the North. The plan completed the arrangement of buildings defining Lincoln Field, proposed an amphitheater to negotiate the grade change between Maxcy and Lyman, and a mid-block walkway North to the Pembroke campus. The plan served as a guide for the building sites, but the landscape elements were never realized.

By 1938, the Brown Campus had grown to include the entire block bounded by Waterman, Prospect, Thayer, and George Streets, as well as other sites beyond the core campus including the new John Hay Library across Prospect Street (1910), Ladd Observatory (1891), and Brown Stadium (1925). At this time several buildings had been completed at Pembroke Campus as well. The University had also begun to acquire houses in the surrounding community.

The years between 1938 and 1975 were a period of rapid expansion. Three major residential quadrangles transformed the area to the South of the campus: Wriston Quadrangle (1951), Keeney Quadrangle (1957), and the Graduate Center (1968). To the west, Rockefeller Library (1964) and List Art Center (1970) defined the gateway to the downtown part of the City. To the North, a new Biomedical Center (1969) and the Brown Office Building (1969) began to close the gap between Brown's main campus and the Pembroke campus. Barus & Holley science building (1965), the Sciences Library (1971), and the beginnings of a new athletic complex Meehan Auditorium, (1961), and Smith Swim Center (1973), expanded Brown to the east. The acquisition of the Bryant College Campus in 1969 provided several blocks of land with small residential and academic buildings to the east of Brook Street.

Following 1975, campus athletic facilities continued to grow, with the completion of the Olney-Margolies Athletic Center and Pizzitola Sports Center (1989). Student housing at New

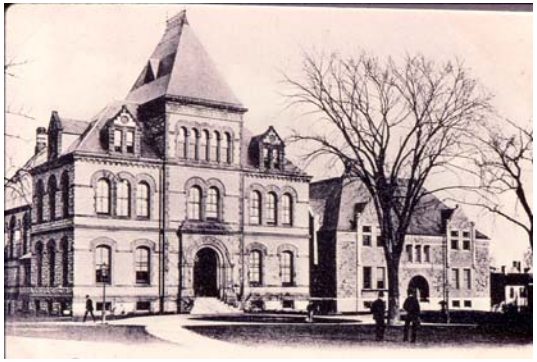
Pembroke (1979) and Vartan Gregorian Quadrangle (1991) added new on-campus resources. Major buildings for the sciences in recent years include Geo Chemistry (1982), Watson C.I.T. (1988) and Macmillan Hall (1998), concentrating science buildings along Manning Walk, and the continued growth of bio-medical space along Meeting Street. The Power Street Parking Garage (1988) is the first such facility on the Brown campus. Recent adaptive reuse projects such as Smith-Buonanno Hall and the joining of buildings on Brown Street for the English Department indicate a new approach to revitalization of historic buildings on the campus, and the new Watson Institute signals a new direction in carefully fitting modern buildings into historic contexts.

Presently, the Brown campus contains six buildings listed on the National Register of Historic Places, two of which are identified as National Landmarks (University Hall and Nightingale Brown House). The campus is also overlaid with five National Historic Districts, and all but 80 Brown buildings are identified as contributing structures within these historic districts. As such, any project utilizing federal funds is required to adhere to Section 106 in the National Historic Preservation Act. In addition, many buildings fall within one of three local historic districts, so projects affecting the exterior of these buildings are reviewed by the Providence Historic District Commission.

The map on the following page illustrates the boundaries of the various historic districts and identifies those buildings listed individually on the National Register of Historic Places.

Nightingale Brown House

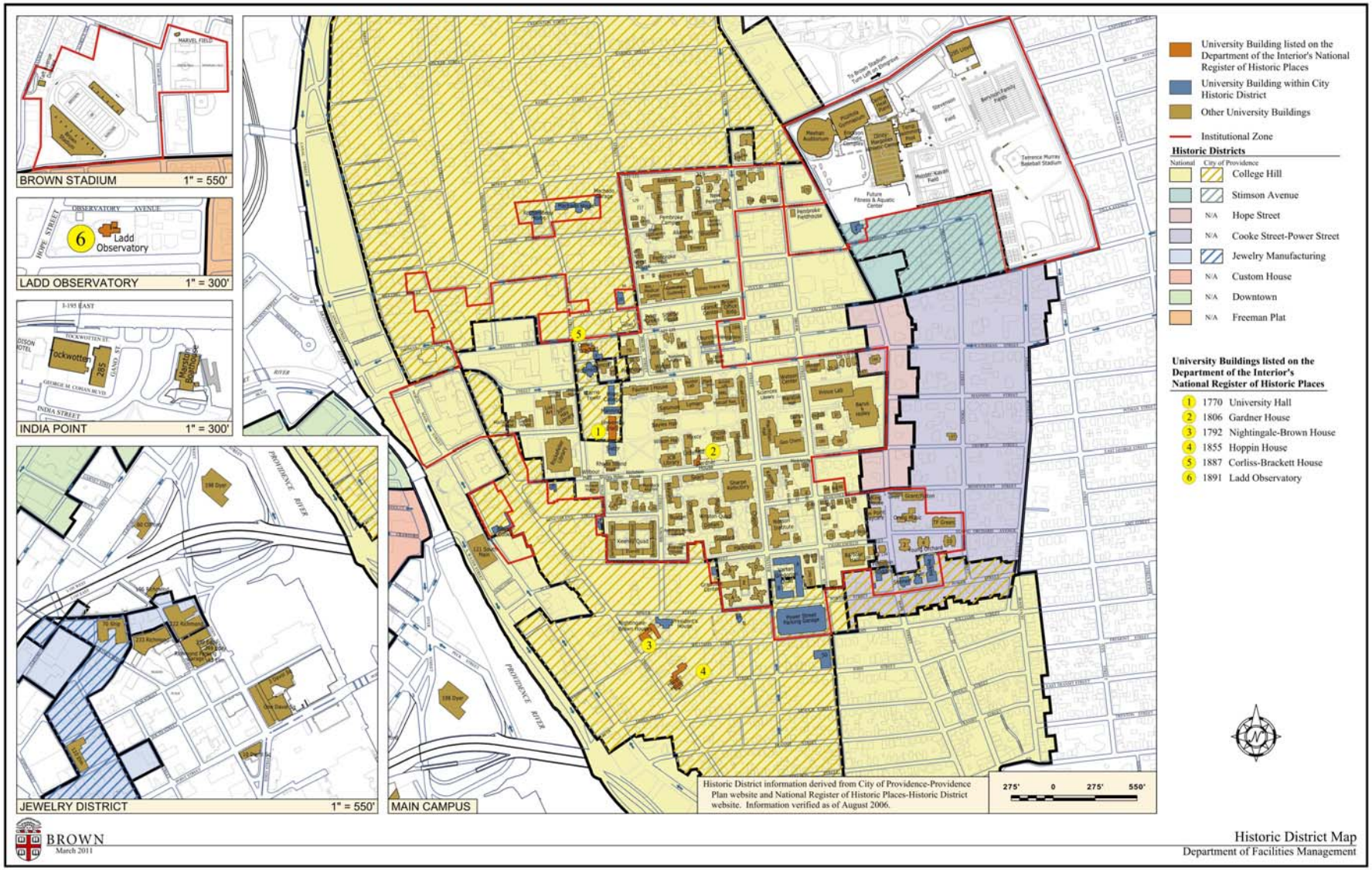
Historic Postcard of University Hall



Sayles Hall & Wilson Hall

Hope College, Manning Hall, University Hall

Planning Context



Existing Campus & Property Holdings

Brown University, founded in 1764, is a teaching and research institution with approximately 6,000 undergraduate students, 2,000 graduate students, 3,600 employees, and 400 medical students. It currently owns 239 buildings totaling just over 7 million square feet. Most buildings are located on College Hill and the Jewelry District, within a half mile from the historic Main Green. A few specific functions are located beyond this, including the Brown Stadium almost two miles north of the center of the campus, the Marston Boathouse and two warehouses located on India Point, historic Ladd Observatory located on Doyle Avenue, and the Library Annex located at 10 Park Lane. Brown also owns a 376 acre property in Bristol, RI, which includes a museum and research facilities. In addition, the University leases approximately 140,000 square feet located in the College Hill area, the Jewelry District, and Butler Hospital.

Building usage generally reflects the historic growth pattern of the campus. Most academic space is clustered around the core of the campus – the Main Green, Lincoln Field, Manning Walk, The Walk, and Pembroke Campus. Residence Halls are clustered on the north and south ends of campus, specifically on the north end Pembroke campus, south of the Main green in Wriston and Kenney Quads – both built in the post war years - and in and around the former Bryant Campus. Athletic facilities are grouped to the northeast of campus on the former Aldridge Dexter Asylum. In between there are a number of houses, many of which have been acquired and adapted over time to serve various academic and administrative functions. Several of these houses are significant contributors to the ambience of the University and the neighborhood, and some are historic structures of national importance.

Recent Changes in Property Holdings

As the University continues to follow the guidelines established in the *Strategic Framework for Physical Planning*, a number of real estate transactions have been made and are being planned in an effort to “Consolidate the Core” and “Move Beyond College Hill”. These include the sale of underutilized properties beyond the core campus such as 86 South Main Street (Old Stone Bank), 110 South Main Street (Benoni Cooke House), 1140 North Main Street, 1128 North Main Street (sale pending), 240 Bowen Street (currently marketing) and a series of residential houses as part of the Brown to Brown Home Ownership Program (see page 25). The sale of 1128 North Main Street will require the demolition of the existing building (former Ethan Allen Store) for redevelopment. In addition, the University has recently acquired additional property in the Jewelry District, including 60 Clifford Street and the adjacent parking lot, 43 Elm Street, and 198-200 Dyer Street (see page 31). 60 Clifford Street will remain commercial (leased to NabSys) while 43 Elm Street will be utilized as a joint substation for the Providence Police Department and Brown Public Safety.

The following table is a complete list of the buildings owned or leased by Brown University, arranged by Plat and Lot numbers:

60 Clifford Street (leased to NabSys)

43 Elm Street (Police substation)

198-200 Dyer Street

PLAT-LOT	BUILDING	BUILT	USE
01-022	NORTH MAIN 1128	1950	COMMERCIAL
07-003	BROWN STADIUM	1925	ATHLETICS
07-357	TAFT AVE DAYCARE CTR	1982	SUPPORT
08-265	LADD OBSERVATORY	1891	ACAD
10-229	ROCHAMBEAU HOUSE	1929	ACAD
10-263	PETER GREEN HOUSE	1890	ACAD
10-266	SHARPE HOUSE	1873	ACAD
10-284	OLIVE ST 020	1885	AUX. HOUSING
10-333	WEST HOUSE	1885	DORMITORY
10-337	CUSHING ST 084-086	1895	AUX. HOUSING
10-337A	BROWN ST 111	1900	DORMITORY
10-344	BROWN ST 095	1885	AUX. HOUSING
10-347	MACHADO (ANTONIO) HOUSE	1912	DORMITORY
10-353	BROWN ST 093	1885	AUX. HOUSING
10-356	BROWN ST 131-133	1850	AUX. HOUSING
10-577	NEW PEMBROKE NO. 1	1974	DORMITORY
10-577	NEW PEMBROKE NO. 2	1974	DORMITORY
10-577	NEW PEMBROKE NO. 3	1974	DORMITORY
10-577	NEW PEMBROKE NO. 4	1974	DORMITORY
10-580	BOWEN ST 219	1896	DORMITORY
10-619	BROWN ST 109	1900	AUX. HOUSING
10-649	VERNEY-WOOLLEY HALL	1960	DINING
10-649A	ALUMNAE HALL	1926	ACAD
10-649B	ANDREWS HALL	1947	DORMITORY
10-649C	CHAMPLIN	1960	DORMITORY
10-649D	EMERY	1963	DORMITORY
10-649E	METCALF HALL	1919	DORMITORY
10-649F	MILLER HALL	1910	DORMITORY
10-649G	MORRISS HALL: PEMBROKE QUAD	1960	DORMITORY
10-649H	PEMBROKE HALL	1897	ACAD
10-649J	WOOLLEY HALL: PEMBROKE QUAD	1963	DORMITORY
10-649L	SMITH-BUONANNO HALL	1907	ACAD
10-704	BIO-MED ACF	1969	ACAD
10-704	BIO-MED CTR	1969	ACAD
10-704	BIOMED GG	1989	ACAD
10-704	SIDNEY E. FRANK HALL LIFE SCIENCES	2006	ACAD
10-717	GRANOFF CTR FOR CREATIVE ARTS	2011	ACAD
10-718	BROWN OFFICE BLDG	1969	ADMIN
11-110	STIMSON AVE 002	1861	ACAD
11-116	CENTRAL HEAT PLANT	1969	SUPPORT
11-133	LLOYD AVE 295	2003	SUPPORT
11-133	MEEHAN	1961	ATHLETICS
11-133	OLNEY-MARGOLIES ATHLETIC CENTER	1981	ATHLETICS
11-133	PIZZITOLA	1989	ATHLETICS
11-133	SMITH SWIM TRAILERS	2007	ATHLETICS
11-133	TEMPORARY POOL	2007	ATHLETICS
12-050	SOUTH MAIN STREET 121	1983	ACAD
12-154B	CORLISS-BRACKETT	1877	ADMIN
12-154C	FONES ALLEY 008	1900	ACAD
12-158	BROWN ST 070	2001	ACAD
12-159A	WALTER HALL	1884	ACAD
12-159B	J. WALTER WILSON BUILDING	1962	ADMIN
12-161	ANGELL ST 129	1849	AUX. HOUSING

PLAT-LOT	BUILDING	BUILT	USE
12-162	URBAN ENVIRONMENTAL LAB	1984	ACAD
12-167	CHURCHILL HOUSE	1907	ACAD
12-170	HEMISPHERE BLDG	1989	ADMIN
12-177	ANGELL ST 195	1902	SUPPORT
12-191	LIPPITT HOUSE	1900	ACAD
12-192	WATERMAN ST 094	1860	COMMERCIAL
12-196	WATERMAN ST 086	1880	AUX. HOUSING
12-198	NORWOOD HOUSE	1865	ACAD
12-201	BROWN ST 068.5	2001	ACAD
12-201	PARTRIDGE HALL & ANNEX	1894	STUDENT AC
12-203	WATERMAN ST 070	1859	ACAD
12-204	MENCOFF HALL	1844	ACAD
12-205	ROBINSON HALL	1878	ACAD
12-217	MACFARLANE HOUSE	1845	ACAD
12-218	GERARD HOUSE, SAMUEL N.	1838	ACAD
12-219	LIST (ALBERT & VERA) ART BUILDING	1971	ACAD
12-222A	JOHN HAY LIBRARY	1910	LIBRARY
12-222B	PROSPECT HOUSE	1875	ACAD
12-222C	BLISTEIN HOUSE	1867	ACAD
12-235	ANGELL ST 127	1853	AUX. HOUSING
12-241A	ROCKEFELLER LIBRARY	1964	LIBRARY
12-241B	WILBOUR HALL	1888	ACAD
12-246	SEARS HOUSE: WRISTON QUAD	1951	DORMITORY
12-249	UNIVERSITY HALL	1770	ADMIN
12-249A	ARNOLD LAB	1915	ACAD
12-249B	CARRIE TOWER	1904	SUPPORT
12-249C	CASWELL HALL	1903	DORMITORY
12-249D	FAUNCE HOUSE	1903	STUDENT AC
12-249E	GARDNER HOUSE	1806	SUPPORT
12-249F	PLANT ENVIRONMENTAL CENTER	1900	ACAD
12-249G	HEGEMAN HALL	1926	DORMITORY
12-249H	HOPE COLLEGE	1822	DORMITORY
12-249I	HUNTER LAB OF PSYCHOLOGY	1958	ACAD
12-249J	JOHN CARTER BROWN LIBRARY	1904	LIBRARY
12-249K	LINCOLN FIELD BUILDING	1903	ACAD
12-249L	LITTLEFIELD HALL	1926	DORMITORY
12-249M	LYMAN HALL	1891	ACAD
12-249N	MANNING HALL	1834	ACAD
12-249O	MAXCY HALL	1895	ACAD
12-249P	MEDICAL RESEARCH LAB	1965	ACAD
12-249Q	METCALF CHEMICAL LABORATORY	1923	ACAD
12-249R	METCALF RESEARCH LAB	1938	ACAD
12-249S	RHODE ISLAND HALL	1840	ACAD
12-249T	SALOMON CTR FOR TEACHING	1862	ACAD
12-249U	SAYLES HALL	1881	ACAD
12-249V	SLATER HALL	1879	DORMITORY
12-249X	WILSON HALL	1891	ACAD
12-262	MEIKLEJOHN HOUSE	1900	ACAD
12-271	WATSON CIT	1988	ACAD
12-272	SCIENCES LIBRARY	1971	LIBRARY
12-272B	MARSTON HALL	1926	ACAD
12-306	KASSAR (EDWARD W.) HOUSE	1894	ACAD
12-326	FACULTY CLUB	1865	DINING
12-333	HORACE MANN HOUSE	1854	ADMIN

PLAT-LOT	BUILDING	BUILT	USE
12-340	SHIRLEY MILLER HOUSE	1915	ACAD
12-341	GEORGE ST 067	1821	ACAD
12-344	BENEVOLENT ST 026	1823	STUDENT AC
12-345	BENEVOLENT ST 022	1816	AUX. HOUSING
12-346	BENEVOLENT ST 020	1820	ADMIN
12-370A	GEORGE ST 155	1930	ACAD
12-372	BENEVOLENT ST 070-072	1880	AUX. HOUSING
12-373	BENEVOLENT ST 074-080	1883	AUX. HOUSING
12-374	THAYER ST 135	1928	ACAD
12-378	BENEVOLENT ST 005	1844	ADMIN
12-408	BENEVOLENT ST 083-085	1857	COMMERCIAL
12-415	GEORGE ST 163	1900	ACAD
12-444	CHARLESFIELD ST 059	1877	AUX. HOUSING
12-455	ARCHIBALD HALL: KEENEY QUAD	1957	DORMITORY
12-455	BRONSON HALL: KEENEY QUAD	1957	DORMITORY
12-455	EVERETT HALL: KEENEY QUAD	1957	DORMITORY
12-455	JAMESON HALL: KEENEY QUAD	1957	DORMITORY
12-455	MEAD HALL: KEENEY QUAD	1957	DORMITORY
12-455	POLAND HALL: KEENEY QUAD	1957	DORMITORY
12-456	BUXTON HOUSE: WRISTON QUAD	1951	DORMITORY
12-456	CHAPIN HOUSE: WRISTON QUAD	1951	DORMITORY
12-456	DIMAN HOUSE: WRISTON QUAD	1951	DORMITORY
12-456	GODDARD HOUSE: WRISTON QUAD	1951	DORMITORY
12-456	HARKNESS HOUSE: WRISTON QUAD	1951	DORMITORY
12-456	MARCY HOUSE: WRISTON QUAD	1951	DORMITORY
12-456	WAYLAND HOUSE: WRISTON QUAD	1951	DORMITORY
12-457	SHARPE REFECTORY	1951	DINING
12-458	OLNEY HOUSE: WRISTON QUAD	1951	DORMITORY
12-458A	ANDREWS HOUSE	1900	SUPPORT
12-458B	ANNMARY BROWN MEMORIAL LIBRARY	1922	LIBRARY
12-469A	NICHOLSON HOUSE	1872	ADMIN
12-469B	MADDOCK ALUMNI CENTER	1830	ADMIN
12-474	BARUS BUILDING	1885	ACAD
12-474	GEO-CHEM BLDG	1982	ACAD
12-474	MACMILLAN HALL	1998	ACAD
12-476	WATSON INSTITUTE	2002	ACAD
12-481	GEORGE ST 025	1913	ADMIN
13-012	LLOYD AVE 165-167	1910	AUX. HOUSING
13-015	BOWEN ST 240	1885	AUX. HOUSING
13-016	THAYER ST 315	1900	AUX. HOUSING
13-040A	PEMBROKE FIELD HOUSE	1937	SUPPORT
13-076	MINDEN HALL	1912	DORMITORY
13-081	WATERMAN ST 129	1871	VACANT
13-082	WATERMAN ST 131	1852	ACAD
13-083	WATERMAN ST 133	1885	ACAD
13-083	WATERMAN ST 137	1910	ACAD
13-085A	HOPE ST 190	1865	ACAD
13-088A	PRINCE ENGINEERING LAB	1962	ACAD
13-088B	BARUS & HOLLEY	1965	ACAD
13-110A	GEORGE ST 182	1885	ACAD
13-110B	GEORGE ST 180	1960	ACAD
13-122	BENEVOLENT ST 099	1860	AUX. HOUSING
13-129	BENEVOLENT ST 088	1867	SUPPORT
13-130	BENEVOLENT ST 086	1865	AUX. HOUSING

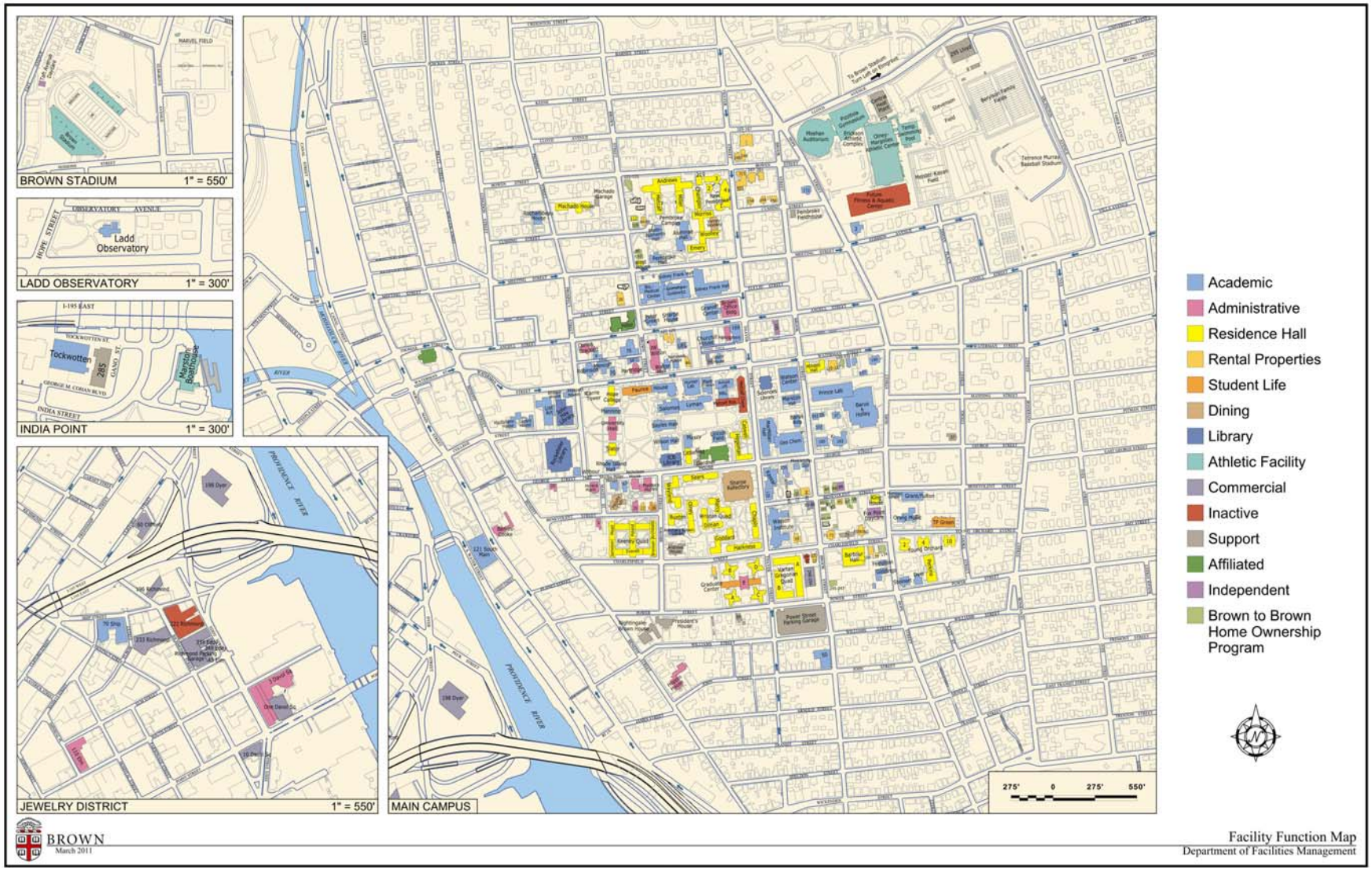
PLAT-LOT	BUILDING	BUILT	USE
13-132	BROOK ST 287	1870	VACANT
13-132	BROOK ST 291	1870	VACANT
13-133	BENEVOLENT ST 089	1857	VACANT
13-134	BENEVOLENT ST 095	1885	AUX. HOUSING
13-135	BENEVOLENT ST 097	1860	AUX. HOUSING
13-137	BROOK ST 281-283	1980	AUX. HOUSING
13-138	KING HOUSE	1895	DORMITORY
13-140	CHARLESFIELD ST 071-073	1870	AUX. HOUSING
13-142	CHARLESFIELD ST 075-077	1967	SUPPORT
13-144	FIERING HOUSE	1865	AUX. HOUSING
13-145A	MORRISON-GERARD STUDIO	1845	ACAD
13-145B	GRANT FULTON	1845	ACAD
13-145C	ORWIG MUSIC HALL	1905	ACAD
13-147	T.F. GREEN HALL	1959	STUDENT AC
13-169	FOX POINT DAY CARE CTR	1960	SUPPORT
13-223	BENEVOLENT ST 084	1865	AUX. HOUSING
13-249	BROOK ST 333	1900	ACAD
13-250	BOWEN ST 251	1900	AUX. HOUSING
13-251	BOWEN ST 247	1895	AUX. HOUSING
13-256	COOKE ST 037	1909	SUPPORT
13-271	WATERMAN ST 125-127	1863	AUX. HOUSING
13-277	BENEVOLENT ST 093	1854	VACANT
13-288A	BROOK ST 341	1895	ACAD
13-288B	MANNING ST 029	1938	ACAD
13-288C	MANNING ST 037	1897	ACAD
13-292	BROOK ST 456	1885	AUX. HOUSING
13-292	CUSHING ST 154	1895	AUX. HOUSING
13-292	CUSHING ST 166	1885	AUX. HOUSING
13-292	THAYER ST 307	1865	VACANT
135-6	HAFFENREFFER BARN	1928	ACAD
135-6	HAFFENREFFER MUSEUM	1928	ACAD
135-6	HAFFENREFFER OUTING FACILITY	1970	STUDENT AC
135-7	HAFFENREFFER CARETAKER HOUSE	1900	SUPPORT
16-164	HOPE ST 134	1910	AUX. HOUSING
16-175	CHARLESFIELD ST 070-072	1915	AUX. HOUSING
16-198	POWER ST 089	1842	SUPPORT
16-202	NIGHTINGALE-BROWN HOUSE	1792	SUPPORT
16-239	HOPPIN (THOMAS P.) HOUSE	1855	ADMIN
16-253	JOHN ST 050	1910	ACAD
16-437	PRESIDENT'S HOUSE	1922	SUPPORT
16-519	FEINSTEIN	1917	ACAD
16-533	BROOK ST 245-247	1900	AUX. HOUSING
16-538	GIDDINGS HOUSE	1908	ACAD
16-568	CHARLESFIELD ST 108-110	1910	AUX. HOUSING
16-588	CHARLESFIELD ST 066-068	1915	VACANT
16-597	CHARLESFIELD ST 038	1845	AUX. HOUSING
16-597	GRADUATE CTR B	1968	DORMITORY
16-597	GRADUATE CTR C	1968	DORMITORY
16-597	GRADUATE CTR D	1968	DORMITORY
16-597	GRADUATE CTR E	1968	ADMIN
16-597A	GRADUATE CTR A	1968	DORMITORY
16-598	BARBOUR HALL	1904	DORMITORY
16-633	POWER STREET PARKING GARAGE	1988	SUPPORT
16-634	BROOK ST 248-254	1900	COMMERCIAL

PLAT-LOT	BUILDING	BUILT	USE
16-642	VARTAN GREGORIAN QUAD A	1991	DORMITORY
16-642	VARTAN GREGORIAN QUAD B	1991	DORMITORY
17-054	MARSTON BOAT HOUSE	1967	ATHLETICS
17-069	TOCKWOTTEN ST 271	1950	ACAD
17-169	YOUNG ORCHARD AVE 004	1973	DORMITORY
17-261	STEINERT CENTER	1966	ACAD
17-262A	PERKINS HALL	1960	DORMITORY
17-262B	DYER HOUSE	1822	ACAD
17-604	YOUNG ORCHARD AVE 002	1973	DORMITORY
17-605	YOUNG ORCHARD AVE 010	1973	DORMITORY
17-616	TOCKWOTTEN 285	1895	VACANT
20-205	DYER 198	1948	ACAD
20-301	CLIFFORD ST 060	1945	COMMERCIAL
20-353	RICHMOND STREET 196	1920	COMMERCIAL
21-105	SHIP STREET 070	1902	ACAD
21-127	RICHMOND STREET 233	1970	COMMERCIAL
21-132	RICHMOND STREET 222	1928	ACAD
21-132	RICHMOND STREET 222 GARAGE	1989	SUPPORT
21-141	EDDY ST 349	1968	COMMERCIAL
21-313	DAVOL SQ 010	1880	COMMERCIAL
21-391	ELM ST 043	1945	SUPPORT
21-398	EDDY ST 339	1900	COMMERCIAL
21-407	DAVOL SQ 001	1900	COMMERCIAL
50-719	PARK LANE 010	1969	SUPPORT

LEASED

PLAT-LOT	NAME	BUILT	USE
12-171	ANGELL ST 169	1915	ACAD
12-473	BENONI COOKE HOUSE	1828	ADMIN
15-168	WATERMAN ST 229	1945	ACAD
15-469	RICHMOND SQUARE 4	1989	ADMIN
21-202	ELM STREET 110	1848	ADMIN
21-441	DAVOL SQ 003	1900	ADMIN
38-002	BUTLER HOSPITAL BLUMER BUILDING		HOSPITAL
38-002	BUTLER HOSPITAL DUNCAN BUILDING		HOSPITAL

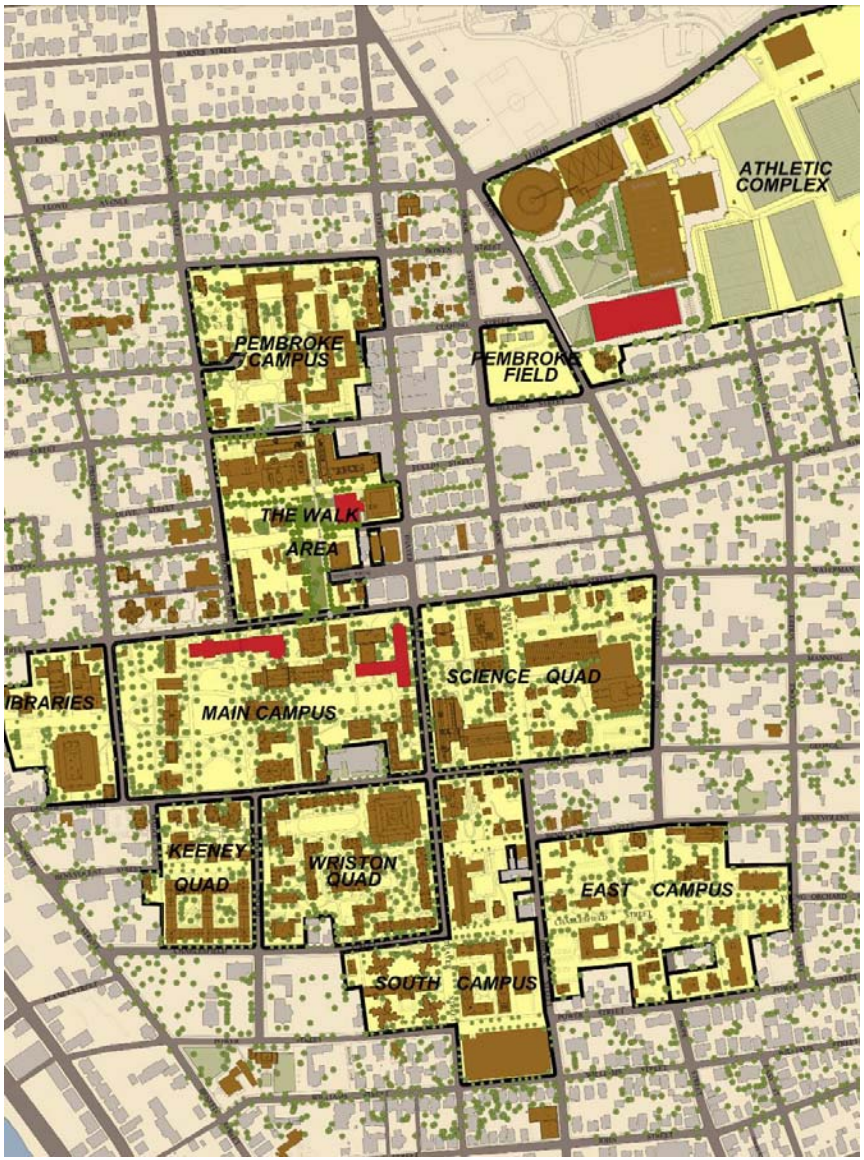
Planning Context



Tree Canopy Inventory

Brown's campus remains one of the greenest parts of the City, something that is readily apparent when looking at aerial photography. In compliance with Section 425 of the Zoning Ordinance, the University has updated its calculation of the overall tree canopy on-campus. As can be seen below the overall canopy of Brown's campus is well above the required 30%.

	Tree Canopy	Lot Area (SF)	Ratio
Athletic Complex	481,400	1,623,385	30%
Pembroke Field	48,200	77,230	62%
Pembroke Campus	290,000	515,450	56%
The Walk Area	144,600	295,080	49%
Main Campus	334,300	603,200	55%
Libraries	83,000	174,780	47%
Science Quad	223,700	441,540	51%
Keeney Quad	77,100	159,950	48%
Wriston Quad	170,900	330,160	52%
South Campus	173,100	396,545	44%
East Campus	210,300	379,570	55%
Total Canopy	**2,236,600**	**4,960,890**	**45%**



Developing Circulation Infrastructure

The first planning principle listed in the *Strategic Framework for Physical Planning* is to "Develop a circulation infrastructure to foster community, unify and enhance the campus and its surroundings." In the last five years the University has made significant strides in developing its circulation infrastructure.

- Over two miles of sidewalk were replaced
- Approximately 100 crosswalks were painted
- The Walk was created to connect the main historic campus with Pembroke campus
- Traffic lights were installed and re-sequenced along the Angell Street / Waterman Street.
- The University invested in improvements planned by the Thayer Street District Management Authority.
- Brown created the College Hill Parking Task Force, a broad coalition that developed a set of recommendations for on-street parking in College Hill.
- Free RIPTA access was provided for faculty, staff, and students through UPass Program
- Shuttle service to the Jewelry District and the hospitals was created.
- Zip Car expanded from two cars to 15 cars.
- Student parking is being provided only in special circumstances.
- Parking fees were increased by 55%.
- Contractors for major projects continue to park off-street.

Pedestrian Improvements

Because of Brown's integration into the fabric of the city, public streets are an important part of the pedestrian circulation system of the campus. Consequently, the University will continue to invest over $200,000 per year in streetscape and pedestrian improvements on city streets. The work will include sidewalk replacement, accessible curb cuts, new street trees with an engineered soil mix, and crosswalks. Standard details have been developed in cooperation with the Department of Public Works, the City Forrester, and a team of landscape architects, and will be followed for all improvement projects on College Hill. A separate set of standard details has been developed for the Jewelry District and will continue to be used in this area.

Transportation Demand Management

Results of the current demand management strategies demonstrate its success in reducing the number of cars coming to campus.

- 3900 riders per month are utilizing the RIPTA UPass for over 30,000 rides per month
- Brown's Downtown shuttle is carrying over 300 rides per day back and forth to the Jewelry District.
- 1400 on-campus members of ZipCar and approximately 400 non-Brown members, allowing ZipCar to expand from two cars to 15.
- Student parking numbers have dropped from 500 in 2005 to less than 50.

In addition, the University is planning several enhancements to these strategies, including:

- Improved shuttle routes with better headway
- Thru-routes for RIPTA buses from areas with high Brown-related populations
- Pilot for a bike-share program
- Assistance with the implementation of College Hill Parking task Force Recommendations

Parking Plan

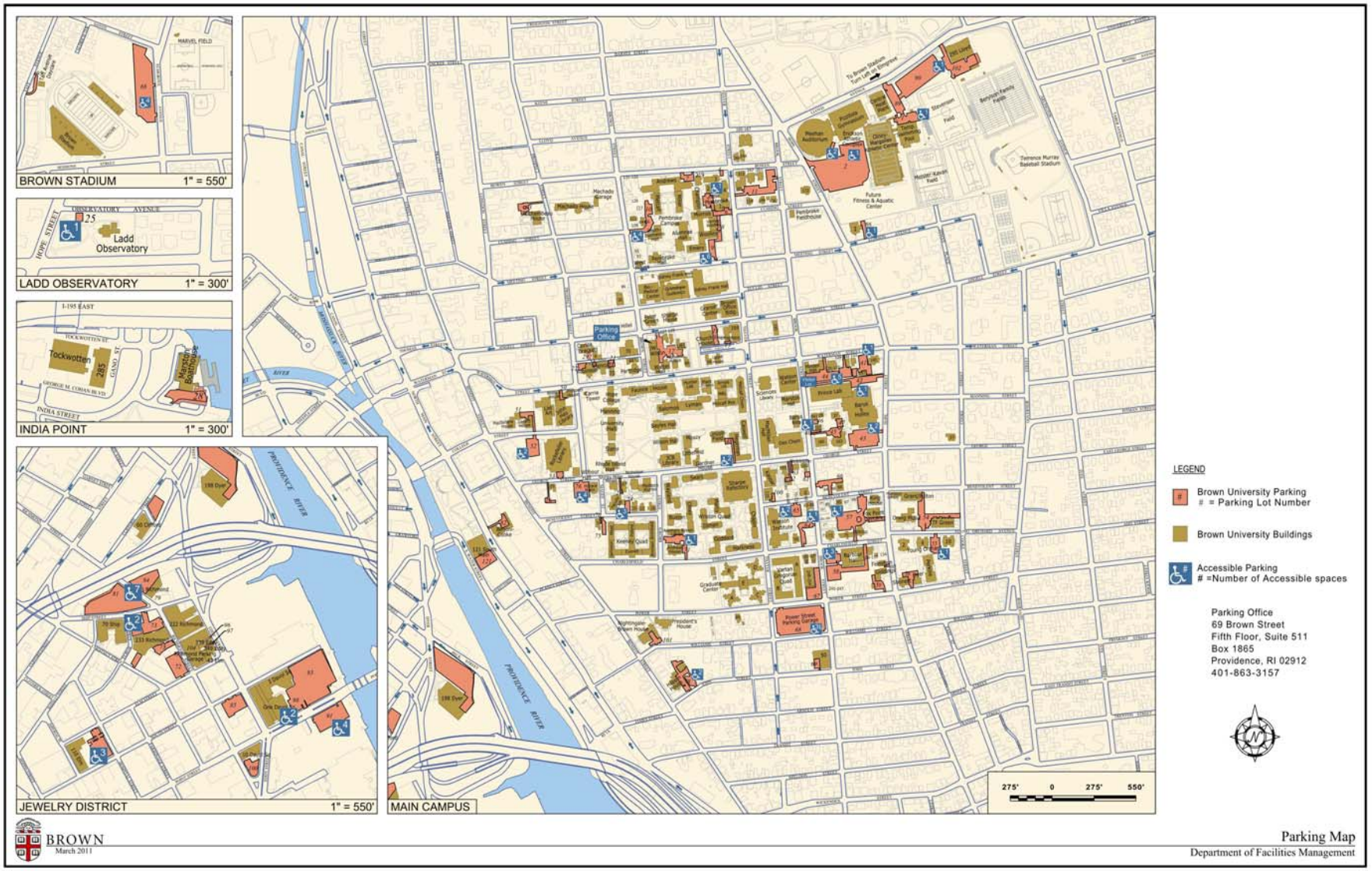
The University currently provides 2,384 parking spaces in over 100 off-street lots. These lots are scattered throughout the campus and are occupied primarily by faculty and staff. (see the parking map on the following page)

The requirement for off-street parking is a calculation based on the on-campus population, not square footage. Population growth is expected to continue but at a relatively slow rate. In the next five years we anticipate adding 15 faculty members, 300 graduate and medical students, and 100 staff. Undergraduate enrollment is expected to remain steady at 6000.

