

PENNSSTATE



Penn State University Planned District Transportation Study

**March 1, 2013
FINAL**

Prepared by:

McCormick
Engineers & Planners
Since 1946 **Taylor**

PENN STATE UNIVERSITY PLANNED DISTRICT TRANSPORTATION STUDY

Executive Summary

The University Park Planned District

University Planned District (UPD) is a zoning classification currently adopted within the ordinances of State College Borough, College Township, and Patton Township. The designated UPD for Penn State University's University Park Campus includes approximately 4,200 acres, which is divided into 18 sub-districts.

The District Plan Transportation Study, which is a UPD ordinance requirement, is to be prepared every tenth year as a planning tool that documents travel trends and identifies potential transportation effects of projected development and activities within the district during the next 10-year period. The previous UPD District Plan Transportation Study was completed in 2000 and provided a mostly forward-looking evaluation of vehicular traffic impacts related to network alternatives to be implemented by 2010. The current Update is both forward-looking and backward-looking, analyzing travel trends observed during the last 10 years as well as changes forecasted to the future 2022 Horizon Year. It also presents a broader, multi-modal perspective on the University's diversified transportation system. As such, this Update meets and exceeds the UPD ordinance requirements, which focus heavily on impacts to vehicular travel.

University Park Campus Development & Investment, 2000-2012

The University made considerable investments in campus facilities and infrastructure projects between 2000 and 2012, guided by the 1999 University Park Campus Master Plan. The scale and scope of these projects have significantly changed the landscape of University Park. New buildings and additions added approximately 3.8 million gross square feet of floor area in the UPD Study Area. The University's commensurate investment in the transportation infrastructure focused on Master Plan goals to reduce vehicular travel demand and access to the Core Campus, thereby creating space and incentives for other modes of travel.

Base Year UPD Transportation Assessment

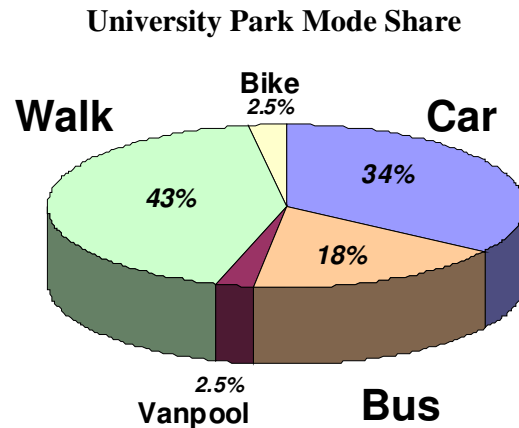
The analysis of Base Year transportation conditions evaluated the "level-of-use" for travel modes serving the University Park campus—car, transit, vanpool, walk, and bike. Backward-looking comparisons were completed against year 2000 data, where available.

- Benchmark Locations at the edges of the UPD Study Area were studied to establish a reference point for vehicular traffic growth and patterns of the larger region. Between 2000 and 2012, vehicular traffic volumes decreased by about 8 percent during both the AM and PM peak periods. The Benchmark Locations west of campus displayed even greater decreases in traffic volume, while locations east of campus displayed slight increases. The vehicular volume changes were consistent with recent roadway network changes, such as the Blue Course Drive and I-99 connections, as well as the University's development of commuter lot parking on the east side of campus.

- Gateway Locations represent the major access points to the core areas of the University Park Campus. Between 2000 and 2012, vehicular traffic volumes decreased by about 8 percent during both the AM and PM peak periods. The conversion of Shortlidge Road to a pedestrian mall induced volume decrease at the Shortlidge Road Gateways along Park Avenue and College Avenue. Meanwhile, the construction of East Deck, the extension of Curtin Road to Atherton Street, and reconfiguration of Fischer Road led to volume increases at these gateways. The net effect was a shift in vehicular traffic volume among the various Gateways. Traffic volumes at the Gateways have also “spread” away from the peak hours, which results in a more even distribution of traffic and more efficient use of the system throughout the day. This phenomenon is likely influenced by how classes, activities, and events are scheduled. Drivers may also be eliminating peak trips or modifying their travel routines to avoid campus during periods of known congestion.
- The evaluation of Total Campus Traffic Access supplies the most comprehensive measure of the University’s vehicular level-of-use. The evaluation isolates vehicular traffic accessing University uses within the UPD Study Area, including the Gateway Locations, Commuter Parking Lots, West Campus, and uses north of Park Avenue accessed from Bigler Road and University Drive. Taking all campus access locations together, between 2000 and 2011, vehicular traffic volumes decreased by about 4 percent during both the AM and PM peak periods. In light of the land development added to the University Park campus between 2000 and 2011, the overall decrease in traffic volume indicates Penn State’s successful management of their vehicular travel demand, even to the point of reducing vehicular traffic impacts on the roadway network. This result is attributed to the University’s investments in infrastructure and programs that have strengthened other modes, expanded the number of affordable modal alternatives, encouraged mode shifts, reduced the need to travel, and dispersed travel to off-peak times of the day.
- Transit ridership on the Loop, Link, and CATA Regional Routes totaled more than 35,000 trips per day in 2011 when Penn State classes were in session. This represents a 10 percent increase in trips by the transit mode between 2000 and 2011. At the same time, the number of CATA transit vehicle trips accessing campus decreased by about 7 percent. Curtin Road between Atherton Street and University Drive is the most transit-intensive corridor on campus, carrying more than 70 transit buses per hour, including tripper buses, during the peak periods. The Curtin Road Gateways at Atherton Street and University Drive, taken together, accommodate more than half of all transit vehicles trips accessing campus.
- The University operates four shuttle systems that augment CATA’s transit routes and fill specialized roles in providing comprehensive access to the campus and reducing the need for personal automobile travel: Campus Shuttle, Paratransit Shuttle, Engineering CATO Park Shuttle, and the Hershey Shuttle. Total daily ridership on all shuttles averaged nearly 380 trips per day during the Spring 2011 semester when Penn State classes were in session. The Campus Shuttle carried the bulk of those trips, with an average of 346 trips per day.
- Since 2007, CATA has administered the former University vanpool program, now referred to as CATA Commute. As of April 2012, 19 vanpools carrying an average of 10 commuters per van have Penn Sate University as the primary commute destination.
- The number of pedestrians and bicycles accessing campus were counted at major nexus points in April 2012 during the AM and PM peak periods. Taken together, the walk and bike modes accounted for more than 16,000 trips during the AM and PM peak periods. It is noted that these

volumes represent both “primary trips,” where no other modes are part of the trip (car or transit) and “secondary” trips, where another mode was first used to reach campus.