Parking supply will be added by bringing the Richmond Street garage on-line in conjunction with the new Medical School Building and with the construction of a new parking garage at the Athletic Complex (see page 22). The parking calculation, in accordance with Section 703, is shown for both 2011 and 2016 on the following table. It illustrates the University's efforts to increase the surplus to help address on-street parking issues.

	2011 Total	**Spaces Req'd.**	**2016 Total**	**Spaces Req'd.**
Faculty & Staff	3921	1307	4071	1357
On-Campus Students	4960	620	5256	657
Off-Campus Students	2532	1266	2744	1372
Total		3193		3386
Available		2384		2933
Grandfather		931		931
Surplus		**122**		**478**

Developing Circulation Infrastructure



Traffic Study

In 2005 Brown University commissioned a comprehensive traffic study by Vanasse Hangen Brustlin (VHB). The intent was to establish a baseline from which the University and the City can monitor the changes in the area, and to assess the proposed projects and recommend improvement measures. Now in 2011, VHB has again conducted an analysis of the current conditions by collecting peak period vehicular and pedestrian traffic counts in and around the Brown University campus. The map at right identifies those intersections monitored.

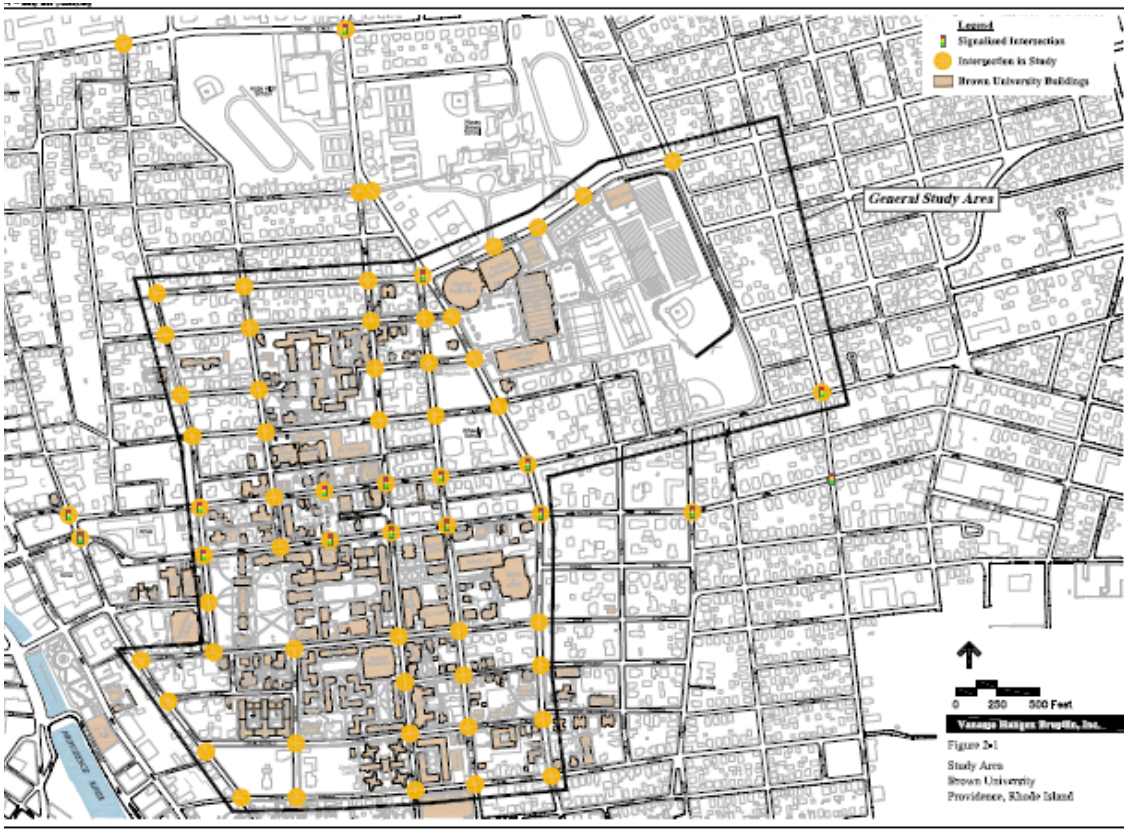
The traffic count data indicates generally reduced levels of traffic volume throughout the campus since the 2005 study. The cause of this can be attributed to a number of factors, including the University's TDM measures, more stringent parking enforcement both off-street and on-street, construction activities, the general state of the economy, and the effect of the 195 project. The analysis also identified only a handful of intersections that operated with higher delays, including:

- Hope Street / Lloyd Avenue / Brook Street
- Angell Street / Brown Street
- Hope Street / Barnes Street / Moses Brown

Two of these intersections are expected to improve with the completion of the projects included in this Master Plan, specifically the extension of The Walk and the signalization improvements at Hope / Lloyd / Brook Street associated with the Stevenson Field / Parking Garage project (see page 22).

A complete copy of the Transportation Component by VHB, including the analysis of current conditions, future conditions, and level of service at each intersection has been submitted to the Department of Planning and Development and is available at the following website:

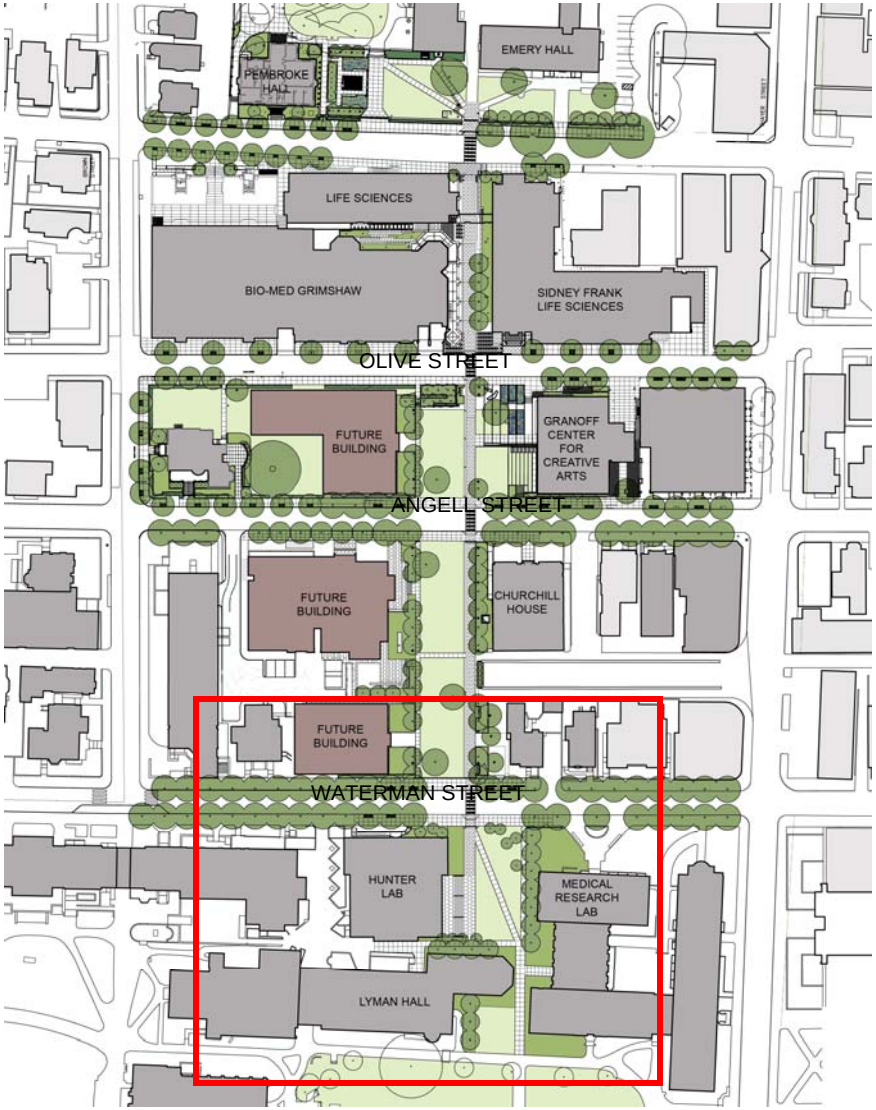
http://www.brown.edu/Facilities/Building_Brown/resources/



Consolidating the Core

The second planning principle in the *Strategic Framework for Physical Planning* is to "Consolidate the Core." Together with its eight underlying principles, this helped shape much of what has been done in the past five years, including:

- Significant upgrades to the campus utility system to ensure reliability, energy efficiency and potential for future growth
- Development of the Walk as a new campus landscape and an area for future growth
- Construction of the Granoff Center for Creative Arts, a new interdisciplinary academic space on The Walk
- Renovation of over 200,000 square feet of existing historic buildings for academic use
- Renovation of J. Walter Wilson and Faunce House to establish a new "Student Hub" at Waterman and Brown Street
- Creation of a new master plan for the Athletic Complex centered around a major green space and campus-based architecture
- Relocation of books from existing library space to a high density storage building in order to recapture library space.
- Relocation of the Peter Greene House to create a more appropriate campus edge
- Renovation of three historic houses as visiting scholar and graduate student housing
- Sale of five houses as part of the Brown to Brown Home Ownership Program.



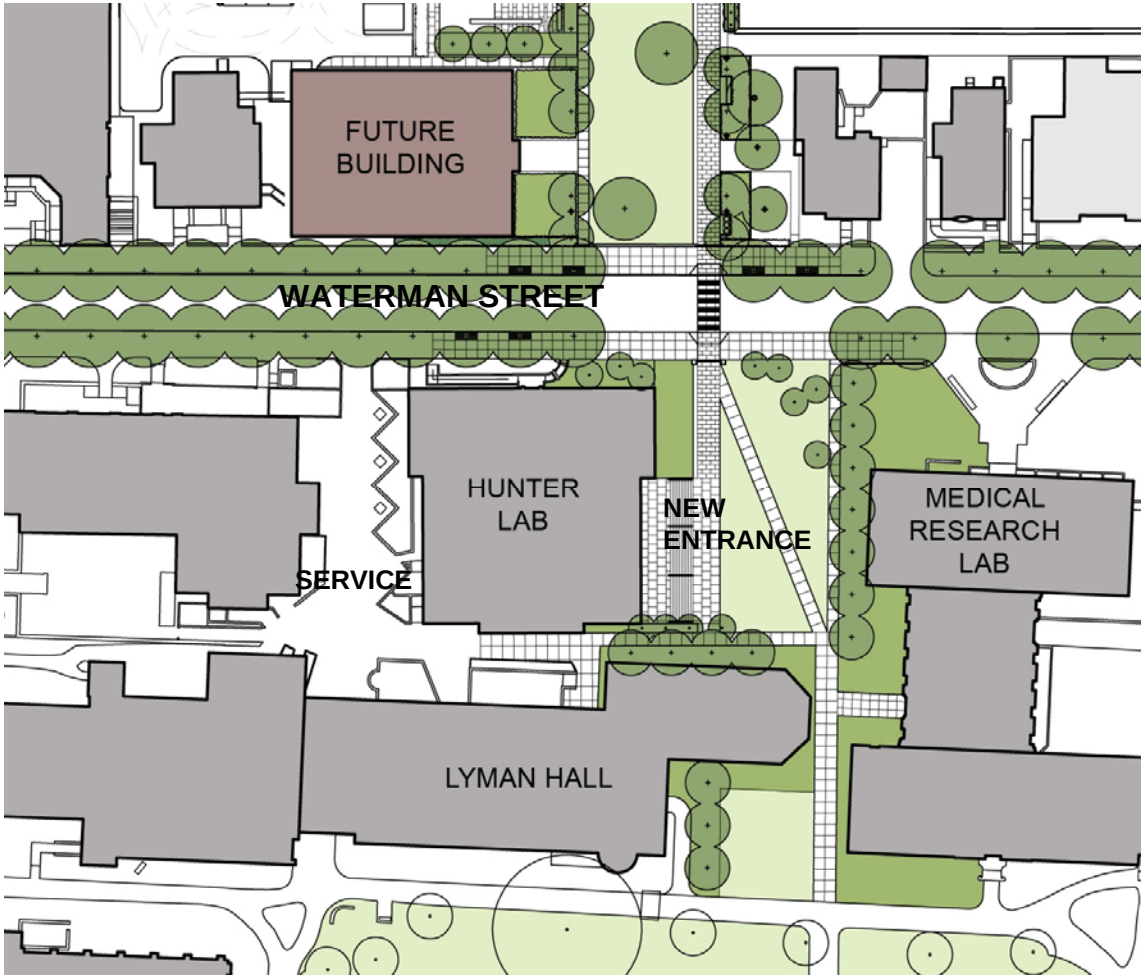
<u>The Walk Master Plan</u>

One of the most important area master plans that was developed previously is master plan for The Walk (shown at right). This plan calls for a series

of new interconnected green spaces that link the Pembroke Campus to the historic Brown Campus. These new green spaces are framed by higher density academic buildings. At this point the landscape work is complete and two new buildings – Sidney Frank Hall for Life Sciences and the Granoff Center for Creative Arts have been constructed, leaving future growth potential of approximately 200,000 square feet. Although this submission does not include new construction in this area, the Master Plan for The Walk is helping to shape a significant renovation project in Hunter lab, located at the southern end of The Walk.

<u>Hunter lab Renovation</u>

Hunter Lab is a 55,000 square foot building constructed in 1956 for the Psychology Department that has remained essentially unaltered since that time. With the completion of the renovation of the Metcalf Chemistry Complex, Hunter Lab will be emptied, so a full renovation can be done for the emerging programs in Environmental Sciences. The building will be designed to include a new greenhouse on the top floor enabling the demolition of the adjacent Plant Environmental Center so The Walk can extend south of Waterman Street. A new entrance into Hunter Lab from The Walk will lead to a public first floor with classrooms and offices, while the upper floors will be dedicated to research. The design will target LEED Gold certification and no variances are anticipated. (see site plan at right)

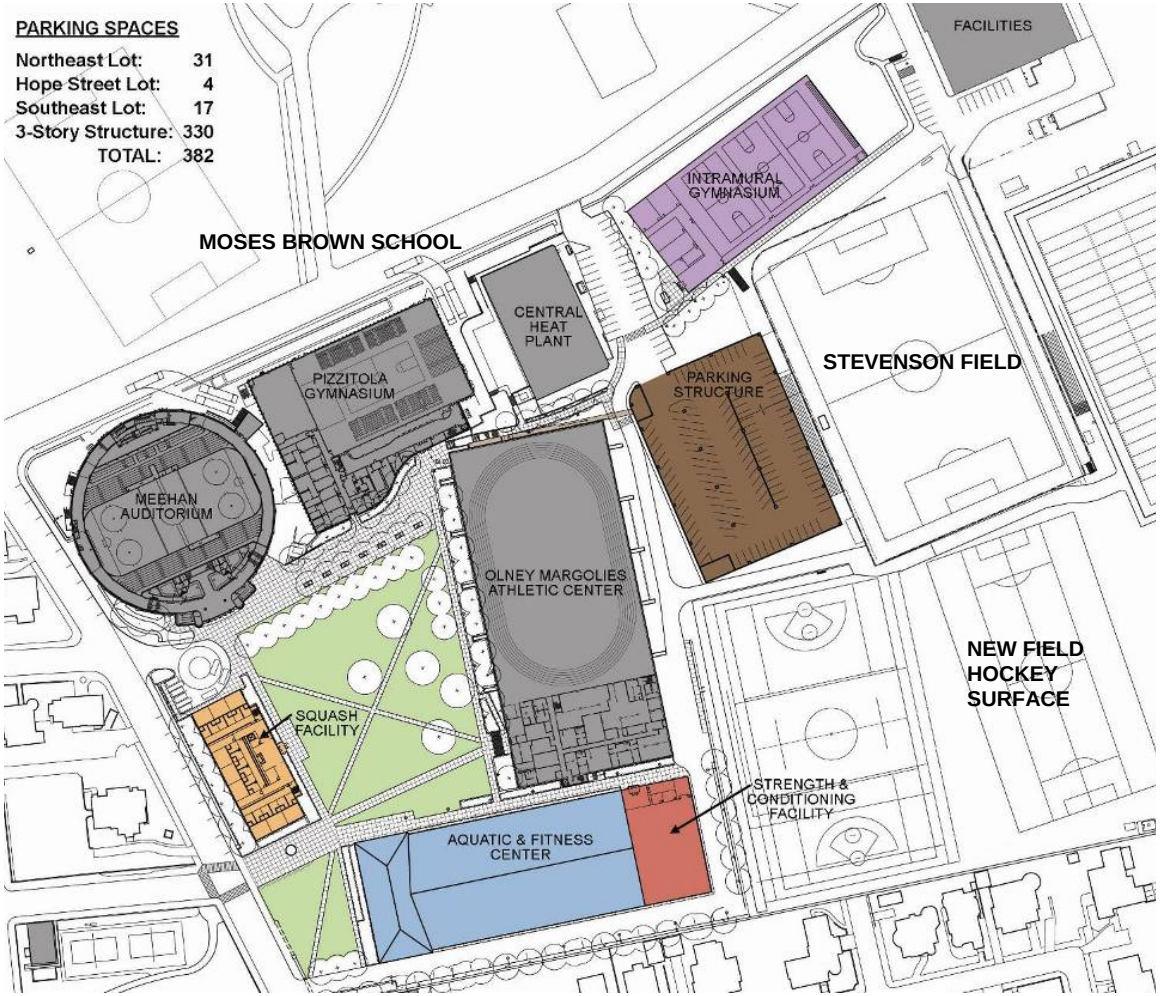


Erickson Athletic Complex Master Plan

In 2009, the Corporation Committee for Facilities & Design adopted a new master plan for the Erickson Athletic Complex. Like the master plan for The Walk, the new plan focuses on the creation of a major green space – now called Ittleson Quad – with future buildings framing it. In this case, these future buildings will take on a more campus-based architectural style, similar to the new Nelson Fitness Center and Moran Coleman Aquatics Center currently under construction. The plan (shown at right) includes a future building along Hope Street, a parking garage located behind the Olney Margolies Athletic Center (OMAC), and reconfigured fields.

Stevenson Field Stadium & Parking Garage

Based on this area master plan, the University can combine several seemingly disparate needs into a consolidated project that sets the stage for the future. In this case, the need for a new field hockey field, improved playing conditions at Stevenson Field, the desire for a soccer stadium, and the need for additional parking can be combined with the community concerns about glare from the lights at Stevenson Field, pedestrian safety on Lloyd Avenue, and drainage to create one project that resolves all of these issues. The project includes: 1) the replacement of the existing natural-turf practice soccer field just south of Stevenson Field with a new Astro-turf field for field hockey; 2) the replacement of the existing natural-turf on Stevenson Field with Field-turf to allow soccer and lacrosse teams to practice on the field as well as play games; 3) the replacement of the existing lights on Stevenson Field with more efficient and lower glare fixtures;



Master Plan for the Erickson Athletic Complex

4) the replacement of the existing bleachers (1500 seats) on Stevenson Field with a new 2000 seat stadium with restrooms, concessions, and ticketing; 5) the construction of a new 300-350 space parking garage immediately adjacent and hidden behind the stadium; 6) the installation of “neck-downs” and a flasher on Lloyd Avenue to ensure safe pedestrian crossings near Moses Brown; 7) the replacement of an existing damaged storm sewer line running beneath the fields; and 8) repair of the traffic light at the intersection of Hope Street/Lloyd Avenue/Brook Street to increase efficiency of the intersection.

With the construction of the new parking garage, the total parking capacity in the Erickson Athletic Complex will be 480 spaces (up from 310 spaces at the completion of the current fitness center project, and up slightly from 425 spaces before the fitness center construction began). Based on an analysis of the attendance records over the last three years, 480 spaces will be more than enough to accommodate all but a handful of events, and it will help relieve pressure on parking availability on-street during the day.

Aesthetically the impact will be minimized by the stadium and the significant grade change to the north. Based on the latest traffic study, the traffic impact on Lloyd Avenue will be minimal, especially after the signals at Hope/Lloyd/Brook are corrected.

Proposed Soccer Stadium from Lloyd Avenue

Proposed Stadium from Stevenson Field

Consolidating the Core

Residence Hall Plan

In 2009, the Brown University Corporation encouraged the creation of a comprehensive plan for improving the Residence Halls. The primary objectives of that plan are to:

1) Solidify first year communities
2) Create an intentional sophomore experience
3) Increase the number of suites & apartments, primarily for juniors and seniors
4) Increase the total capacity by 300-350 beds
5) Increase dining capacity

To accomplish these objectives, a series of renovations and conversions are planned, which will increase the capacity and enable the full renovations of many of our residence halls. However, to meet the total capacity goal, the University will also have to build approximately 300 new beds. While a specific proposal is not included in this submission, planning is underway to examine several options. It is expected that this will be the subject of a subsequent amendment in the near future.

315 Thayer Street

Residence Hall Conversions

By simply converting three buildings to fully functioning residence halls, the University will gain approximately 150 beds over the next five years.

The first of these is 315 Thayer Street, a historic apartment building designed by Fredrick Ellis Jackson currently treated as off-campus housing. After a full interior renovation, the building will house 60 students in a suite-style residence hall.

The second conversion will be made by eliminating the Saunders Inn currently located on the top two floors of Gregorian Quad. Simply by changing furniture, 46 beds will be added to the University inventory.

The third conversion is Wayland Hall, located at the corner of Brown Street and George Street. Administrative offices currently occupy the entire first floor in an otherwise exclusively residence hall complex. By relocating the administrative functions and performing minor interior renovations, it will be possible to gain approximately 34 beds.

Gregorian Quad

Renovations to Existing Buildings

The gain of 150 beds will create enough capacity for the University to begin substantial renovations (not limited to summer projects) in several of the existing residence halls, as well as the dining halls. These renovations will be phased over the next five years and will include MEP systems upgrades, life safety upgrades, accessibility accommodations, and some reconfiguration of the room types. Little if any exterior work will be done on each of these. Buildings included in this program include:

- Miller Hall
- Metcalf Hall
- Andrews Hall
- Emery / Woolley / Morriss / Champlin
- Keeney Quadrangle
- The Minden
- Grad Center
- Perkins Hall
- Hegeman Hall
- Verney Woolley Dining
- Sharpe Refectory

This major initiative will result in the renovation of over 900,000 square feet and approximately 1,200 beds within the existing housing stock.

Brown to Brown Home Ownership Program

In 2006, the University launched the Brown to Brown Home Ownership Program primarily as a pilot. The program is designed to encourage home ownership by faculty and staff adjacent to campus, and to return these properties to owner occupied, tax-paying status. Houses identified for the program are first renovated, and then sold to faculty or staff at a discounted price. The caveat is they can only sell it back to the University. Since then the University has successfully renovated and sold five houses:

- 86 Brown Street
- 129 Brown Street
- 117 Brown Street
- 277 Brook Street
- 66-68 Benevolent Street

With the anticipated increased capacity of the residence halls and the success of the program to-date, Brown is proposing to add 14 more houses to the program – located primarily at the edges of campus - the goal being to renovate and sell four houses per year. In addition, the University will utilize the proceeds from the program to renovate other single-family houses it needs to maintain in its inventory as residential advisor houses, visiting scholar residences, and graduate student housing. In total, it is anticipated that 22 single family homes will be renovated under this program over the next five years. (see photos at right and following page)

For more information about this program see the website:

http://www.brown.edu/Facilities/browntobrown/

93 Brown Street (built 1885)

95 Brown Street (built 1885)

109 Brown Street (built 1900)

131-133 Brown Street (built 1850)

Consolidating the Core

Brown to Brown home Ownership Program

134 Hope Street (built 1910)

95 Benevolent Street (built 1885)

99 Benevolent Street (built 1860)

93 Benevolent – Bannister House (built 1854)

97 Benevolent Street (built 1880)

84 Benevolent Street (built 1860)

Consolidating the Core

Brown to Brown Home Ownership Program

86 Benevolent Street (built 1865)

70-72 Benevolent Street (built 1880)

Other House Renovations using Proceeds

307 Thayer Street (built 1865)

240 Bowen Street (1885)

281-283 Brook Street (built 1890)

38 Charlesfield Street (built 1845)

Consolidating the Core

Other House Renovations using Proceeds

22 Benevolent Street (built 1816)

291 Brook Street (built 1870)

165-167 Lloyd Avenue (built 1910)

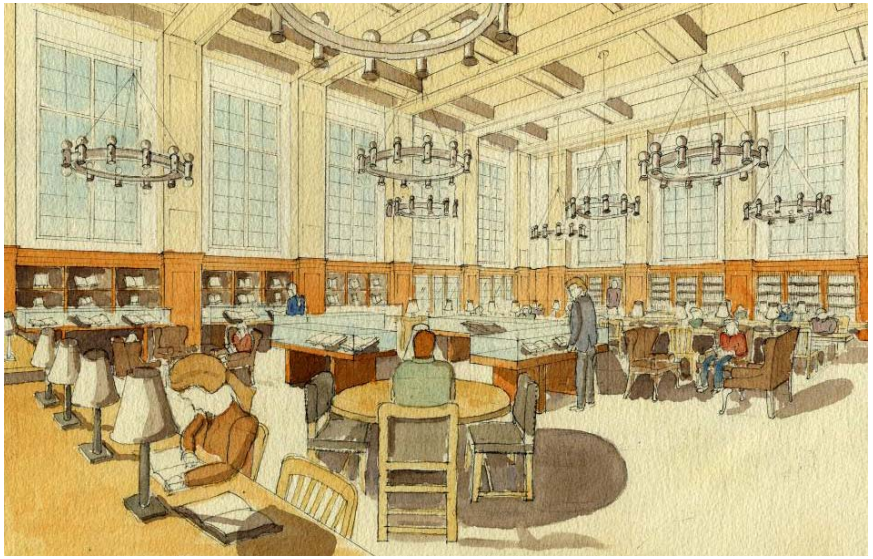
86 Cushing Street (built 1895)

287 Brook Street (built 1870)

20 Olive Street (built 1885)

Library Planning

With changes in technology and the way information is accessed, the libraries are undergoing a significant transition. In the past five years, the University has moved 800,000 books and periodicals from the libraries on-campus to its high density storage annex at 10 Park Lane. This has allowed for the recapture of existing space within the libraries to create collaborative study space that has proven to be incredibly successful. Examples include the Friedman Study Center in the lower floors of the Science Library, the Science Center on the 4th floor of the Sciences Library, the Finn Reading Room in the Rockefeller Library, and the Bopp Seminar Room in the John Hay Library. The next planned projects are the renovation of the main reading room in the John Hay Library, one of the most dramatic historic spaces in the City, and the renovation of the first two levels of the Rockefeller Library. Both projects will create enhanced opportunities for students to study in the library collaboratively and individually.



Rendering of Main Reading Room in John Hay

Addition to the Library Annex (10 Park Lane)

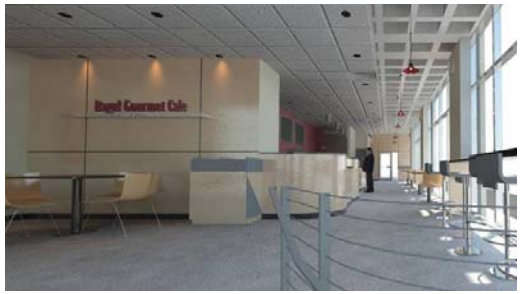
Because of the success of these renovations projects and the desire to move even more books off-campus, the University will need to construct an addition to the existing high bay portion of the building at 10 Park Lane. The addition will be of similar construction and will be designed to house an additional 1 million volumes in approximately 12,000 square feet.
(see aerial photo at right)

Moving Beyond College Hill

The third planning principle articulated in the *Strategic Framework for Physical Planning* is to "Move Beyond College Hill". At the time this was a watershed for the University, but since then it has adopted this principle not only in its physical planning, but also in its relationship with the City. Brown recognizes that its success is directly linked with the success of the City. Many efforts have been undertaken to strengthen the University's role in both planning and building its economy. Examples include:

- In 2009, in partnership with the Greater Providence Chamber of Commerce, the City, the RI-EDC, the Slater Technology Fund, RISD, and others, Brown helped create the Rhode Island Center for Innovation and Entrepreneurship (RICIE). Brown is providing space and staffing for this incredibly successful venture. In the past year over 5000 future entrepreneurs attended programs held at RICIE, and over 30 start-up companies are in "the pipeline".
- In partnership with IBM, Brown built the Ocean State Consortium of Advanced Resources (OSCAR), which engages public and private partners across disciplines and organizations to build capacity and drive an innovative, clean and economically sustainable community. The OSCAR network of over fifty public and private partners leverages the collaborative culture, expertise and entrepreneurial spirit to address RI's most challenging problems.
- IBM and Brown collaborated to build a statewide supercomputer – "Big Rhody" - that provides access to the entire state.
- Brown supported OSHEAN in its successful $21.7 million effort to bring affordable broadband capacity to the public and contribute 210 jobs through the Broadband & Technology Opportunity Grant Program.
- In January 2011, OSCAR launched Green the Knowledge District (GKD), an initiative to build a model that connects efforts and concentrates resources in a targeted geographical area in order to transform the community.
- In March 2011, the City of Providence, in collaboration with OSCAR, announced it was named 1 of 24 global cities in the IBM Smarter Cities Challenge giving Providence access to not only IBM's expertise, but also to an international network of urban innovation centers.
- Brown has played a major role in transportation planning (Transit 2020 and the Core Connector Study), the Pedestrian Bridge Design, the Park Design, and future programming of the new public spaces.
- In addition to locating the Medical School in the Jewelry District, Brown is investing heavily in "place-making" in the area. This effort includes streetscape improvements, the creation of a public square on Brown owned land (see images at right), the construction of a retail café on Richmond Street, and the utilization of one of its buildings for a neighborhood substation for both the Providence Police and Brown Public Safety.
- Brown is leasing the majority of its commercial space to knowledge-based companies (in many cases at discounted rates) in order to help build a critical mass of knowledge based activities in the Jewelry District. Examples include Isis Biopolymers, Nabsys, Beta-Spring, the Center for Weight Control and Diabetes, and Nu-Label.

Rendering of Ship Street Square



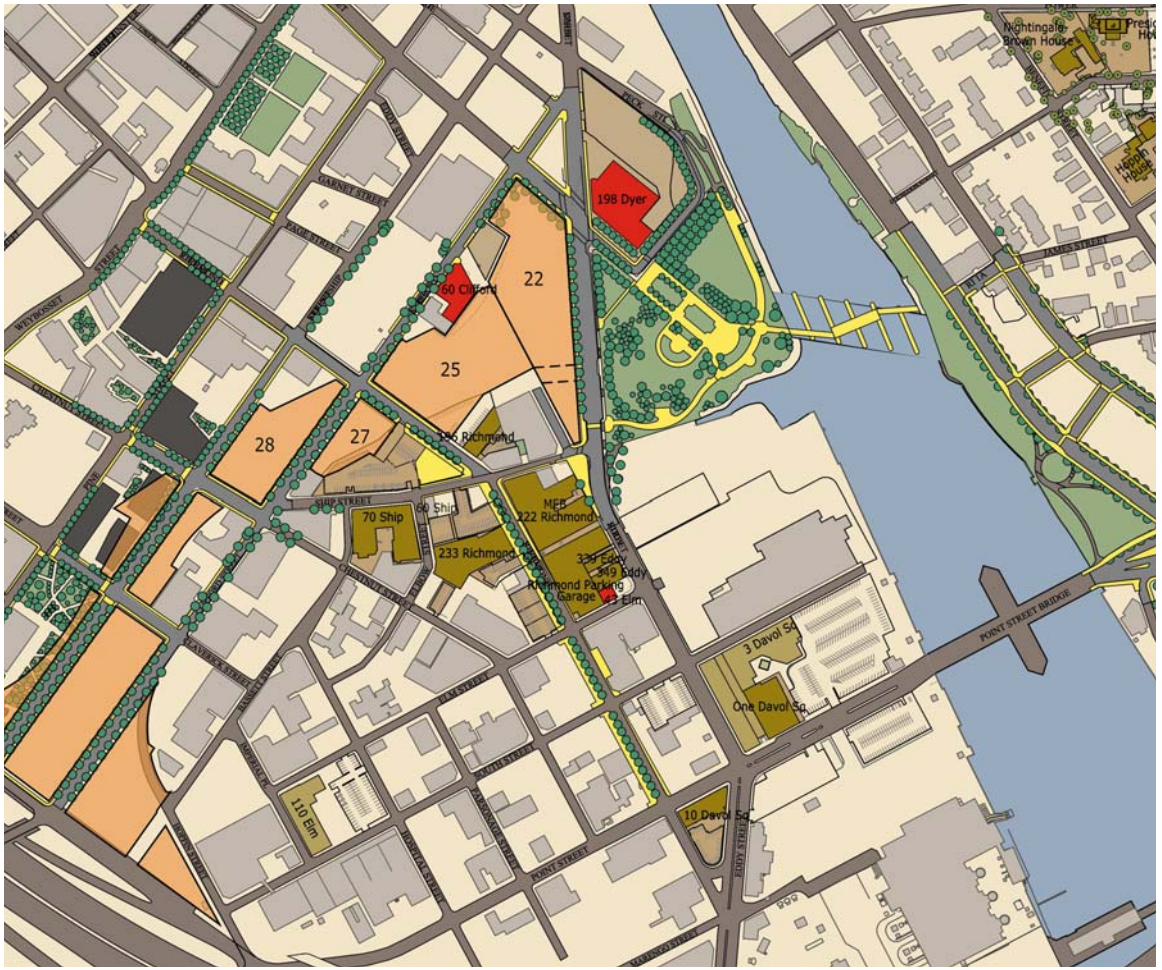
Rendering of the Café at Richmond & Ship Street

Streetscape Improvements on Richmond

198-200 Dyer Street

As part of Brown's effort to re-energize the area near the Alpert Medical School, it recently acquired this building and is planning a renovation for the Continuing Education Department - both administrative offices and classrooms. From this building the University will offer classes and a degree program specifically oriented toward adults. Because this 41,000 square foot building is located outside the Institutional Zone, educational uses require a Special Use Permit from the Zoning Board. An application has already been submitted and is scheduled to be heard on May 25, 2011.

The scope of the project includes a full interior renovation, stucco repairs on the exterior, and the replacement of selected windows and glass block. The map at right shows Brown owned properties in brown and red (recent acquisitions) in relation to the 195 parcels and future build-out of the park and pedestrian bridge.

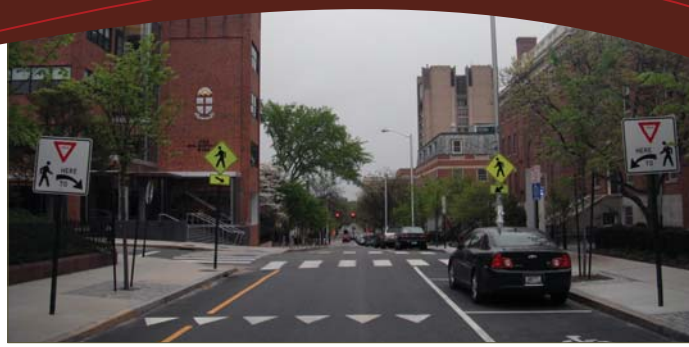


Future Research Needs

Brown University is a thriving research institution, and as such new research activities are constantly being identified. Currently, planning is underway to develop space for the newly created School of Engineering and the Brown Institute for Brain Sciences. It is anticipated that space for both of these will need to be identified or built within the planning horizon of this Master Plan, but no specific proposals are ready at this point. It is hoped that these space requirements can be met within the Jewelry District, again adding to the critical mass of knowledge-based activities.

Transportation Component

Brown University Institutional Master Plan



PREPARED FOR

Brown University
Providence, Rhode Island

PREPARED BY

VHB *Vanasse Hangen Brustlin, Inc.*

May 2011

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Introduction and Executive Summary

Introduction

As part of its on-going master plan update process, Brown University has retained Vanasse Hangen Brustlin (VHB), Inc. to consider the transportation implications of the plan through an update of the Transportation Component that was included in the 2006 Institutional Master Plan (hereinafter referred to as the 2006 Plan). The updated Transportation Component will be included as part of the supporting documentation for the 2011 Institutional Master Plan (hereinafter referred to as the IMP) that is currently under preparation. This document summarizes the transportation needs of the University and describes the Master Plan's implications for the transportation system serving the University.

Many projects included in the 2006 Plan have been completed or are nearing completion. This report re-establishes a transportation baseline for the campus and accesses the impacts of the projects during construction and after completion. As part of this update, previously collected traffic data and projections were reviewed to determine if the prior projections for traffic redistribution were realized and refinements were made to projections for future changes on campus.

As with the 2006 Transportation Component, this report also presents an analysis of the transportation system serving Brown University today, a projection of how this system would operate in the future without any of the planned IMP developments, and an assessment of the effect of specific IMP developments that are planned to be constructed within the next 5-10 years.

Although an assessment of the effect of specific projects slated for implementation within the IMP shows that they are not expected to have any major impacts on the area transportation system, the University recognizes that its campus is a major generator of transportation demand within the City of Providence. To help moderate the demand the University is placing upon the transportation system, the University

proposes an update to the transportation improvement program outlined in the 2006 Plan, including minor infrastructure improvements and an enhanced Transportation Demand Management (TDM) program that further emphasizes and promotes multi-modal transportation opportunities for campus users. Proposed infrastructure improvements include traffic signal improvements at the intersection of Hope Street with Lloyd Avenue/Brook Street, traffic calming/pedestrian improvements on Lloyd Avenue near Moses Brown School, and a series of potential pedestrian enhancements that could be considered at various locations within the campus.

Study Outline

The following tasks helped develop the major components and inform the findings of this transportation study:

- Inventory of the surrounding roadway infrastructure (update)
- Observations of traffic, pedestrian, and bicycle flows
- Collection of new daily and peak period traffic and pedestrian counts
- Identification of planned transportation improvement projects
- Review of other planned projects in the area surrounding the University that may affect future transportation system operation
- Evaluation of the IMP projects' impact on the transportation system
- Identification of anticipated short-term construction impacts associated with the Master Plan development program

Additionally, enhancements to the University's Transportation Demand Management (TDM) program, transit services and parking strategy discussed elsewhere within the IMP were also reviewed as part of this study.

Executive Summary

The Transportation Component of the IMP provides a comprehensive review of the transportation system serving the University and provides an analysis of the projected impact of the proposed IMP projects on this system. The following section provides a brief summary of the transportation analysis and results.

Existing Conditions

Over the past 5 years, approximately $700 million of construction work has been completed at the University, including approximately two miles of improved public

streetscapes, improvements to the campus utilities system, adaptive reuse of nearly 500,000 square feet (sf) of historic buildings, construction of over 125,000 sf of new buildings, and a new medical school in the Jewelry District.

Specifically, since the completion of the 2006 Plan, the following projects and initiatives that were referenced within it and have implications to the campus circulation infrastructure, have been completed or are close to completion. These projects, in a large part, contributed to the changes in traffic and pedestrian flow that were observed in 2011.

- Completion of the Life Sciences Building
- Completion of the Creative Arts Center
- Construction of the "Walk", connecting the main historic campus with Pembroke campus
- Replacement of over two miles of sidewalk
- Painting of over 100 crosswalks with enhanced signing for pedestrians
- Installation of new traffic signal equipment and implementation of coordination along the Angell Street and Waterman Street corridors (project nearing completion, but had not been finalized as of the dates of the observations in this study)
- Investment in improvements planned by the Thayer Street District Management Authority
- Creation of the College Hill Parking Task Force, a broad coalition that developed a set of recommendations for on-street parking on College Hill
- Providing free RIPTA access to faculty, staff, and students
- Creation of a shuttle service to the Jewelry District and the hospitals
- Expansion of the Zip Car program from two cars to 15 cars
- Elimination of student parking except for special circumstances.
- Increasing parking fees by 55%
- Continuation of off-street parking requirements for contractors for major projects

The transportation analysis contained in this updated report reflects an expanded study area when compared to the 2006 study. The expanded study area is generally bounded by Lloyd Avenue to the north, Power Street to the south, Arlington Avenue to the east and Benefit Street to the west. Daily and peak hour traffic volumes were collected for the major roadway corridors and at sixty-four (64) intersections within the study area. In comparison, the 2006 study included data collection at 37 intersections. The new traffic data was analyzed to understand the quality of the traffic operations within the study area.

Pedestrian activity on the campus continues to be much higher during the afternoon and evening peak hours compared to the morning peak hour period, due to the lower levels of student activity and commercial activity on Thayer Street during the morning peak hour period. Pedestrian volumes along Thayer Street and Brown Street and at the primary street crossings along Angell Street, Waterman Street, and George Street continue to be very high.

At the unsignalized intersections of Brown Street with Angell Street and with Waterman Street, pedestrians crossing the roadways interfere with flow of traffic, which results in areas of congestion during peak periods. Along Thayer Street between Cushing Street and Waterman Street, several factors cause restrictions to traffic flow throughout the day. These factors included truck loading/deliveries, pedestrians crossing against the traffic signals and at mid-block locations, bus maneuvers, parking maneuvers, and double-parked vehicles.

Vehicular capacity analysis results indicate that the majority of the intersections operate at acceptable calculated levels of service during the peak hour periods. However, based on field observations, many of the intersections appear to operate at poorer levels of service with longer delays and queues than the operations analysis suggests. This is commonly the result of queuing generated at adjacent intersections, (caused in part by existing traffic signal timings, which will be improved with the completion of the Angell Street/Waterman Street signalization project), blocking the flow of these intersections as well as disruptions to traffic flow caused by non-University related factors.

Future Conditions

The changes in transportation demand associated with planned projects on the campus were estimated based on changes in parking supply, projections for faculty/staffing growth, graduate student enrollment growth, and building program information provided by the University.

Since the planned projects on the campus involve loss of existing parking spaces, a net reduction in vehicular trips through the intersections and roadways immediately surrounding the project sites can be expected. On the contrary, the strong emphasis on pedestrian mobility through the campus aids in promoting additional pedestrian activity as a result of some of the planned projects. Each of these transportation demand elements were quantified using standard traffic engineering practices for use in the analysis.

In addition to accounting for the transportation demand posed by specific projects on the campus, general traffic growth increases in the area as well as potential non-campus related transportation and development projects were also considered in the estimation of future conditions traffic volumes.

Overall, since the estimated transportation demand for known projects is not substantial, the future conditions analysis shows only a few minor changes in traffic operational levels of service. In most cases, intersections which show degradations in the calculated levels of service are those that are near threshold values or near capacity under No-Build traffic volumes.

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Improvement Measures

Although the planned projects do not generate significant transportation demand, the University is committed to continuing to reduce its overall impact on the operation of the transportation system serving the campus. Consistent with this objective, this report identifies an improvement program that addresses the limited project impacts while helping to improve some existing deficiencies.

Enhancements to the Transportation Demand Management Program

One of the core elements of the University's improvement program is a robust transportation demand management (TDM) program that is aimed at reducing single occupancy vehicles and travel during peak hours. This has traditionally been achieved on the campus through aggressive promotion of public transportation and innovative changes to parking policies.

A more detail discussion of the current campus TDM programs and potential improvements to it are discussed elsewhere in the IMP.

Traffic Signal Improvements

During VHB's field inventory, it was determined that the Brook Street and Hope Street approaches of the Hope Street/Lloyd Avenue/Brook Street intersection have faulty vehicle detection, which contribute to some of the observed congestion at that location during peak hours of operations. As part of the transportation improvements associated with the implementation of the IMP projects, it is recommended that the faulty vehicle detection be fixed, and the traffic signal timings at the intersection adjusted.

It is also recommended that traffic signal timings and coordination settings at the intersections along Angell Street and Waterman Street be reviewed and revised, if necessary, at regular intervals, to ensure optimal performance of the traffic signal system on the campus.

Pedestrian Improvements on Lloyd Avenue near Moses Brown School

Based on VHB's field reviews and analysis findings, it is recommended that curb "bump-outs" and high visibility crosswalk treatments be considered at the west driveway for Moses Brown School on Lloyd Avenue to help improve pedestrian visibility and driver awareness of pedestrian crossing locations. Such traffic calming improvements would also help mitigate the impact of potential additional traffic that would be generated by the IMP projects planned within the athletic complex.

Additional Pedestrian Related Enhancements

It is expected that the limited additional transportation demand expected to be generated by new IMP projects in the next five to ten years can be supported by improvements that have already been implemented based on the 2006 Plan, and the additional improvements outlined above. Some additional relatively minor improvements, such as the following, may be considered for locations across the campus to supplement previously implemented improvements:

- Maintain consistent, highly visible crosswalk striping throughout the campus
- Upgrade and maintain signing to meet the latest standards
- Install curb extensions (bump-outs or bulb-outs) at certain locations
- Enhance pedestrian accommodations at traffic signals.

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Existing Conditions

Introduction

As part of this chapter, Vanasse Hangen Brustlin Inc. (VHB) reviewed existing traffic, pedestrian, parking, and public transportation conditions on and around the campus. The first section describes the University's surroundings and the study focus area. The subsequent three sections describe in detail each of the primary transportation modes serving the campus:

- Vehicular access including roadway operations and parking
- Public Transportation
- Pedestrian and bicycle activity

The final two sections of this chapter briefly describe the University's loading and service vehicle access procedures and the University's transportation demand management (TDM) programs, which are intended to minimize its impacts on the transportation system serving the University and its neighbors.

Study Area

Brown University is located primarily within the College Hill neighborhood of Providence's East Side and is surrounded by different neighborhoods within the city. The Blackstone and Wayland neighborhoods border the campus to the east, and the Fox Point neighborhood borders the campus to the south.

The 2006 transportation study focused on the northern portions of the campus and surrounding area. For this study, the limits have been expanded to the south to include several roadways and intersections extending to Power Street. The study area is generally bounded by Lloyd Avenue to the north, Power Street to the south, Arlington Avenue/Hope Street to the east and Prospect Street/Benefit Street to the west, as shown in Figure 2-1. To maintain consistency with prior analyses performed

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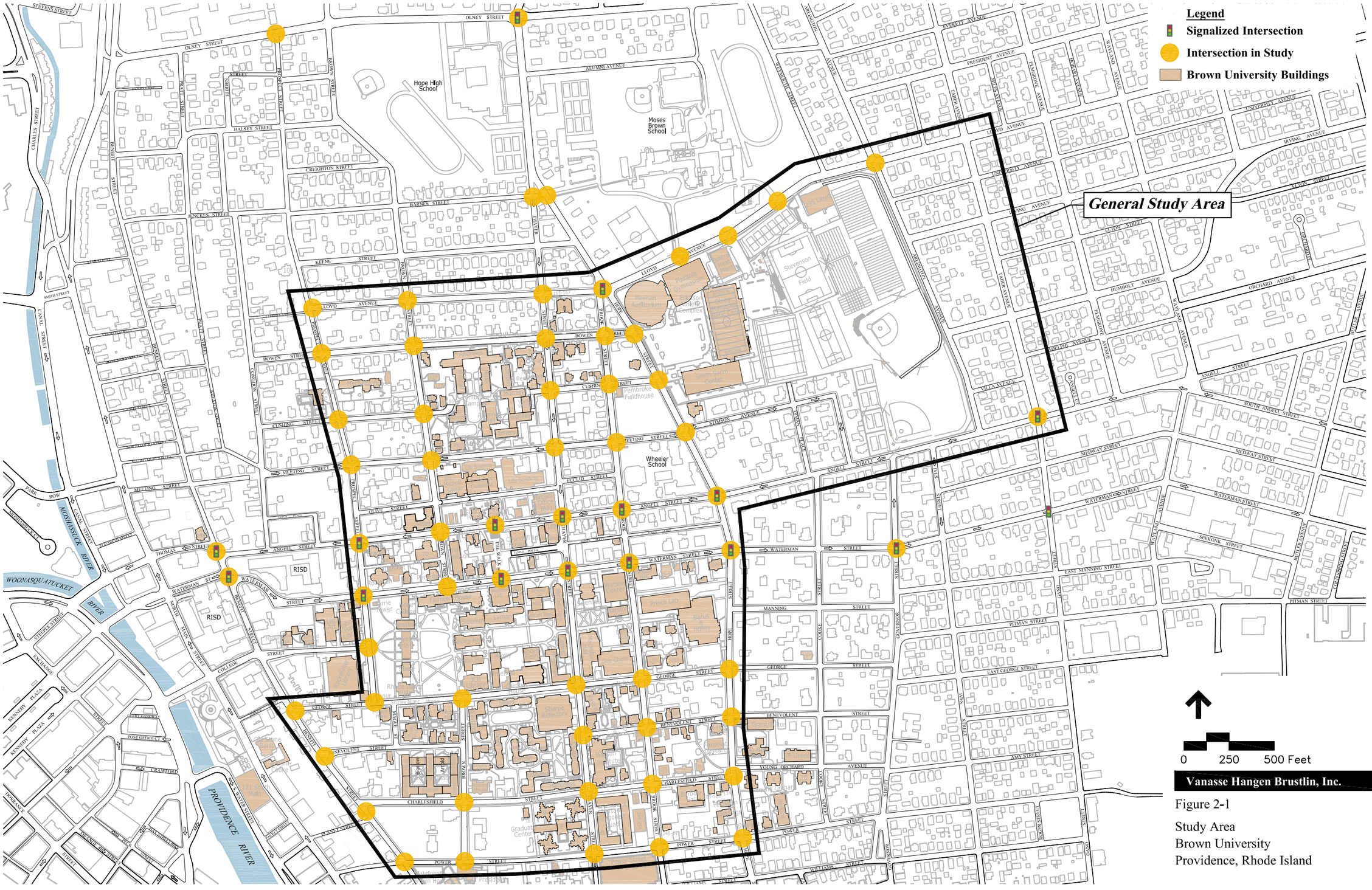

Vanasse Hangen Brustlin, Inc.

Figure 2-1

Study Area
Brown University
Providence, Rhode Island

on the campus, additional intersections outside of the general study area were also included for the purpose of identifying existing traffic patterns to/from the University campus area and to help establish a baseline for traffic operations around the campus that will be used to assess the impacts of future university projects. In total, this study includes the following intersections:

1. Angell Street/Gano Street (signalized)
2. Angell Street/Hope Street (signalized)
3. Angell Street/Brook Street (signalized)
4. Angell Street/Thayer Street (signalized)
5. Angell Street/The Walk (signalized)
6. Angell Street/Brown Street
7. Angell Street/Prospect Street (signalized)
8. Angell Street/Thomas Street/Benefit Street (signalized)
9. Waterman Street/Benefit Street (signalized)
10. Waterman Street/Prospect Street (signalized)
11. Waterman Street/Brown Street
12. Waterman Street/The Walk (signalized)
13. Waterman Street/Thayer Street (signalized)
14. Waterman Street/Brook Street (signalized)
15. Waterman Street/Hope Street (signalized)
16. Waterman Street/Governor Street (signalized)
17. Lloyd Avenue/Arlington Avenue
18. Lloyd Avenue/Moses Brown East Drive
19. Lloyd Avenue/Brown University Parking Areas Nos. 89 & 90
20. Lloyd Avenue/Moses Brown West Drive
21. Hope Street/Olney Street (signalized)
22. Hope Street/Barnes Street/Moses Brown Drive
23. Hope Street/Lloyd Avenue/Brook Street (signalized)
24. Hope Street/Bowen Street
25. Hope Street/Cushing Street
26. Hope Street/Meeting Street
27. Hope Street/George Street
28. Hope Street/Benevolent Street
29. Hope Street/Charlesfield Street
30. Hope Street/Power Street
31. Brook Street/Bowen Street
32. Brook Street/Cushing Street
33. Brook Street/Meeting Street
34. Brook Street/George Street
35. Brook Street/Benevolent Street
36. Brook Street/Charlesfield Street
37. Brook Street/Power Street
38. Thayer Street/Barnes Street
39. Thayer Street/Lloyd Avenue
40. Thayer Street/Bowen Street

41. Thayer Street/Cushing Street
42. Thayer Street/Meeting Street
43. Thayer Street/George Street
44. Thayer Street/Benevolent Street
45. Thayer Street/Charlesfield Street
46. Thayer Street/Power Street
47. Brown Street/Lloyd Avenue
48. Brown Street/Bowen Street
49. Brown Street/Cushing Street
50. Brown Street/Meeting Street
51. Brown Street/George Street
52. Brown Street/Charlesfield Street
53. Brown Street/Power Street
54. Prospect Street/Olney Street
55. Prospect Street/Lloyd Avenue
56. Prospect Street/Bowen Street
57. Prospect Street/Cushing Street
58. Prospect Street/Meeting Street
59. Prospect Street/College Street
60. Prospect Street/George Street
61. Benefit Street/George Street
62. Benefit Street/Benevolent Street
63. Benefit Street/Charlesfield Street/Planet Street
64. Benefit Street/Power Street

These study area intersections were evaluated in detail using standard traffic engineering analysis techniques to establish the baseline that will be used to identify incremental impacts of future traffic growth and site-generated traffic.

In addition to understanding traffic and pedestrian flow through various locations spread throughout the campus, the effect of specific large generators of transportation demand within the campus was also factored into the analysis. Notably, several neighboring institutions around the campus have a direct impact on transportation operations. Along with the University, these neighboring institutions rely on an efficiently functioning transportation system that is comprised of several different modes including automobiles, public transportation, bicycles, and walking. The following institutions are near the campus within the College Hill neighborhood:

- The Wheeler School, a private institution with total enrollment of approximately 800 students from nursery school through high school, is located within the Brown University campus area. The Wheeler School campus is bounded by Angell Street to the south, Brook Street to the west, Meeting Street to the north, and Hope Street to the east.
- Moses Brown School, a private institution with total enrollment of approximately 775 students from nursery school through high school, is located to the north of

the Brown University campus. The Moses Brown School campus is generally bounded by Lloyd Avenue to the south, Hope Street to the west, Alumni Avenue to the north, and Weymouth Street to the east.

- Hope High School, a public high school with enrollment of approximately 1,500 students is located to the north of the Brown University campus. The Hope High School campus is generally bounded by Barnes Street to the south, Brown Street to the west, Olney Street to the north, and Hope Street to the east.
- Rhode Island School of Design (RISD), a private institution of higher learning with total enrollment of approximately 2,200 students, is located to the west of the Brown University campus primarily in the area north of College Street and south of Meeting Street.

Vehicular Access and Roadway Conditions

The following section describes the University campus vehicular access, roadway circulation, observed conditions, traffic volumes and traffic operations.

Vehicular Access

The University is bisected by two one-way principal arterial roadways: Angell Street, which is one-way westbound, and Waterman Street, which is one-way eastbound. The campus is also bisected by two urban collector roadways: Brook Street, which is a two-way north-south roadway, and Thayer Street, which is a one-way southbound from Hope Street to Waterman Street. In addition, Hope Street, which is classified as a minor urban arterial, runs north-south through the eastern portion of the campus. These roadways plus several city streets such as Prospect Street, Brown Street, Lloyd Avenue, Gano Street, and College Street, provide primary vehicular access to the campus.

Roadways

The primary roadways providing access to the University campus, including academic and administrative buildings, residential halls, athletic facilities, and both on-street and off-street parking areas, are described below.

Angell Street

Angell Street is a one-way westbound principal arterial roadway from South Angell Street to Benefit Street. The Angell Street corridor, which includes South Angell Street to the east and Thomas Street/Steeple Street to the west, provides a direct connection westbound from East Providence to Downtown Providence beginning at

the Henderson Bridge over the Seekonk River. This connection also functions as a diversionary route into Providence when incidents or backups occur on Route I-195. In the vicinity of the University, Angell Street is approximately 25' wide with parking prohibited along the south side and time restricted parking generally allowed along the north side. Due to the on-street parking and limited pavement width, Angell Street operates as one westbound travel lane between Hope Street and Prospect Street during most times of the day. On the westbound approach to Hope Street, Angell Street operates as two travel lanes (a shared left-turn/through lane and a right-turn only lane) during the peak hour periods, as parking along the north side of Angell Street is prohibited between 6:00 AM and 9:30 AM and between 3:30 PM and 6:00 PM from Diman Place to Hope Street. The Wheeler School is located on the north side of Angell Street between Hope Street and Brook Street.

Traffic signals exist at the Angell Street intersections with Gano Street, Hope Street, Brook Street, Thayer Street, The Walk, Prospect Street, and Benefit Street. The unsignalized intersections along Angell Street are controlled by stop-signs on the north-south "minor street" approaches.

Waterman Street

Waterman Street is a one-way eastbound principal arterial roadway from Benefit Street to the Henderson Bridge over the Seekonk River. Waterman Street, which runs parallel to Angell Street, provides a direct connection from Washington Street in Downtown Providence to East Providence. In the vicinity of the University, Waterman Street is approximately 26' wide with parking prohibited along the north side and two-hour parking allowed on the south side. Due to the on-street parking and limited pavement width, Waterman Street operates as one eastbound travel lane through the study area during most times of the day. On the eastbound approach to Hope Street, Waterman Street frequently operates as two travel lanes (a left-turn only lane and a shared through/right-turn lane) during the peak hour periods

Traffic signals exist at the Waterman Street intersections with Benefit Street, Prospect Street, The Walk, Thayer Street, Brook Street, Hope Street, Governor Street and Gano Street. The unsignalized intersections along Waterman Street are controlled by stop-signs on the north-south "minor street" approaches.

Hope Street

Hope Street is a north-south minor urban arterial, which runs from East Avenue in Pawtucket to George M. Cohan Boulevard south of Wickenden Street in Providence. Within the study area, Hope Street is approximately 34' wide south of Barnes Street and approximately 40' wide north of Barnes Street with various levels of parking restrictions on both sides of the road. Hope High School is located on the west side of Hope Street between Barnes Street and Olney Street, Moses Brown School is located on the east side of Hope Street north of Lloyd Avenue, and Wheeler School is located on the west side of Hope Street between Angell Street and Meeting Street. The Brown

University Athletic Complex is located on the east side of Hope Street between Meeting Street/Stimson Avenue and Lloyd Avenue.

Traffic signals exist at the Hope Street intersections with Olney Street, Lloyd Avenue/Brook Street, Angell Street, and Waterman Street. The intersection with George Street is controlled by four-way stop signs, and the remaining unsignalized intersections along Hope Street within the study focus area are controlled with stop-signs on the east-west "minor street" approaches.

Brook Street

Brook Street is a north-south urban collector roadway which runs from Hope Street to George M. Cohan Boulevard south of Wickenden Street. Within the study area, Brook Street is between 30' and 32' wide with various levels of parking restrictions on both sides of the road. The Wheeler School is located on the east side of Brook Street between Angell Street and Meeting Street.

Traffic signals exist at the Brook Street intersections with Hope Street/Lloyd Avenue, Angell Street, and Waterman Street. The intersections with Bowen Street and George Street are controlled by four-way stop signs. The remaining unsignalized intersections along Brook Street within the study focus area are controlled with stop-signs on the east-west "minor street" approaches.

Thayer Street

Thayer Street is a north-south urban collector roadway which runs from Hope Street to Transit Street north of Wickenden Street. Thayer Street is one-way southbound between Hope Street and Waterman Street, two-way between Waterman Street and Power Street, and one-way northbound between Transit Street and Power Street. Within the study area, Thayer Street is approximately 30' wide, with the exception of between Angell Street and Waterman Street, where it is approximately 40' wide. The entrance to a bus tunnel that runs from Thayer Street to South Main Street is located on the west side of Thayer Street between Angell Street and Waterman Street. Land use along Thayer Street is mostly commercial between Cushing Street and Waterman Street and academic/residential to the north and south.

Traffic signals exist at the Thayer Street intersections with Angell Street and Waterman Street. The intersections with Bowen Street and George Street are controlled by all-way stop signs. The remaining unsignalized intersections along Thayer Street within the study focus area are controlled with stop-signs on the east-west "minor street" approaches.

Prospect Street

Prospect Street is a north-south local roadway that runs from Olney Street to George Street. Prospect Street is approximately 30' wide south of Meeting Street and

approximately 24' wide north of Meeting Street. Various levels of parking restrictions exist along both sides of Prospect Street through the study area. Prospect Street is the signed route to Brown University for vehicles traveling eastbound on Olney Street.

Traffic signals exist at the Prospect Street intersections with Angell Street and Waterman Street. The intersections with Lloyd Avenue, Bowen Street, Cushing Street, and Meeting Street are controlled by four-way stop signs. The remaining unsignalized four-way intersections along Prospect Street within the study focus area are controlled with stop-signs on the east-west "minor street" approaches.

Lloyd Avenue

Lloyd Avenue is an east-west roadway, which is classified as an urban collector between Hope Street and Blackstone Boulevard and a local roadway between Prospect Street and Hope Street. Lloyd Avenue is approximately 30' wide west of Hope Street and approximately 40' wide east of Hope Street. Parking is allowed, with various restrictions, in areas along both sides of Lloyd Avenue. East of Hope Street, Moses Brown School is located on the north side of Lloyd Avenue, and the Brown University Facilities Management Building and Athletic Complex is located on the south side of Lloyd Avenue.

A traffic signal exists at the intersection of Lloyd Avenue with Hope Street/Brook Street. The Lloyd Avenue intersections with Prospect Street, Brown Street, Thayer Street and Arlington Avenue are controlled by all-way stop signs.

George Street

George Street is an east-west local roadway that runs from Benefit Street to Governor Street. It is approximately 28 feet wide within the study area. Parking is generally restricted along the north side of George Street, while parking is allowed for segments along the south side.

There are no signalized intersections along George Street. At the intersections of George Street with Thayer Street, Brook Street, and Hope Street, traffic is controlled by all-way stop signs. At the intersections of George Street with Brown Street and Prospect Street, the cross streets have stop signs, while at its intersection with Benefit Street, George Street traffic is under stop sign control.

Benefit Street

Benefit Street is a north-south urban collector roadway that runs from North Main Street to Wickenden Street. It is approximately 32 feet wide. There are various parking restrictions along Benefit Street through the study area, including no parking on the west side of the roadway.

Benefit Street has two signalized intersections in close proximity to one another at the intersections with Angell Street and Waterman Street. The unsignalized intersection of Benefit Street and Power Street is controlled by four-way stop signs. The remaining unsignalized intersections on Benefit Street within the study area consist of stop-signs on the east-west "minor street" approaches.

Benevolent Street

Benevolent Street is an east-west local roadway that runs from Benefit Street to Brown Street and from Thayer Street to Governor Street. It is approximately 30 feet wide, except at the intersection with Benefit Street, where it is 70 feet wide. Parking is restricted on the south side of Benevolent Street, while parking is allowed on the north side of the roadway within the study area.

There are no signalized intersections along Benevolent Street. The intersections along the street are controlled by stop-signs, with Benevolent Street approaches operating as the stop controlled approaches.

Charlesfield Street

Charlesfield Street is an east-west local roadway that runs from Benefit Street to Hope Street. It is approximately 30 feet wide. Parking is restricted on the south side of Charlesfield Street, while parking is allowed on the right hand side of the roadway.

There are no signalized intersections along Charlesfield Street. All-way stop-signs are in place at Thayer Street and Brown Street, and two-way stop control for Charlesfield Street is at the intersections with Benefit Street, Brook Street, and Hope Street.

Power Street

Power Street is an east-west local roadway that runs from South Water Street to Gano Street. It is approximately 26 feet wide. Various levels of parking restrictions exist along both sides of Power Street through the study area.

There are no signalized intersections along Power Street. The intersections of Power Street with Benefit Street, Hope Street, and Brook Street are controlled by all-way stop signs. At the intersection with Brown Street, traffic is controlled by a stop sign on Brown Street. Additionally, at Thayer Street, traffic is controlled by stop signs on Power Street.

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Observed Conditions

VHB observed traffic conditions along the various roadways and intersections and adjacent to large generators of transportation demand within the study area. The

following observations are relevant for consideration in the traffic analysis and interpretation of the results.

Moses Brown School Operations

The Moses Brown School has three driveways within the study area. The west drive is located on Lloyd Avenue approximately 450 feet east of Hope Street. A second drive is located on Lloyd Avenue approximately 600 feet east of the west driveway, and a third drive is located on Hope Street across from Barnes Street.

The majority of the parent drop-off/pick-up activity was observed to occur on campus, with parents/guardians entering at the east Lloyd Avenue driveway and exiting at the Hope Street driveway. At times during the morning arrival period, the queue of vehicles entering the east Lloyd Avenue driveway backed up onto Lloyd Avenue impacting the flow of traffic along Lloyd Avenue for brief periods.

The majority of the school bus drop-off and pick-up activity occurs on Lloyd Avenue at the west driveway, as most school buses do not enter the Moses Brown property. The number of students entering/existing the school buses range from a few to approximately 15-20 students. Buses picking up/dropping off student athletes for home and/or away games were observed at the Hope Street entrance to Moses Brown School. The majority of the school bus students were observed to be dropped off on Lloyd Avenue heading westbound. Some students were dropped off by buses on Lloyd Avenue eastbound and crossed Lloyd Avenue to the west driveway with the help of a crossing guard. During this time period, the queue of buses extended to Hope Street, but cleared very quickly. By 8:15 AM, most school related activity had stopped along Lloyd Avenue. The crossing guard was observed to leave around this time as well.

Most student pedestrian traffic was observed entering the west drive. Some students walked from Hope Street while some older students parked their vehicles along the north side of Lloyd Avenue. Students walking along the south side of Lloyd Avenue used the designated crosswalk with the help from a crossing guard. Approximately half of the pedestrian traffic along Lloyd Avenue was observed to be Moses Brown School related.

Before the afternoon dismissal (3:00 PM), school buses started to line up along the south side of Lloyd Avenue, within the designated bus parking area. Three buses were observed to be waiting before the afternoon dismissal. During the dismissal, two additional school buses were observed to pick-up students on the north side of Lloyd Avenue, heading westbound. By 3:15 PM, most school related activity had stopped along Lloyd Avenue, and the crossing guard was observed to leave around that time.

Wheeler School Operations

Student drop-off and pick-up activities at the Wheeler School were observed to cause congestion on the adjacent roadway network during school arrival and departure periods. The school buses drop off and pick up students along Hope Street in the morning and Angell Street in the afternoon. Parent drop-off/pick-up for the younger children is designated along Meeting Street, and parent drop-off/pick-up of older students was observed to occur along Angell Street, Hope Street, and to a lesser extent, Brook Street. A large number of students gather at the intersection of Hope Street and Meeting Street, where a crossing guard is positioned during the school arrival and departure periods. Students being dropped off and faculty/staff parking in the Wheeler School parking lot on the east side of Hope Street often cross Hope Street at a midblock crossing between Meeting Street and Angell Street. Delays from traffic yielding to pedestrians at this crossing result in a vehicle queue that extends to Angell Street during the school peak periods.

Parents dropping off students in the morning sometimes double-park on Angell Street, which restricts the flow of through traffic along Angell Street. This was also observed along Meeting Street. The disruptions in traffic flow during the morning peak period caused by Wheeler School activities were observed to last approximately 20 minutes, and they generally subsided by 8:05 AM.

For afternoon student pick-ups, Wheeler School closes Meeting Street to through traffic between approximately 2:30 PM and 3:30 PM, and the roadway is designated for student pick-ups only. Parents in cars were observed to begin lining up at approximately 2:30 PM, while students began to get out of school at approximately 2:50 PM. Younger students, which are only allowed to be picked up along Meeting Street, are not allowed to leave the school grounds until the parent/guardian vehicle arrives in front of the pick-up area and the student's name is called. This activity along Meeting Street caused vehicle queues that extended back to Brook Street and along Brook Street to Angell Street. During the height of afternoon student pick-up activity, the vehicle queue impacted the flow of traffic along Angell Street. School buses picking up students on Angell Street in the afternoon caused traffic congestion, as they would stop all traffic on Angell Street to pick students up, rather than pulling into the parking lane. The congestion in the area at the end of the school day is made worse by the vehicle queues from the nearby traffic signals, on-street parking maneuvers, and pedestrian activity. The disruptions in traffic flow during the afternoon peak period caused by Wheeler School activities were observed to last approximately 30 minutes, and they generally subsided by 3:15 PM.

Brown/Fox Point Early Childhood Education Center Operations

Student drop-off and pick-up activities at the Brown/Fox Point Early Childhood Education Center, which is located on the west side of Hope Street between Benevolent Street and Charlesfield Street, causes minor congestion on Hope Street

adjacent to the facility during school arrival and departure periods. This is primarily because parents are required to walk the children into/out of the building, and most parents were observed to park along the curb rather than use the parking lot behind the building (Brown Lot 57) which can be accessed via Benevolent Street and Charlesfield Street.

Specifically, parents dropping off students in the morning between 7:30 AM and 9:30 AM and picking them up between 3:30 PM and 5:30 PM frequently parked on Hope Street, which sometime restricted the flow of through traffic along Hope Street. While the disruption to traffic flow seems to be minimal due to the low traffic volumes on Hope Street adjacent to the facility, the queue of vehicles staked along the west side of Hope Street often extended to Benevolent Street during the morning drop-off.

Additional Observations

Additional observations made by VHB traffic engineers during the data collection efforts include:

- The vehicle detection at the intersection of Hope Street at Lloyd Avenue/Brook Street was not working properly, resulting in unnecessary delays for vehicles at the intersection.
- At signalized intersections within the study area, pedestrians generally waited for the "walk" signal indications during periods of heavy traffic. During off-peak periods, pedestrians were observed to cross at various times in the traffic signal cycles.
- At the unsignalized intersections of Brown Street with Angell Street and with Waterman Street, pedestrians crossing the roadways disrupted traffic flow, which resulted in areas of congestion during peak periods.
- Several vehicles on the roadway network were observed to be circulating around the blocks looking for on-street parking.
- The large number of pedestrians, parking maneuvers, and buses related to the Hope High School restrict the flow of traffic along Hope Street during the afternoon school dismissal peak period.
- Several factors caused restrictions to traffic flow throughout the day along Thayer Street between Cushing Street and Waterman Street. These factors included truck loading/deliveries, pedestrians crossing against the traffic signals and at mid-block locations, bus maneuvers, parking maneuvers, and double-parked vehicles.
- Congestion within Downtown Providence often spills back to South Main Street at Steeple Street/Thomas Street during the peak hour periods. This congestion

further restricts the flow of traffic along Angell Street at the intersection with Benefit Street.

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Traffic Volumes

An extensive transportation data collection program was conducted in March-April 2011 to establish base traffic conditions within the study area. This effort included conducting morning and evening peak hour manual turning movement counts (TMCs) and observations at various times between 7:00 AM and 9:00 AM and between 4:00 PM and 6:00 PM throughout the study area. Traffic counts and observations were also conducted between 2:00 PM and 4:00 PM in the areas adjacent to Moses Brown School and the Wheeler School.

Daily automatic traffic recorder (ATR) data were collected along several roadways throughout the study area. Table 2-1 presents a summary of the observed daily and peak hour traffic from the ATR data.

In addition, traffic data collected and analyses performed on the campus by VHB for other projects in recent years were reviewed, including the following:

- 2006 Transportation Component of the IMP
- 2008 Design Study Report for the Angell Street/Waterman Street Traffic Signal Coordination project
- 2010 Traffic Impact Analysis for the Fitness Center Project
- 2010 Angell Street/Waterman Street Pedestrian Crossing Review and Campus-Wide Pedestrian Crossing Inventory

Based on a review of the new traffic count data, the study area's overall morning peak hour was determined to occur between 7:45 AM and 8:45 AM, and the overall evening peak hour was determined to occur between 5:00 PM and 6:00 PM. The peak hours along Lloyd Avenue east of Hope Street occurred between 7:30 AM and 8:30 AM and between 2:30 PM and 3:30 PM due to the activity related to the Moses Brown School.

The new traffic count data was compared to the data collected in 2005 at various locations within the study area. Since the 2005 counts, traffic volumes in the study area have generally reduced throughout the campus, some locations more than others. The reduction in traffic volumes could be attributable to various reasons, including the differences caused by counting during different times of the year (September 2005 vs. March 2011), effect of the aggressive TDM measures implemented on the campus in conjunction with stringent parking management policies, construction related activity on the campus at any given time of the year which could divert traffic to alternate routes, the general state of the economy/

employment levels in the region that could influence traffic flow through the campus to/from downtown Providence, and finally, the effect of major infrastructure enhancements to the I-95/I-195 interchange that could have resulted in downtown traffic choosing to stay on the freeway until it gets to the downtown area rather than exit onto local streets before reaching congested sections of the freeway. Notwithstanding the differences, since one of the goals of this updated study is to reestablish a baseline for understanding campus traffic operations, the latest 2011 count data was used in the analysis.

In addition to a comparison of old and new peak hour traffic volumes, an equally important exercise is the comparison of the corresponding overall distribution of campus traffic via the various roadways serving the campus. This comparison would help understand if any of the campus projects, policies and initiatives since the 2006 Plan have resulted in a notable change in the usage of certain streets by vehicular traffic than others. It should be noted that this comparison is not intended to understand micro-level traffic redistributions, for example, the effect of the Walk crossing improvements on Angell and Waterman streets on Brown and Thayer streets' intersections on either side of the Walk, but rather the campus-wide arrival/departure patterns in the cardinal directions. The distribution of traffic entering/exiting the study area based on the 2011 data is shown in Figure 2-2. As shown, approximately 72% of the traffic accesses the study area along the arterial roadways of Angell Street, Waterman Street, and Hope Street, which is consistent with the finding presented in the 2006 Plan.

Seasonal Traffic Variation

To evaluate the potential for seasonal fluctuation of traffic volumes on roadways within the study area, monthly RIDOT seasonal adjustment factors were reviewed. According to the RIDOT statistics, traffic on urban facilities such as the roadways within the study area, in the month of March is higher than the average month. To present a conservative analysis, RIDOT seasonal adjustment factors were not applied to the higher than average traffic counts collected in March 2011. The existing weekday morning peak hour traffic volumes are presented in Figures 2-3 and 2-4, and the existing weekday evening peak hour traffic volumes are presented in Figures 2-5, and 2-6.

Table 2-1
Existing Traffic Volume Summary

Location	Daily	Weekday Morning Peak Hour			Weekday Evening Peak Hour		
	Weekday (vpd)[1]	Volume (vph)[2]	"K" Factor[3]	Directional Distribution	Volume (vph)	"K" Factor	Directional Distribution
Angell Street (east of Hope Street)	8,030	710	8.8	100% WB	505	6.3	100% WB
Waterman Street (west of Prospect Street)	5,410	295	5.5	100% EB	380	7.0	100% EB
Waterman Street[4] (east of Governor Street)	8,860	315	3.6	100% EB	620	7.0	100% EB
Hope Street (north of Angell Street)	10,290	525	5.1	53% NB	560	5.4	60% NB
Hope Street[4] (south of Angell Street)	8,520	515	6.0	70% SB	460	5.4	60% SB
Brook Street (north of Angell Street)	4,930	305	6.2	64% NB	405	8.2	63% NB
Thayer Street (south of Meeting Street)	4,530	250	5.5	100% SB	215	4.8	100% SB
Brown Street (south of Meeting Street)	3,510	85	2.4	59% SB	110	3.1	50% NB
Prospect Street (south of Meeting Street)	2,600	240	9.2	69% SB	235	9.0	57% SB
Olney Street[4] (west of Hope Street)	7,230	730	10.1	53% EB	600	8.3	58% EB
Lloyd Avenue (east of Hope Street)	4,620	435	9.4	52% WB	385	8.3	61% EB
Lloyd Avenue[4] (west of Thayer Street)	1,080	120	11.1	75% WB	90	8.3	55% WB
Bowen Street[4] (west of Brook Street)	1,270	65	5.1	69% WB	105	8.3	62% WB
Cushing Street[4] (west of Brook Street)	840	15	1.8	66% WB	70	8.3	71% WB
Meeting Street[4] (west of Brook Street)	780	25	3.2	60% WB	65	8.3	69% WB
George Street[4] (west of Brook Street)	2,050	70	3.4	57% WB	170	8.3	62% EB
Thayer Street (north of Power Street)	2,510	30	1.2	67%SB	85	3.4	65%SB
Brook Street (north of Power Street)	3,680	310	8.4	50%NB	310	8.4	56%NB

Source: Compiled by VHB from traffic data collected in 2011
1 Daily traffic expressed in vehicles per day (vpd)
2 Peak hour volumes expressed in vehicles per hour (vph).
3 "K" factor = percent of daily traffic that occurs during the peak hour
4 Estimated based on peak hour volumes

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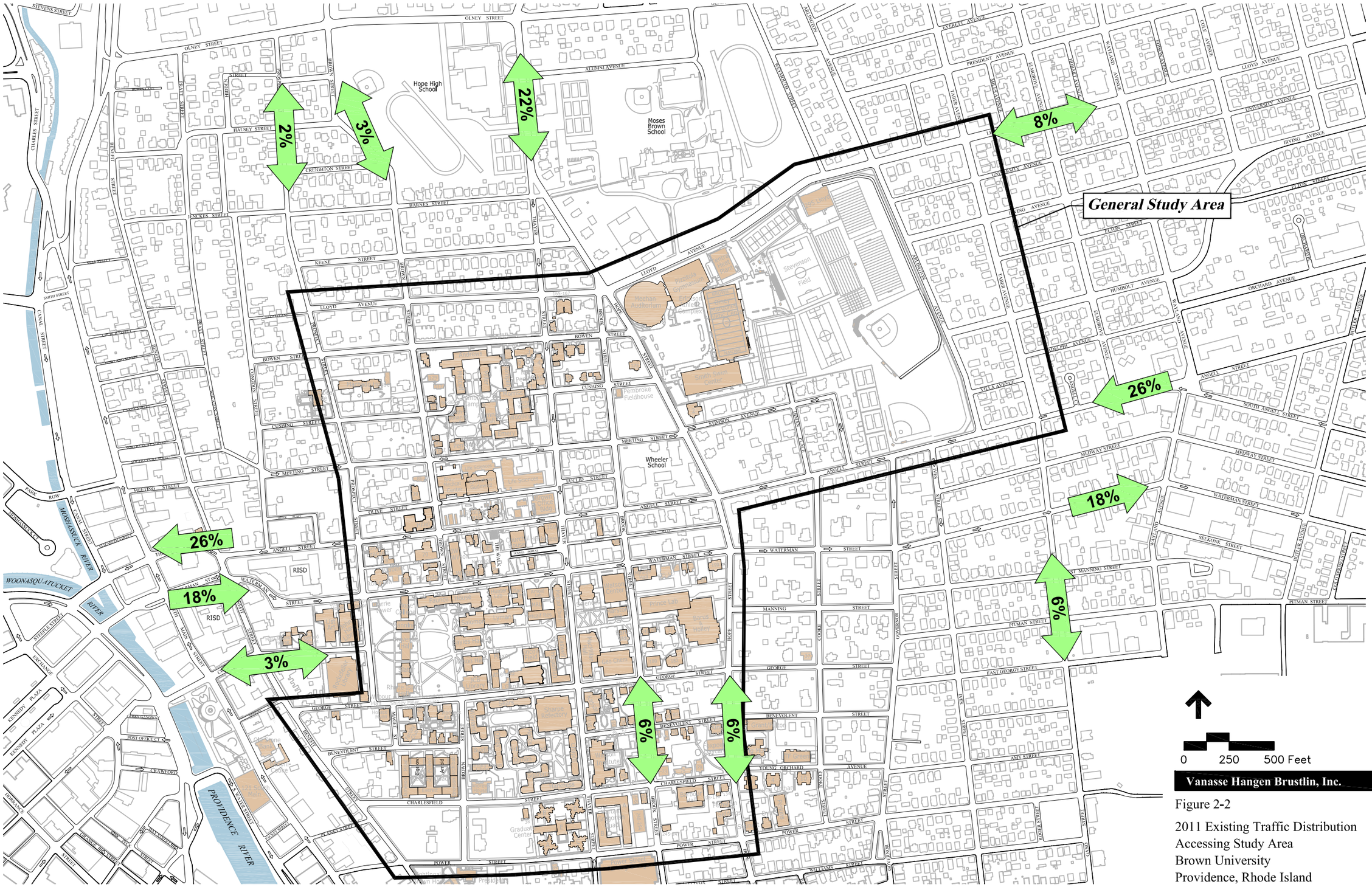
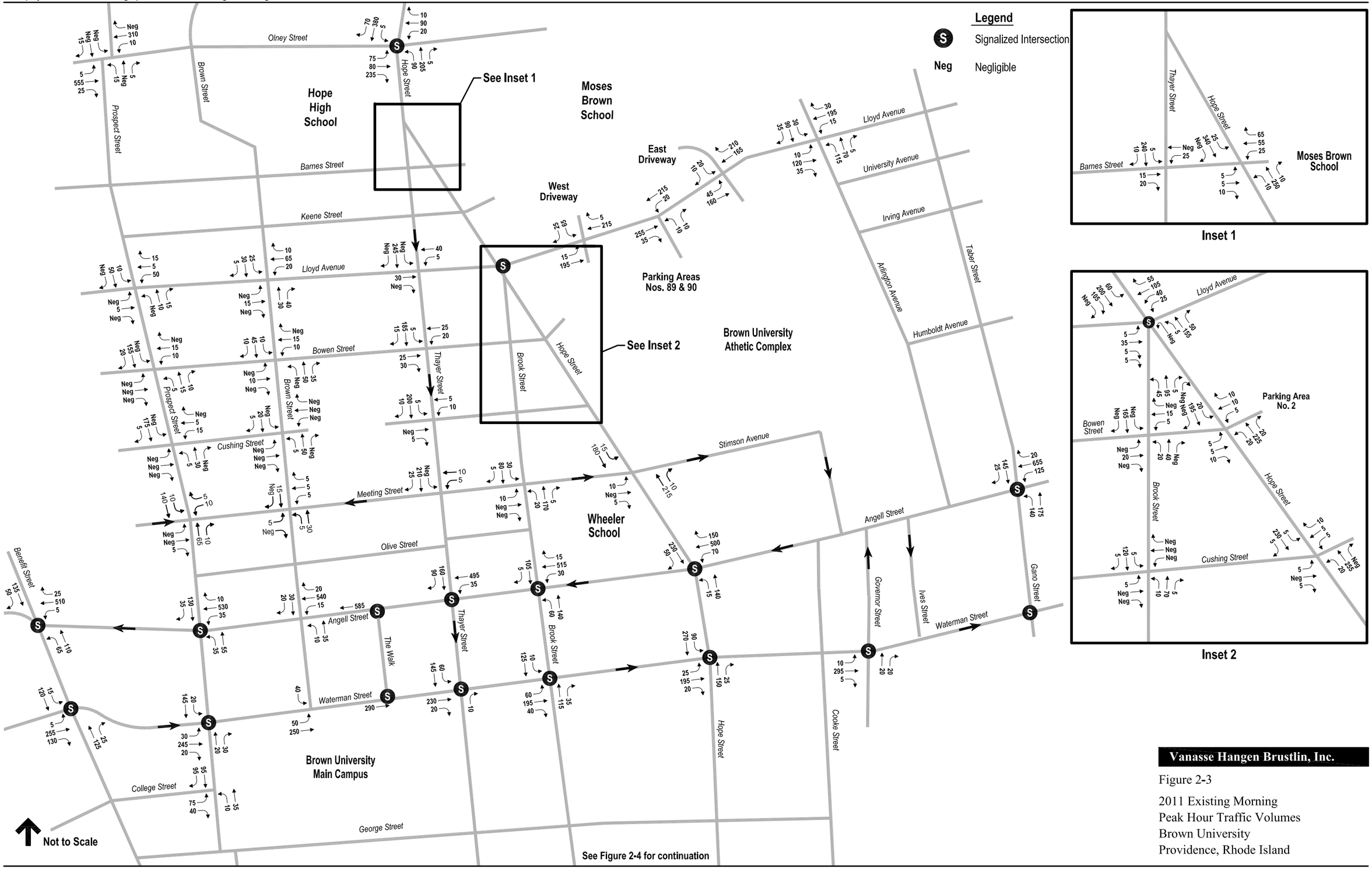


Figure 2-2

2011 Existing Traffic Distribution
Accessing Study Area
Brown University
Providence, Rhode Island



Inset 1

Inset 2

Vanasse Hangen Brustlin, Inc.