- The mode share for trips accessing the University Park UPD was estimated using the AM and PM peak period data, which encompasses the four traditional hours of highest travel during the day. The pie chart illustrates mode share percentages according to the number of person-trips per by mode. More than 66% of University Park trips are on modes that do not involve a personal automobile. The walk mode carries the highest proportion of trips (43%), with car (34%) and bus (18%) as the other major modal choices.



Future Year UPD Transportation Assessment

Compared to the scope and scale of new buildings and structural changes completed from 2000 to 2012, the University’s investments during the next 10 years are expected to be much more focused on maintenance, renovation, optimization, and expansion of existing facilities and programs. The future level-of-use and potential impacts to the transportation system of the University’s 2012 to 2022 development program were evaluated from two different perspectives.

Project-level evaluations provide a micro-scale perspective on the localized impacts of individual University development projects. Five of the identified projects may generate new traffic sufficient to create localized network impacts and trigger the UPD ordinance requirements for additional planning or study:

- Pegula Ice Arena – The detailed traffic impact study for the Ice Arena has been completed and approved. Management of event transportation operations will be provided, but no other roadway system improvements were required. Construction of the arena has commenced.
- Stadium West Parking Lot Expansion – The expansion of up to 900 new parking spaces may generate about 200 new trips during each of the AM and PM peak periods. A detailed traffic impact study will be required. Roadway impacts requiring a new right-turn lane are likely at the Park Avenue/Stadium West intersection.
- Bigler Fields Master Plan – The plan encompasses construction and expansion of athletic facilities east of Bigler Road, including McCoy Natatorium, Indoor Tennis Facility, Intramural Building Addition, and Lacrosse Stadium. A recent study of event parking for overlapping events indicated the need for additional parking. This conclusion is part of the justification for expanding the Stadium West parking lot. The University will continue to refine its strategy of actively managing event traffic on a case-by-case basis by deploying personnel in the field.
- Penn State Arboretum Education Center, Planetarium, and Conservatory – These three elements of the Penn State Arboretum Master Plan are scheduled for construction during the next 10 years. Based on the parking available at the Arboretum, a maximum of 200 vehicular trips per hour may

be generated for any given program. A detailed traffic impact study may be required. Roadway impacts are possible, but not likely, at the Park Avenue/Bigler Road intersection.

- Conversion of Power Plant to Clean Natural Gas – The conversion will change the plant’s fuel from coal to natural gas. The conversion will eliminate 40 to 50 coal delivery truck trips per day and (14,000 truck trips per year) on the campus and Downtown State College roadway network.

The regional-level evaluation provides a broader, macro-scale evaluation of the complete University development plan. Trend travel forecasts from the Centre County Travel Demand Model were used to assess future level-of-use on the UPD Study Area roadways.

- Within the model, University Park trips are forecasted to increase by 2 to 3 percent from 2012 to 2022. At the same time, traffic loads in the UPD Study Area are shown to increase by much greater percentages, indicating that the University’s trip-making will not drive future increases in traffic or the need for significant capacity-adding roadway projects.

Travel Demand Management Programs

The University is committed to maintaining, enhancing, and identifying emerging opportunities to manage its travel demand. The Intermodal Transportation Plan for University Park is an outcome-based comprehensive plan for with metrics for evaluating travel demographics, modes, facilities, perception/knowledge, and the flexibility for modal changes. The Plan’s emphasis is on reducing the number of vehicle trips, particularly single-occupancy vehicle trips, frequently by incentivizing alternative modes. The Ride for Five, Rideshare, and Vanpool programs are successful examples of programs that will be maintained with plans for expansion and refinement during the next 10-years.

In 2011, the University conducted its first Campus Transportation Survey. The 44-question survey was completed via an online portal, with more than 10,000 total responses compiled from faculty, staff, and students. It will be repeated periodically to gain feedback on the success and progress of the Intermodal Transportation Plan. Using the survey and other workforce distribution data, the University is conceptualizing new travel demand reduction programs that better target populations with reasonable ability and willingness to participate.

Several new travel demand management and modal enhancement programs are currently in the concept stage. Some programs, such as the University’s bikeshare program, are being readied for implementation, perhaps during the 2012-13 academic year. Carshare and an “occasional-use” parking permit program are also under consideration.

The University is developing a campus-wide scheduling tool that will integrate scheduling of activities and events for all University Park venues in one central place. The tool will not only help in the coordination of event traffic management activities but also in the tweaking the supply of campus transit (Loop, Link, and shuttles) and managing the demand for parking. It is hoped that situations that exceed travel and parking capacity demand can be avoided by using the tool for advance planning.

Table of Contents

Chapter 1. Background & Purpose1-1

- A. The University Park UPD.....1-1
- B. UPD Ordinance Requirements1-1
- C. The 2012 UPD District Plan Transportation Update.....1-3
 - C.1. Study Area1-3

Chapter 2. University Park Campus Development & Investment, 2000-20122-1

- A. 1999 University Park Campus Master Plan.....2-1
- B. University Park Land Development2-1
- C. University Park Transportation Infrastructure Investment.....2-1
 - C.1. Roadway and Parking Infrastructure Investments2-3
 - C.2. Pedestrian, Bicycle and Transit Infrastructure Investments.....2-5
 - C.3. University Park Transportation Demand Management Programs2-6
- D. Regional Transportation Influences.....2-6

Chapter 3. Base Year UPD Transportation Analysis3-1

- A. Transportation Data Collection Program.....3-1
 - A.1. Daily Traffic Counts3-1
 - A.2. Intersection Turning Movement Counts3-1
 - A.3. Pedestrian & Bicycle Counts3-1
 - A.4. Transit Ridership.....3-1
- B. Network & Link Level Analysis3-4
 - B.1. 2011 Daily Traffic.....3-4
 - B.2. 2011 vs. 2000 Daily Traffic by Location.....3-4
 - B.3. 2011 vs. 2000 Intra-Day Traffic3-7
 - B.3.a. University Drive – Increasing Traffic Volume Example.....3-7
 - B.3.b. Curtin Road – Stable Traffic Volume Example.....3-7
 - B.3.c. Allen Road – Decreasing Traffic Volume Example3-8
 - B.4. AM & PM Peak Hour Traffic Use – Vehicle Bandwidth.....3-9
- C. Intersection Level Analysis3-12
 - C.1. Benchmark Intersections – Regional Level-of-Use3-12
 - C.1.a. Benchmark Peak Period Traffic Volumes, 2011 vs. 2000.....3-12
 - C.2. Gateway Intersections – Campus Access Level-of-Use3-14
 - C.2.a. Gateway Peak Period Traffic Volumes, 2011 vs. 2000.....3-14
 - C.2.b. Gateway Peak Period Traffic Volumes by 15-Min Interval, 2011 vs. 2000.....3-16
 - C.2.c. Gateway Peak Period Traffic Access Distribution, 2011 vs. 2000.....3-16
 - C.3. On-Campus Intersections – Campus Circulation Level-of-Use.....3-18
 - C.3.a. On-Campus Peak Period Traffic Volumes, 2011 vs. 2000.....3-18
 - C.4. Total Campus Vehicular Traffic Access & Level-of-Use3-20
 - C.4.a. Total Campus Peak Period Traffic Volumes, 2011 vs. 2000.....3-20
 - C.4.b. Total Campus Peak Hour Traffic Volumes, 2011 vs. 2000.....3-20
- D. Regional & Campus Transit Use3-23
 - D.1. Transit System Ridership throughout the Day3-23

D.2.	Blue and White Loop Ridership.....	3-26
D.3.	Transit Ridership by Direction of Approach & Departure.....	3-31
D.4.	Peak Hour Transit Use – Transit Vehicle Bandwidth.....	3-31
D.5.	Total Transit Vehicles Accessing Campus	3-31
E.	University Park Shuttle Systems	3-35
E.1.	Campus Shuttle	3-35
E.2.	Paratransit Shuttle	3-37
E.3.	Engineering Cato Park Shuttle	3-37
E.4.	Hershey Shuttle	3-37
F.	CATA Commute Vanpools	3-37
G.	University Park Pedestrian Access.....	3-38
H.	University Park Bicycle Access	3-38
I.	University Park Campus Mode Share	3-43
Chapter 4. Future Year UPD Transportation Assessment		4-1
A.	University Park Campus & Infrastructure Development Program.....	4-1
A.1.	Building and Land Development Projects	4-1
A.2.	Transportation & Parking Infrastructure Projects	4-3
B.	Future Level-of-Use and Potential Impacts.....	4-5
B.1.	Project-Level Evaluations	4-5
B.1.a.	Pegula Ice Arena.....	4-5
B.1.b.	Stadium West Parking Lot Expansion	4-5
B.1.c.	Bigler Fields Master Plan	4-6
B.1.d.	Penn State Arboretum.....	4-7
B.1.e.	Conversion of Power Plant to Clean Natural Gas.....	4-8
B.2.	Regional-Level Evaluation	4-8
B.2.a.	Centre County Travel Demand Model.....	4-8
B.2.b.	Trend Scenario Forecasts.....	4-9
B.2.c.	Vehicular Trip Estimation – Base vs. Trend Scenario.....	4-13
B.2.d.	Vehicular Traffic Volume Assignment – Base vs. Trend Scenario.....	4-15
B.2.e.	Roadway Volume-to-Capacity Evaluation	4-15
Chapter 5. Future Transportation Demand Management Opportunities.....		5-1
A.	The Intermodal Transportation Plan for University Park.....	5-1
B.	University Campus-Wide Travel Survey	5-3
C.	Existing Demand Management Programs	5-3
D.	Creating New Demand Management Programs	5-5
E.	Other Transportation Management Opportunities.....	5-9
E.1.	Universal Transit Access	5-9
E.2.	University Park Event Scheduling System	5-9
Chapter 6. Technical Summary of Major Findings.....		6-1

List of Tables

Table 3.1	2011 CATA Ridership Data for Selection of Analysis Date
Table 3.2	Distribution of Peak Period Vehicular Traffic among Gateway Intersections, 2000 vs. 2011
Table 3.3	CATA Transit Monthly Ridership, April 2002 vs. April 2011
Table 3.4	CATA Transit Vehicle Trips Accessing Campus, 2000 vs. 2011
Table 3.5	Person Trips by Mode and Mode Share for Trips Access University Park, 2011
Table 4.1	Estimated Event Parking Demand for University Park Venues
Table 4.2	Trip Generation for the Penn State Arboretum Education Center, Planetarium, and Conservatory
Table 4.3	Demographic Input Variables for the Centre County Travel Demand Model, University Park Campus TAZs
Table 4.4	Summary of CCTDM Trips Accessing University Park TAZs

List of Figures

- Figure 1.1 The University Park Planned District and Transportation Study Area
- Figure 2.1 University Park Land Development Projects, 2000-2012
- Figure 2.2 University Park Investments in Roadway and Parking Infrastructure, 2000-2012
- Figure 2.3 University Park Investments in Pedestrian, Bicycle, and Transit Infrastructure, 2000-2012
- Figure 3.1 2011 UPD Transportation Study Traffic Data Collection Program
- Figure 3.2 Total Daily Traffic Volumes by Location, 2011
- Figure 3.3 Total Daily Traffic Volumes by Location, 2011 vs. 2000
- Figure 3.4 University Drive Daily Traffic, between Park Avenue and Curtin Road, 2000 vs. 2011
- Figure 3.5 Curtin Road Daily Traffic, between Allen Road and Shortlidge Road, 2000 vs. 2011
- Figure 3.6 Allen Road Daily Traffic, between Park Avenue and Curtin Road, 2000 vs. 2011
- Figure 3.7 AM Peak Hour Vehicular Bandwidth – Total Vehicles, 2011
- Figure 3.8 PM Peak Hour Vehicular Bandwidth – Total Vehicles, 2011
- Figure 3.9 Vehicular Traffic at Benchmark Intersections, 2000 vs. 2011
- Figure 3.10 Vehicular Traffic Accessing Core Campus by Gateway, 2000 vs. 2011
- Figure 3.11 Vehicular Traffic Accessing Core Campus by 15-Minute Interval, 2000 vs. 2011
- Figure 3.12 Vehicular Traffic at Primary On-Campus Intersections, 2000 vs. 2011
- Figure 3.13 Total Campus Access Traffic by Location, 2000 vs. 2011
- Figure 3.14 Total Campus Access Traffic by 15-Minute Interval, 2000 vs. 2011
- Figure 3.15 Centre Area Transportation Authority (CATA) Transit Bus System, 2011
- Figure 3.16 Hourly CATA Ridership by Commute Direction, April 21, 2011
- Figure 3.17 2011 Blue Loop Passenger Load with Boardings & Alightings by Stop, AM Peak Period (7:00 AM to 9:00 AM)
- Figure 3.18 2011 Blue Loop Passenger Load with Boardings & Alightings by Stop, PM Peak Period (4:00 PM to 6:00 PM)
- Figure 3.19 2011 White Loop Passenger Load with Boardings & Alightings by Stop, PM Peak Period (7:00 AM to 9:00 AM)
- Figure 3.20 2011 White Loop Passenger Load with Boardings & Alightings by Stop, PM Peak Period (4:00 PM to 6:00 PM)
- Figure 3.21 CATA Transit Ridership by Direction of Approach & Departure, 2011
- Figure 3.22 AM Peak Hour CATA Vehicle Bandwidth – Vehicles by Direction, 2011
- Figure 3.23 PM Peak Hour CATA Vehicle Bandwidth – Vehicles by Direction, 2011
- Figure 3.24 University Park Shuttle Systems, 2011