Figure 2-3

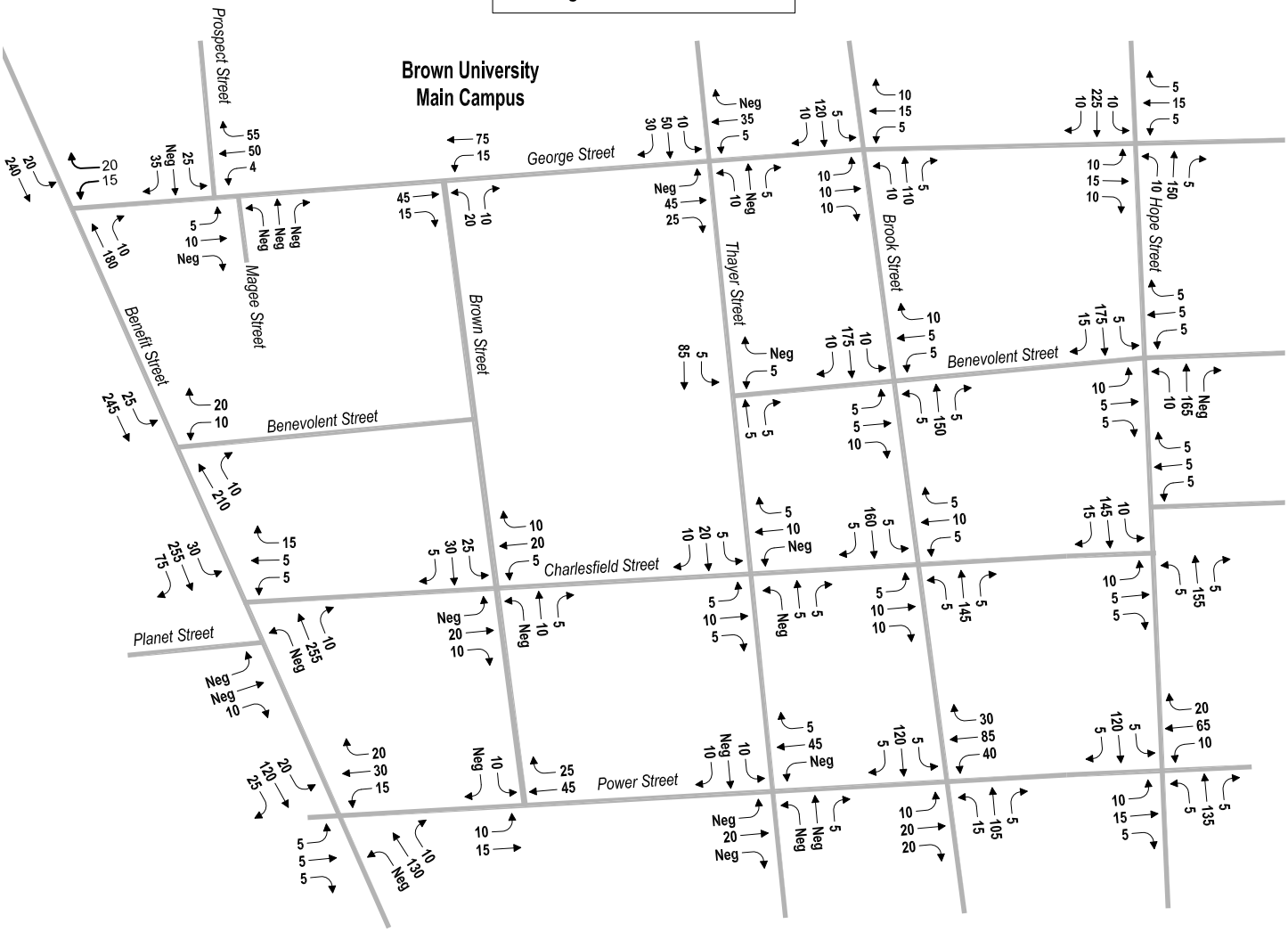
2011 Existing Morning
Peak Hour Traffic Volumes
Brown University
Providence, Rhode Island

Legend

S — Signalized Intersection

Neg — Negligible

See FIgure 2-3 for contInuatIon

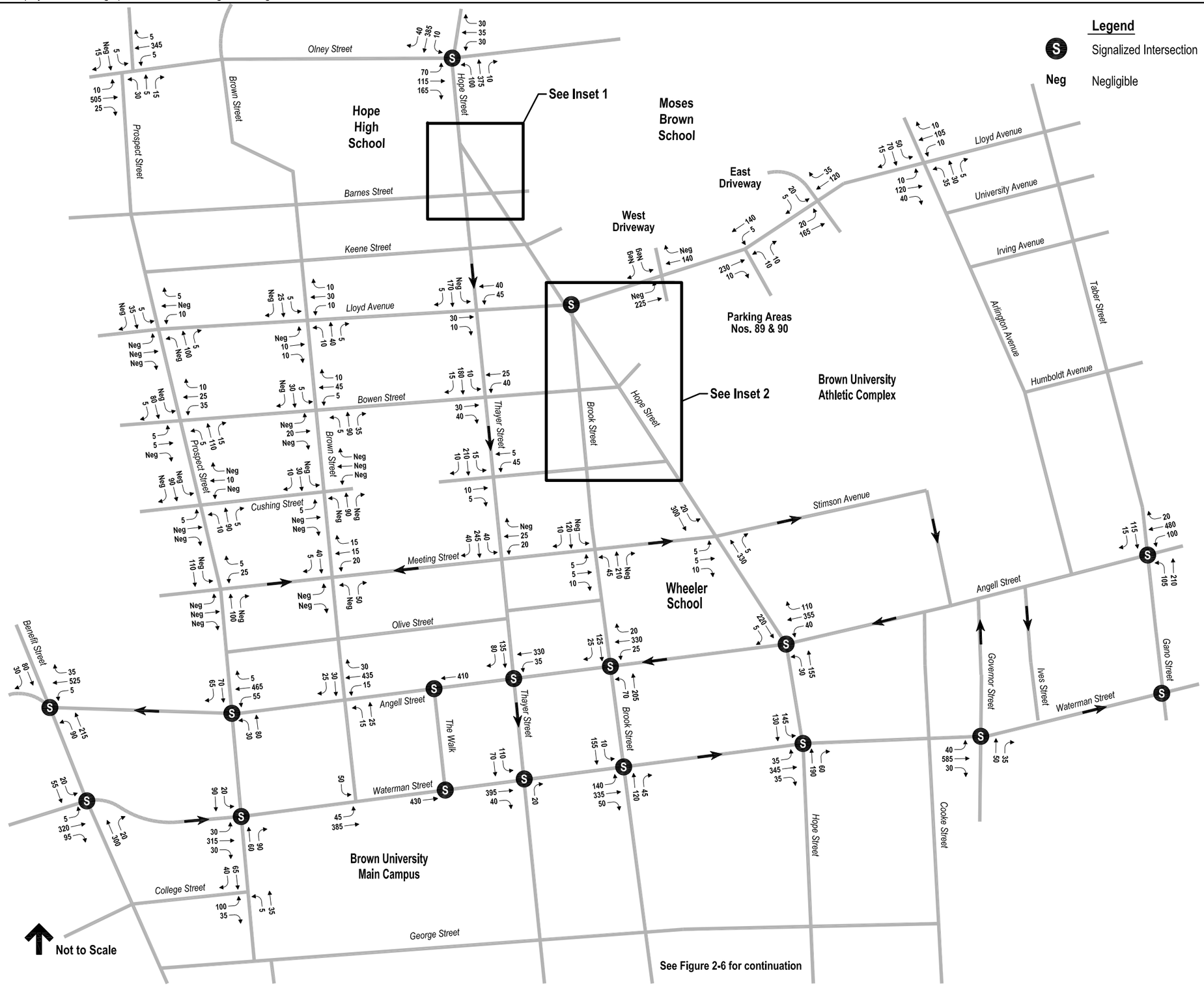


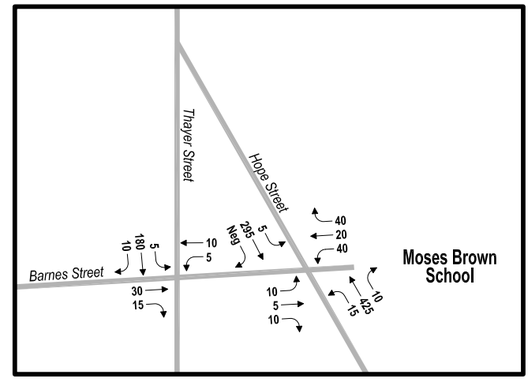
Not to Scale

Vanasse Hangen Brustlin, Inc.

2011 Existing Morning
Peak Hour Traffic Volumes
Brown University
Providence, Rhode Island

Figure 2-4





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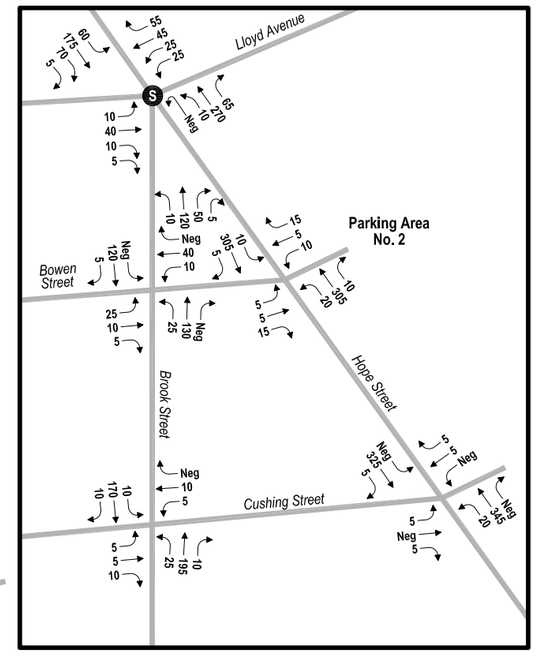


Inset 2

Vanasse Hangen Brustlin, Inc.

Figure 2-5

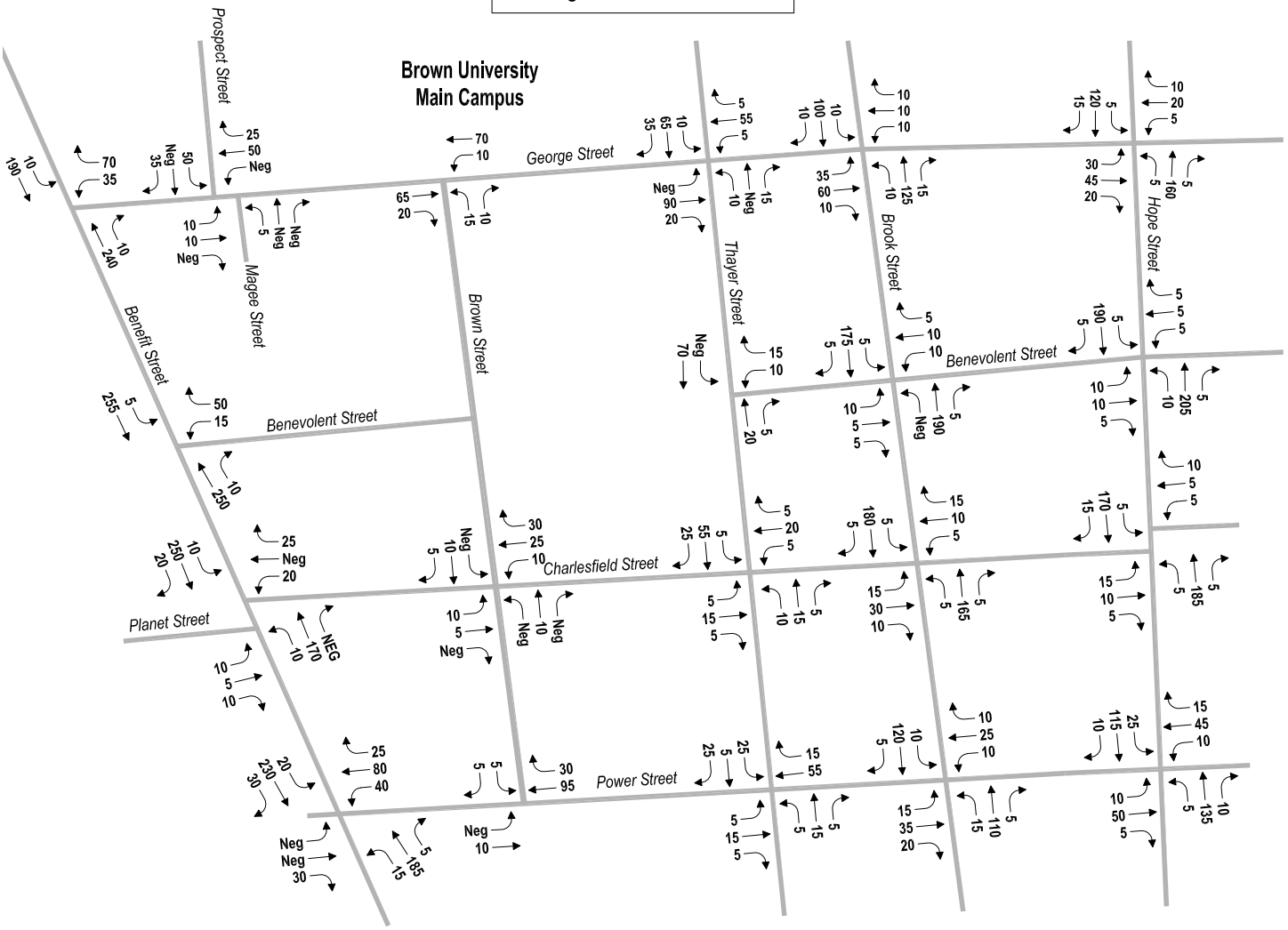
2011 Existing Evening
Peak Hour Traffic Volumes
Brown University
Providence, Rhode Island

Legend

S — Signalized Intersection

Neg — Negligible

See FIgure 2-5 for contInuatIon



Not to Scale

Vanasse Hangen Brustlin, Inc.

2011 Existing Evening
Peak Hour Traffic Volumes
Brown University
Providence, Rhode Island

Figure 2-6

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Traffic Operations Analysis

Measuring existing traffic volumes quantifies traffic flow within the study area. To assess quality of flow, intersection capacity analyses were conducted using existing traffic volumes, intersection geometry, and traffic control. Capacity analyses provide an indication of how well the roadway facilities serve the traffic demands placed upon them. Roadway operating conditions are classified by calculated levels of service as described below

Level-Of-Service Criteria

Level-of-service (LOS) is the term used to denote the different operating conditions which occur on a given roadway segment under various traffic volume loads. It is a qualitative measure of the effect of a number of factors including roadway geometrics, speed, travel delay and freedom to maneuver. Level-of-service provides an index to the operational qualities of a roadway segment or an intersection. Level-of-service designations range from A to F, with LOS A representing the best operating conditions with little or no delay and LOS F representing the worst operating conditions with highly congested operations and long delays. In an urbanized area, LOS D or better is generally considered an acceptable operating condition. The evaluation criteria used to analyze area intersections are based on the 2000 Highway Capacity Manual.

Level-of service designation is reported differently for signalized and unsignalized intersections. For signalized intersections, the analysis considers the operation of each lane or lane group entering intersection and the LOS designation is for overall conditions at the intersection. For unsignalized intersections, however, the analysis assumes that traffic on the mainline is not affected by traffic on the side streets. The LOS is only determined for left turns from the main street and all movements from the minor street. The overall LOS designation is for the most critical movement, which is often the left turn out of the side street.

Signalized Intersections

Capacity analyses were conducted at the sixteen signalized intersections included in this study. Traffic signal timings for the Angell Street and Waterman Street intersections were based on the final design plans from the traffic signal coordination project, as the construction project was nearing completion at the time of the analyses. At the remaining signalized intersections, the traffic signal timings used for the analyses were based on actual field measurements or extracted traffic signal controller data obtained by VHB. A summary of the signalized intersection capacity analyses results for "2011 Existing Conditions" is presented in Table 2-2.

It is important to note that the capacity analysis software analyzes the operation at the intersections only. Interruptions to traffic flow caused by pedestrians, crossing guards, bus blockages, delivery trucks, parking maneuvers, double parked vehicles, and extended vehicle queues from adjacent traffic signals often occur between the signalized intersections. These interruptions can block traffic from getting to and/or through the signalized intersections resulting in congestion between intersections. Blockages of traffic on approaches or departures of a signalized intersection will degrade the overall operation of the intersection and can result in severe congestion if the volume of traffic at the intersection is at or near capacity.

Due to the fact that the capacity analysis does not totally take into account disruptions to traffic flow between intersections, the reported delay times and resulting levels of service can be underestimated. In this case, the capacity analysis software is a tool used to identify problem areas and to give a comparison between existing and future conditions.

As shown in Table 2-2, the results of the capacity analyses indicate that all of the signalized intersections within the study area operate at acceptable calculated level of service (LOS) D or better during both peak periods analyzed. However, based on field observations, several intersections appear to operate at poorer levels of service than the operations analysis suggests. Field observations revealed lengthy queues and long delays for some of the approaches to the intersections. This is commonly the result of queuing generated at adjacent intersections, caused in part by poor traffic signal timings, blocking the flow through these intersections and additional disruptions to traffic flow discussed previously. This traffic condition is expected to improve with the finalization of the Angell Street/Waterman Street traffic signal coordination project and subsequent fine tuning of the traffic signal timings.

A significant improvement in operations can be noted at two signalized study intersections of Benefit Street with Angell and Waterman streets when compared to the 2006 analysis. In the prior study, both locations demonstrated poor operations, which was primarily due to the condition of the existing traffic signal hardware and synchronization issues at that time. With the completion of the Angell Street/Waterman Street traffic signal coordination project, both of these intersections show significant improvement in traffic operations.

Table 2-2
Existing Conditions Signalized Intersection Capacity Analysis Summary

		2011 Existing		
Location	Peak Hour	V/C[1]	Delay[2]	LOS[3]
Angell Street/	Weekday Morning	0.73	19.6	B
Gano Street/Taber Avenue	Weekday Evening	0.51	15.2	B
Angell Street/	Weekday Morning	0.69	15.9	B
Hope Street	Weekday Evening	0.64	16.8	B
Angell Street/	Weekday Morning	0.83	17.5	B
Brook Street	Weekday Evening	0.58	16.9	B
Angell Street/	Weekday Morning	0.51	1.8	A
The Walk	Weekday Evening	0.57	10.0	A
Angell Street/	Weekday Morning	0.61	14.4	B
Thayer Street	Weekday Evening	0.53	13.4	B
Angell Street/	Weekday Morning	0.60	11.2	B
Prospect Street	Weekday Evening	0.58	12.3	B
Angell Street/	Weekday Morning	0.36	9.2	A
Benefit Street	Weekday Evening	0.44	7.7	A
Waterman Street/	Weekday Morning	0.28	11.5	B
Benefit Street	Weekday Evening	0.47	14.5	B
Waterman Street/	Weekday Morning	0.44	16.2	B
Prospect Street	Weekday Evening	0.38	16.7	B
Waterman Street/	Weekday Morning	0.39	8.0	A
The Walk	Weekday Evening	0.56	17.6	B
Waterman Street/	Weekday Morning	0.39	20.2	C
Thayer Street	Weekday Evening	0.43	20.2	C
Waterman Street/	Weekday Morning	0.37	19.9	B
Brook Street	Weekday Evening	0.65	14.4	B
Waterman Street/	Weekday Morning	0.53	12.0	B
Hope Street	Weekday Evening	0.70	15.5	B
Waterman Street/	Weekday Morning	0.27	5.2	A
Governor Street	Weekday Evening	0.54	7.3	A
Hope Street/	Weekday Morning	0.84	41.0	D
Lloyd Avenue/Brook Street	Weekday Evening	0.67	28.0	C
Hope Street/	Weekday Morning	0.74	19.8	B
Olney Street	Weekday Evening	0.78	20.9	C

Source: Synchro 7 software using the procedures in the 2000 Highway Capacity Manual.
1 V/C = volume to capacity ratio.
2 Delay = Vehicle delay expressed in seconds per vehicle. See Note below.
3 LOS = Level of service
Note: Interruptions to traffic flow caused by pedestrians, bus blockages, delivery vehicles, parking maneuvers, and double parking vehicles were observed on the study area roadways between intersections. These interruptions caused congestion along these roadways during the peak hour periods. As a result, the observed delay times at some intersections exceeded the calculated values.

Unsignalized Intersections

Capacity analyses were also conducted at the unsignalized intersections included in this study. A summary of the unsignalized intersection capacity analysis results for existing conditions is presented in Table 2-3.

As stated in the signalized intersections analysis section, the capacity analysis software analyzes the operation at the intersections only and does not totally take into account disruptions to traffic flow between intersections. As a result, the reported delay times and resulting levels of service can be underestimated. In this case, the capacity analysis software is a tool used to identify problem areas and to give a comparison between existing, no-build, and build conditions.

During the weekday morning peak hour period, the intersection of Angell Street and Brown Street operates at a lower calculated level of service (LOS E) due to traffic volumes along Angell Street.

The delays experienced at the intersection of Hope Street and Barnes Street/Moses Brown School (LOS D) are due to the traffic volumes along Hope Street and the traffic exiting Moses Brown School over a concentrated peak period. The delays experienced at many of the other intersections with deficient calculated levels of service during the weekday evening peak period are primarily due to the large number of pedestrians crossing the roadways.

Table 2-3
Existing Conditions Unsignalized Intersection Capacity Analysis Summary

		2011 Existing			
Location	Peak Hour	Critical Movement[1]	Demand[2]	Delay[3]	LOS[4]
Angell Street/	Weekday Morning	NB LT	45	46.9	E
Brown Street	Weekday Evening	NB LT	40	34.0	D
Waterman Street/	Weekday Morning	SB L	40	13.3	B
Brown Street	Weekday Evening	SB L	50	20.6	C
Lloyd Avenue/	Weekday Morning	WB LTR	240	14.0	B
Arlington Avenue	Weekday Evening	SB LTR	135	9.3	A
Lloyd Avenue/	Weekday Morning	SB LR	30	14.9	B
Moses Brown East Drive	Weekday Evening	SB LR	25	11.7	B
Lloyd Avenue/	Weekday Morning	NB LR	20	13.7	B
Parking Areas Nos. 89 & 90	Weekday Evening	NB LR	20	11.0	B
Lloyd Avenue/	Weekday Morning	SB LR	90	24.3	C
Moses Brown West Drive	Weekday Evening	Driveway closed during this peak period			
Hope Street/	Weekday Morning	WB LTR	145	33.1	D
Barnes Street/Moses Brown	Weekday Evening	WB LTR	100	34.3	D
Hope Street/	Weekday Morning	WB LTR	25	13.4	B
Bowen Street	Weekday Evening	WB LTR	30	15.1	C
Hope Street/	Weekday Morning	EB LR	10	15.8	C
Cushing Street	Weekday Evening	EB LR	10	20.4	C
Hope Street/	Weekday Morning	EB LTR	15	12.5	B
Meeting Street	Weekday Evening	EB LTR	20	14.4	B
Hope Street/	Weekday Morning	SB LTR	245	10.1	B
George Street	Weekday Evening	NB LTR	170	9.3	A
Hope Street/	Weekday Morning	EB LTR	20	12.7	B
Benevolent Street	Weekday Evening	EB LTR	25	14.5	B
Hope Street/	Weekday Morning	EB LTR	20	15.2	C
Charlesfield Street	Weekday Evening	EB LTR	30	17.6	C
Hope Street/	Weekday Morning	NB LTR	145	9.2	A
Power Street	Weekday Evening	SB LTR	150	9.0	A
Brook Street/	Weekday Morning	WB LTR	5	7.8	A
Bowen Street	Weekday Evening	NB LT	155	8.8	A
Brook Street/	Weekday Morning	EB LTR	5	12.4	B
Cushing Street	Weekday Evening	WB LTR	15	14.4	B
Brook Street/	Weekday Morning	EB LTR	10	13.8	B
Meeting Street	Weekday Evening	EB LTR	20	12.3	B
Brook Street/	Weekday Morning	NB LTR	125	8.0	A
George Street	Weekday Evening	EB LTR	105	8.5	A
Brook Street/	Weekday Morning	WB LTR	20	11.4	B
Benevolent Street	Weekday Evening	WB LTR	25	13.8	B

Table 2-3 (Continued)
Existing Conditions Unsignalized Intersection Capacity Analysis Summary

		2011 Existing			
Location	Peak Hour	Critical Movement[1]	Demand[2]	Delay[3]	LOS[4]
Brook Street/	Weekday Morning	WB LTR	20	12.4	B
Charlesfield Street	Weekday Evening	EB LTR	55	17.8	C
Brook Street/	Weekday Morning	SB LTR	155	9.6	A
Power Street	Weekday Evening	NB LTR	130	8.6	A
Thayer Street/	Weekday Morning	WB LT	30	13.1	B
Barnes Street	Weekday Evening	WB LT	20	13.1	B
Thayer Street/	Weekday Morning	WB LT	50	11.6	B
Lloyd Avenue	Weekday Evening	WB LT	85	18.7	C
Thayer Street/	Weekday Morning	WB LT	45	13.4	B
Bowen Street	Weekday Evening	WB LT	65	16.5	C
Thayer Street/	Weekday Morning	WB LT	10	12.4	B
Cushing Street	Weekday Evening	WB LT	50	22.1	C
Thayer Street/	Weekday Morning	WB LT	15	14.7	B
Meeting Street	Weekday Evening	WB LT	45	18.4	C
Thayer Street/	Weekday Morning	SB LTR	90	7.7	A
George Street	Weekday Evening	SB LTR	110	8.0	A
Thayer Street/	Weekday Morning	WB LR	5	7.4	A
Benevolent Street	Weekday Evening	SB T	70	7.4	A
Thayer Street/	Weekday Morning	SB LTR	25	7.1	A
Charlesfield St/Planet St	Weekday Evening	SB LTR	85	7.5	A
Thayer Street/	Weekday Morning	EB LTR	25	7.3	A
Power Street	Weekday Evening	WB TR	70	7.5	A
Benefit Street/	Weekday Morning	WB LR	35	11.9	B
George Street	Weekday Evening	WB LR	105	13.4	B
Benefit Street/	Weekday Morning	WB LR	30	11.9	B
Benevolent Street	Weekday Evening	WB LR	65	12.0	B
Benefit Street/	Weekday Morning	WB LTR	25	13.0	B
Charlesfield Street	Weekday Evening	EB LTR	25	12.9	B
Benefit Street/	Weekday Morning	SB LTR	165	8.4	A
Power Street	Weekday Evening	SB LTR	280	10.7	B
Brown Street/	Weekday Morning	WB LTR	90	7.9	A
Lloyd Street	Weekday Evening	SB LTR	30	7.5	A
Brown Street/	Weekday Morning	WB LTR	20	7.6	A
Bowen Street	Weekday Evening	NB LTR	130	8.0	A
Brown Street/	Weekday Morning	NB LT	55	0.7	A
Cushing Street	Weekday Evening	EB L	5	10.2	B

Table 2-3 (Continued)
Existing Conditions Unsignalized Intersection Capacity Analysis Summary

		2011 Existing			
Location	Peak Hour	Critical Movement[1]	Demand[2]	Delay[3]	LOS[4]
Brown Street/	Weekday Morning	EB LR	5	7.4	A
Meeting Street	Weekday Evening	NB LTR	55	7.7	A
Brown Street/	Weekday Morning	NB LR	30	11.7	B
George Street	Weekday Evening	NB LR	25	13.0	B
Brown Street/	Weekday Morning	SB LTR	60	7.5	A
Charlesfield Street	Weekday Evening	EB LTR	15	7.3	A
Brown Street/	Weekday Morning	SB LR	10	9.2	A
Power Street	Weekday Evening	SB LR	10	9.3	A
Prospect Street/	Weekday Morning	NB LTR	20	24.7	C
Olney Street	Weekday Evening	NB LTR	50	34.7	D
Prospect Street/	Weekday Morning	WB LTR	70	7.6	A
Lloyd Avenue	Weekday Evening	NB TR	105	7.6	A
Prospect Street/	Weekday Morning	SB TR	175	8.1	A
Bowen Street	Weekday Evening	WB LRT	60	8.2	A
Prospect Street/	Weekday Morning	SB TR	180	8.2	A
Cushing Street	Weekday Evening	NB LTR	105	7.8	A
Prospect Street/	Weekday Morning	SB LT	150	8.1	A
Meeting Street	Weekday Evening	SB LT	110	7.9	A
Prospect Street/	Weekday Morning	EB LR	115	15.0	C
College Street	Weekday Evening	EB LR	135	14.9	B
Prospect Street/	Weekday Morning	EB LT	15	7.3	A
George Street	Weekday Evening	EB LT	20	7.7	A

Source: Synchro 7 software using the procedures in the 2000 Highway Capacity Manual. Compiled by VHB.
1 L= Left-turn movement, T= Through movement, R= Right-turn movement
2 Demand = Demand of critical movement, expressed in vehicles per hour
3 Delay = Vehicle delay expressed in seconds per vehicle (See note below)
4 LOS = Level of service
Note: Interruptions to traffic flow caused by pedestrians, bus blockages, delivery vehicles, parking maneuvers, and double parking vehicles were observed on the study area roadways between intersections. These interruptions caused congestion along these roadways during the peak hour periods. As a result, the observed delay times at some intersections exceeded the calculated values.

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Parking

A detailed discussion of parking supply and demand analysis is handled elsewhere within the IMP. However, since trip generation estimation for the campus is closely tied to available parking supply, this section provide a limited summary of on- and off-street parking supply, as it relates to the input needs for the trip generation analysis.

On-street Parking

On-street parking supply surrounding the University that was presented in the 2006 Plan is shown in Figure 2-7. While some changes to the on-street parking would have occurred in the past five years as a result of various changes/projects on the campus, the general location, extent and types of use restrictions of parking that was reflected in the graphic continue to be applicable and as such, it continues to serve as a useful reference tool for understanding on-street parking supply on the campus.

According to the 2008 College Hill Parking Task Force report, there were over 3,040 on-street parking spaces in the College Hill area generally bounded by Olney Street to the north, Benefit Street to the west, Williams Street to the south, and Arlington Street/Ives Street to the east. There is a limited amount of metered parking along sections of Prospect Street, Angell Street, and Waterman Street, although the College Hill Parking Task Force recommended the installation of meters on various additional roadways adjacent to the Brown University campus. The Task Force also recommended a "logical and comprehensive plan on a street-by-street basis for short-term, long-term, and all-day parking." As of the date of this study, these recommendations of the Task Force had not been implemented.

Off-Street Parking

Brown University's current off-street parking supply within, or in close proximity to, the main campus area consists of approximately over 100 parking areas including one structured parking garage. These lots range in size from 1 space to approximately 400 spaces and total 2,384 parking spaces occupied primarily by faculty and staff

Based on the City of Providence Zoning requirements, the required number of parking spaces for Brown University is 3,193 spaces. However, a shortage of 931 parking spaces has been grandfathered through previous approvals with the City of Providence. The shortfall is made up by on-street parking on the city streets surrounding the campus. With the grandfathered shortage, the revised required number of off-street parking spaces is 2,262 spaces. Based on the existing supply of 2,384 off-street parking spaces, there is an existing surplus based on the Zoning requirements of 122 spaces.

For specific and most recent updated parking calculations, refer to the parking section located elsewhere in the IMP document.

Public Transportation

The University is served by the Rhode Island Public Transit Authority (RIPTA) and various safeRIDE shuttle services. Six bus routes, including a Providence LINK

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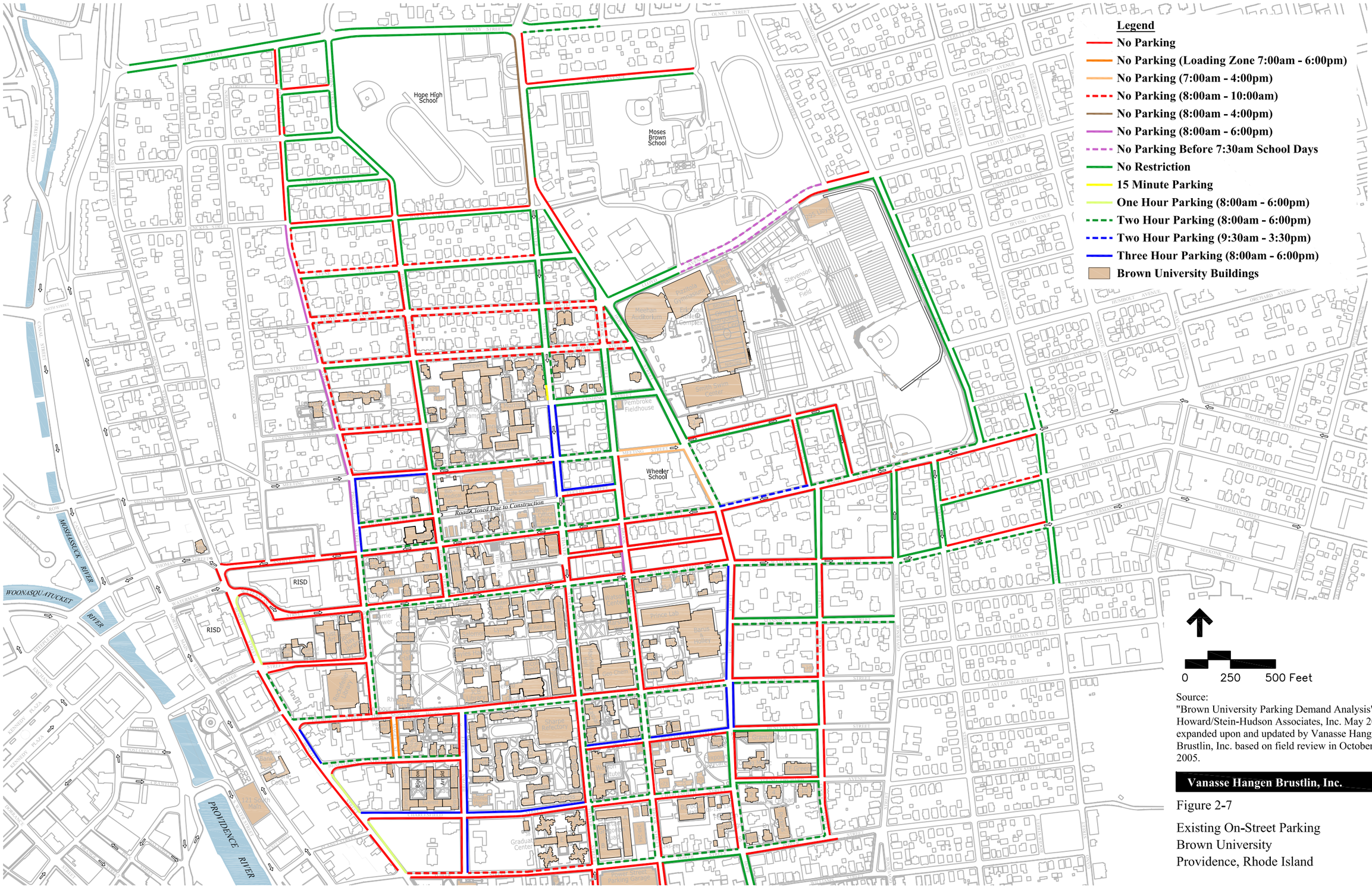


Source:
"Brown University Parking Demand Analysis", Howard/Stein-Hudson Associates, Inc. May 2002 expanded upon and updated by Vanasse Hangen Brustlin, Inc. based on field review in October 2005.

Vanasse Hangen Brustlin, Inc.

Figure 2-7

Existing On-Street Parking
Brown University
Providence, Rhode Island

trolley route serve the Brown University campus and the surrounding area. All of these routes connect to RIPTA's Intermodal Transit Center at Kennedy Plaza, where connections can be made to other bus routes throughout the state of Rhode Island. The connection from Brown University to Kennedy Plaza is facilitated by an existing bus tunnel from Thayer Street to South Main Street.

safeRIDE Shuttle service is a scheduled fixed-route and on-call shuttle service around the Brown University and Rhode Island School of Design (RISD) campuses. These shuttles, which circle around designated routes and are also available on-call during the evening hours, are available to all Brown and RISD students, faculty, and staff with a valid identification.

Additional information on public transportation serving the Brown University the shuttle campus can be found elsewhere within the IMP.

Pedestrian and Bicycle Activity

This section discusses existing pedestrian and bicycle activity on campus. Pedestrian and bicycle activity was observed and recorded at various locations within the study area during the morning and evening peak periods on typical weekdays during March-April 2011.

Pedestrian Activity

Pedestrian volumes were counted in the study area in conjunction with the traffic volumes, as previously described, on typical weekdays during the weekday morning and weekday evening peak hour periods. Figures 2-8 and 2-9 present the peak hour pedestrian flows during the commuting peak periods. Pedestrian volumes at some locations are much higher during other parts of the day, when there is less automobile traffic.

The pedestrian activity during the afternoon and evening peak hours were generally much higher than during the morning peak hour period, due to the lower levels of student activity and commercial activity on Thayer Street during the morning peak hour period. In general, the highest pedestrian volumes in the area during the morning and evening peak hour periods occurs along Thayer Street, Brown Street and Brook Street. Higher pedestrian activity on Brown and Brook streets however is generally concentrated in the vicinity of Angell Street and Waterman Street, with diminishing volumes as the distance from the main campus increases. George Street also experiences higher levels of pedestrian activity in the vicinity of the main campus.

The construction of "The Walk" was projected to result in a noticeable shift in north-south pedestrian traffic from the Brown Street and Thayer Street crosswalks across Angell Street and Waterman Street to the new mid-block crossings at "The Walk". Comparison of the previously projected vs. actual observed pedestrian volume at the Walk shows that there has in fact been a noticeable shift in pedestrian volumes from the Brown Street and Thayer Street crosswalks to the Walk since its construction. However, there is still a considerable amount of pedestrian activity at the Brown Street and Thayer Street crosswalks. The lack of such a direct pedestrian connection from The Walk to the south is likely contributing to the less than expected usage of The Walk at this time. The use of the Walk could be further encouraged in the future when a more direct connection is afforded through the completion of projects such as the Hunter Lab renovation.

■

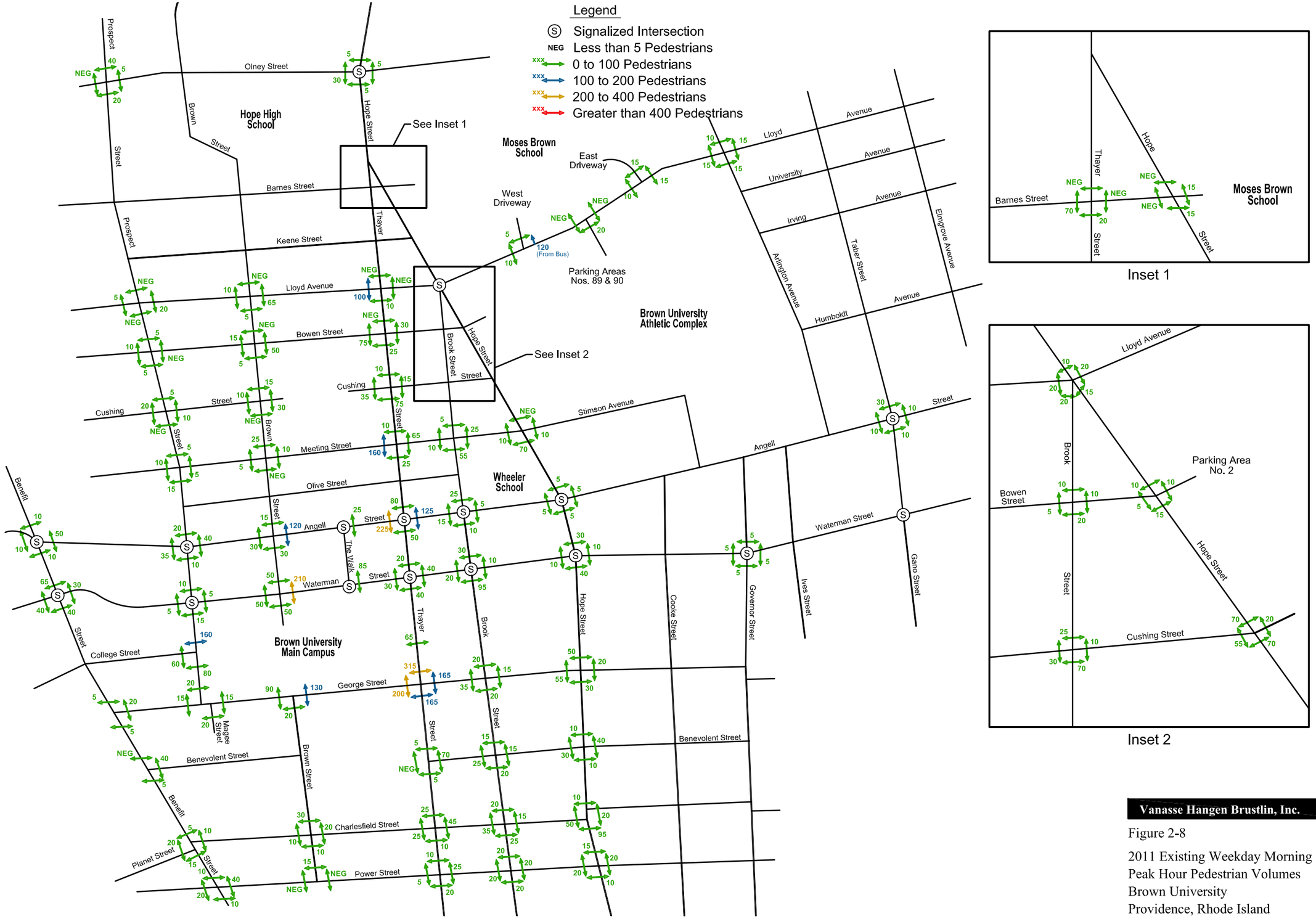
Bicycle Activity

Bicycling is a popular mode of travel in Providence's East Side and the Brown University campus. Bicycle usage was observed throughout the campus with the most activity occurring along Thayer Street and Hope Street, but of which are primary area bicycle routes along with Angell Street and Waterman Street. At the time of the 2006 Plan, there were bicycle racks located at over 100 locations on the Brown University campus with a total rack capacity of over 500 bicycles. Based on discussions with the University, a significant number of additional bicycle racks have been installed in the campus over the past five years as part of various projects, and the University has plans to install another dozen bicycle racks in the summer of 2011. Overall, the significant level of investment in bicycle accommodations speaks of the level of success achieved on the campus in the promotion of bicycling as a viable alternate mode of transportation.

Loading, Service, and Emergency Access

Based on information from the University, there are nine major delivery points on the University campus under current conditions:

- Brown Office Building and the Creative Arts Center (via Olive Street)
- J. Walter Wilson student resources and services building (via Angell Street)
- Faunce House (via Waterman Avenue)
- Sciences Library/Watson Center (via Waterman Avenue)
- Rockefeller Library (via George Street)
- Sharpe Refectory (via Thayer Street)
- Verney Whoolley (via Thayer Street)



Inset 1

Inset 2

Vanasse Hangen Brustlin, Inc.

Figure 2-8

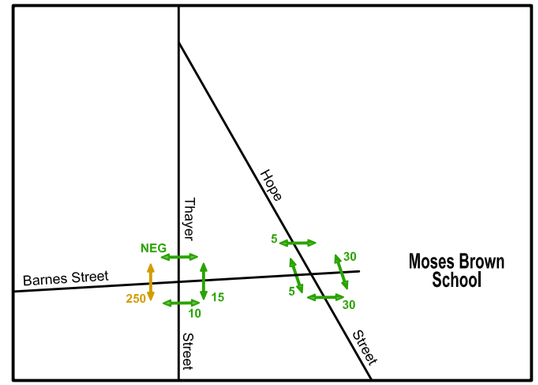
2011 Existing Weekday Morning Peak Hour Pedestrian Volumes
Brown University
Providence, Rhode Island

Legend

- (S) Signalized Intersection
- NEG Less than 5 Pedestrians
- xxx 0 to 100 Pedestrians
- xxx 100 to 200 Pedestrians
- xxx 200 to 400 Pedestrians
- xxx Greater than 400 Pedestrians

Hope High School
Moses Brown School
Brown University Athletic Complex
Wheeler School
Brown University Main Campus
Parking Areas Nos. 89 & 90
East Driveway
West Driveway
See Inset 1
See Inset 2

Prospect Street
Brown Street
Hope Street
Thayer Street
Barnes Street
Keene Street
Olney Street
Lloyd Avenue
Bowen Street
Cushing Street
Meeting Street
Olive Street
Angell Street
Waterman Street
College Street
George Street
Benevolent Street
Charlesfield Street
Power Street
Planet Street
Benefit Street
Stimson Avenue
Brook Street
The Walk
Magee Street
Brown Street
Cooke Street
Governor Street
Ives Street
Gano Street
Waterman Street
Lloyd Avenue
University Avenue
Irving Avenue
Humboldt Avenue
Arlington Avenue
Taber Street
Elmgrove Avenue
Angell



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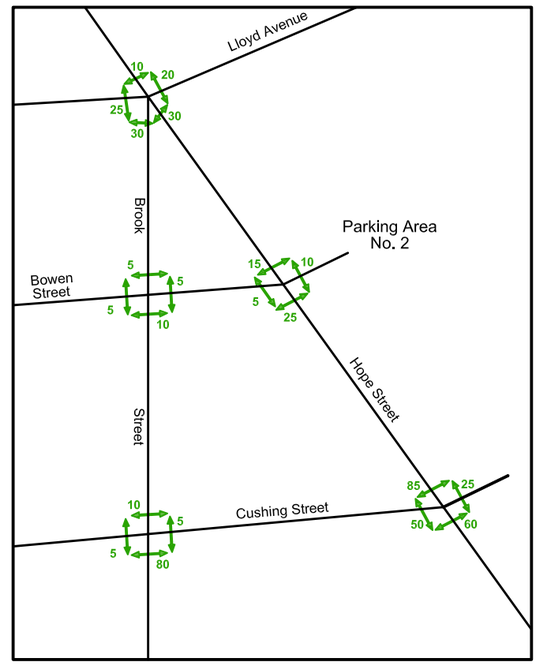

Inset 2

Not to Scale

Vanasse Hangen Brustlin, Inc.

Figure 2-9

2011 Existing Weekday Evening Peak Hour Pedestrian Volumes
Brown University
Providence, Rhode Island

- Prince Lab/Barus & Holley (via Hope Street)
- Facility Services 295 Lloyd Avenue (via Lloyd Avenue)

The locations of the major delivery points are shown in Figure 2-10.

All campus mail is distributed through a centralized facility in the J. Walter Wilson student resources and services building. A mail truck provides parcel delivery to all departments on campus and limited first class mail delivery/pick-up service. University departments that do not receive first class mail delivery collect the mail from department mailboxes. Some deliveries of supplies such as those by courier and express delivery companies occur within the public right-of-way.

Emergency access to the campus is provided by the city street network, principally the arterial streets of Angell Street, Waterman Street, and Hope Street. Access into the campus is provided by local streets and a network of service roadways and pathways through the campus.

Transportation Demand Management

Brown University continues to provide a number of successful transportation demand management (TDM) programs in response to the needs of the students, faculty, and staff and in concert with the urban environment of the campus. These programs, which are designed to encourage alternatives to driving and parking at the campus, include:

- RIPTA pass program, which includes more than 30,000 rides per month
- Brown University shuttles, which carry more than 300 rides per day back and forth to the Jewelry District
- ZipCar, which has 1,400 on-campus members and approximately 400 non-Brown University members, which has allowed the program to expand from two cars to 15
- Limited student parking on-campus, which has reduced from 500 cars in 2005 to less than 50 cars

Additional information on University TDM measures can be found elsewhere within the IMP.

\\vhb\proj\providence\72353.00\graphics\figures\fig2-10 deliverypoints (72066).dwg

Source:
Brown University Facility Management Department

Vanasse Hangen Brustlin, Inc.

Figure 2-10

Major Campus Delivery Points
Brown University
Providence, Rhode Island

3

Future Conditions

Future Analysis Years and Conditions

To assess the magnitude of change that can be expected in transportation demand in the future, transportation conditions (traffic volumes, pedestrian volumes, number of parking spaces, etc.) were projected to 2016 (5-year time horizon) and analyzed. Because of the uncertainty with longer range plans, it was determined that projections beyond a 5-year time horizon might not be accurate at this stage in the process. Two different scenarios are examined:

- **No-Build.** The No-Build scenario analyzes the transportation system serving the University campus without any of the planned projects in the IMP. The No-Build scenario includes growth in traffic volumes associated with generalized regional growth as well as traffic growth due to specific projects near the campus.
- **Build.** The Build conditions present the building program envisioned in the IMP over the course of the next five years. The traffic shifts and new trips associates with the projects contained within the IMP are added to the No-Build traffic volumes.

The transportation analyses for each of these conditions are presented in detail in this chapter.

No-Build Conditions

No-Build traffic conditions are projected based on planned transportation infrastructure improvements and traffic volume changes. Transportation infrastructure improvements include roadway improvements, public transit improvements, and pedestrian and bicycle enhancements. Traffic volume changes are estimated based on two different factors, an annual growth rate and traffic growth associated with specific developments near the campus.

Infrastructure Improvement Projects

Three planned transportation infrastructure projects that will have an impact on study are roadways were identified based on discussions with the City of Providence Department of Planning & Development, the Department of Public Works (DPW), and the Rhode Island Department of Transportation (RIDOT). The projects, which are not expected to have a significant impact on the existing Brown University campus and surrounding infrastructure during the planning horizon, are described below:

- The Providence Core Connector Study is currently underway to evaluate the implications of a multi-modal transportation system in the city, with the specific focus of implementing a street car system. While it is possible that one of the routes on the street car system might extend into the College Hill area through the bus tunnel on Thayer Street, it is too early to define the specifics of the project and its effects on the University transportation system. Additionally, it is not likely that the system will be implemented within the 5-year time horizon considered in this study. The project was therefore not included in the updated transportation analysis for the University.
- There may be some utility related work on Lloyd Avenue; however, any related impacts can be expected to be minimal and temporary.
- The City is considering repaving a portion of Gano Street due to problems with the repaving work that was completed last year. However, as with the utility work on Lloyd Street, any related impacts can be expected to be minimal and temporary.

Regional Traffic Growth

2016 No-Build traffic volumes were projected by applying a general growth rate to existing volumes and adding traffic volumes expected to be generated by specific known development projects. First, an annual growth rate was applied to the existing traffic volumes to reflect annual background traffic volume growth as a result of regional economic activity and development. Based on historical traffic data, between 2005 and 2011, traffic volumes in the area generally decreased even with the growth of the University. To provide for a conservatively high estimate of background growth without additional University growth, and to maintain consistency with the assumptions made in the 2006 Plan, a 0.5 percent per year annual growth rate (not including the University population growth) was used in the development the 2016 baseline traffic volumes.

Site Specific Traffic Growth

Based on information from the City of Providence Department of Planning & Development, there are no proposed non-university related development projects within or adjacent to the study area that could have a notable effect on traffic/ transportation operations on the roadways serving the campus.

While there are no non-university development projects in the area, one relevant project currently under construction on the campus was identified for inclusion in the No-Build analysis. This is the Katherine Moran Coleman Aquatics Center and Jonathan Nelson Fitness Center project (aquatic/fitness center project) within the Erickson Athletic Complex on Lloyd Avenue. The specifics of this project are outlined below.

The project involves the construction of a new Aquatic and Fitness Center, located where the former swimming pool building was situated. The facility will contain approximately 87,000 square feet of exercise studios, a 56m competition pool with seating for 800 spectators, a fitness cardio/weight loft, offices, locker rooms, 12,000 sf varsity strength and conditioning facility and a lobby/cafe. Access points to the complex as well as parking lots on the complex are proposed to be reconfigured as part of the project. It is anticipated that the project will result in a net loss of 111 parking spaces. Transportation impacts of the project, documented in a May 11, 2010 technical memorandum submitted to the University by VHB, was used in the current No-Build analysis.

No-Build Traffic Volumes

The 0.5 percent annual background growth rate over the five-year planning horizon and the projected vehicular traffic reassignment associated with the loss of parking spaces at the athletic complex were added to the 2011 Existing traffic volume networks to develop the projected 2016 No-Build traffic volumes. The resulting 2016 No-Build weekday morning peak hour traffic volumes are presented in Figures 3-1, and 3-2, and the 2016 No-Build weekday evening peak hour volumes are presented in Figures 3-3 and 3-4.

No-Build Traffic Analysis

The 2010 No-Build traffic volumes were analyzed at all of the study area intersections. The results of these analyses are presented in Tables 3-1 and 3-2. As shown, the differences in calculated delay at the study area intersections between 2011 Existing and 2016 No-Build are minimal. The intersections which show degradations in the calculated levels of service are those that are near threshold values under existing traffic volumes. Although the

differences in calculated delay times between Existing and No-Build conditions are minimal, as stated previously, the projected future traffic volumes used for the analyses are conservatively high. The actual differences in delays between the two conditions are expected to be less than what is shown.

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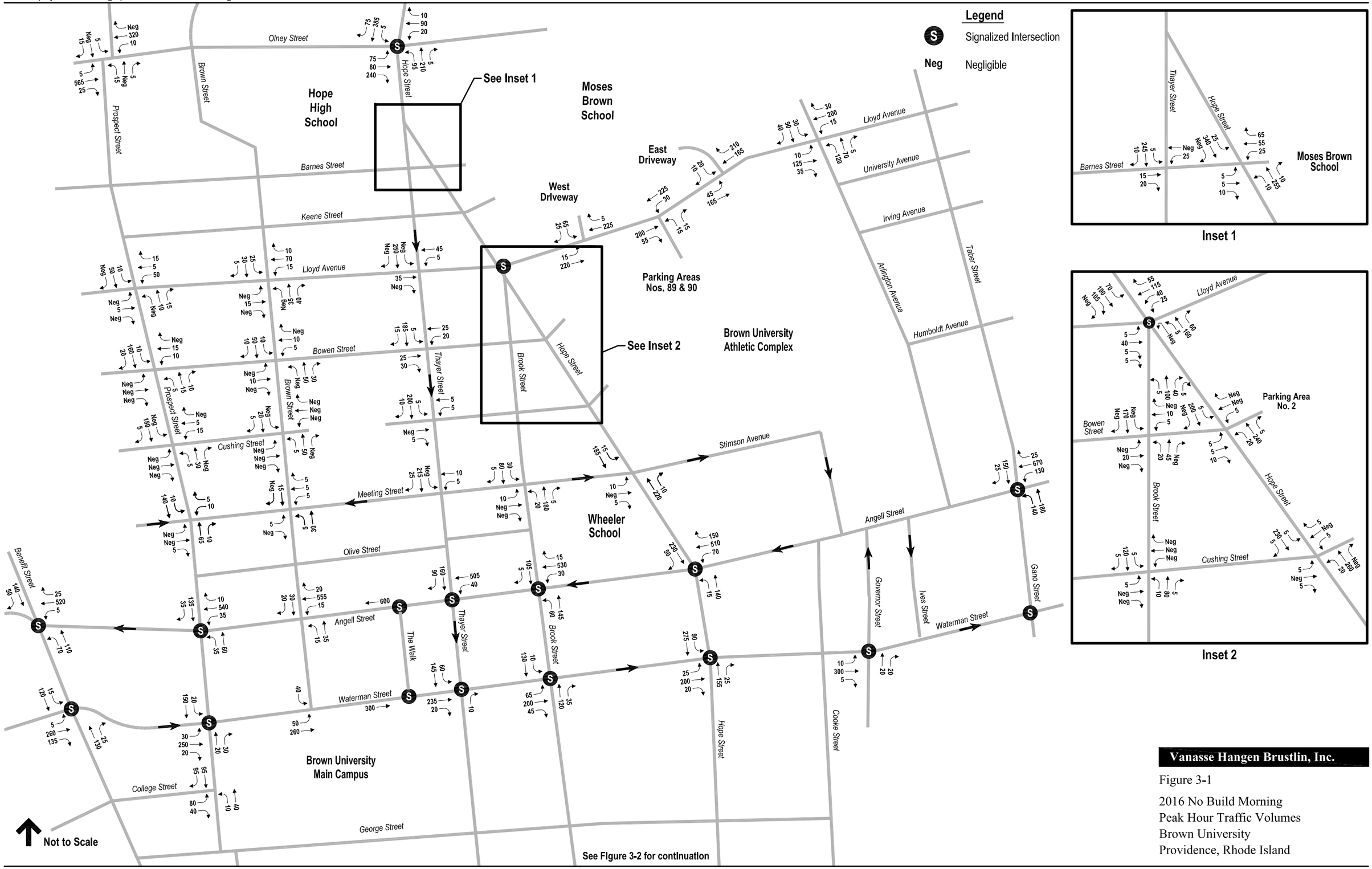


Vanasse Hangen Brustlin, Inc.

Figure 3-1

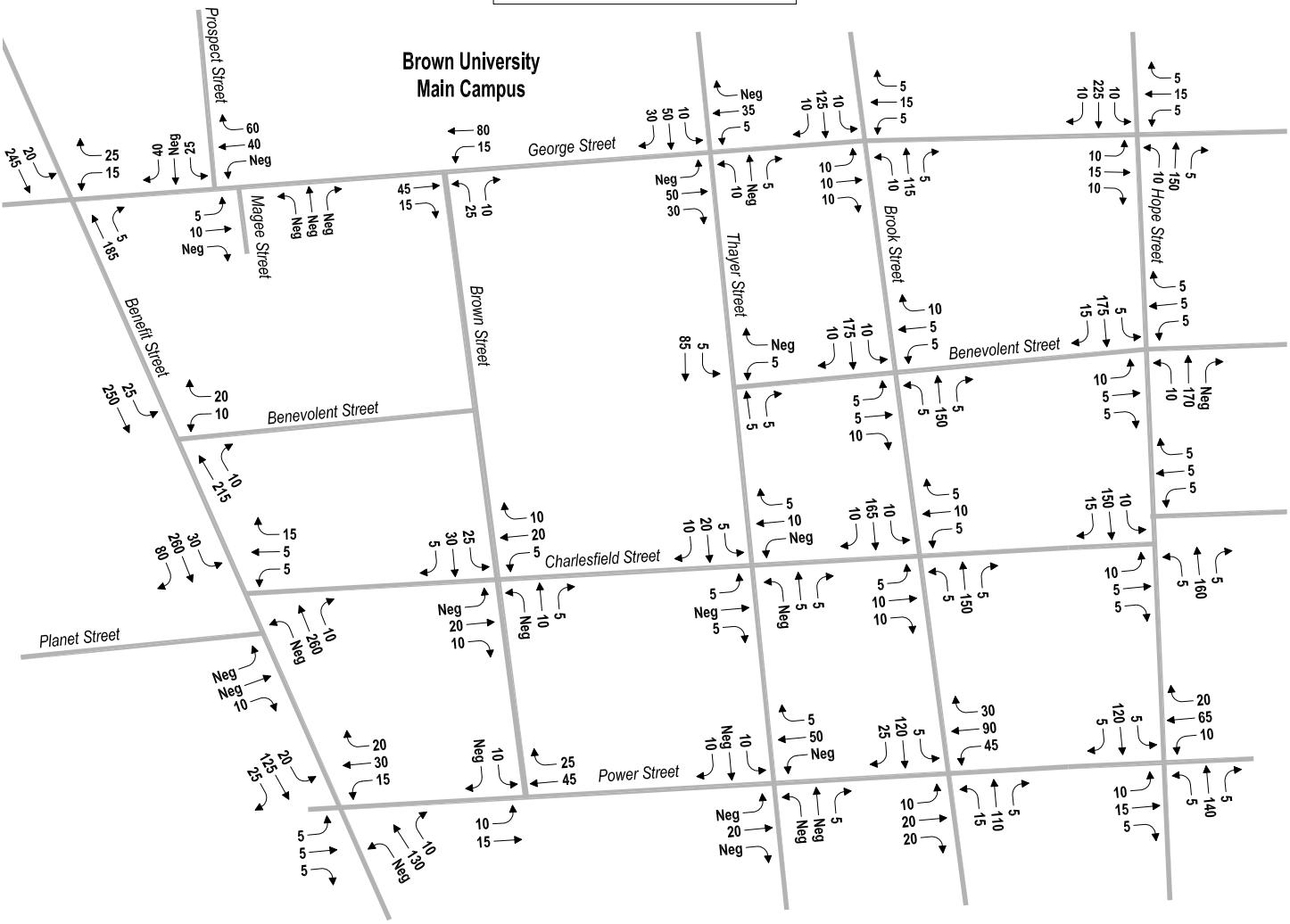
2016 No Build Morning
Peak Hour Traffic Volumes
Brown University
Providence, Rhode Island

Legend

S — Signalized Intersection

Neg — Negligible

See FIgure 3-1 for contInuatIon

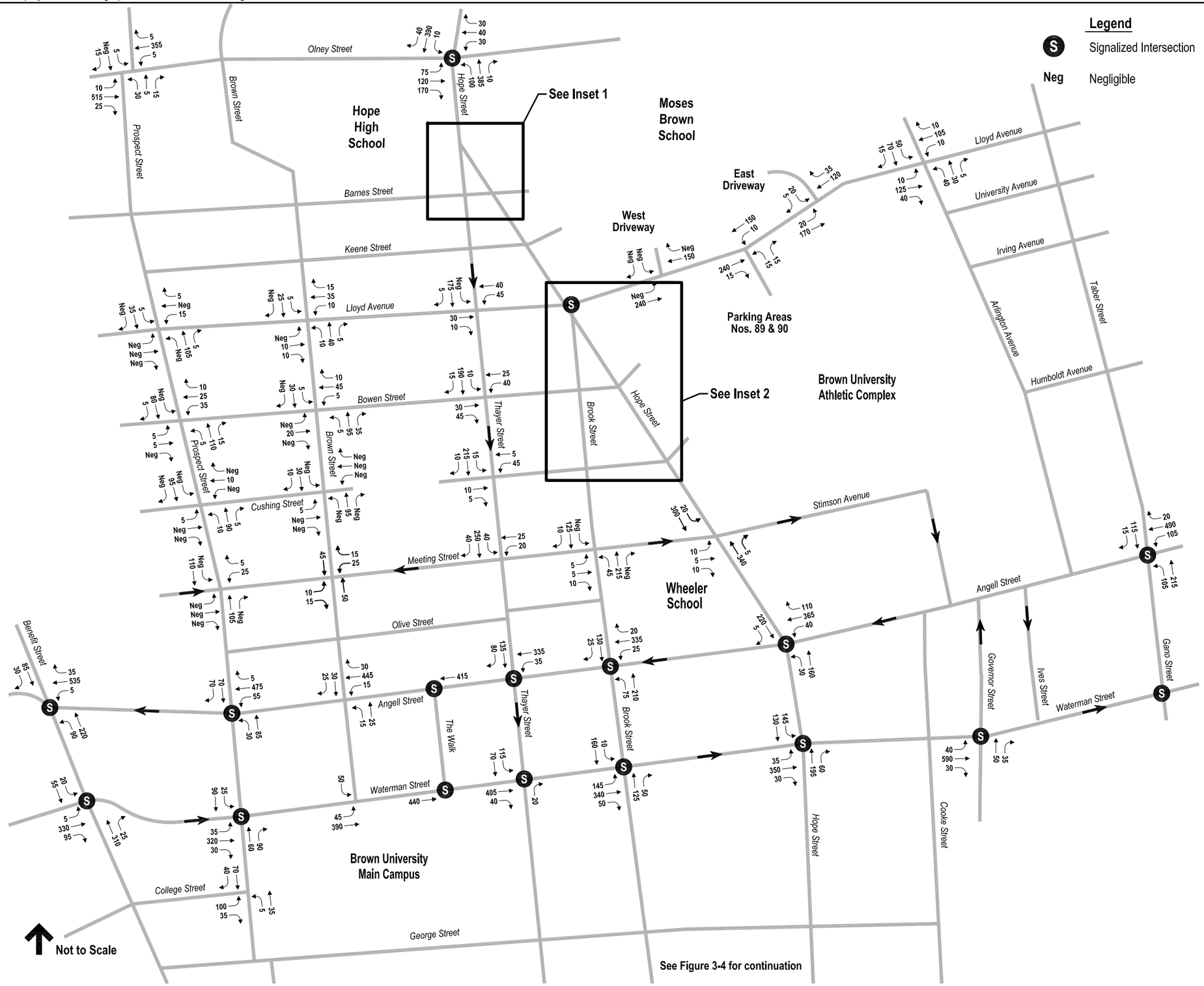


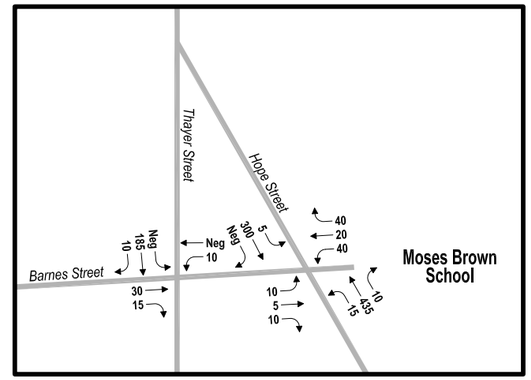
Not to Scale

Vanasse Hangen Brustlin, Inc.

2016 No Build Morning
Peak Hour Traffic Volumes
Brown University
Providence, Rhode Island

Figure 3-2





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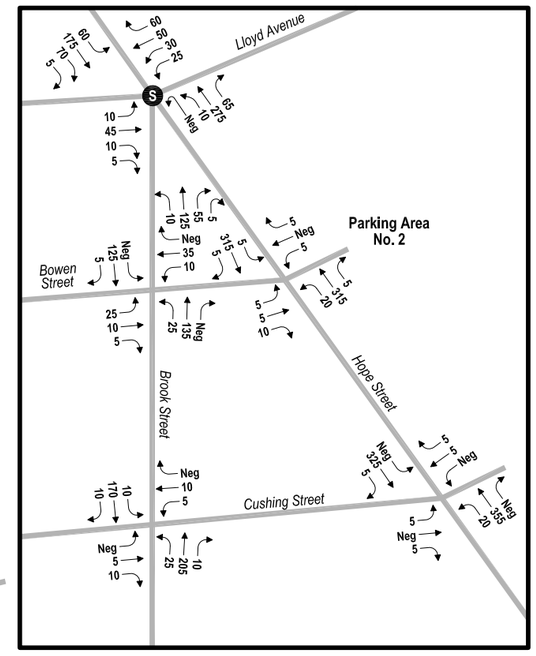

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Vanasse Hangen Brustlin, Inc.

Figure 3-3

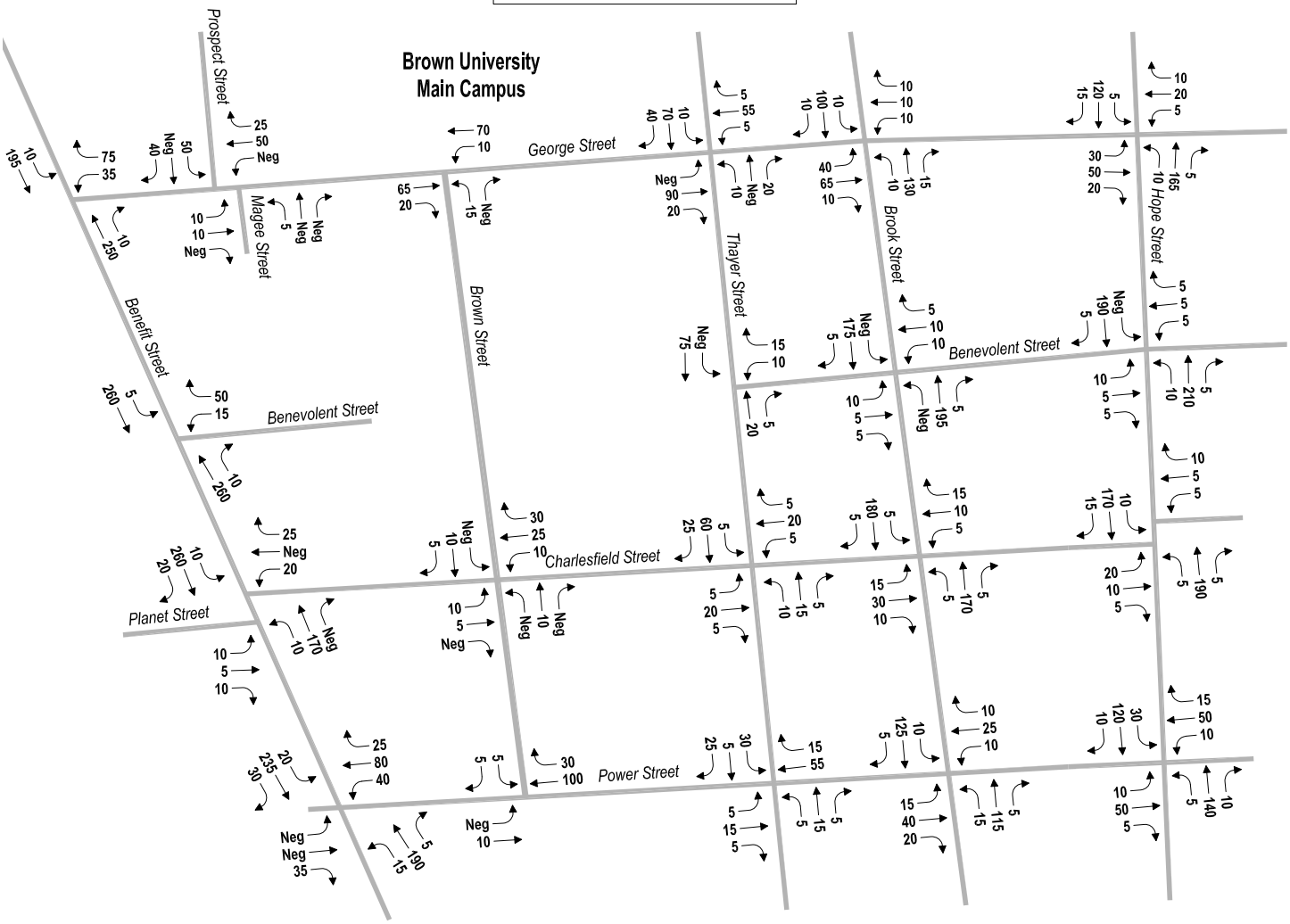
2016 No Build Evening
Peak Hour Traffic Volumes
Brown University
Providence, Rhode Island

Legend

S — Signalized Intersection

Neg — Negligible

See FIgure 3-3 for contInuatIon



Not to Scale

Vanasse Hangen Brustlin, Inc.

2016 No Build Evening
Peak Hour Traffic Volumes
Brown University
Providence, Rhode Island

Figure 3-4

Table 3-1
No-Build Signalized Intersection Capacity Analysis Summary

		2011 Existing			2016 No Build		
Location	Peak Hour	V/C[1]	Delay[2]	LOS[3]	V/C[1]	Delay[2]	LOS[3]
Angell Street/	Weekday Morning	0.73	19.6	B	0.74	19.7	B
Gano Street/Taber Avenue	Weekday Evening	0.51	15.2	B	0.52	15.2	B
Angell Street/	Weekday Morning	0.69	15.9	B	0.70	16.1	B
Hope Street	Weekday Evening	0.64	16.8	B	0.55	15.8	B
Angell Street/	Weekday Morning	0.83	17.5	B	0.86	19.8	B
Brook Street	Weekday Evening	0.58	16.9	B	0.60	15.7	B
Angell Street/	Weekday Morning	0.51	1.8	A	0.52	1.8	A
The Walk	Weekday Evening	0.57	10.0	A	0.57	9.9	A
Angell Street/	Weekday Morning	0.61	14.4	B	0.63	14.6	B
Thayer Street	Weekday Evening	0.53	13.4	B	0.53	13.2	B
Angell Street/	Weekday Morning	0.60	11.2	B	0.61	11.5	B
Prospect Street	Weekday Evening	0.58	12.3	B	0.60	12.7	B
Angell Street/	Weekday Morning	0.36	9.2	A	0.36	9.1	A
Benefit Street	Weekday Evening	0.44	7.7	A	0.45	7.9	A
Waterman Street/	Weekday Morning	0.28	11.5	B	0.28	11.4	B
Benefit Street	Weekday Evening	0.47	14.5	B	0.49	14.9	B
Waterman Street/	Weekday Morning	0.44	16.2	B	0.44	16.2	B
Prospect Street	Weekday Evening	0.38	16.7	B	0.38	16.8	B
Waterman Street/	Weekday Morning	0.39	8.0	A	0.39	7.9	A
The Walk	Weekday Evening	0.56	17.6	B	0.58	18.0	B
Waterman Street/	Weekday Morning	0.39	20.2	C	0.39	20.5	C
Thayer Street	Weekday Evening	0.43	20.2	C	0.44	20.4	C
Waterman Street/	Weekday Morning	0.37	19.9	B	0.39	20.0	B
Brook Street	Weekday Evening	0.65	14.4	B	0.67	14.8	B
Waterman Street/	Weekday Morning	0.53	12.0	B	0.55	12.3	B
Hope Street	Weekday Evening	0.70	15.5	B	0.71	16.1	B
Waterman Street/	Weekday Morning	0.27	5.2	A	0.14	4.5	A
Governor Street	Weekday Evening	0.54	7.3	A	0.29	4.9	A
Hope Street/	Weekday Morning	0.84	41.0	D	0.88	46.7	D
Lloyd Avenue/Brook Street	Weekday Evening	0.67	28.0	C	0.71	29.5	C
Hope Street/	Weekday Morning	0.74	19.8	B	0.75	20.3	C
Olney Street	Weekday Evening	0.78	20.9	C	0.80	21.9	C

Source: Synchro 7 software using the procedures in the 2000 Highway Capacity Manual. Compiled by VHB.
1 V/C = volume to capacity ratio.
2 Delay = Vehicle delay expressed in seconds per vehicle. See Note below.
3 LOS = Level of service
Note: Interruptions to traffic flow caused by pedestrians, bus blockages, delivery vehicles, parking maneuvers, and double parking vehicles were observed on the study area roadways between intersections. These interruptions caused congestion along these roadways during the peak hour periods. As a result, the observed delay times at some intersections exceeded the calculated values.