List of Figures (continued)

- Figure 3.25 Campus Shuttle Ridership, 2010-2011 Academic Year
- Figure 3.26 University Park Pedestrian Access, 2012 AM Peak Period
- Figure 3.27 University Park Pedestrian Access, 2012 PM Peak Period
- Figure 3.28 University Park Bicycle Access, 2012 AM Peak Period
- Figure 3.29 University Park Bicycle Access, 2012 PM Peak Period
- Figure 4.1 University Park 10-Year Development and Transportation Infrastructure Plan, 2012-2022
- Figure 4.2 Model Coverage Area for the Centre County Travel Demand Model
- Figure 4.3 Detail of Model Coverage Area in the UPD Study Area
- Figure 4.4 Forecasted Daily Traffic Volume Change, 2008-2022
- Figure 4.5 Forecasted AM Peak Period Traffic Volume Change, 2008-2022
- Figure 4.6 Forecasted PM Peak Period Traffic Volume Change, 2008-2022
- Figure 4.7 Projected Segments of Concern for the AM Peak Period
- Figure 4.8 Projected Segments of Concern for the PM Peak Period
- Figure 4.9 University Park Employees in or Near Population Centers, 2011
- Figure 4.10 Percent of University Park Employees with Parking Permits, 2011

List of Appendices

- Appendix A Listing of University Park Facilities & Land Development Projects, 2000-2012
- Appendix B Listing of University Park Roadway, Parking, and Transit System Projects, 2000-2012
- Appendix C Listing of University Park Pedestrian and Bike Projects, 2000-2012
- Appendix D University Park Mode Share Methodology & Assumptions
- Appendix E 2011 University Park Campus Travel Survey & Executive Summary

Chapter 1. Background & Purpose

A. The University Park UPD

University Planned District (UPD) is a zoning classification currently adopted within the ordinances of State College Borough, College Township, and Patton Township. The UPD boundary extends beyond the three municipalities that have formally adopted the UPD ordinance, to include contiguous University property in Ferguson and Benner Townships.

The ordinance purpose and intent states:

The University Planned District is designed to promote the careful planning and orderly development of the University campus, consistent with the community development goals of the Centre Region and its member municipalities as described in the Centre Region Comprehensive Plan.¹

The designated UPD for Penn State University's University Park Campus (**Figure 1.1**) includes approximately 4,200 acres, which is divided into 18 sub-districts. Since 2000, changes have occurred to University properties covered by the UPD. These changes include property sales, most notably the Circleville property (formerly Sub-District 1) and rezonings (Millbrook Marsh, Gateway Commercial District, and Pegula Ice Arena). To reflect these changes, the University is undertaking a revision of the UPD mapping and development data, which will be presented separately to the municipalities for their review and approval.

B. UPD Ordinance Requirements

The District Plan Transportation Study, which is a UPD ordinance requirement, is to be prepared every tenth year as a planning tool that documents travel trends and identifies potential transportation effects of projected development and activities within the district during the next 10-year period. The previous UPD District Plan Transportation Study was completed in 2000 and provided a mostly forward-looking evaluation of vehicular traffic impacts related to network alternatives to be implemented by 2010. The current Update is both forward-looking and backward-looking, analyzing travel trends observed during the last 10 years as well as changes forecasted to the future 2022 Horizon Year. It also presents a broader, multi-modal perspective on the University's diversified transportation system. As such, this Update meets and exceeds the UPD ordinance requirements, which focus heavily on impacts to vehicular travel.

The following elements of the District Plan Update are noted:²

- Parking Area Identification and Projections – Identify existing parking areas, and the general size and location of areas within each sub-district which are projected for use as parking areas within a 10-year period.
- Traffic Analysis – Identify the transportation study area and the transportation systems to be studied. Existing transportation conditions for highway links and intersections serving the

¹ State College Borough Zoning Ordinance, University Planned District, Section 1201.a.

² State College Borough, Zoning Ordinance, University Planned District, Section 1209.