Table 3-2
No Build Unsignalized Intersection Capacity Analysis Summary

		2011 Existing				2016 No Build			
Location	Peak Hour	Critical Movement[1]	Demand[2]	Delay[3]	LOS[4]	Critical Movement	Demand	Delay	LOS
Angell Street/	Weekday Morning	NB LT	45	46.9	E	NB LT	50	60.2	F
Brown Street	Weekday Evening	NB LT	40	34.0	D	NB LT	40	36.0	E
Waterman Street/	Weekday Morning	SB L	40	13.3	B	SB L	40	13.6	B
Brown Street	Weekday Evening	SB L	50	20.6	C	SB L	50	21.6	C
Lloyd Avenue/	Weekday Morning	WB LTR	240	14.0	B	WB LTR	245	14.6	B
Arlington Avenue	Weekday Evening	SB LTR	135	9.3	A	SB LTR	135	9.4	A
Lloyd Avenue/	Weekday Morning	SB LR	30	14.9	B	SB LR	30	15.0	B
Moses Brown East Drive	Weekday Evening	SB LR	25	11.7	B	SB LR	25	11.7	B
Lloyd Avenue/	Weekday Morning	NB LR	20	13.5	B	NB LR	30	14.9	B
Parking Areas Nos. 89 & 90	Weekday Evening	NB LR	20	11.0	B	NB LR	30	11.4	B
Lloyd Avenue/	Weekday Morning	SB LR	90	24.3	C	SB LR	90	26.8	D
Moses Brown West Drive	Weekday Evening	Driveway closed during this peak period				Driveway closed during this peak period			
Hope Street/	Weekday Morning	WB LTR	145	33.1	D	WB LTR	145	34.4	D
Barnes Street/Moses Brown	Weekday Evening	WB LTR	100	34.3	D	WB LTR	100	35.9	E
Hope Street/	Weekday Morning	WB LTR	25	13.4	B	WB LTR	5	15.6	C
Bowen Street	Weekday Evening	WB LTR	30	15.1	C	WB LTR	10	16.7	C
Hope Street/	Weekday Morning	EB LR	10	15.8	C	EB LR	10	16.3	C
Cushing Street	Weekday Evening	EB LR	10	20.4	C	EB LR	10	27.6	D
Hope Street/	Weekday Morning	EB LTR	15	12.5	B	EB LTR	15	12.5	B
Meeting Street	Weekday Evening	EB LTR	20	14.4	B	EB LTR	20	15.2	C
Hope Street/	Weekday Morning	SB LTR	245	10.1	B	SB LTR	245	10.1	B
George Street	Weekday Evening	NB LTR	170	9.3	A	NB LTR	175	9.4	A
Hope Street/	Weekday Morning	EB LTR	20	12.7	B	EB LTR	20	12.7	B
Benevolent Street	Weekday Evening	EB LTR	25	14.5	B	EB LTR	25	14.6	B
Hope Street/	Weekday Morning	EB LTR	20	15.2	C	EB LTR	20	15.4	C
Charlesfield Street	Weekday Evening	EB LTR	30	17.6	C	EB LTR	30	17.8	C
Hope Street/	Weekday Morning	NB LTR	145	9.2	A	NB LTR	150	9.3	A
Power Street	Weekday Evening	SB LTR	150	9.0	A	SB LTR	145	8.9	A
Brook Street/	Weekday Morning	SB T	165	8.2	A	SB T	170	8.3	A
Bowen Street	Weekday Evening	NB LT	155	8.8	A	NB LT	160	8.9	A
Brook Street/	Weekday Morning	EB LTR	5	12.4	B	EB LTR	5	14.2	B
Cushing Street	Weekday Evening	WB LTR	15	14.4	B	WB LTR	15	14.5	B
Brook Street/	Weekday Morning	EB LTR	10	13.8	B	EB LTR	10	14.2	B
Meeting Street	Weekday Evening	EB LTR	20	12.3	B	EB LTR	20	12.6	B
Brook Street/	Weekday Morning	NB LTR	125	8.0	A	NB LTR	130	8.1	A
George Street	Weekday Evening	EB LTR	105	8.5	A	NB LTR	155	8.6	A

Table 3-2 (Continued)
No Build Unsignalized Intersection Capacity Analysis Summary

		2011 Existing				2016 No Build			
Location	Peak Hour	Critical Movement[1]	Demand[2]	Delay[3]	LOS[4]	Critical Movement	Demand	Delay	LOS
Brook Street/	Weekday Morning	WB LTR	20	11.4	B	WB LTR	20	11.5	B
Benevolent Street	Weekday Evening	WB LTR	25	13.8	B	WB LTR	25	14.1	B
Brook Street/	Weekday Morning	WB LTR	20	12.4	B	WB LTR	20	12.5	B
Charlesfield Street	Weekday Evening	EB LTR	55	17.8	C	EB LTR	55	17.9	C
Brook Street/	Weekday Morning	SB LTR	155	9.6	A	SB LTR	155	9.6	A
Power Street	Weekday Evening	NB LTR	130	8.6	A	NB LTR	135	8.6	A
Thayer Street/	Weekday Morning	WB LT	30	13.1	B	WB LT	30	13.2	B
Barnes Street	Weekday Evening	WB LT	20	13.1	B	WB LT	10	14.4	B
Thayer Street/	Weekday Morning	WB LT	50	11.6	B	WB LT	50	11.7	B
Lloyd Avenue	Weekday Evening	WB LT	85	18.7	C	WB LT	85	19.0	C
Thayer Street/	Weekday Morning	WB LT	45	13.4	B	WB LT	45	13.5	B
Bowen Street	Weekday Evening	WB LT	65	16.5	C	WB LT	55	16.6	C
Thayer Street/	Weekday Morning	WB LT	10	12.4	B	WB LT	10	12.4	B
Cushing Street	Weekday Evening	WB LT	50	22.1	C	WB LT	50	37.7	E
Thayer Street/	Weekday Morning	WB LT	15	14.7	B	WB LT	15	14.8	B
Meeting Street	Weekday Evening	WB LT	45	18.4	C	WB LT	45	19.1	C
Thayer Street/	Weekday Morning	SB LTR	90	7.7	A	SB LTR	90	7.7	A
George Street	Weekday Evening	SB LTR	110	8.0	A	SB LTR	115	8.1	A
Thayer Street/	Weekday Morning	WB LR	5	7.4	A	WB LR	5	7.4	A
Benevolent Street	Weekday Evening	SB T	70	7.4	A	SB T	75	7.4	A
Thayer Street/	Weekday Morning	SB LTR	25	7.1	A	SB LTR	25	7.1	A
Charlesfield St/Power St	Weekday Evening	SB LTR	85	7.5	A	SB LTR	85	7.5	A
Thayer Street/	Weekday Morning	EB LTR	25	7.3	A	EB LTR	25	7.3	A
Power Street	Weekday Evening	WB TR	70	7.5	A	WB TR	70	7.5	A
Benefit Street/	Weekday Morning	WB LR	35	11.9	B	WB LR	35	12.0	B
George Street	Weekday Evening	WB LR	105	13.4	B	WB LR	105	13.6	B
Benefit Street/	Weekday Morning	WB LR	30	11.9	B	WB LR	30	11.9	B
Benevolent Street	Weekday Evening	WB LR	65	12.0	B	WB LR	65	12.1	B
Benefit Street/	Weekday Morning	WB LTR	25	13.0	B	WB LTR	25	13.1	B
Charlesfield Street	Weekday Evening	EB LTR	25	12.9	B	EB LTR	25	13.0	B
Benefit Street/	Weekday Morning	SB LTR	165	8.4	A	SB LTR	180	8.5	A
Power Street	Weekday Evening	SB LTR	280	10.7	B	SB LTR	285	10.8	B
Brown Street/	Weekday Morning	WB LTR	90	7.9	A	WB LTR	95	7.9	A
Lloyd Street	Weekday Evening	SB LTR	30	7.5	A	SB LRT	30	7.5	A
Brown Street/	Weekday Morning	WB LTR	20	7.6	A	WB LTR	20	7.6	A
Bowen Street	Weekday Evening	NB LTR	130	8.0	A	NB LTR	135	8.0	A
Brown Street/	Weekday Morning	NB LT	55	0.7	A	NB LT	55	0.7	A
Cushing Street	Weekday Evening	EB L	5	10.2	B	EB L	5	10.2	B

Table 3-2 (Continued)
No Build Unsignalized Intersection Capacity Analysis Summary

		2011 Existing				2016 No Build			
Location	Peak Hour	Critical Movement[1]	Demand[2]	Delay[3]	LOS[4]	Critical Movement	Demand	Delay	LOS
Brown Street/	Weekday Morning	EB LR	5	7.4	A	EB LR	5	7.4	A
Meeting Street	Weekday Evening	NB LTR	55	7.7	A	NB LTR	55	7.7	A
Brown Street/	Weekday Morning	NB LR	30	11.7	B	NB LR	35	11.9	B
George Street	Weekday Evening	NB LR	25	13.0	B	NB LR	25	13.1	B
Brown Street/	Weekday Morning	SB LTR	60	7.5	A	SB LTR	60	7.5	A
Charlesfield Street	Weekday Evening	EB LTR	15	7.3	A	EB LTR	15	7.3	A
Brown Street/	Weekday Morning	SB LR	10	9.2	A	SB LR	10	9.2	A
Power Street	Weekday Evening	SB LR	10	9.3	A	SB LR	10	9.4	A
Prospect Street/	Weekday Morning	NB LTR	20	24.7	C	NB LTR	20	25.5	D
Olney Street	Weekday Evening	NB LTR	50	34.7	D	NB LTR	50	36.9	E
Prospect Street/	Weekday Morning	WB LTR	70	7.6	A	WB LTR	70	7.6	A
Lloyd Avenue	Weekday Evening	NB TR	105	7.6	A	NB TR	110	7.7	A
Prospect Street/	Weekday Morning	SB TR	175	8.1	A	SB TR	180	8.1	A
Bowen Street	Weekday Evening	WB LRT	60	8.2	A	WB LTR	70	8.2	A
Prospect Street/	Weekday Morning	SB TR	180	8.2	A	SB TR	185	8.3	A
Cushing Street	Weekday Evening	NB LTR	105	7.8	A	NB LTR	105	7.8	A
Prospect Street/	Weekday Morning	SB LT	150	8.1	A	SB LT	150	8.1	A
Meeting Street	Weekday Evening	SB LT	110	7.9	A	SB LT	110	7.9	A
Prospect Street/	Weekday Morning	EB LR	115	15.0	C	EB LR	115	15.3	C
College Street	Weekday Evening	EB LR	135	14.9	B	EB LR	135	15.4	C
Prospect Street/	Weekday Morning	EB LT	15	7.3	A	EB LT	15	7.3	A
George Street	Weekday Evening	EB LT	20	7.7	A	EB LT	20	7.7	A

Source: Synchro 7 software using the procedures in the 2000 Highway Capacity Manual. Compiled by VHB.
1 L= Left-turn movement, T= Through movement, R= Right-turn movement
2 Demand = Demand of critical movement, expressed in vehicles per hour
3 Delay = Vehicle delay expressed in seconds per vehicle (See note below)
4 LOS = Level of service
Note: Interruptions to traffic flow caused by pedestrians, bus blockages, delivery vehicles, parking maneuvers, and double parking vehicles were observed on the study area roadways between intersections. These interruptions caused congestion along these roadways during the peak hour periods. As a result, the observed delay times at some intersections exceeded the calculated values.

■

No-Build Pedestrian, Bicycle, and Transit Conditions

The proposed fitness/aquatic center project is expected to result an increase in pedestrian traffic between the facility and points throughout the campus. Cushing Street will serve as a major pedestrian connection from The Walk and the Pembroke Campus to the new facility. Pedestrian traffic is not expected to increase along Lloyd Avenue as the access to the facility will be primarily via Hope Street. The project is expected to generate approximately 100 to 300 new people trips during the weekday morning and weekday afternoon peak hour periods across Hope Street. These

projected pedestrian volumes were taken into account for the development of the No-Build pedestrian volume networks presented in Figures 3-5, and 3-6 for the weekday morning and weekday evening peak hour conditions, respectively.

No significant changes are expected with the bicycle and transit conditions within or adjacent to the campus in the No-Build conditions. In other words, without the IMP projects, the No-Build conditions for each of these other modes on the campus are expected to be similar to those under Existing conditions. The effect of the proposed IMP projects on the various modes is described in later sections of this chapter.

Build Conditions

The Build Condition includes transportation demand caused by the construction of the projects identified in the IMP over the next 5 years. Because of the uncertainty with longer range plans, it was determined that projections beyond a 5-year time horizon might not be accurate at this stage in the process. Also included in the Build condition projections is the growth in student and faculty/staff numbers. The assumptions for both these calculations are outlined in the following two sections.

Institutional Master Plan Projects

While the IMP outlines various projects planned for the next 5 years, not all the projects are relevant from a transportation demand analysis point of view. For example, projects such as the library annex or renovations to the Hunter Lab are not expected to result in any new demand on the University's transportation system.

Specific projects that are planned to be constructed over the next five to ten years, as outlined in the IMP, that should be considered from a transportation point of view based on discussions with the University are listed below, along with a brief description of the scope of each of the projects. Detailed description of each of these projects is presented elsewhere within the IMP.

1. Extend the connectivity of "The Walk" south of Waterman Street: The location of the existing Plant Environmental Center adjacent to the Hunter Lab does not lend itself to a convenient and direct connection of the Walk to the southerly portions of the campus. The lack of such a direct pedestrian connection to the south is likely contributing to the less than expected usage of The Walk at this time. Part of the Hunter Lab renovation project included in the IMP involves the demolition of the existing Plant Environmental Center so that The Walk can provide a more direct connection to points south of Waterman Street. As a result, after the completion of the Hunter Lab renovation project, more pedestrian activity can be expected at The Walk. This increase was estimated for inclusion in the 2016 pedestrian volume projections for the area.

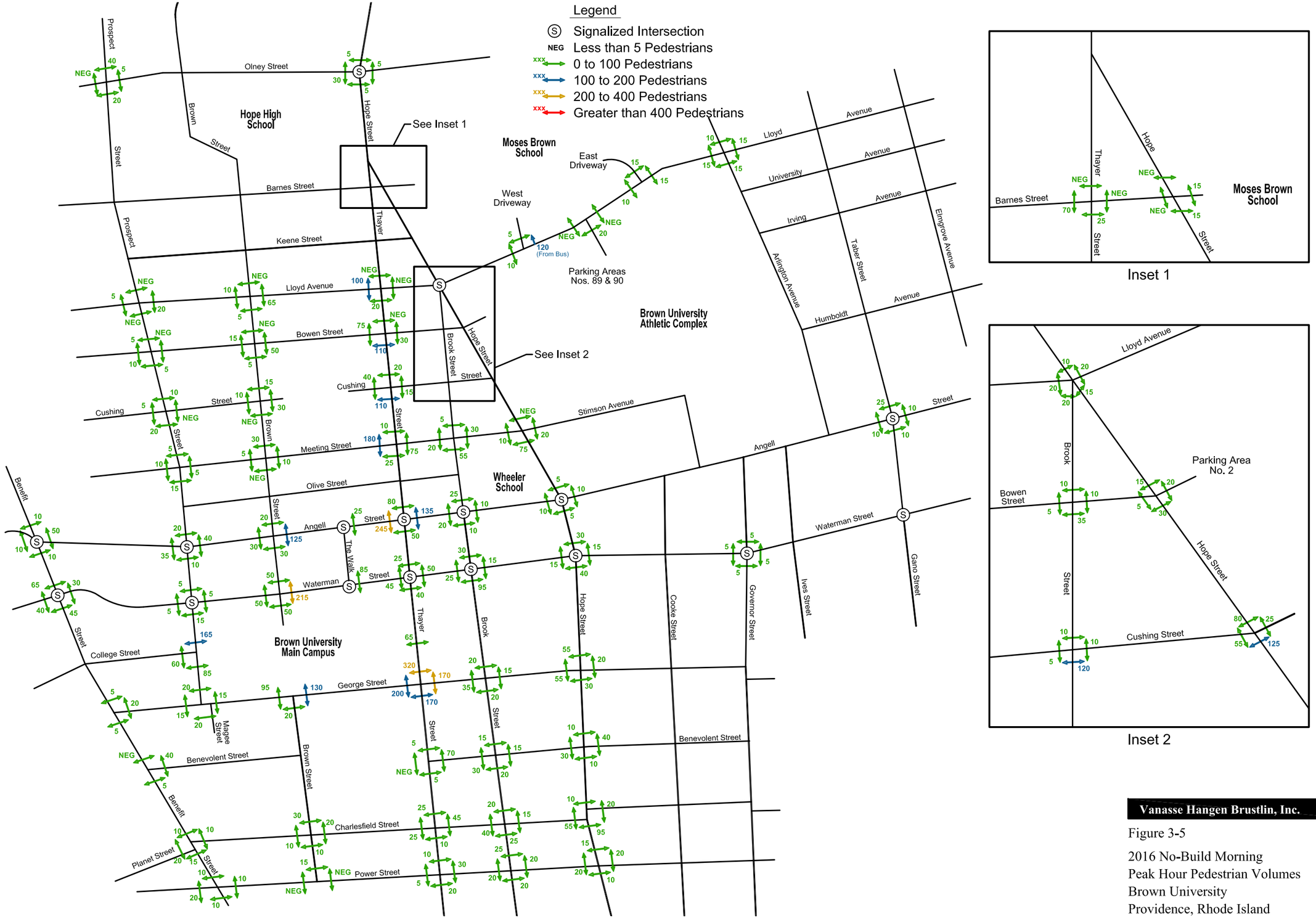


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Figure 3-5

2016 No-Build Morning
Peak Hour Pedestrian Volumes
Brown University
Providence, Rhode Island

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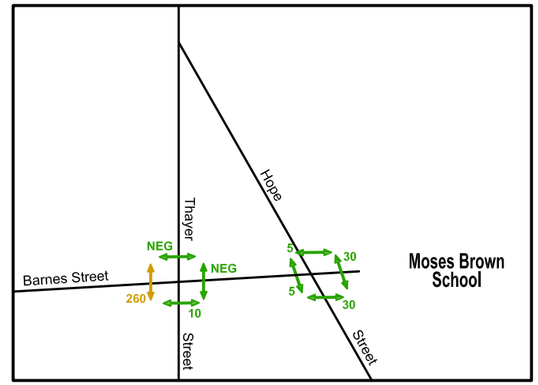

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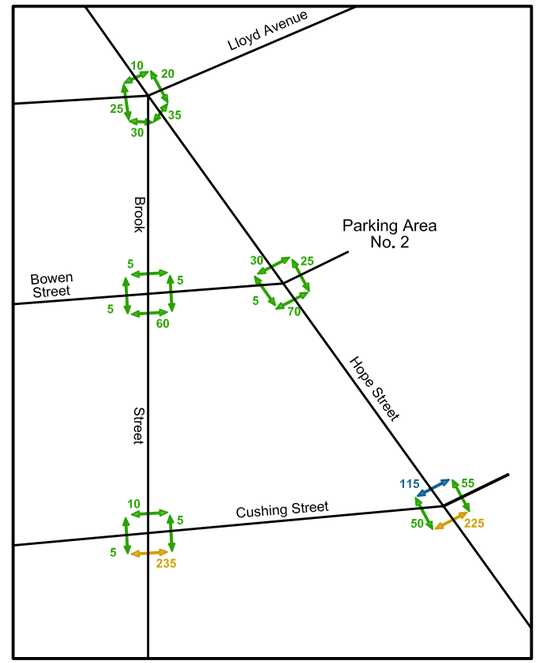

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Figure 3-6

2016 No-Build Evening
Peak Hour Pedestrian Volumes
Brown University
Providence, Rhode Island

2. A 300-space parking garage at the athletic complex: To accommodate the parking demand associated with the majority of events that occur in the Athletic Complex, the IMP includes the construction of a new parking garage with a capacity of approximately 300 spaces in the current location of the Temporary Swim Center. Taking into account the loss of existing surface spaces within the complex as a result of the fitness center project, a net increase of approximately 200 spaces can be expected at the athletic complex. On typical (non sporting event) days, it is expected that the additional parking will serve faculty and staff parking needs. Therefore, traffic projections associated with the usage of the additional parking at the athletic complex during the weekday morning and evening peak hours was considered in the capacity analysis.
3. Conversion of three existing buildings' to residence halls: Brown University estimates that by converting three existing buildings (315 Thayer Street, Saunders Inn located in Gregorian Quad and Wayland Hall, located at the corner of Brown Street/George Street) to fully functioning residence halls, the University can gain approximately 150 beds. While these conversions would not result in any significant changes in vehicular traffic, pedestrian activity in the area can be expected to increase. This increase in pedestrian activity was estimated for inclusion in the 2016 pedestrian projections for the area.

Two additional projects outlined in the IMP: a new soccer stadium within the athletic complex (increasing seating capacity from 1,500 to 2,000), and the Brown to Brown home ownership initiative (involves bringing 26 single family homes on-line in the next five years, are not expected to have noticeable impacts on day to day vehicular and/or pedestrian traffic flows in the area.

The expected vehicular and pedestrian trip generation and reassignments of trips associated with displacement/elimination of parking spaces, based on the above projects, were estimated and included into the Build condition traffic and pedestrian volumes and associated analyses.

■

Increase in Student Enrollment, Faculty, and Staffing Levels

In addition to accounting for vehicular and pedestrian trip projections associated with the implementation of IMP projects outlined above, trip generation estimates based on projected changes in student enrollment and the number of employees at the University was also considered.

Total student enrollment (graduate and undergraduate) at the University in 2011 is approximately 7,500. During the five-year analysis horizon, the student population is expected to increase by a total of approximately 500 students. During the same five-year period, the number of faculty/staff is projected to increase by approximately 150 people. However, this does not translate into an equivalent increase in vehicular

traffic. This is because, before raw University growth estimates are used in transportation demand analysis, appropriate adjustments need to be applied to account for various modes of travel (higher pedestrian mode share for students residing on-campus vs. higher automobile share for students who may choose to reside off-campus, etc.)

Additionally, parking supply for students, the biggest group of the campus population, is aggressively managed and controlled by the University. Limitations imposed on the issuance of parking permits, in and of itself, have the mitigating effect of reduced travel to the campus via personal automobiles. This is evidenced in the campus parking zoning requirements which specifies that students who reside on the campus can be served by a parking ratio of 0.125 (1 space per 8 students), whereas the corresponding parking ratio for commuter students is 0.5 (1 space per 2 students). Thus, constraining the transportation demand analysis by mode of travel and parking limitations on the campus, it is estimated that the campus related vehicular traffic could be expected to increase at approximately 1.3 percent per year over the next five years. This annual growth rate was applied to all of the movements at the study area intersections to develop the 2016 baseline Build traffic volumes. Since a significant proportion of traffic on the campus roadways during the morning and afternoon commuter peak hours are not related to the University, but rather related to traffic traveling through the campus to outside destinations, the application of the growth rate uniformly to all traffic movements at the study intersections results in conservative (higher) transportation demand estimates.

Impact Analysis

Detailed analysis of the impact of the estimated transportation demand on the different modes of accessing the campus are described in the following sections.

Automobile/Pedestrian

As noted earlier, automobile traffic to and from the campus will be impacted in two different ways. First, the minor increases in faculty, staff, and graduate students, will result in more vehicles arriving to the campus. Second, the proposed IMP projects will have an effect on vehicular and pedestrian trip generation and also cause reassignments of some trips which are associated with displacement/elimination of parking spaces. The impact of these factors on traffic operations are outlined below.

Build Condition Vehicular Volumes

The trip generation estimates for planned projects that could affect vehicular volume at the University by 2016 were added to the roadway network based on the existing distribution of trips described in Chapter 2 and estimated traffic shifts due to the building program and shifts in parking. The 2016 Build weekday morning peak hour traffic volumes are presented in Figures 3-7 and 3-8, and the 2016 Build weekday evening peak hour traffic volumes are presented in Figures 3-9 and 3-10.

Build Condition Pedestrian Volumes

Concurrent with changes in vehicular volumes and travel patterns, the projects listed in the IMP would also affect pedestrian volumes and travel patterns through the campus. For analyses purposes, it was assumed that the pedestrian activity in the area would increase by the same percentage as the vehicular traffic (1.3%) compared to existing conditions, even though, based on the growth projections provided by the University for increase in on- and off-campus population pedestrian growth could trend slightly lower than vehicular growth. The resulting 2016 Build weekday morning and weekday evening pedestrian volumes are presented in Figures 3-11, and 3-12, respectively.

Build Condition Traffic Analysis

The 2016 Build conditions traffic volumes were analyzed at all of the study area intersections. The results of this analysis are summarized in Tables 3-3 and 3-4.

As shown, the projects outlined in the IMP for construction in the next 5-year timeframe are expected to result in minor changes in levels of service. The intersections which show degradations in the calculated levels of service are those that are near threshold values or near capacity under No-Build traffic volumes. Although the differences in calculated delay times between No-Build and Build conditions are minimal, as stated previously, the projected future traffic volumes used for the analyses are conservatively high. The actual differences in delays between the two conditions are expected to be less than what is shown.

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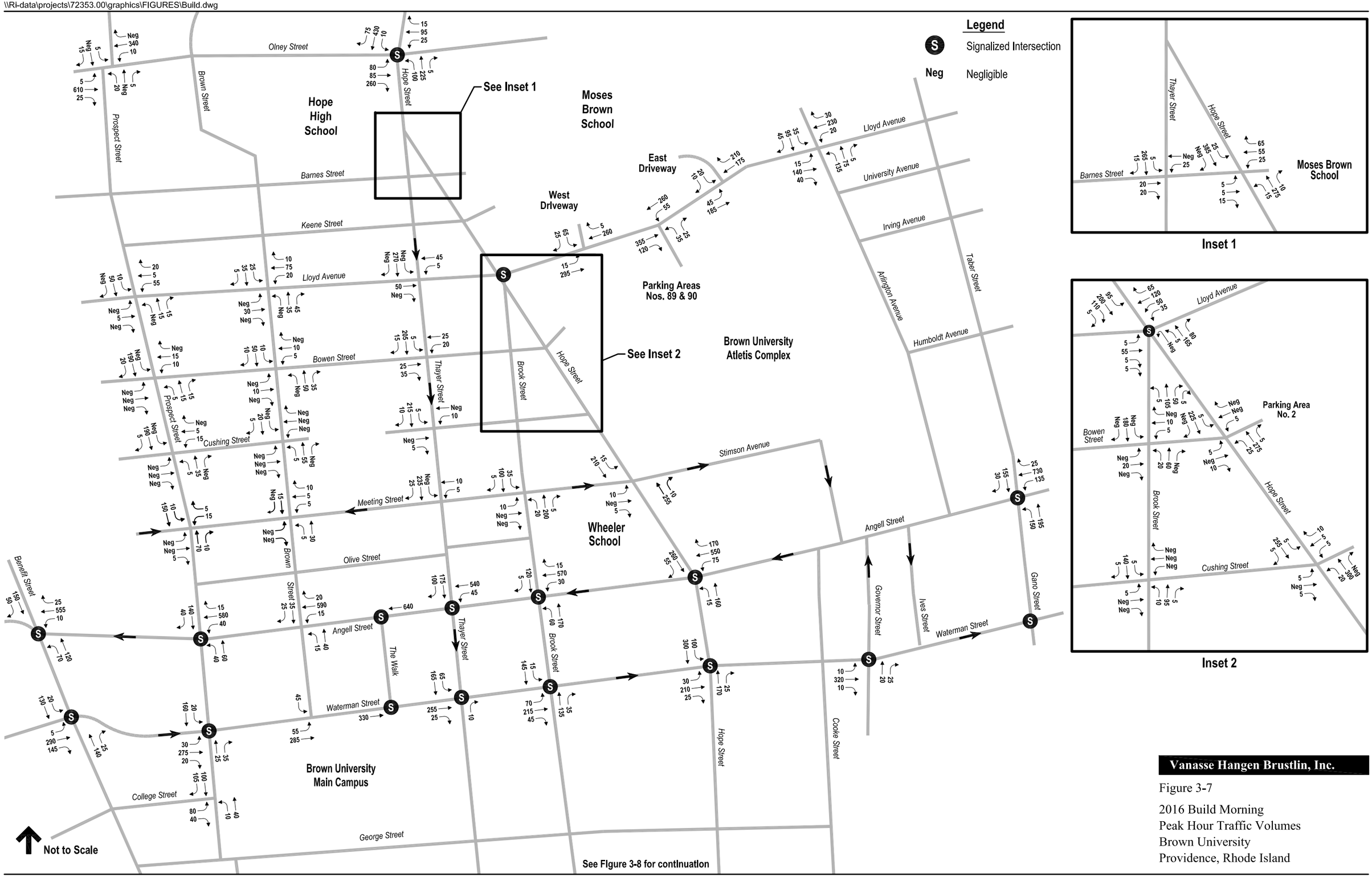

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Vanasse Hangen Brustlin, Inc.

Figure 3-7

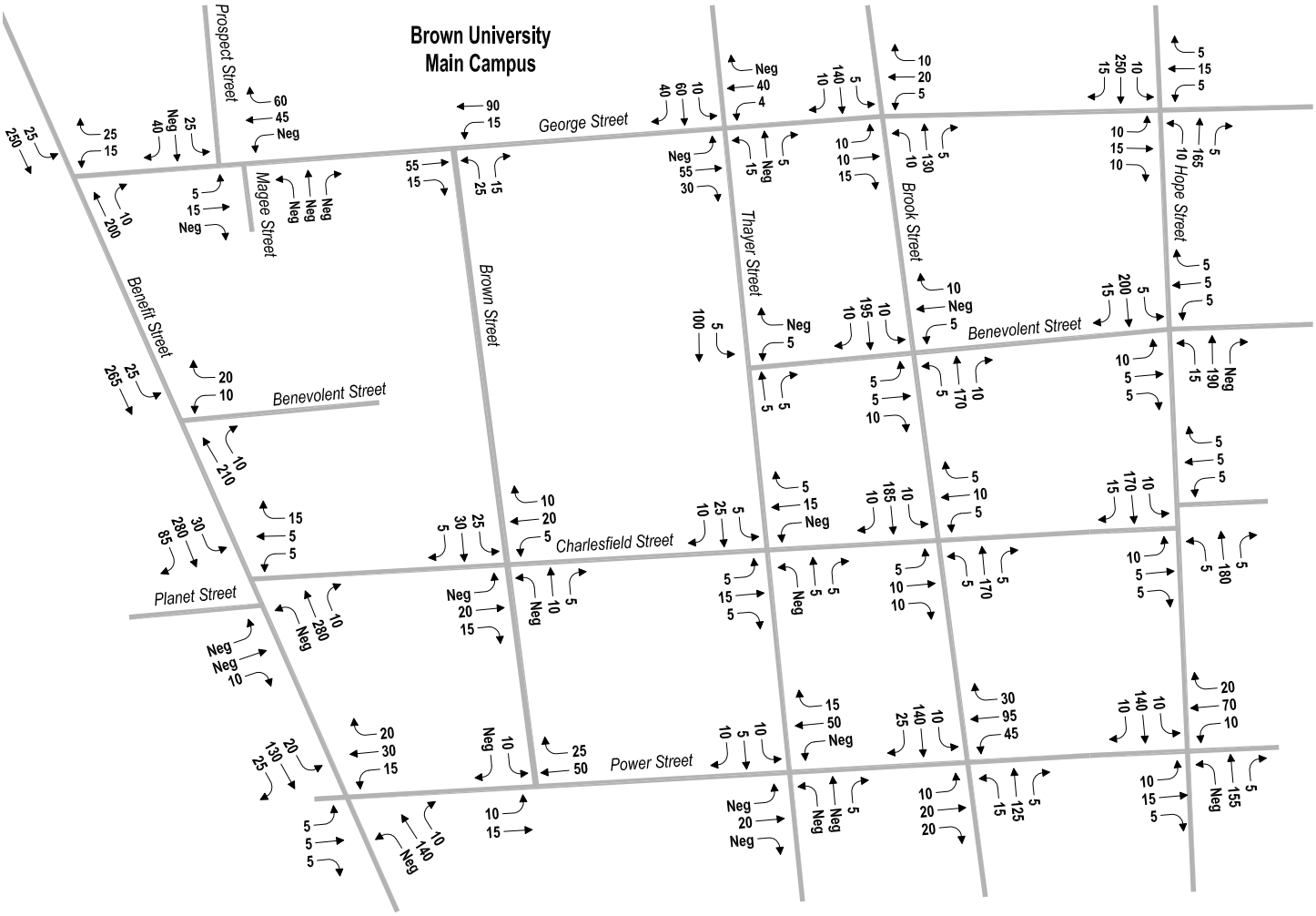
2016 Build Morning
Peak Hour Traffic Volumes
Brown University
Providence, Rhode Island

Legend

S — Signalized Intersection

Neg — Negligible

See FIgure 3-7 for contInuatIon

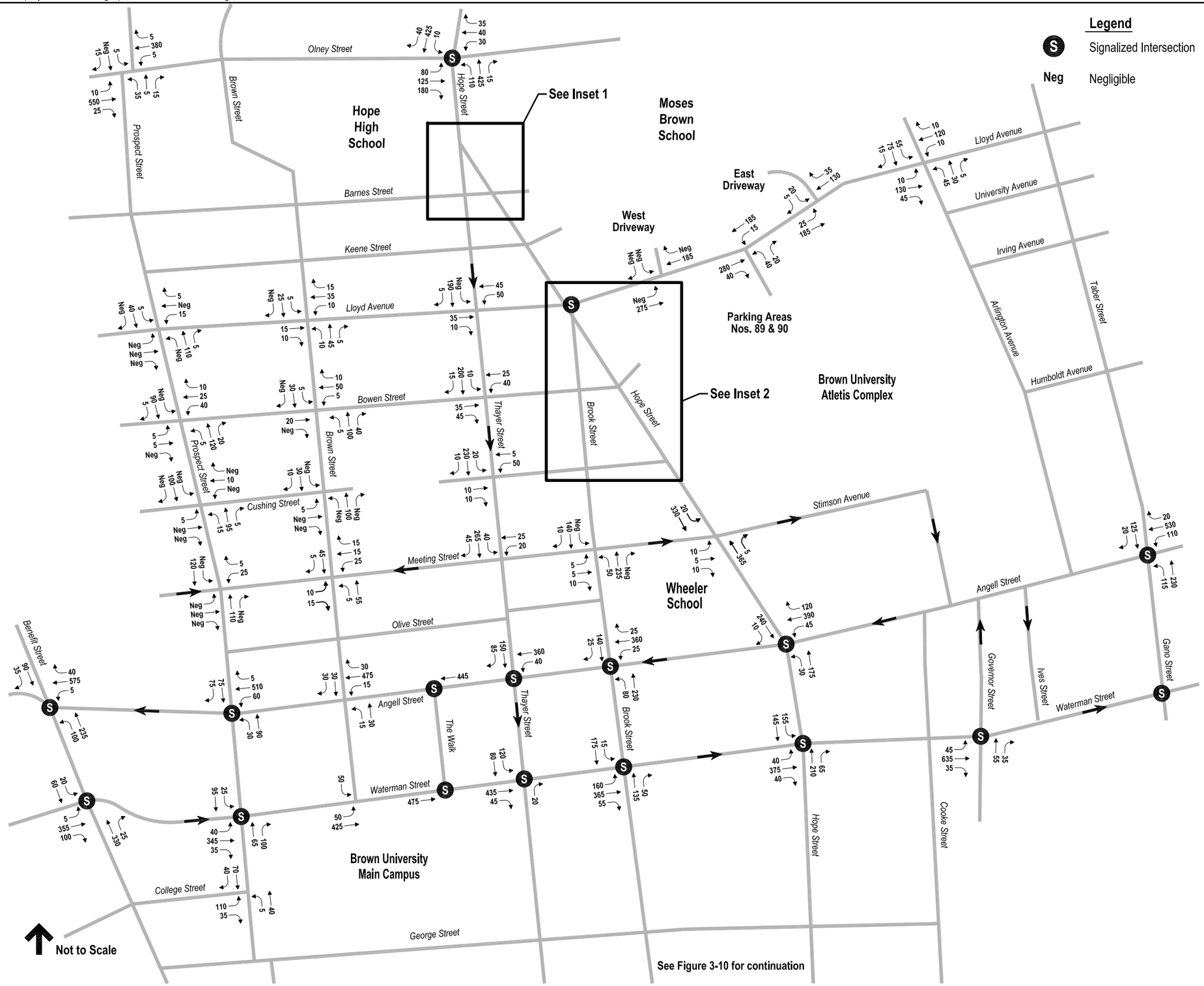


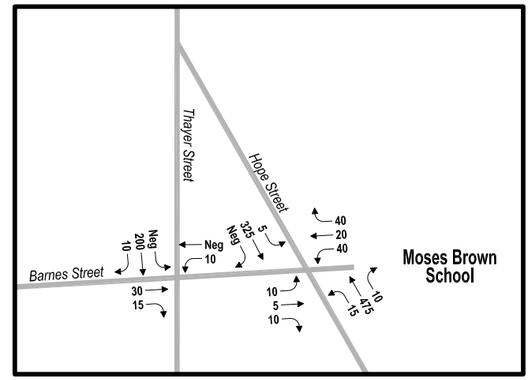
Not to Scale

Vanasse Hangen Brustlin, Inc.

2016 Build Morning
Peak Hour Traffic Volumes
Brown University
Providence, Rhode Island

Figure 3-8





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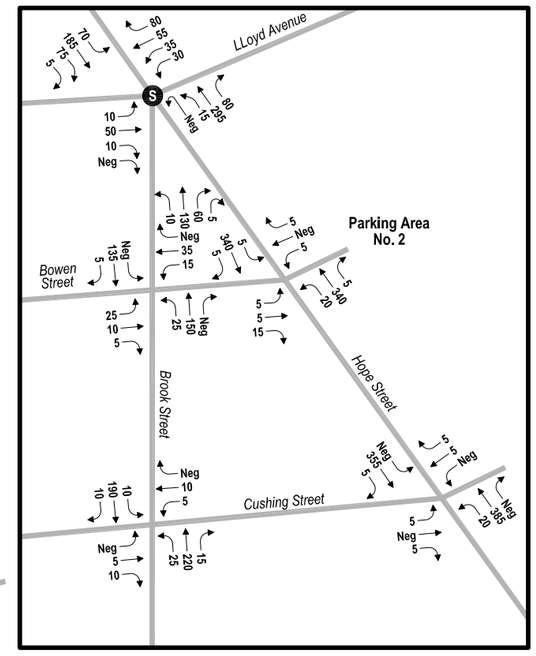

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Vanasse Hangen Brustlin, Inc.

Figure 3-9

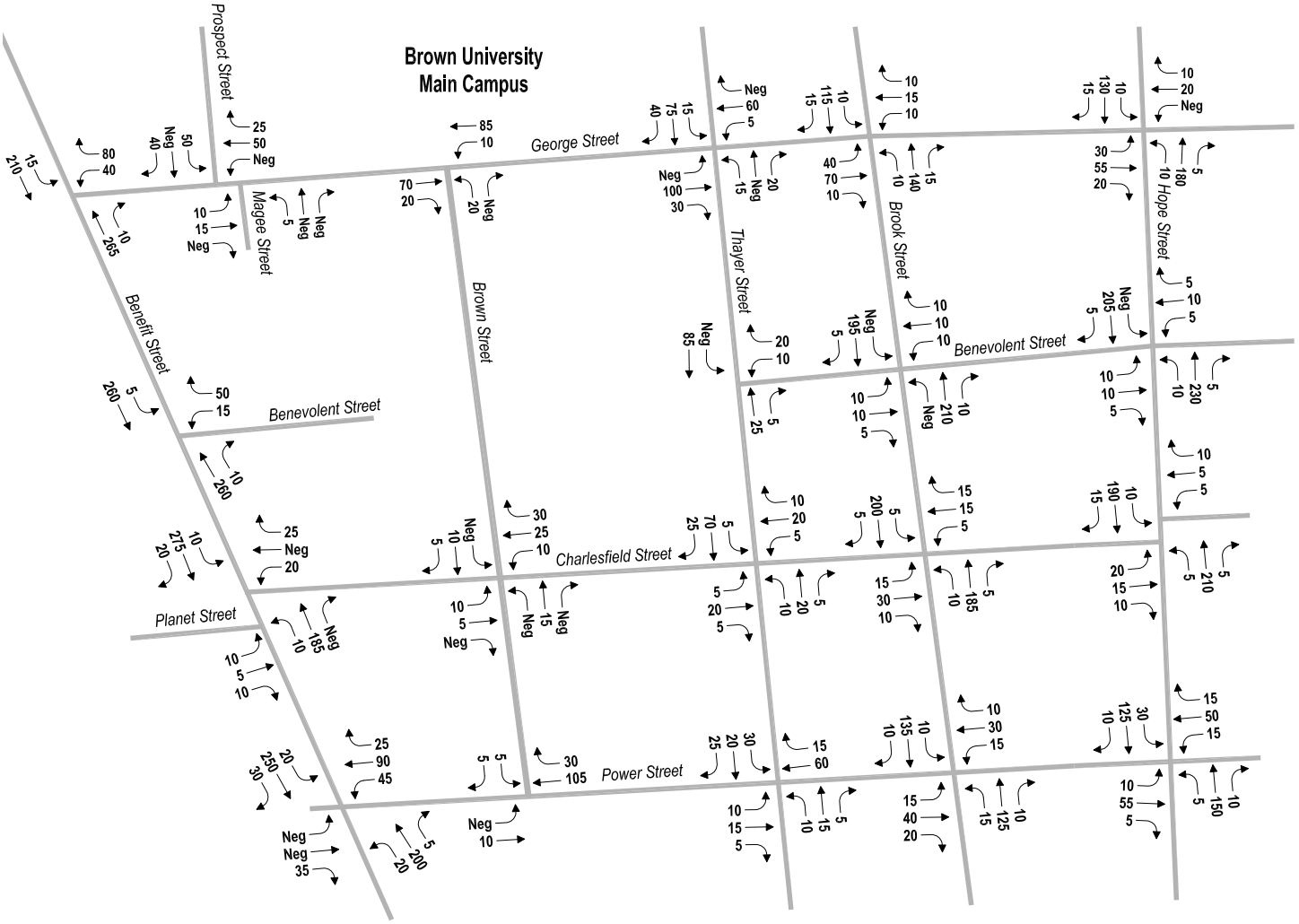
2016 Build Evening
Peak Hour Traffic Volumes
Brown University
Providence, Rhode Island

Legend

S — Signalized Intersection

Neg — Negligible

See FIgure 3-9 for contInuatIon



Not to Scale

Vanasse Hangen Brustlin, Inc.

2016 Build Evening
Peak Hour Traffic Volumes
Brown University
Providence, Rhode Island

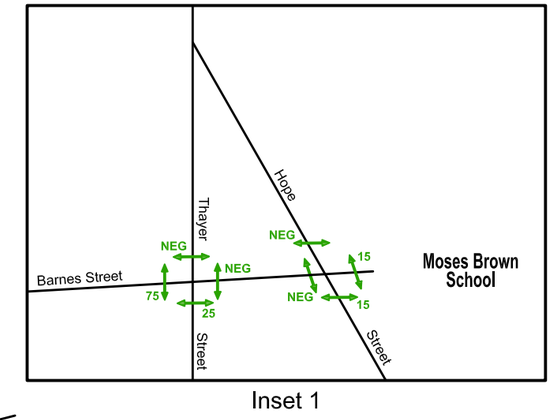
Figure 3-10

Legend

- Signalized Intersection
- NEG Less than 5 Pedestrians
- xxx 0 to 100 Pedestrians
- xxx 100 to 200 Pedestrians
- xxx 200 to 400 Pedestrians
- xxx Greater than 400 Pedestrians

Hope High School
Moses Brown School
Brown University Athletic Complex
Brown University Main Campus
Wheeler School
See Inset 1
See Inset 2
East Driveway
West Driveway
Parking Areas Nos. 89 & 90
(From Bus)

Prospect Street
Olney Street
Brown Street
Hope Street
Barnes Street
Keene Street
Thayer Street
Lloyd Avenue
Bowen Street
Cushing Street
Brook Street
Stimson Avenue
Meeting Street
Olive Street
Angell Street
The Walk
Waterman Street
College Street
George Street
Magee Street
Benevolent Street
Charlesfield Street
Planet Street
Power Street
Benefit Street
Cooke Street
Governor Street
Ives Street
Gano Street
Waterman Street
Lloyd Avenue
University Avenue
Irving Avenue
Humboldt Avenue
Arlington Avenue
Tabor Street
Elmgrove Avenue



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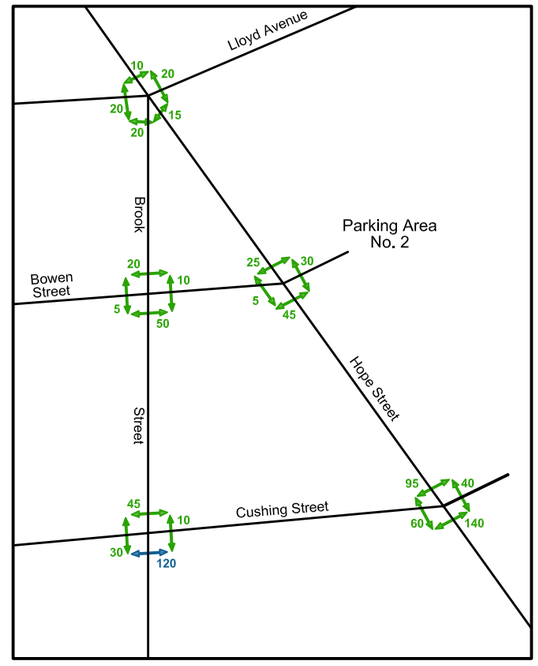


Inset 2

Not to Scale

Vanasse Hangen Brustlin, Inc.

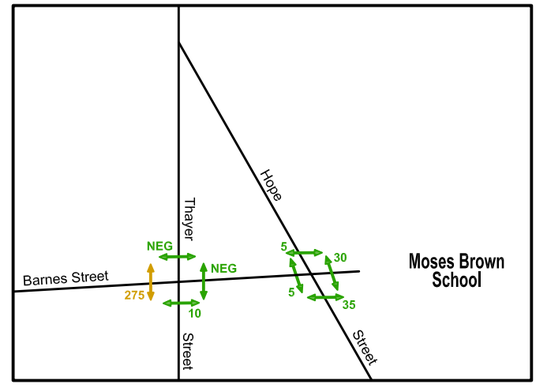
Figure 3-11

2016 Build Morning
Peak Hour Pedestrian Volumes
Brown University
Providence, Rhode Island

Legend

- Signalized Intersection
- NEG Less than 5 Pedestrians
- xxx 0 to 100 Pedestrians
- xxx 100 to 200 Pedestrians
- xxx 200 to 400 Pedestrians
- xxx Greater than 400 Pedestrians

Hope High School
Moses Brown School
Brown University Athletic Complex
Wheeler School
Brown University Main Campus
Parking Areas Nos. 89 & 90
East Driveway
West Driveway
See Inset 1
See Inset 2
Not to Scale



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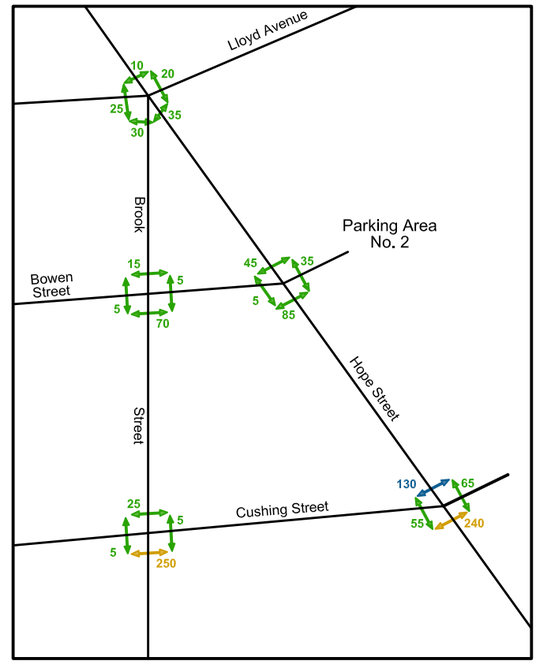

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Vanasse Hangen Brustlin, Inc.

Figure 3-12

2016 Build Evening
Peak Hour Pedestrian Volumes
Brown University
Providence, Rhode Island

Table 3-3
Build Signalized Intersection Capacity Analysis Summary

		2016 No Build			2016 Build		
Location	Peak Hour	V/C[1]	Delay[2]	LOS[3]	V/C[1]	Delay[2]	LOS[3]
Angell Street/	Weekday Morning	0.74	19.7	B	0.82	22.6	C
Gano Street/Taber Avenue	Weekday Evening	0.52	15.2	B	0.56	15.7	B
Angell Street/	Weekday Morning	0.70	16.1	B	0.77	17.0	B
Hope Street	Weekday Evening	0.55	15.8	B	0.60	15.5	B
Angell Street/	Weekday Morning	0.86	19.8	B	0.92	28.1	C
Brook Street	Weekday Evening	0.60	15.7	B	0.65	16.7	B
Angell Street/	Weekday Morning	0.52	1.8	A	0.55	2.0	A
The Walk	Weekday Evening	0.57	9.9	A	0.62	9.8	A
Angell Street/	Weekday Morning	0.63	14.6	B	0.69	16.4	B
Thayer Street	Weekday Evening	0.53	13.2	B	0.59	13.9	B
Angell Street/	Weekday Morning	0.61	11.5	B	0.66	11.6	B
Prospect Street	Weekday Evening	0.60	12.7	B	0.64	13.0	B
Angell Street/	Weekday Morning	0.36	9.1	A	0.40	9.4	A
Benefit Street	Weekday Evening	0.45	7.9	A	0.48	8.4	A
Waterman Street/	Weekday Morning	0.28	11.4	B	0.31	11.4	B
Benefit Street	Weekday Evening	0.49	14.9	B	0.52	15.0	B
Waterman Street/	Weekday Morning	0.44	16.2	B	0.48	16.5	B
Prospect Street	Weekday Evening	0.38	16.8	B	0.41	17.3	B
Waterman Street/	Weekday Morning	0.39	7.9	A	0.43	8.9	A
The Walk	Weekday Evening	0.58	18.0	B	0.62	18.7	B
Waterman Street/	Weekday Morning	0.39	20.5	C	0.43	20.4	C
Thayer Street	Weekday Evening	0.44	20.4	C	0.48	20.0	B
Waterman Street/	Weekday Morning	0.39	20.0	B	0.42	20.2	C
Brook Street	Weekday Evening	0.67	14.8	B	0.73	16.2	B
Waterman Street/	Weekday Morning	0.55	12.3	B	0.59	11.4	B
Hope Street	Weekday Evening	0.71	16.1	B	0.77	16.9	B
Waterman Street/	Weekday Morning	0.14	4.5	A	0.15	4.5	A
Governor Street	Weekday Evening	0.29	4.9	A	0.32	5.0	A
Hope Street/	Weekday Morning	0.88	46.7	D	0.96	48.6	D*
Lloyd Avenue/Brook Street	Weekday Evening	0.71	29.5	C	0.81	32.0	C*
Hope Street/	Weekday Morning	0.75	20.3	C	0.79	21.9	C
Olney Street	Weekday Evening	0.80	21.9	C	0.90	31.8	C

Source: Synchro 7 software using the procedures in the 2000 Highway Capacity Manual. Compiled by VHB.

1 V/C = volume to capacity ratio.

2 Delay = Vehicle delay expressed in seconds per vehicle. See Note below.

3 LOS = Level of service

* Results under the Build condition assumes that the existing faulty loop detectors on the Brook Street and Hope Street approaches are fixed and the traffic signal timings are optimized for the projected peak hour traffic volume conditions.

Note: Interruptions to traffic flow caused by pedestrians, bus blockages, delivery vehicles, parking maneuvers, and double parking vehicles were observed on the study area roadways between intersections. These interruptions caused congestion along these roadways during the peak hour periods. As a result, the observed delay times at some intersections exceeded the calculated values.

Table 3-4
Build Unsignalized Intersection Capacity Analysis Summary

		2016 No Build				2016 Build			
Location	Peak Hour	Critical Movement[1]	Demand[2]	Delay[3]	LOS[4]	Critical Movement	Demand	Delay	LOS
Angell Street/	Weekday Morning	NB LT	50	60.2	F	NB LT	55	56.8	F
Brown Street	Weekday Evening	NB LT	40	36.0	E	NB LT	45	30.6	D
Waterman Street/	Weekday Morning	SB L	40	13.6	B	SB L	45	21.2	C
Brown Street	Weekday Evening	SB L	50	21.6	C	SB L	50	23.2	C
Lloyd Avenue/	Weekday Morning	WB LTR	245	14.6	B	WB LTR	275	18.4	C
Arlington Avenue	Weekday Evening	SB LTR	135	9.4	A	SB LTR	145	9.7	A
Lloyd Avenue/	Weekday Morning	SB LR	30	15.0	B	SB LR	30	15.6	C
Moses Brown East Drive	Weekday Evening	SB LR	25	11.7	B	SB LR	25	12.1	B
Lloyd Avenue/	Weekday Morning	NB LR	30	14.9	B	NB LR	60	23.8	C
Parking Areas Nos. 89 & 90	Weekday Evening	NB LR	30	11.4	B	NB LR	60	13.6	B
Lloyd Avenue/	Weekday Morning	SB LR	90	26.8	D	SB LR	90	31.3	D
Moses Brown West Drive	Weekday Evening	Driveway closed during this peak period				Driveway closed during this peak period			
Hope Street/	Weekday Morning	WB LTR	145	34.4	D	WB LTR	145	46.3	E
Barnes Street/Moses Brown	Weekday Evening	WB LTR	100	35.9	E	WB LTR	100	45.9	E
Hope Street/	Weekday Morning	WB LTR	5	15.6	C	WB LTR	5	17.8	C
Bowen Street	Weekday Evening	WB LTR	10	16.7	C	WB LTR	10	18.9	C
Hope Street/	Weekday Morning	EB LR	10	16.3	C	EB LR	10	18.3	C
Cushing Street	Weekday Evening	EB LR	10	27.6	D	EB LR	10	32.8	D
Hope Street/	Weekday Morning	EB LTR	15	12.5	B	EB LTR	15	13.4	B
Meeting Street	Weekday Evening	EB LTR	20	15.2	C	EB LTR	25	18.9	C
Hope Street/	Weekday Morning	SB LTR	245	10.1	B	SB LTR	275	10.7	B
George Street	Weekday Evening	NB LTR	175	9.4	A	NB LTR	190	9.7	A
Hope Street/	Weekday Morning	EB LTR	20	12.7	B	EB LTR	20	13.3	B
Benevolent Street	Weekday Evening	EB LTR	25	14.6	B	EB LTR	25	15.4	C
Hope Street/	Weekday Morning	EB LTR	20	15.4	C	EB LTR	20	16.4	C
Charlesfield Street	Weekday Evening	EB LTR	30	17.8	C	EB LTR	40	20.5	C
Hope Street/	Weekday Morning	NB LTR	150	9.3	A	NB LTR	165	9.7	A
Power Street	Weekday Evening	SB LTR	145	8.9	A	SB LTR	165	9.3	A
Brook Street/	Weekday Morning	SB T	170	8.3	A	SB T	180	8.4	A
Bowen Street	Weekday Evening	NB LT	160	8.9	A	NB LT	175	9.1	A
Brook Street/	Weekday Morning	EB LTR	5	14.2	B	EB LTR	5	14.8	B
Cushing Street	Weekday Evening	WB LTR	15	14.5	B	WB LTR	15	17.2	C
Brook Street/	Weekday Morning	EB LTR	10	14.2	B	EB LTR	10	14.9	B
Meeting Street	Weekday Evening	EB LTR	20	12.6	B	EB LTR	20	13.2	B
Brook Street/	Weekday Morning	NB LTR	130	8.1	A	NB LTR	145	8.3	A
George Street	Weekday Evening	NB LTR	155	8.6	A	NB LTR	165	8.8	A
Brook Street/	Weekday Morning	WB LTR	20	11.5	B	WB LTR	20	11.9	B
Benevolent Street	Weekday Evening	WB LTR	25	14.1	B	WB LTR	25	14.8	B

Table 3-4 (Continued)
Build Unsignalized Intersection Capacity Analysis Summary

		2016 No Build				2016 Build			
Location	Peak Hour	Critical Movement[1]	Demand[2]	Delay[3]	LOS[4]	Critical Movement	Demand	Delay	LOS
Brook Street/	Weekday Morning	WB LTR	20	12.5	B	WB LTR	20	13.1	B
Charlesfield Street	Weekday Evening	EB LTR	55	17.9	C	EB LTR	55	19.8	C
Brook Street/	Weekday Morning	SB LTR	155	9.6	A	SB LTR	175	10.1	B
Power Street	Weekday Evening	NB LTR	135	8.6	A	NB LTR	150	8.9	A
Thayer Street/	Weekday Morning	WB LT	30	13.2	B	WB LT	30	13.2	B
Barnes Street	Weekday Evening	WB LT	10	14.4	B	WB LT	15	14.3	B
Thayer Street/	Weekday Morning	WB LT	50	11.7	B	WB LT	50	12.0	B
Lloyd Avenue	Weekday Evening	WB LT	85	19.0	C	WB LT	95	20.7	C
Thayer Street/	Weekday Morning	WB LT	45	13.5	B	WB LT	45	14.0	B
Bowen Street	Weekday Evening	WB LT	55	16.6	C	WB LT	65	18.6	C
Thayer Street/	Weekday Morning	WB LT	10	12.4	B	WB LT	15	13.2	B
Cushing Street	Weekday Evening	WB LT	50	37.7	E	WB LT	55	49.4	E
Thayer Street/	Weekday Morning	WB LT	15	14.8	B	WB LT	15	15.4	C
Meeting Street	Weekday Evening	WB LT	45	19.1	C	WB LT	45	19.7	C
Thayer Street/	Weekday Morning	SB LTR	90	7.7	A	SB LTR	110	7.9	A
George Street	Weekday Evening	SB LTR	115	8.1	A	SB LTR	130	8.3	A
Thayer Street/	Weekday Morning	WB LR	5	7.4	A	SB T	95	7.5	A
Benevolent Street	Weekday Evening	SB T	75	7.4	A	SB T	85	7.5	A
Thayer Street/	Weekday Morning	SB LTR	25	7.1	A	SB LTR	35	7.3	A
Charlesfield Street	Weekday Evening	SB LTR	85	7.5	A	SB LTR	95	7.6	A
Thayer Street/	Weekday Morning	EB LTR	25	7.3	A	EB LTR	25	7.3	A
Power Street	Weekday Evening	WB TR	70	7.5	A	WB TR	75	7.6	A
Benefit Street/	Weekday Morning	WB LR	35	12.0	B	WB LR	40	12.2	B
George Street	Weekday Evening	WB LR	105	13.6	B	WB LR	120	14.5	B
Benefit Street/	Weekday Morning	WB LR	30	11.9	B	WB LR	30	12.3	B
Benevolent Street	Weekday Evening	WB LR	65	12.1	B	WB LR	65	12.1	B
Benefit Street/	Weekday Morning	WB LTR	25	13.1	B	WB LTR	25	13.6	B
Charlesfield St/Planet St	Weekday Evening	EB LTR	25	13.0	B	EB LTR	25	13.6	B
Benefit Street/	Weekday Morning	SB LTR	180	8.5	A	SB LTR	175	8.5	A
Power Street	Weekday Evening	SB LTR	285	10.8	B	SB LTR	300	11.4	B
Brown Street/	Weekday Morning	WB LTR	95	7.9	A	WB LTR	105	8.1	A
Lloyd Street	Weekday Evening	SB LRT	30	7.5	A	SB LTR	30	7.5	A
Brown Street/	Weekday Morning	WB LTR	20	7.6	A	WB LTR	20	7.6	A
Bowen Street	Weekday Evening	NB LTR	135	8.0	A	NB LTR	145	8.1	A
Brown Street/	Weekday Morning	NB LT	55	0.7	A	NB LT	60	0.6	A
Cushing Street	Weekday Evening	EB L	5	10.2	B	EB L	5	10.6	B
Brown Street/	Weekday Morning	EB LR	5	7.4	A	EB LR	5	7.4	A
Meeting Street	Weekday Evening	NB LT	55	7.7	A	NB LT	60	7.7	A

Table 3-4 (Continued)
Build Unsignalized Intersection Capacity Analysis Summary

		2016No Build				2016 Build			
Location	Peak Hour	Critical Movement[1]	Demand[2]	Delay[3]	LOS[4]	Critical Movement	Demand	Delay	LOS
Brown Street/	Weekday Morning	NB LR	35	11.9	B	NB LR	40	12.5	B
George Street	Weekday Evening	NB LR	25	13.1	B	NB LR	25	14.0	B
Brown Street/	Weekday Morning	SB LTR	60	7.5	A	SB LTR	60	7.5	A
Charlesfield Street	Weekday Evening	EB LTR	15	7.3	A	EB LTR	15	7.3	A
Brown Street/	Weekday Morning	SB LR	10	9.2	A	SB LR	10	9.3	A
Power Street	Weekday Evening	SB LR	10	9.4	A	SB LR	10	9.4	A
Prospect Street/	Weekday Morning	NB LTR	20	25.5	D	NB LTR	25	30.3	D
Olney Street	Weekday Evening	NB LTR	50	36.9	E	NB LTR	55	47.5	E
Prospect Street/	Weekday Morning	WB LTR	70	7.6	A	WB LTR	80	7.6	A
Lloyd Avenue	Weekday Evening	NB TR	110	7.7	A	NB TR	115	7.7	A
Prospect Street/	Weekday Morning	SB TR	180	8.1	A	SB TR	190	8.2	A
Bowen Street	Weekday Evening	WB LTR	70	8.2	A	NB LTR	140	8.4	A
Prospect Street/	Weekday Morning	SB TR	185	8.3	A	SB TR	200	8.4	A
Cushing Street	Weekday Evening	NB LTR	105	7.8	A	NB LTR	110	7.8	A
Prospect Street/	Weekday Morning	SB LT	150	8.1	A	SB LT	160	8.2	A
Meeting Street	Weekday Evening	SB LT	110	7.9	A	SB LT	120	8.0	A
Prospect Street/	Weekday Morning	EB LR	115	15.3	C	EB LR	120	16.2	C
College Street	Weekday Evening	EB LR	135	15.4	C	EB LR	145	16.4	C
Prospect Street/	Weekday Morning	EB LT	15	7.3	A	EB LT	20	7.3	A
George Street	Weekday Evening	EB LT	20	7.7	A	EB LT	25	7.7	A

Source: Synchro 7 software using the procedures in the 2000 Highway Capacity Manual. Compiled by VHB.
1 L= Left-turn movement, T= Through movement, R= Right-turn movement
2 Demand = Demand of critical movement, expressed in vehicles per hour
3 Delay = Vehicle delay expressed in seconds per vehicle (See note below)
4 LOS = Level of service
Note: Interruptions to traffic flow caused by pedestrians, bus blockages, delivery vehicles, parking maneuvers, and double parking vehicles were observed on the study area roadways between intersections. These interruptions caused congestion along these roadways during the peak hour periods. As a result, the observed delay times at some intersections exceeded the calculated values.

As indicated in Chapter 2 – Existing Conditions, it is important to note that the capacity analysis software analyzes the operation at the intersections only. Interruptions to traffic flow caused by pedestrians, crossing guards, bus blockages, delivery trucks, parking maneuvers, double parked vehicles, and extended vehicle queues from adjacent traffic signals often occur between the signalized intersections. These interruptions can block traffic from getting to and/or through the signalized intersections resulting in congestion between intersections. Blockages of traffic on approaches or departures of a signalized intersection will degrade the overall operation of the intersection and can result in severe congestion if the volume of traffic at the intersection is at or near capacity.

Due to the fact that the capacity analysis does not totally take into account disruptions to traffic flow between intersections, the reported delay times and resulting levels of service can be underestimated. In this case, the capacity analysis software is a tool used to identify problem areas and to give a comparison between existing and future conditions.

Future Parking & Public Transportation Issues

As noted earlier, a detailed discussion of proposed parking supply in relation to future demand estimates as well planned enhancements to the campus transit system which is part of the more comprehensive Transportation Demand Management program for the University, are handled elsewhere in the IMP and are therefore excluded from this document.

■

Loading and Service

Since the completion of the 2006 Plan, the University has implemented a new materials handling plan. The plan involves shifting away from sidewalk based pick-ups and deliveries to a more consolidated strategy, which is intended to reduce the visibility of trash and materials coming into the University and reduce the truck traffic associated with transport of these materials. By consolidating these activities to specific loading docks, the University the University has started to more efficiently manage truck traffic and the flow of materials.

As part of the IMP projects at the athletic complex, the University plans to eliminate loading and drop off zone in front of the buildings. Loading for both buses and materials will occur off of Lloyd Avenue for the auditorium and the gymnasium, while loading for the athletic center and the new fitness/aquatic center will occur via the service road that will run behind the complex.

The University intends to continue to enhance and adjust its material handling plan to take into account additional efficiencies that are afforded by new projects that come on-line as part of the IMP process.

4

Improvement Measures

Brown University recognizes that it is a significant generator of transportation activity in terms of vehicle traffic and pedestrian activity within the East Side of the City of Providence. Although the development associated with the IMP does not generate significant transportation demand, the University has developed a transportation improvement program that addresses the impacts of the specific projects, improves in the University's management of its transportation facilities, and strives to reduce its impact on the operation of the transportation system serving the campus.

The cornerstone of the University's improvement plan that does not directly deal with roadway geometric and traffic signal enhancements is its Transportation Demand Management (TDM) program. As with most well thought out TDM plans, strategic investments in certain automobile trip reduction measures, combined with incentives that promote the use of alternative modes of transportation, has the ability to provide a superior return-on-investment when compared to comparable investments in physical/structural improvement measures such as roadways and traffic signals. Specifics of the University's planned enhancements to its TDM program are discussed in detail elsewhere within the IMP.

Enhancements to the Transportation Demand Management Program

As noted in chapter 2, Brown University continues to provide a number of successful transportation demand management (TDM) programs in response to the needs of the students, faculty, and staff and in concert with the urban environment of the campus. The IMP outlines the following enhancements to the current TDM program in order to encourage alternatives to driving and parking at the campus:

- Continue to invest over $200,000 per year in streetscape and pedestrian improvements on city streets including sidewalk replacement, accessible curb

cuts, new street trees with an engineered soil mix, and crosswalks at various locations in the campus

- Improve campus shuttle routes with more frequent headways
- Continue of RIPTA UPass program and establish thru-routes for RIPTA buses from areas with high university-related population
- Expansion of Zip Car program
- Implement a pilot bike-share program
- Increase parking fees to create a disincentive to traveling by personal automobile
- Assistance with the implementation of additional recommendations from the College Hill Parking Task Force

Additional information on University TDM measures can be found elsewhere within the IMP.

Roadway Infrastructure Improvements

Although only minor traffic impacts are associated with the IMP projects, improvements are recommended to continue to improve the overall traffic operations and pedestrian environment throughout the campus.

Traffic Signal Improvements

Hope Street at Lloyd Avenue/Brook Street

During VHB's field inventory and observations, it was noted that the vehicle detection on the Brook Street and Hope Street approaches to the Hope Street/Lloyd Avenue/Brook Street intersection was not working properly, which contributed to some of the peak hour congestion observed at that location. As part of the transportation improvements associated with the implementation of the IMP projects, it is recommended that the faulty loop detectors be replaced, and the traffic signal control equipment be upgraded and the timings at the intersection be adjusted for optimal operations at the intersection. Build condition analysis results in Table 3-4 show the projected operations at the intersection after completion of the IMP projects and installation of new vehicle detection and signal timing adjustments.

Angell Street and Waterman Street Corridors

As noted in Chapter 1, the major traffic signal improvement project along Angell Street and Waterman Street identified in the 2006 Plan has already been

implemented, and is currently being finalized and fine tuned. While the analysis presented in this report does not identify the need for further significant investment in such solutions to support the planned IMP projects, it is recommended that traffic signal timings/coordination settings be revisited and fine tuned at regular intervals to ensure that the overall traffic signal system on the campus continues to operate optimally.

■

Pedestrian Related Improvements

In addition to an optimally operating traffic signal system, it is important that IMP projects on the campus be paired with pedestrian related improvements that are aimed at improving safety and minimizing driver confusion. The remainder of this section discusses one specific location where such measures may be warranted and outlines a series of measures that may be considered at locations across the campus.

Lloyd Avenue Improvements

As noted in Chapter 2, approximately half of the pedestrian traffic along Lloyd Avenue was observed to be Moses Brown School related. The majority of the school bus drop-off and pick-up activity for the school occurs on Lloyd Avenue at the west driveway. While the majority of the school bus students were observed to be dropped off on Lloyd Avenue heading westbound, some students were dropped off on Lloyd Avenue eastbound. These students were observed to cross Lloyd Avenue to the west driveway with the help of a crossing guard. Students walking along the south side of Lloyd Avenue also used the designated crosswalk with the help from a crossing guard.

With the completion of the IMP projects at the athletic complex, including the fitness center, new parking garage, and the new soccer stadium, and associated changes to the traffic circulation pattern relative to traffic entering/exiting the athletic complex, it is expected that Lloyd Avenue would experience additional vehicular and pedestrian activity when compared to the existing conditions.

Based on VHB's review of the existing and projected future conditions, it is recommended that certain pedestrian enhancements/traffic calming improvements such as curb extensions (bump-outs) and high visibility crosswalk treatments such as a Rapid Rectangular Flashing Beacon (RRFB) system be considered at the west driveway for Moses Brown School on Lloyd Avenue to help improve the pedestrian environment, promote lower travel speeds and increase driver awareness of pedestrian crossing locations.

Additional Pedestrian Improvements

As previously stated, the University has been involved with the painting of over 100 crosswalks with enhanced signing for pedestrians throughout the campus. The University will work with the City of Providence Department of Public Works and Division of Traffic Engineering to identify and implement additional measures to further enhance the overall pedestrian environment around the Brown University campus. These measures would complement the capacity enhancement and pedestrian improvement measures that have already been implemented around the campus, and they can be tailored to meet specific needs of the individual locations where such improvements are necessary. Suggested enhancements are summarized below.

Maintain consistent, highly visible crosswalk striping throughout the campus

All crosswalks should be the City of Providence standard "piano key" style, which are more visible to drivers on approaches to the crosswalks and they should be reflectorized so they are visible at night. At locations where there is a significant amount of pedestrian activity, and especially at mid-block pedestrian crossings, wider crosswalks should be considered. In addition, elimination of additional parking on approaches to crosswalks should be considered if needed to improve sight distance for pedestrians.

Upgrade and maintain signing to meet the latest standards

When used, all Pedestrian and School signs located at a crosswalk should be supplemented with a downward diagonal arrow. It is recommended that the highly visible fluorescent yellow-green background signs be used when such new signs are installed. Non-standard signs such as "Stop for Pedestrians", "Stop for Pedestrians in Crosswalk", and "Yield for Pedestrians in Crosswalk" should be removed and replaced with the Manual of Uniform Traffic Control Devices (MUTCD) standard "Yield Here to Pedestrians" signs where appropriate. The signs should be installed on the crosswalk approaches 20 to 50 feet in advance of the nearest edge of the crosswalk, and not at the actual crosswalk location. The signs should be supplemented by yield lines (row of triangles pointing towards approaching vehicles), and parking should be prohibited in the area between the yield line and the crosswalk.

It is recommended that regular maintenance schedules of campus infrastructure include ensuring that signs are free of stickers and graffiti to maximize their visibility.

Install curb extensions (bump-outs or bulb-outs) at certain locations

Curb extensions increase the visibility of pedestrians and should be considered where there are higher pedestrian and vehicle volumes and higher travel speeds. The use of curb extensions needs to be evaluated at each specific intersection to ensure that required turning movements can still be achieved. An alternative at some locations where pedestrian activity is expected to be heavy in all directions would be to install a raised intersection to better identify the location as a pedestrian crossing area. However, raised intersection installations needs to be considered carefully after taking into account issues such as snow plow impacts, street cleaning operations and potential for delays to emergency response vehicles.

Suggested locations for consideration of curb extensions (or possibly raised intersections) in addition to the intersection of Hope Street and Cushing Street, where one is proposed as part of the Jonathan Nelson Fitness Center project include:

- Lloyd Avenue at Moses Brown West Drive (previously described).
- Hope Street at Thayer Street/Barnes Street (curb extensions to channelize pedestrians on Hope Street and to calm traffic on Thayer Street southbound).
- Angell Street at Brown Street.
- Waterman Street at Brown Street.
- Angell Street at Thayer Street.
- Waterman Street at Thayer Street.

Enhance pedestrian accommodations at traffic signals

Additional pedestrian accommodations that could be considered at the traffic signals in the area include:

- Installation of pedestrian countdown timers, which provide information to crossing pedestrians to help them make a decision as to whether there is sufficient time to cross the intersection. Countdown timers are now required in the latest edition (2009) of the Manual on Uniform Traffic Control Devices (MUTCD) for all signalized crossings where the required pedestrian crossing interval is greater than seven seconds.
- Programming of leading pedestrian intervals (LPIs). LPIs provide pedestrians a few seconds of lead time to cross before the traffic moving on the same direction receives a green signal indication. This may be used to reduce conflicts between pedestrians and turning vehicles where there is concurrent pedestrian signal phasing.

- Installation of "Turning Vehicles Yield to Pedestrians" (R10-15) signs where there are a large number of conflicts between pedestrians and turning vehicles.
- Conversion to exclusive pedestrian phases where all vehicle traffic stops when the pedestrian phase is active. This would require additional analysis to determine the impact to coordination and queue management between signalized intersections in the system.

5

Short Term Construction Impacts

Construction Management

With respect to the construction of the projects in the IMP, the University will continue to apply the following construction management practices.

■

Parking for Construction Workers

The University requires its contractors to make arrangements for the transportation of workers to the job site. Consistent with past practices and University policy, parking for construction workers working on major projects on College Hill are contractually prohibited from parking on the streets. Limited off-street parking is occasionally permitted within the confines of the specific job site. On site secure storage is made available for worker's tools and supplies, eliminating the need to transport them to and from the job site on a daily basis.

■

Construction Vehicle Traffic Management/Truck Routes

Construction vehicle traffic is controlled in accordance with applicable City regulations and procedures. Construction management plans will be developed for each project and reviewed by the City of Providence Department of Traffic Engineering and the Department of Public Works.

The University works with its contractors to minimize noise and other disturbances associated with construction traffic and construction vehicles are routed to avoid residential neighborhoods. As in past projects, it is expected that construction traffic will use major arterial roadways such as Angell Street, Waterman Street, Gano Street, and Hope Street for access to the construction sites.

Construction traffic and deliveries will be timed to minimize impact to traffic on area streets by scheduling deliveries outside of the peak hour periods to the extent practical.

■

Pedestrian Access/Site Security

Generally, all construction activities will be limited to the project site to minimize impacts on University operations and the public. Protective fencing and barriers will be provided as needed on each project to segregate construction activity from walkways and roadways. Appropriate lighting, temporary sidewalks, and crosswalks will be installed to ensure pedestrian safety.

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Brown University Institutional Master Plan – Amendment #1

submitted June 2012

BROWN

In 2003, Brown University along with the other educational institutions reached an agreement with the City of Providence to make voluntary contributions to the City over the next twenty years. In accordance with that agreement, the University has paid the City $11.5 million since 2003 and $1.2 million this year alone. In addition, the University makes voluntary tax payments on some properties used for educational purposes ($1.2 million) and non-educational purposes ($1.1 million) as well as leased properties ($470,000), for a total annual payment to the City of over $4million. The agreement also stipulates that the University make voluntary transition payments on any property that is acquired and converted to educational use for a period of fifteen years.

Now, with the local economy faltering and the City's financial health in crisis, Brown has forged an additional agreement with the City that dramatically increases its financial support over the next 11 years – an additional $31.5 million. While this short-term financial support is important, the most effective role for the University is to work in a productive partnership and be a strong engine for economic growth – providing both direct and indirect employment, attracting research funding and capital investment from out of state, and spawning new commercial ventures.

The new agreement begins to solidify this partnership by including two provisions that have the potential to benefit both the City and the University. Both provisions require specific City Council action and are therefore included in this amendment to Brown's 2011 Institutional Master Plan. In addition, the University has discovered a structural hazard in one of its buildings and is therefore requesting approval to demolish it.

Street Conveyance

In accordance with the recent agreement, Brown has submitted a petition to the City Council to abandon portions of three streets: Olive Street, Brown Street, and Benevolent Street. The specific locations are shown on page 4. In each case the intent of the abandonment is to help create a safer and more welcoming environment for pedestrians, and like other areas of the campus they will remain open to the public except for specific events. At Olive Street loading zones will be created at both ends servicing the BioMed Complex, Sidney Frank Hall, the Granoff Center for Creative Arts, and the Brown Bookstore, but in the middle pedestrians will be the prime consideration as the landscape of The Walk will continue across the street. At Brown Street and Benevolent Street, inviting pedestrian thoroughfares will be created with important gateways to campus at the entry points. All three streets will include provisions for emergency vehicles and easements for the public utilities currently located in the streets.

Based on previous traffic studies by VHB, all three streets carry minimal vehicular traffic but very high pedestrian activity. The following table shows rush hour vehicular traffic and pedestrian crossings at adjacent intersections.

	Vehicles/hr.	Pedestrians/hr.
Olive Street	30	220
Brown Street	40	480
Benevolent St.	30	120

While the University has not fully developed plans for the three streets, it is committed to working through an open design process to finalize its plans for each location.

On-Street Parking License

In 2007 Brown convened the College Hill Parking Task Force, a broad based coalition of institutions, neighborhood groups, city departments, and RIPTA working to improve parking and congestion in the College Hill area. In April 2008, the task force issued a set of findings and recommendations, but very few of them have been enacted by the City. The proposed parking license that has been submitted to the City Council is based on the findings of the College Hill Parking Task Force and is a significant step toward the implementation of the recommendations.

The primary finding of the College Hill Parking Task Force was that there are generally enough parking spaces in College Hill, but the on-street parking spaces need to be managed differently in order to optimize their use. First of all, more should be done to reduce demand throughout College Hill. Brown has been working aggressively on this, but the impact has been limited due to the availability of free on-street parking. Second, existing on-street spaces should be regulated in order to encourage appropriate behavior. Currently the number of two-hour spaces significantly outnumbers the demand for short-term parking. Consequently, all-days parkers are encouraged to move their cars every two hours, adding to the traffic and congestion in the area. In fact, a 1993 study conducted in New York suggested that up to 30% of the traffic is caused by drivers simply looking for parking spaces.

The proposed license grants Brown the right to utilize 250 on-street spaces (shown on the map on page 4) for employee parking for the next 20 years. Faculty and staff will be charged by

Brown for a permit to park in these spaces (creating an incentive to use public transit) and they will be allowed to park all day (ending the two-hour shuffle). This right will be exclusive between 8:00 AM and 12:00 PM on weekdays, but at other times parking will be available to the public as two-hour parking. Parking regulations will be enforced jointly, but all revenues for violations will be collected by the City.

The location of the on-street spaces to be licensed has been specifically selected utilizing data from the College Hill Parking Task Force which mapped the parking demand for the various entities in College Hill against the available spaces. The selected streets have no metered parking, nor do they have significant overlapping demand from other entities.

Because it is specific to the non-exclusive use of on-street parking spaces, the proposed license will also have no effect on the University's overall off-street parking calculation. Nevertheless, an updated calculation is shown below.

	2012 People	**2012 Spaces**
Faculty & Staff	3984	1328
On-Campus Students	5084	636
Off-Campus Students	2725	1363
Calculated Requirement		3326
Current Inventory (off street)		2630
Grandfathered Shortage		931
Calculated Surplus		**235**

Demolition of Sanford Gold

Located at 285 Tockwotten Street (or 230 India Street), Sanford Gold is a flat roof, two story brick building, approximately 26,000 sf. It was originally part of the Union Oil Company complex that occupied much of the area near the former railroad yards, dating back to 1875. In 1919 the entire complex was purchased by the American Cottonseed Oil Company, and in 1926 the eastern half of the complex, including this building, was purchased by the Eastern Asbestos and Rhode Island Sales Company. The building was finally purchased by Brown University in 1981 and was used for storage until 2003.

Because the property is outside of the Institutional Zone it has been underutilized for several years. Brown recently commissioned Odeh Engineers, to perform a structural assessment of the building. The report identified a number of significant issues, including severe and widespread deterioration of the exterior brick walls, deterioration of interior load bearing walls, bulging and separating exterior walls, rotten heavy timber floor and roof framing, and several isolated structural deficiencies. Together these issues create an unstable condition, and the costs of repairs are quite significant. While the University uses the adjacent workshop building for academic purposes, our long term planning will likely result in future disposition of this property. Consequently, the University is seeking to move forward with plans to demolish the building. After demolition the site will be planted with grass and street trees.