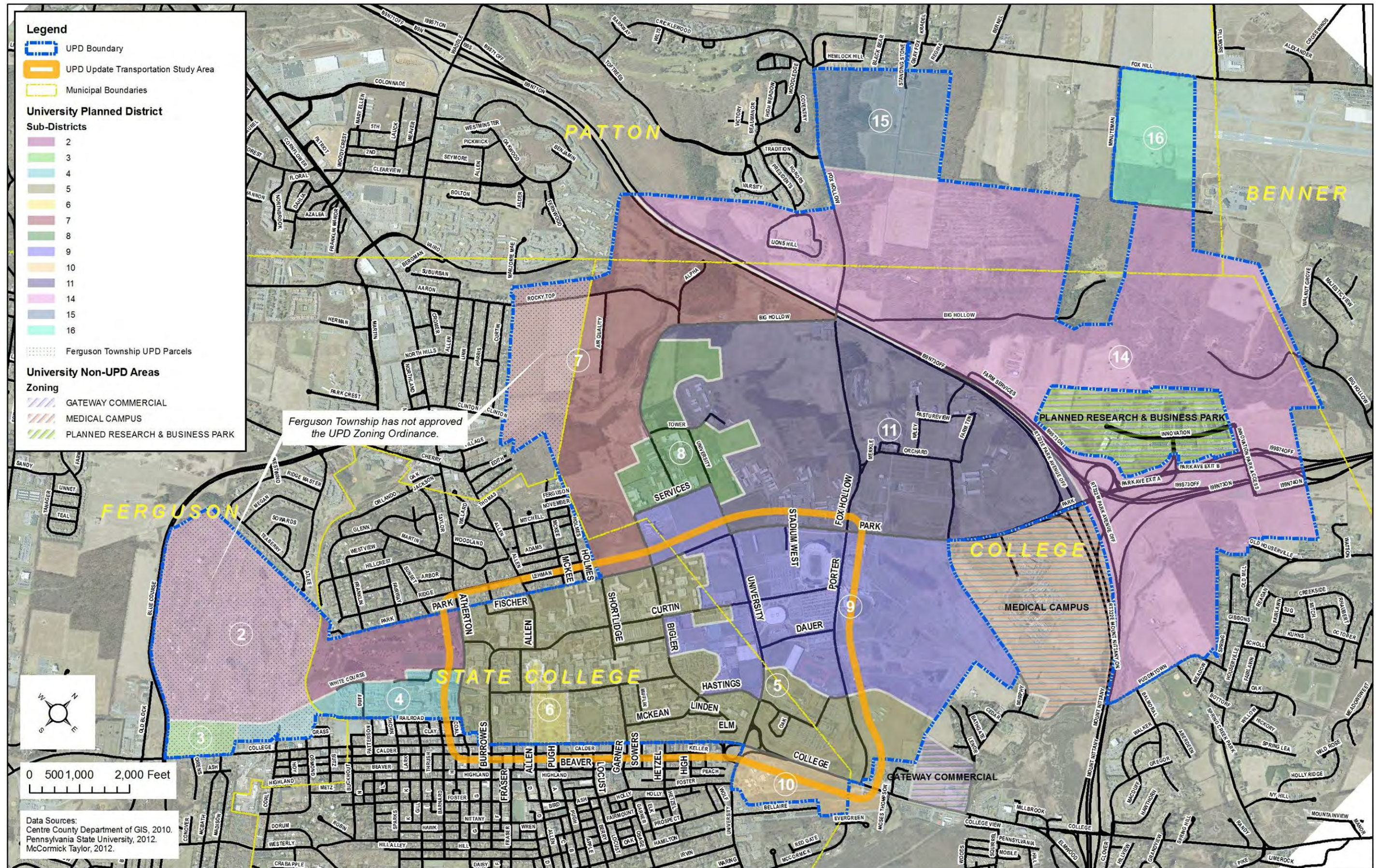


Figure 1.1. The University Park Planned District and Transportation Study Area

- UPD must be described and the existing level of use analyzed. Potential transportation impacts of future parking development must be assessed for a 10-year period. Recommendations for potential system or service improvements in order to accommodate the projected transportation impacts of UPD development shall be included. When feasible, the study shall identify specific recommendations designed to reduce or avoid impacts created by campus development on existing and future residential neighborhoods.
- Internal Circulation and Facilities – Describe existing and proposed internal roads for vehicular traffic; existing and proposed connections to the public street network; plans for street openings and closings, and possible impacts on the adjoining transportation system and adjoining zoning districts; existing and proposed facilities and accommodations for public transportation, pedestrian circulation, bicycle paths and other transportation methods.
- Travel Demand Management – Include a travel demand management analysis, addressing the manner in which various methods, such as promotion of ride sharing, pedestrian/bicycle improvements, and changes to on-campus and public transportation systems, will be utilized to reduce the number of single-occupancy vehicle trips associated with existing or future development under the District Plan.

C. The 2012 UPD District Plan Transportation Update

This report provides the required UPD District Plan Transportation Update. This Update uses a Base Year of 2011 and a Horizon Year of 2022. The Update expands upon the previous studies by providing a true multi-modal perspective on the University’s transportation system.

C.1. Study Area

The Study Area selected for this update of the UPD Transportation Study (**Figure 1.1**) generally includes the most transportation-intensive areas of the University, including most parts of UPD Sub-Districts 5, 6 and 9 in State College Borough and College Township. This update assesses the “level-of-use” of the following transportation facilities and system elements within this Study Area:

Roadway Network System – The roadway system encompasses the network of state, municipal, and University roadways within the Study Area that function as a traffic-carrying network. Some but not all driveways, access roadways, parking lots, and service areas were also investigated.

CATA Transit System – CATA operates the Loop, Link, and Regional Route public transit systems in Centre County, with service focused in the Centre Region municipalities. The University contracts with CATA to provide the Loop and Link services, and CATA’s Regional Routes link to the University Park Campus as the primary hub of regional service.

University Park Shuttle Systems – The University operate shuttle systems that supplement transit services provided by CATA. Some of these shuttle routes extend beyond the Study Area but have significant transportation effects within the Study Area.

Pedestrian & Bicycle Systems – The pedestrian and bicycle facilities include crossings, gateways, shared-use paths, bike lanes, bike parks, and intermodal elements that support non-motorized travel. This investigation focuses on the transportation effects of these modes within the Study Area, as a connected element of the larger regional system.

Chapter 2. University Park Campus Development & Investment, 2000-2012

The University made considerable investments in campus facilities and infrastructure projects between 2000 and 2012, guided by the 1999 University Park Campus Master Plan. The scope of these projects is particularly relevant to this UPD Update, since many projects contained elements that have shaped the transportation context of University Park. Taken together, this chapter provides the groundwork for discussing the inter-relationship between land use and transportation, generating an illustration of the evolving multi-modal transportation system and the influences that drive travel demand at University Park.

A. 1999 University Park Campus Master Plan

In March 1999, the Pennsylvania State University adopted its current Master Plan, which established a vision, purpose, and approach for a 20+ year horizon. The plan is structured around three core elements: 1) Campus-Wide Opportunities, which includes System Plans that cover key components of the campus; 2) three Subcampus Area Evaluations for the Agricultural, Science, and Engineering/EMS areas; and 3) Campus Design Guidelines.

Related to transportation, the Master Plan includes System Plans for pedestrian, bicycle, and vehicular circulation, as well as the parking system. In general, the following themes and principles guide the development of the circulation and parking systems:

- Creation of a core campus that is pedestrian-oriented;
- Decreasing dependence on single occupancy vehicles and parallel increase in the use of alternative forms of transportation, including transit and bicycle; and
- Removal of parking to the periphery of core campus.

B. University Park Land Development

Figure 2.1 illustrates the sites of land development projects undertaken by the University during the 2000 to 2012 period. The map symbology distinguishes new buildings, building additions, and athletics-specific facilities.³ A listing of the individual projects is included in **Appendix A**. Taken together, the new buildings and additions added approximately 3.8 million gross square feet of floor area in the UPD Study Area.

C. University Park Transportation Infrastructure Investment

During the 2000 to 2012 period, the University also made significant investments in the roadway, pedestrian, bicycle, transit, and parking infrastructure both within and adjacent to the campus. The scale and scope of these investments have significantly changed the transportation landscape of University Park, creating a more diverse and multi-modal system. The following sub-sections and figures inventory the projects completed as of summer 2012.⁴

³ The land development mapping does not specifically identify building renovations.

⁴ The inventory excludes utility work and other projects that had a negligible impact on the transportation system.

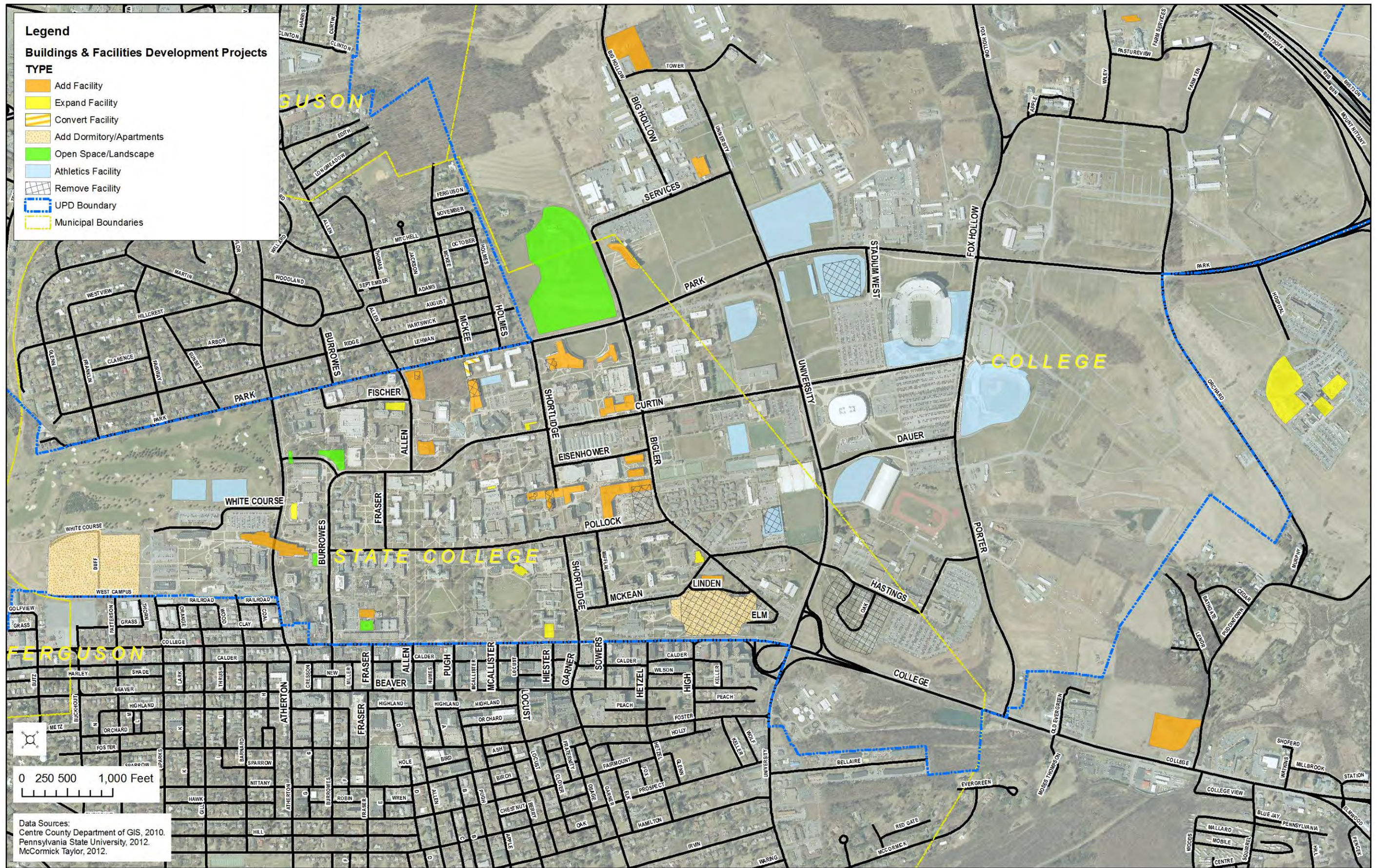


Figure 2.1. University Park Land Development Projects, 2000-2012

C.1. Roadway and Parking Infrastructure Investments

Figure 2.2 illustrates the locations where the University made investments in the roadway and parking infrastructure during the 2000 to 2012 period. A complete listing of the various roadway and parking projects is included in **Appendix B**. The following significant transit system investments were not specifically locatable:

C.2. Pedestrian, Bicycle and Transit Infrastructure Investments

Figure 2.3 illustrates the locations where the University made investments in the pedestrian, bicycle, and transit infrastructure during the 2000 to 2012 period. A complete listing of the various pedestrian and bike system projects is included in **Appendix C**.

The following significant transit system investments were not specifically locatable:

- Implemented the “no fare” zone for campus bus service – CATA transit buses became a “no-fare” service on campus, which assisted the University in moving employees, students and visitors more efficiently and effectively throughout campus.
- Increased the frequency of the Loop transit service – Added additional Loop circulator bus service and designated separate Blue and White Loop routes.
- Added Red and Green Links – Added bus service to Innovation Park and West Campus. In 2011, the Red Link schedule was expanded to provide a stop at the Mount Nittany Medical Center, which assists in moving both the public and students studying in the medical field.
- Constructed the Curtin Road Transit Center – The Transit Center is the largest bus stop on campus and includes intelligent sign systems that show riders the bus arrival times.
- Improved bus stops with amenities – Added new bus shelters and seating.
- Removed bus stops – Removed approximately 30 bus stops for the campus Loop and Link routes, to improve efficiency and headways.
- Added late night bus service – Service is now provided on Thursday, Friday, and Saturday nights to provide a transportation option to the passenger car.
- Added weekend and school break bus services – Worked closely with Fullington Bus Company to provide weekend and school break express bus service to New Jersey/New York and Washington DC/Baltimore areas. These transit services have been successful in reducing the need for students to use a passenger car or bring a car to campus. The services are available to the University and public as well.
- Provided CATA bus passes for Penn State employees working in the Library Building at CATO Park, as an alternative to using a personal vehicle from campus.
- Operated four University Park shuttle systems – Campus Shuttle, Paratransit Shuttle, Engineering CATO Shuttle, and Hershey Shuttle. Each system fills a specialized role in providing comprehensive access to the campus and reducing the need for personal automobile travel.