Photos of Sanford Gold

Amendment #1


Streets where Brown Leases On-Street Parking Spaces
Streets that Brown Purchased
Number of On-Street Parking Spaces per block
ADA Parking Space
Saferide Stop
Fire Hydrant
Brown University Buildings
200' 0 200' 400'
2 LOAD ZONE
2 LOAD ZONE
Sharpe Refectory
Watson Institute
Geo Chem
Sciences Library
Watson Center
Prince Lab
Barus & Holley
Rockefeller Library
Sayles Hall
Wilson Hall
Lyman
Salomon
Faunce House
Manning
University Hall
Rhode Island Hall
Wilbour Hall
Sears
Wriston Quad
Keeney Quad
Goddard
Harkness
Graduate Center
Vartan Gregorian Quad
Barbour Hall
Young Orchard
Grant/Fulton
TF Green
Power Street Parking Garage
President's House
Nightingale-Brown House
121 South Main
Benefit Street
Thayer Street
George Street
Waterman Street
Angell Street
Meeting Street
Brown Street
Hope Street
Williams Street
Power Street
Charlesfield Street
Benevolent Street

City Plan Commission
Angel Taveras, Mayor

June 20, 2014

Lori Hagen, Second Deputy City Clerk
Office of the City Clerk
Providence City Hall
25 Dorrance Street
Providence, RI 02903

Re: Notice of Approval for amendment to Brown University's Institutional Master Plan (IMP)
Applicant: Brown University

Dear Ms. Hagen:

The City Plan Commission (CPC) reviewed the amendment to Brown University's IMP on Tuesday, June 17, 2014 at a regular meeting. The CPC voted unanimously as described below to make certain findings of fact and to approve the amendment to the IMP.

IMP Amendment Overview

Section 503 of the Zoning Ordinance requires institutions to file an IMP with the CPC that describes the institution's proposed development over the next five years or more. The CPC reviews master plans and amendments for compliance with the City's Comprehensive Plan and Zoning Ordinance.

Brown University's current IMP amendment describes proposed changes in property holdings, updates to the parking schedule, expansion of the school of engineering, rehabilitation of the South Street Power Station and improvements scheduled for Thayer Street.

The amendment identifies the Handbook for Physical Planning as the source of planning principles that will guide campus planning and design through this IMP cycle. The Handbook builds on the Strategic Framework for Physical Planning at Brown University developed in 2003. The six key planning principles are:

1. Prioritize academic uses on College Hill
2. Celebrate the Brown scale
3. Energize the Core with a mixture of uses
4. Engage Thayer Street
5. Connect the campus
6. Consolidate landholdings and catalyze partnerships

Summary

The changes to each component of the amendment are hereby summarized:

School of Engineering Expansion

The applicant intends to house the addition to the School of Engineering in a new building on Brook Street providing 80,000 SF of space adjacent to the existing school of engineering site. The building will house research space, clean rooms, faculty offices and support space. The existing Engineering School (Barus and Holley/ Prince Lab) will be separated from the building by open greenspace.

The plan notes that construction of the building will require the demolition of four buildings located at 29 and 37 Manning Street and 333 and 341 Brook Street. Two of the buildings are occupied by the applied math program. The Public Archaeology Lab has conducted research on the houses and begun documentation of each structure.

A new structure providing 13,000 SF will be erected on a site now used as a parking lot at the corner of Hope and George Street to accommodate the displaced applied math labs. The building will transfer lot users to other sites and two large trees will be removed.

Rehabilitation of South Street Power Station

Brown University is partnering with the University of Rhode Island (URI) and Rhode Island College (RIC) to rehabilitate the South Street Power Station to provide administrative space for Brown and space for the URI and RIC nursing education center. Two floors will be added to the top of the building and entrances will be provided from Eddy Street and Point Street. A new parking garage and new graduate student housing at adjacent Davol Square will be built on the site.

Brown will be a long term tenant of the property and consolidate a number of administrative functions within the building.

Thayer Street Improvements

In 2013, Brown partnered with the City and various stakeholders to study the Thayer Street area. The study found the need for a strong management entity, physical improvements and a focus on non-retail commercial uses.

According to the amendment, Brown has created more space by widening sidewalks at the intersection of Thayer Street with Cushing and Meeting Street and adding street furniture. These efforts would coincide with other projects like the repaving and restriping of Thayer, Brook, Bowen and Meeting Streets, the construction of a parklet and improvement of the top of the bus tunnel. Brown will also work with Thayer Street merchants to address the conduct of business patrons.

Property holdings

The amendment includes an update to Brown's land holdings detailing the sale of underutilized properties and those that are part of the Brown-to-Brown ownership program and acquisition of strategic properties.

Properties to be sold are 38 Taft Ave, 95 Brown Street, 93 Brown Street, 109 Brown Street, 134 Hope Street and 240 Bowen Street. 271 Thayer Street, the current location of City Sports will be acquired.

Parking and Transportation Plan
Brown provides a total of 2,774 parking spaces over more than 100 separate lots. That number includes parking spaces on the recently abandoned portions of Olive, Brown and Benevolent Street. The current parking supply projects a surplus of 231 spaces. Taking into account increases in staff and enrollment, the surplus is projected to increase to 249 spaces and includes spaces expected from future garages in the athletic complex and near the South Street power station.

FINDINGS

Providence Tomorrow
Strategy F of Objective LU-7 of Providence Tomorrow: The Comprehensive Plan requires educational institutions to provide five year IMPs to ensure that there is limited growth and negative impacts on neighborhoods. In addition, IMPs are expected to be updated with any new developments between plans. The CPC found that Brown satisfactorily described growth and changes that had occurred since the plan was last presented. By addressing how new development would affect surrounding neighborhood, the CPC found the amendment to be consistent with Strategies A and B of Objective LU-7.

The CPC found that the statement about the provision of parking and its effect on traffic management was consistent with Objectives M-1 and M-6, which promote provision of varied transportation and parking options.

Zoning Ordinance
The CPC found that the amendment followed the format prescribed by the Zoning Ordinance, including all required elements outlined in Section 503.4 (C). The CPC found the amendment to be consistent with the applicable regulations contained in the Zoning Ordinance.

ACTION

Based on the analysis and findings contained in this report, the CPC approved Brown University's IMP amendment.

Please post this notice for 20 days.

Note that this approval does not require any action by the City Council.

Sincerely,

Bonnie Nickerson
Director of Long Range Planning

cc: Michael McCormick, Brown University

Brown University Institutional Master Plan – Amendment #2

submitted May 20, 2014

BROWN

“The mission of Brown University is to serve the community, the nation, and the world by discovering, communicating, and preserving knowledge and understanding in a spirit of free inquiry, and by educating and preparing students to discharge the offices of life with usefulness and reputation. We do this through a partnership of students and teachers in a unified community known as a university-college.”

On October 27, 2012, Brown inaugurated Christina Paxson as its 19th President. With this came a renewed focus on Brown's mission and its goals for the future. This was especially appropriate as the University celebrates its 250th anniversary, reminding all of us how far-reaching the direction we set truly is.

In response, the University initiated a number of planning efforts intended to guide us over the next decade. While none of these efforts signal a significant shift in direction, they provide a more clear vision of Brown in the decades to come. This amendment is intended to capture these plans and facilitate collaboration with the City and our neighbors.

The pages that follow include brief descriptions of the University's new strategic plan, *Building on Distinction: a New Plan for Brown*, and its corresponding physical framework, *Handbook for Physical Planning*. They also describe three initiatives that flow directly out of these plans, transforming parts of both College Hill and the Jewelry District:

1. Expansion of the School of Engineering
2. Rehabilitation of South Street Power Station
3. Reinvestment in the Thayer Street area

All of these initiatives are multi-pronged efforts with several related pieces. As such they require careful planning and coordination, so their execution can have the desired overall effect. This amendment is intended to supplement the information included in the 2011 Institutional Master Plan and enable us to move forward with these initiatives.

Building on Distinction: A New Plan for Brown

In October 2013, the Brown Corporation approved *Building on Distinction: A New Plan for Brown*. This strategic plan offers the broad vision and goals to ensure Brown's capacity to fulfill its mission of teaching, research and service at the highest levels. The plan builds on the core values of intellectual independence, creativity, collaborations, and social purpose to achieve greater levels of academic distinction - uniting innovative education and outstanding research to benefit the community, the nation, and the world. The document reinforces the University's commitment to four key areas: Integrative Scholarship, Educational Leadership, Academic Excellence, and Campus Development that supports Brown's aspirations. A full version can be found at:

http://www.brown.edu/web/documents/BuildingOnDistinctionOct262013.pdf

Handbook for Physical Planning

A new framework plan that corresponds with the vision outlined in the strategic plan was also created in 2013. The plan builds on the *Strategic Framework for Physical Planning at Brown* developed in 2003, but with a new focus on the campus as a physical analog to Brown's open curriculum. Based on this idea, six planning principles were developed to help direct the campus development:

1. Prioritize academic uses on College Hill
2. Celebrate the Brown scale
3. Energize the core with a mixture of uses
4. Engage Thayer Street
5. Connect the campus
6. Consolidate landholdings and catalyze partnerships

The framework plan is set up as a handbook, intended to guide decisions, rather than provide a prescriptive plan. Several examples of how the principles can shape future proposals are given and one case study – the expansion of the School of Engineering – is used to show how the principles can be applied as criteria against which proposals can be evaluated.

In addition, the University continues to develop more focused area plans, including a master plan for the Barus & Holley block, an updated utilities master plan, an assessment and vision for performing arts, and a Sustainability Strategic Plan. A complete version of the *Handbook for Physical Planning* and other area plans can be found at:

http://www.brown.edu/Facilities/Building_Brown/resources/

Contributions to the City

In 2003, Brown University along with the other educational institutions reached an agreement with the City of Providence to make voluntary contributions to the City and to make transition payments over 15 years on any properties that are acquired and converted to educational use. Then in 2012, Brown forged an additional agreement with the City that dramatically increased its financial support. Today total annual tax payments and voluntary contributions are over $8 million per year.

While this support is important, the most valuable role for the University to play is contributing to the

economic vitality of the city and state and to be a productive partner – providing both direct and indirect employment, attracting research funding and capital investment, and spawning new commercial ventures. A recent Appleseed report demonstrates the annual economic value Brown University provides to the State, including:

- $725 million of economic output, including direct University jobs, employment by contractors and vendors, spending by students and visitors, and a multiplier effect.
- $179 million of federal research spending
- $159 million of goods and services (including construction) from Rhode Island companies
- 98 patent applications filed for new technologies developed at Brown.

The goal is to build on this success and serve as an effective catalyst for economic growth. Both the new strategic plan and the framework plan for the campus make this objective very clear. The full Appleseed report can be found at:

http://brown.edu/about/reports/economic-impact/

Community Input

At Brown, it is a strongly held belief that an open and collaborative process helps ensure the best outcome. The development of this amendment is no exception. Brown has worked closely with local stakeholders and is committed to continuing community input throughout the implementation of the plan. For this amendment, Brown delivered over 250 letters, posted the draft on-line, and held the following meetings. While unanimity is difficult to achieve, the amendment clearly benefitted from this input.

2/28/14 Community Working Group
2/24/14 Representative Edie Ajello
2/28/14 Senator Gayle Goldin
2/26/14 City Council members
3/5/14 PPS – Planning & Architecture Review
3/714 Planning Department Staff
3/7/14 Neighbors of the School of Engineering
3/12/14 Neighbors of the School of Engineering
5/2/14 Community Working Group
5/13/14 Open Community Forum
5/14/14 Open Community Forum
5/20/14 PPS Board
5/20/14 Planning Department Staff
6/17/14 City Plan Commission

Property Holdings

Brown University is an institution with roughly 6,200 undergraduates, 1,500 graduate and medical students, and 4,200 employees. It currently owns 226 buildings primarily in College Hill and the Jewelry District. Recent changes in property holdings reflect the planning principles in the *Handbook for Physical Planning*, including both the sale of underutilized properties primarily as part of the Brown to Brown Home Ownership Program and acquisition in key locations:

- Sale of 38 Taft Avenue Day Care
- Sale of 95 Brown Street (Brown to Brown)
- Sale of 93 Brown Street (Brown to Brown)
- Sale of 109 Brown Street (Brown to Brown)
- Acquisition of 271 Thayer Street (City Sports)
- Sale of 134 Hope Street (Brown to Brown)
- Sale of 240 Bowen Street

Parking & Transportation Plan

Brown employs an extensive set of demand management measures in its effort to reduce parking demand, including: RIPTA UPass, ZipCar, Brown University Shuttles, RISD Rides, carpooling, guaranteed ride home, increasing parking fees, and very limited student parking. Usage numbers for these programs continue to grow, so Brown is building on this success and exploring a pilot Bike Share program that would tie into a citywide network.

For those who drive, the University provides 2774 parking spaces in over 100 separate lots, including the recently acquired portions of Olive, Benevolent, and Brown Streets. In addition, Brown has licensed 250 spaces on city streets near the campus for its exclusive use from 8:00-12:00. This allows Brown to charge for the use of on-street parking spaces while the City collects the revenues from violations.

Brown's off-street parking requirement is a calculation based on the number of people on campus. The table below illustrates the calculation for the current year and for the next five years. The projected 2019 numbers include growth in students and employees, and future parking garages in the athletic complex and near the South Street Power Station. Licensed on-street spaces are not included.

	2014 People	**2014 Spaces**	**2019 People**	**2019 Spaces**
Employees	4255	1418	4331	1444
On-Campus Stu.	5008	626	5313	664
Off-Campus Stu.	2860	1430	3003	1502
Required Spaces		3474		3610
Current Supply		2774		2928
Grandfathered		931		931
Calc. Surplus		**231**		**249**

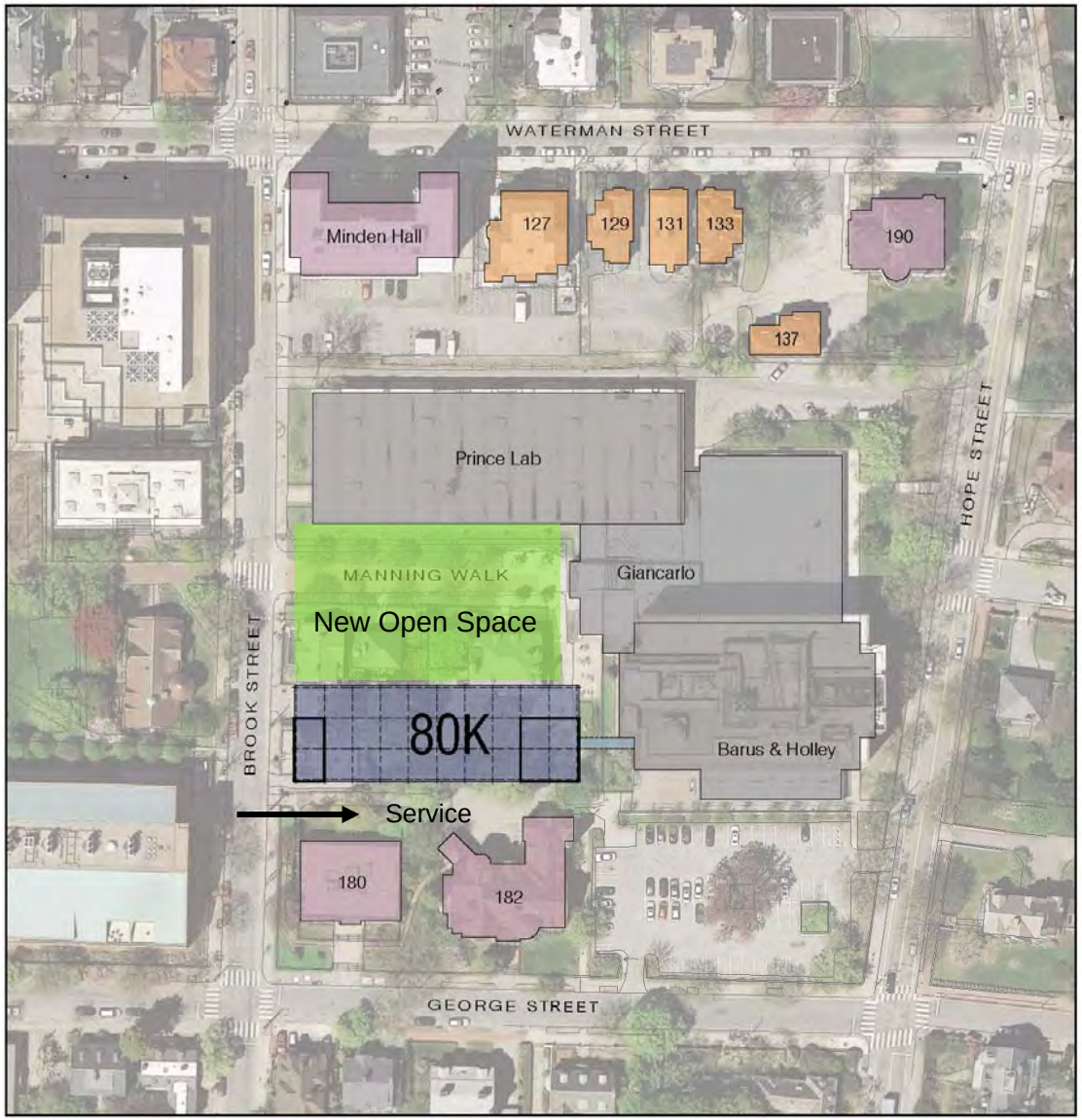
School of Engineering Expansion

The third oldest civilian engineering program in the country and the oldest in the Ivy League, officially made the transition to a School of Engineering in 2011. Focusing on key strategic areas, including Biology and Health Care, Energy and the Environment, Information Technology for the Future, and Entrepreneurial Innovation, the newly created school can broaden its reach and impact. To accomplish these goals, the school has a plan for 30% growth in the faculty and more advanced research space.

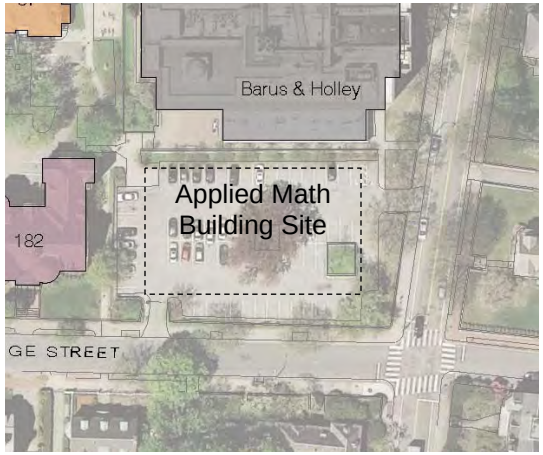
After carefully analyzing whether this growth should occur on College Hill or in the Jewelry District (documented in the *Handbook for Physical Planning*), the University is planning to construct a new building adjacent to the existing home of Engineering - Barus & Holley/Prince Lab. This new building will house research space, clean rooms, faculty offices, and support space in approximately 80,000 gsf. There will be a direct connection to the existing complex, but the footprint and the height will be limited to reduce its perceived mass. The building will be four stories tall with a minimal rooftop penthouse.

The project also includes the creation of a major new open space at the end of the primary east / west axis of the campus, creating a gathering space for the students and faculty and providing capacity to reduce the storm water run-off. A conceptual site plan is show at the right.

Building such a significant project on College Hill requires extensive enabling work. The site is in the core of the campus, but it is currently occupied by four houses, all owned by Brown and used for academic purposes. Two of the houses are occupied by the Division of Applied



Math, which is headquartered in the adjacent 182 George Street. To accommodate the space required to relocate Applied Math and to maintain the connection to its headquarters, a new building of approximately 13,000 gsf is planned in place of the parking lot on the corner of Hope Street and George Street. This building is intended to transition from the existing Barus & Holley complex to the residential neighborhoods on the opposite sides of both George Street and Hope Street. The parking lot will be demolished, faculty and staff parkers will be reassigned, and two large trees (in declining health) will be removed. The building site shown below is intended to identify the site rather than the footprint. It is assumed the design of the new building will occupy only a portion of the site.



With the occupants relocated, the four houses on the site of the new Engineering building will have to be demolished. The Public Archaeology Lab has already conducted historic research on the houses and has begun the appropriate documentation of each:

37 Manning: Designed by Prescott Clarke, later of Clarke & Howe, this house was built in 1900 in the colonial revival style likely as a speculative house. It was initially purchased by Herbert Hinkley, who owned it until his death. The house changed hands a couple of times before Brown acquired it in 1961. It has been converted to a business use, but is otherwise in good condition. Its footprint is 52'x 43', wider than most of the surrounding street right-of-ways, making relocation very difficult.

29 Manning: This lot was originally owned by Herbert Hinckley as part of the 37 Manning property, but after his death it was sold to a local architect J. Peter Gedes, who designed and built a modern style house in 1938. The architect and his wife, Daniel Burnham's daughter, occupied the house until 1967, when it was acquired by Brown. Although it has been converted to a business use, because of its size, it has limited usefulness to the University.

341 Brook: This house was constructed in 1900 by an unknown builder and purchased by Wallace Chandler, an executive from Standard Mill Supply. It changed hands several times before Brown acquired it in 1967. It has not been fully converted to a business use, so significant code upgrades would be required to reuse the space as an academic office space.

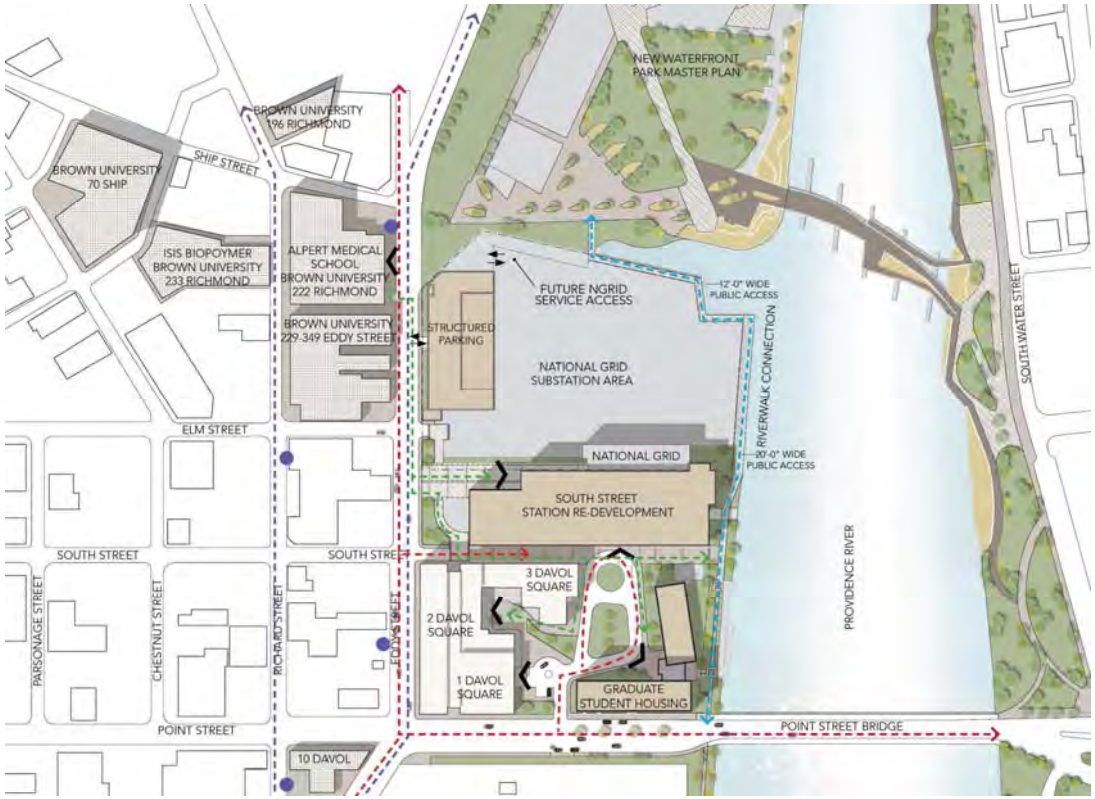
333 Brook: This house was constructed in 1900 by Howland Wood for his parents. It changed hands a few times before becoming the Sweeney School of Shorthand from 1938-1965. Brown acquired the property in 1986 and converted it to a business use for academic offices. Again the footprint (40'x42' exceeds most of the surrounding street right-of-ways.

Rehabilitation of South Street Power Station

Since the South Street Power Station ceased operation, several attempts have been made to reuse this magnificent historic structure. In an effort to revitalize the entire area, Brown is partnering with Commonwealth Ventures, LLC, the University of Rhode Island, and Rhode Island College to rehabilitate the historic building and adjacent parcels, bringing both residents and professionals into the Jewelry District.

The rehabilitation of the historic power plant building will be divided equally between the URI/RIC Nursing Education Center and administrative offices for Brown. Two floors will be added to the top and new entrances off Eddy Street and Point Street will be created. The overall development also includes new housing and retail at Davol Square and a new parking garage. See conceptual site plan at right.

Brown's role is in the project is simply committing to a long term lease of roughly 135,000 sf within the historic power station, but it is a good example of the University's ability to serve as a catalyst for projects of this magnitude. The space will be used to consolidate most of the administrative functions of the University, many of which will be moving from College Hill to the Jewelry District. With an estimated influx of approximately 300 Brown employees – plus URI/RIC's Nursing Education Center – the project will also benefit the surrounding neighborhood, providing a new economic vitality.



Thayer Street Improvements

In January 2013 the City initiated a planning study (funded by Brown) to produce an urban design concept for the Thayer Street area based on a comprehensive analysis of the area's character, the market conditions and potential, and the existing regulatory framework. Working with a group of stakeholders that included representatives from the College Hill Neighborhood Association, Thayer Street District Management Authority, Wheeler School, Providence Preservation Society, RIPTA, Brown University, RISD, City Council, and the residential community, the consultants found that the area has significant untapped economic capacity. By promoting a broad mixture of uses and higher densities, and respecting the character of College Hill, it is possible to make a safer and more vibrant street that is an asset to the entire community. Key lessons learned from other similar streets across the country include the need for a strong management entity, physical improvements that create a clean and attractive environment, and focusing on non-retail uses to attract a diverse customer base.

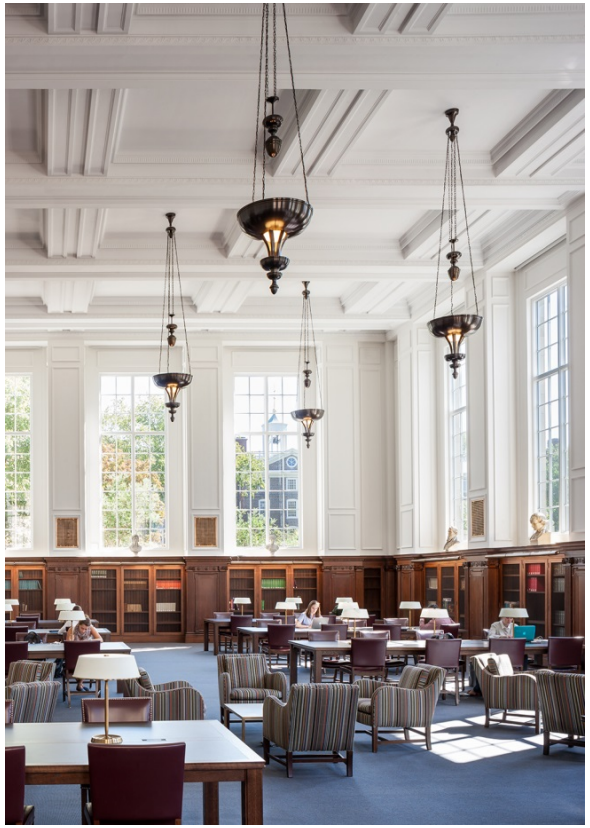
To that end, Brown has committed to creating more public space by widening sidewalks at key intersections (Thayer/Cushing, Thayer/Meeting), improving the alley space at the end of Cushing Street, and adding street furniture. This work is intended to compliment efforts by the City to repave and restripe Thayer Street, Brook Street, Bowen Street, and Meeting Street to make a more pedestrian friendly environment, the PRA's and Thayer Street District Management Authority's construction of a temporary parklet, and RIPTA's plan to enhance the top of the bus tunnel. By leveraging relatively small investments by all parties, substantial overall improvements can be made.

The University is also committed to working with the College Hill Neighborhood Association and the Thayer Street District Management Authority to coordinate advocacy and enforcement in an effort to reduce bad behavior. For example Guide for Business on Thayer Street will be created to set expectations for new and existing merchants on the street, aiding enforcement and a coordinated response to issues. This will take a concerted effort, so the University is increasing its support of the Thayer Street District Management Authority.

Rendering of improved Cushing Street "Alley"

Rendering of Thayer Street Parklet

Brown University Institutional Master Plan – Amendment #3



Submitted December 15, 2015

BROWN

“The mission of Brown University is to serve the community, the nation, and the world by discovering, communicating, and preserving knowledge and understanding in a spirit of free inquiry, and by educating and preparing students to discharge the offices of life with usefulness and reputation. We do this through a partnership of students and teachers in a unified community known as a university-college.”

Building on Distinction: A New Plan for Brown

Approved by the Corporation in 2013, Brown University is guided by our 10-year strategic plan, "Building on Distinction: A New Plan for Brown," which offers the broad vision and goals to ensure the University's capacity to fulfill its mission of teaching, research and service at the highest levels. The plan builds on the core values of intellectual independence, creativity, collaborations, and social purpose to achieve greater levels of academic distinction – uniting innovative education and outstanding research to benefit the community, the nation, and the world. A full version can be found at: http://www.brown.edu/web/documents/BuildingOnDistinctionOct262013.pdf

The Handbook for Physical Planning

A new framework plan that corresponds with the vision outlined in the strategic plan was also created in 2013. The plan builds on the Strategic Framework for Physical Planning at Brown developed in 2003, but with a new focus on the campus as a physical analog to Brown's open curriculum. Based on this idea, six planning principles were developed to help direct the campus development:

1. Prioritize academic uses on College Hill
2. Celebrate the Brown scale
3. Energize the core with a mixture of uses
4. Engage Thayer Street
5. Connect the Campus
6. Consolidate landholdings and catalyze partnerships

A complete version of the *Handbook for Physical Planning* and other area plans can be found at: http://www.brown.edu/Facilities/Building_Brown/resources/

The Operational Plan

In September 2015 the University completed an operational plan to translate the broad, aspirational goals set out in *Building on Distinction* into concrete actions to be taken over the next 10 years. The "Operational Plan for Brown's Excellence" outlines targeted actions to position Brown to enhance its role as a leader in higher education and research. The plan also will drive the University's comprehensive campaign, launched in October 2015 and guide our Institutional Master Plan in the future.

A complete version of the Operational Plan for Brown's Excellence can be found at: http://www.brown.edu/about/administration/provost/sites/brown.edu.about.administration.provost/files/uploads/Operational%20Plan_FINAL%20PUBLIC_2015.09.15.pdf

Contributions to the Community

In 2003, Brown University along with the other institutions of higher education, reached an agreement with the City of Providence to make voluntary contributions to the City over 20 years and to make transition payments over 15 years on any properties that are acquired and converted to academic use. In 2012, Brown forged an additional agreement with the City that dramatically increased its financial support, providing the City $31.5 million over eleven years. Today total annual tax payments and voluntary contributions are over $8.2 million per year.

This amendment includes an update on the successful Brown-to-Brown (B2B) Homeownership Program. Since 2008, Brown has renovated and sold 12 properties under the B2B program, which generate $123,000 in property taxes for the City annually and generated years of work for tradespeople.

Brown is also an engine for economic development and innovation in the City. Brown is the seventh largest employer in Rhode Island with over 4,500 employees. Brown generates over 8,000 jobs per year through direct payroll, purchasing, construction, and student and visitor spending. Brown attracts and spends $164 million per year on scientific research and development, making the University the leading scientific center in Rhode Island. It is expected that this will grow with continued development of the Jewelry District and the I-195 Redevelopment District in the future.

For more information please see: http://www.brown.edu/about/providence/home

Thayer Street Planning Study

In January 2014 the City completed the Thayer Street Planning Study (funded by Brown) which developed an urban design concept for the Thayer Street area based on a comprehensive analysis of the area's character, the market conditions and potential, and the existing regulatory framework. The planning process incorporated input from merchants, property owners, area residents, and neighboring institutions. The near-term goals were focused on regulatory revisions including the development of design guidelines as well as physical improvements for streetscape enhancement, parking, and branding and marketing. These

Amendment #3

changes will set the stage for realizing the long-term intent of creating a more diverse, vibrant, and safe district of commercial, residential, and institutional uses.

Brown has already completed several streetscape improvements on Thayer and is continuing to work as part of the Thayer Street District Management Association (TSDMA) on strengthening the character, vibrancy, and safety of the area.
This amendment to the 2011 Institutional Master Plan includes projects, partnerships, and acquisitions in alignment with the University's strategic direction and with the 2014 Thayer Street Study's goals.

It is intended to supplement previously approved plans and enable us to move forward with these initiatives.

Community Input

At Brown, it is a strongly-held belief that an open and collaborative process helps ensure the best outcome. The development of this amendment is no exception. Brown has worked closely with local stakeholders and is committed to continuing community input throughout the implementation of the plan. For this amendment, Brown delivered over 200 letters by U.S. Mail and over 600 by email to local residents, posted the draft on-line, and held the following meetings.

11/05/15 Planning Department Staff
11/12/15 Providence Preservation Society – Planning & Architecture Review
11/13/15 Community Working Group
11/20/15 Open Community Forum
12/01/15 Thayer Street District Mgmt. Assoc.
12/02/15 Open Community Forum
12/04/15 Planning Department
12/07/15 College Hill Neighborhood Association
01/19/16 City Plan Commission

Property Holdings

Brown University is an institution with 6,200 undergraduates, 2,600 graduate and medical students, and over 4,500 employees. It currently owns 228 buildings primarily in College Hill and the Jewelry District. Recent changes in property holdings reflect the planning principles in the *Handbook for Physical Planning*, including both the sale of underutilized properties primarily as part of the Brown-to-Brown Home Ownership Program and acquisition in key locations:

Acquisitions

- The following seven residential properties were acquired by Farview Inc. (Brown's wholly owned real estate subsidiary) in a single transaction:

  434 Brook Street
  436 Brook Street
  442 Brook Street
  444 Brook Street
  450 Brook Street
  167 Cushing Street
  169 Cushing Street

- 272 Thayer Street, acquired by Farview – a multi-tenant commercial building, continuing to operate as such.

- 37 Charlesfield Street, acquired by Brown– a single-family residence that has long been a rental unit, leased to students. The building is being renovated as a Brown-to-Brown house (see below).

- 26 Ship Street, acquired by Brown – a two-story office building adjacent to the Alpert Medical School, which will be used for the School's office needs.

Brown-to-Brown

The Brown-to-Brown Home Ownership Program is a program designed to sell Brown-owned residential properties to eligible members of the faculty and staff. This program is a demonstration of Brown's commitment to the City of Providence and its College Hill neighbors by enabling Brown faculty and staff to live in the community. Furthermore, once sold, these properties will become taxable as privately-owned residential properties, adding to the tax base of the City of Providence. To date, the program has renovated and sold a total of 12 properties, including the three below since May 2014:

- 95 Benevolent Street
- 97 Benevolent Street
- 99 Benevolent Street

In addition, three properties are in the process of conversion and will be offered for sale in the near future.

Brook Street Interim Parking

In July 2014 Brown acquired seven contiguous properties, each of which was “improved” with a dilapidated two-unit residential structure. The properties’ previous owner held a longstanding vision of demolition of the structures with redevelopment of the site as a hotel. When those plans were not realized, Brown acquired the property with the intent of redeveloping the site for academic or residential use.

Given the poor condition of the existing structures, Brown is seeking to demolish them now in order to remove the unsightly structures and initially create a landscaped parking lot to serve the needs of the Thayer Street commercial district. The project is in keeping with one of the goals outlined in the Thayer Street Study -- to “establish intelligent and sustainable parking solutions.”

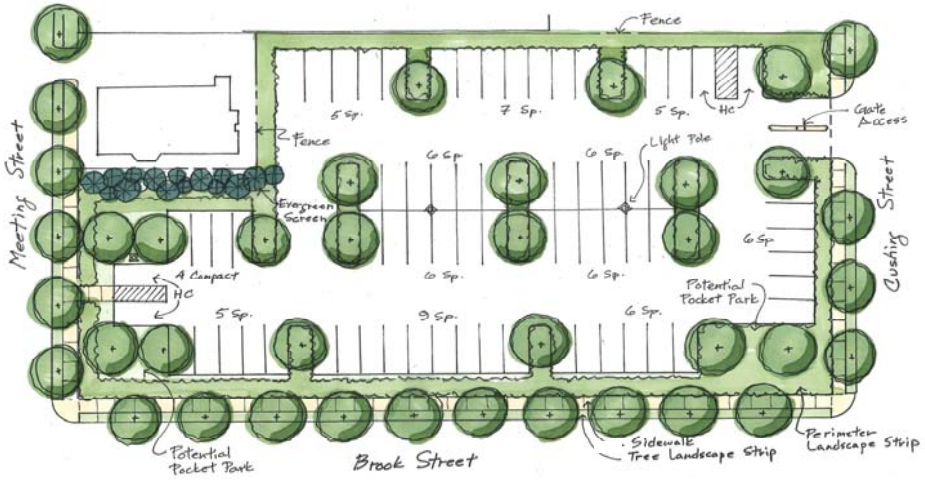
The proposed parking lot will be well-lit and its edges will be carefully landscaped to screen the vehicles from the street. It will be managed by a third-party as a commercial lot, not as a permit parking lot for Brown faculty, staff or students.

In the long-term, the University is interested in developing the site to meet emerging residential or academic needs.

The structures to be demolished are:

- 434 Brook Street
- 436 Brook Street
- 442 Brook Street
- 444 Brook Street
- 450 Brook Street
- 167 Cushing Street
- 169 Cushing Street

Aerial of existing site



Concept for new parking lot (final design may vary from this sketch)

Amendment #3

Parking & Traffic Impact

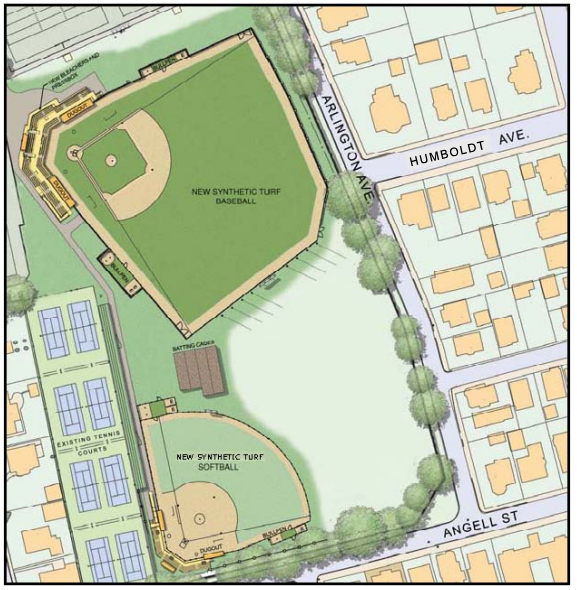
A parking/traffic analysis of the immediate area, conducted by the engineering firm VHB, found that the proposed lot would not generate new vehicle trips and that the existing network can accommodate the project traffic. Their analysis projects no changes in level of service compared with existing conditions and, in addition to the parking spaces gained in the new lot, at least two on-street parking spaces will be gained through the closing of existing curb cuts along Brook St. Their report is included as an appendix to this document

Baseball/Softball Fields Renovation

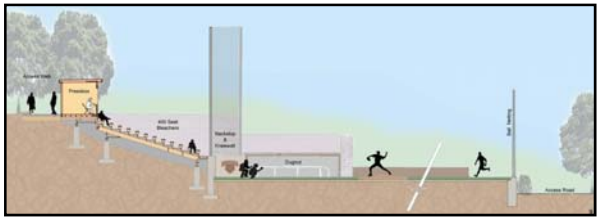
The University is seeking to complete a major renovation of its existing baseball and softball fields. The project will include regrading both fields to bring them up to competitive standards by addressing the significant existing grade change from home plate to the outfield in baseball and at softball. Both fields are intended to have synthetic turf and upgraded amenities such as new press boxes, grandstands (up to 400 seats at Baseball and 300 at Softball), sunken dugouts, bullpens, scoreboard and safety netting/fencing. The fields currently have sound systems which will be replaced in-kind.

The renovation will also include a new entry at the northwest corner, with associated walkways, landscaping, and signage. No field lighting is included in the project.

Aerial of existing site



Concept for new fields (final design may vary from this sketch)



Conceptual E-W section through baseball field (final design may vary from this sketch)