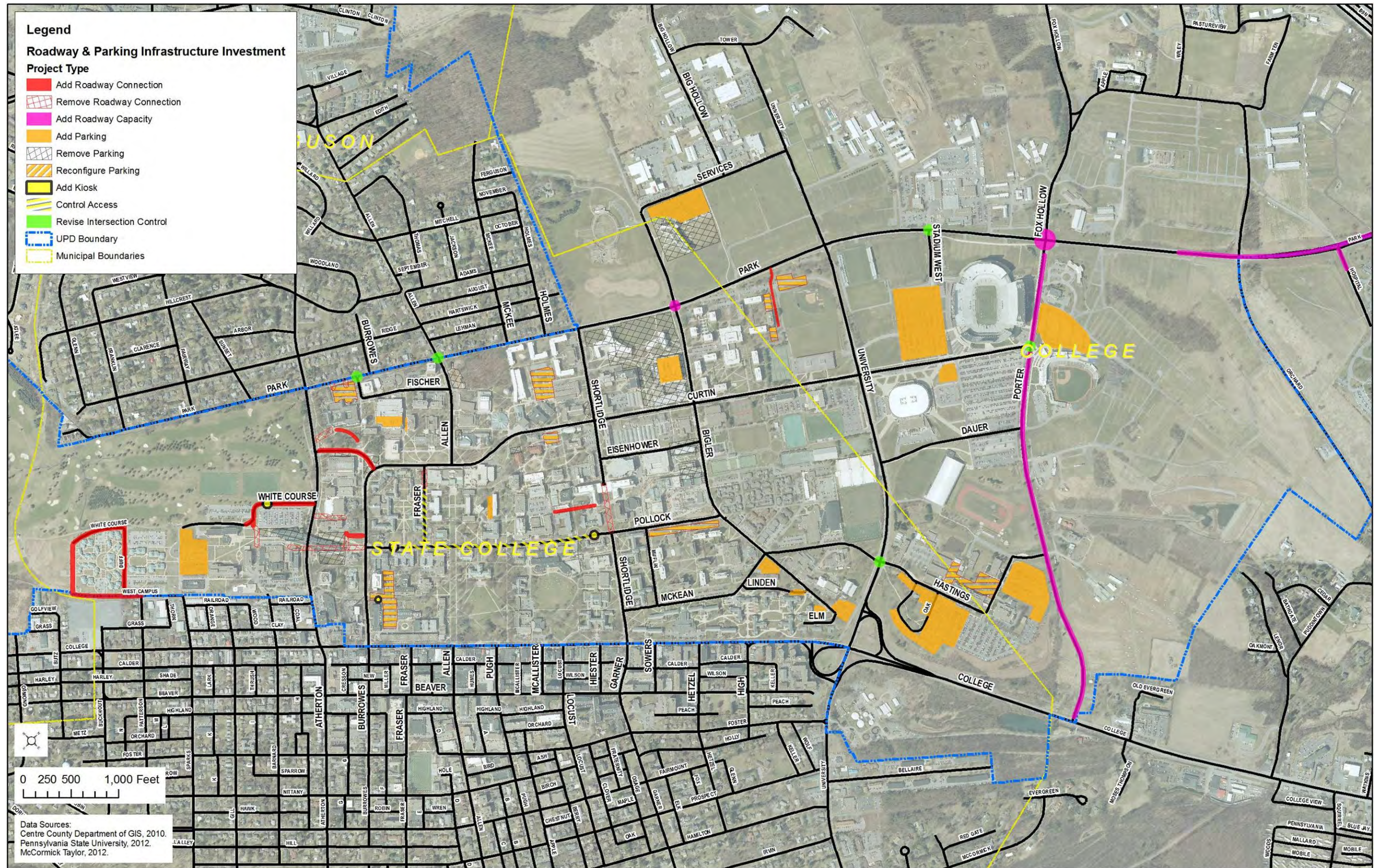


Figure 2.2. University Park Investments in Roadway and Parking Infrastructure, 2000-2012

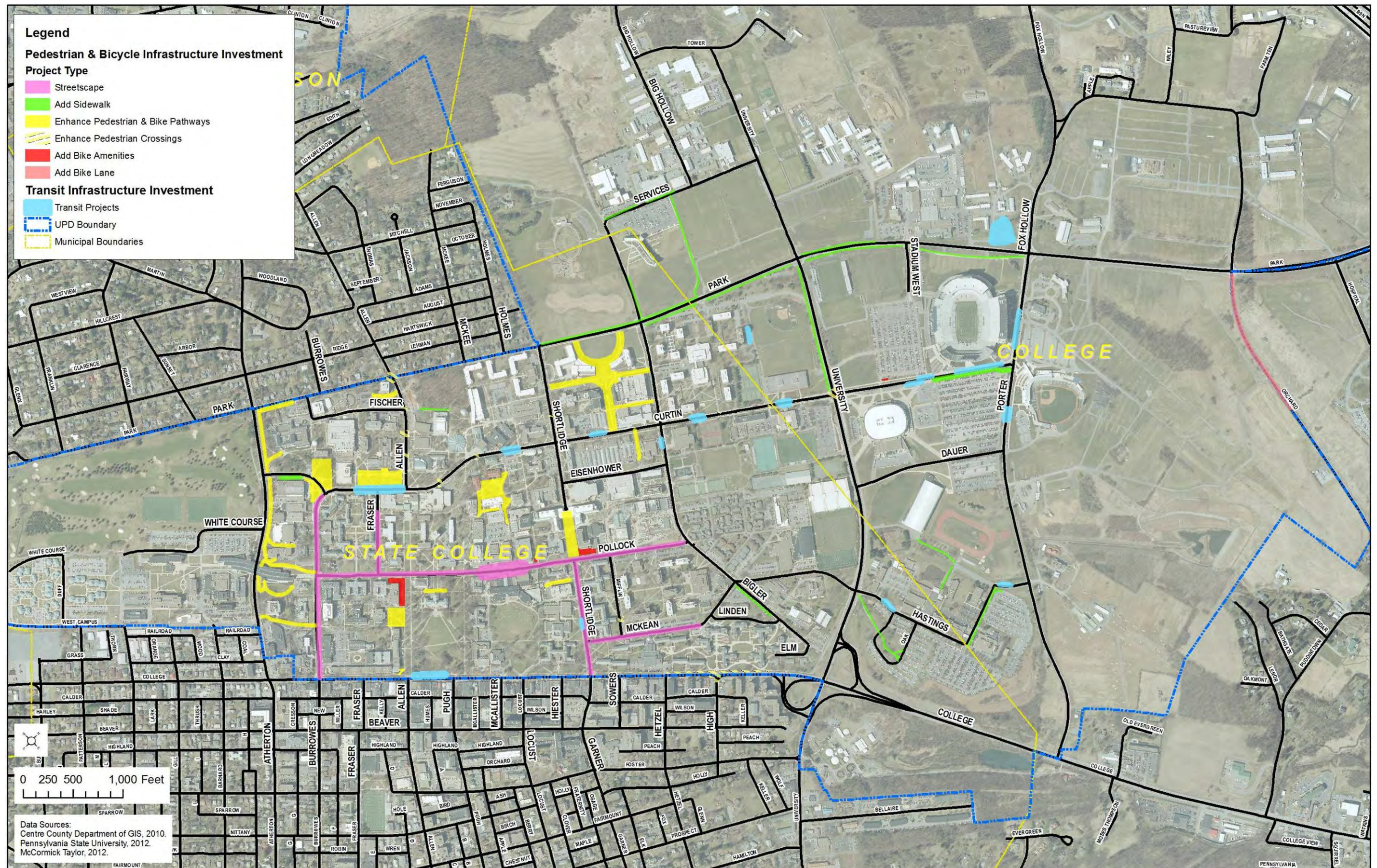


Figure 2.3. University Park Investments in Pedestrian, Bicycle, and Transit Infrastructure, 2000-2012

- Event Transit
 - During large attendance events or inclement weather, University has operated shuttle service from peripheral lots to the venue to reduce traffic congestion and parking demand. The shuttle systems have been well-received and highly used by event patrons.
 - The University has worked closely with Fullington Bus Company and CATA to create the PSU Football Express and CATA Football Shuttle, respectively. The two systems provide transit bus services between peripheral parking locations and the Beaver Stadium area, with the goal of reducing traffic congestion and parking demands on gameday. The shuttles are growing in ridership and provide efficient transportation alternatives to personal vehicle travel.

C.3. University Park Transportation Demand Management Programs

Consistent with the goals of the Master Plan, the University initiated, expanded and/or refined the following transportation demand management programs during the 2000 to 2012 period:

- Rideshare Matching Program
- Ride for Five Program
- Vanpool Program
- Online Student Rideshare Program

D. Regional Transportation Influences

The University Park Campus exists within the wider context of the Pennsylvania, Centre County, and Centre Region transportation systems. The following significant investments in the regional and local transportation systems, beyond but near the UPD Study Area, have been made by non-University sources since 2000. Because of their proximity to the University Park Campus, it is likely that these projects have influenced modal usage patterns, directions of approach/departure, and traffic volumes in the UPD Study Area. As such, they are referenced in subsequent chapters when comparing travel activity trends between 2000 and 2011.

- Construction of Blue Course Drive (a.k.a., Western Inner Loop) – Provides a circumferential connection between North Atherton Street and West College Avenue. The connection allows vehicles to avoid congested intersections along North Atherton Street and College Avenue/Beaver Avenue. When Blue Course Drive was opened in March 2003, Corl Street was closed between Blue Course Drive and West College Avenue.
- Construction of I-99 – Two sections of Interstate 99 within Centre County were opened as they were completed between 2000 and 2012:
 - Mount Nittany Expressway (U.S. 322) to Interstate 80
Fully opened in November 2002
 - I-99, Exit 52 (Bald Eagle) to Mount Nittany Expressway (U.S. 322/U.S. 220)
Fully opened in December 2008

The first of the two sections included the reconstruction of the Park Avenue Interchange, converting the grade-separated diamond interchange to a multi-level interchange with high-speed flyovers for the I-99 mainline and high-speed ramp connections to U.S. 322.

Connections to Park Avenue were maintained from both directions of I-99 and U.S. 322, with signal control at the end of the ramps.

- Toftrees Avenue Extension – As a part of the Toftrees Master Plan, Toftrees Avenue was extended to intersect Fox Hollow Road at a new traffic signal. The connection bypasses residential neighborhoods along Cricklewood Drive and provides a more efficient network route for trips to/from the University Park Airport and Mount Nittany Medical Center.
- Implementation of Transit Signal Priority and Inter-Municipal Signal Coordination on North Atherton Street – In 2010, PennDOT implemented a transit signal priority system, which promotes transit bus movement along the North Atherton Street Corridor. With a concentration of student housing exists in the corridor, transit bus service was improved. The installation also replaced outdated coordination programs that did not coordinate signals across the municipal boundaries between State College Borough, Ferguson Township, and Patton Township.

The economic and political climates also have strong influences on the demand for travel and the likely investments in transportation infrastructure. The following modal trends are notable:

- ⇒ On Pennsylvania roadways, the total daily vehicle miles of travel (VMT) peaked in 2006 at 296,938,866. VMT in 2010 was 277,293,041, a decrease of about 6.6 percent.
- ⇒ During the last eight years, average gasoline prices in Central Pennsylvania have fluctuated widely, from a per gallon price of \$2.25 in 2006 to more than \$4.00 in 2008. The current 2012 average for Central Pennsylvania is about \$3.68 per gallon.
- ⇒ Since 2010, state funding support for public transportation has been reduced by 50 percent and is expected to remain level indefinitely in terms of real dollars (i.e., funding will be reduced when adjusting for inflation).
- ⇒ State funding to the Centre Area Transportation Authority (CATA) was reduced by \$300,000 in 2011 alone, and CATA has cut more than 20 percent of its service during the last five years. In 2011, the monthly cost of a transit pass was increased by \$1.00 in response to the state's funding reductions.
- ⇒ In July 2012, the Federal government approved MAP-21, the federal highway bill that maintains FY 2011 funding levels for the nation's transportation system. MAP-21 creates a new program, Transportation Alternatives (TA), that encompasses most pedestrian and bicycle projects and replaces the former Transportation Enhancements (TE) program. Funding levels for TA are estimated to be about 25% less than the previous TE allocations, and the funding for TA may be transferred to other types of air quality, roadway, and safety improvement projects.

Chapter 3. Base Year UPD Transportation Analysis

The analysis of Base Year 2012 conditions demonstrates the current condition and level-of-use of the transportation system in the vicinity of the University Park campus.

A. Transportation Data Collection Program

The program of transportation data collection focused on the volumes of vehicular and person travel observed at the locations illustrated in **Figure 3.1**.

A.1. Daily Traffic Volume Counts

Counts of daily traffic volumes were conducted in April 2011 at 20 locations (yellow asterisk symbols in **Figure 3.1**). To provide points for comparison, these locations were selected to duplicate those counted in 2000 for the Phase One Transportation Study.

A.2. Intersection Turning Movement Counts

Intersection turning movement counts were conducted in April and May 2011 at 55 intersections. Again, these locations duplicated many that were counted in 2000 for the Phase One Transportation Study. In some cases, network changes required that new locations be added. The intersections were categorized according to function, as illustrated in **Figure 3.1**:

- Benchmark Locations (red points) – 8 intersections
- Gateway Locations (orange points) – 9 intersections
- Primary On-Campus Locations (dark blue points) – 11 intersections
- Secondary & Access Locations (light blue points) – 27 intersections
- Off-Campus Locations (pink points) – 2 intersections

A.3. Pedestrian & Bicycle Counts

Pedestrian and bicycle counts were conducted in April 2012 at 11 campus “nexus” locations (magenta points in **Figure 3.1**). Since no pedestrian or bicycle counts were conducted in 2000, the 2012 counts serve as a baseline, and comparisons may be drawn in future UPD Update studies.

A.4. Transit Ridership

The transit ridership and person-load data provided by CATA for the Loop, Link, and regional transit routes were examined for dates during Penn State’s Spring Semester 2011 that were close to the annual average. **Table 3.1** gives system data for two different dates in April 2011, during which vehicle count data was also being collected: April 21, 2011 and April 28, 2011. While both dates are near the annual average ridership, the April 21, 2011 data is more similar to the system average for the Loop and Link routes, and data for this date was used in the UPD analysis.

Table 3.1. 2011 CATA Ridership Data for Selecting Analysis Date

	2011 Weekday Average <i>(All Days Penn State University Classes were in Session)</i>			April 21, 2011	April 28, 2011
	Days	Total Ridership	Average Ridership	Ridership	Ridership
Totals	159	5,625,304	35,379	35,038	34,275
CATA Regional Routes	159	2,366,131	14,881	14,007	13,691
Red Link	159	362,161	2,278	2,308	2,811
Green Link	159	372,841	2,345	2,295	2,440
Blue Loop	159	1,276,373	8,028	8,391	7,671
White Loop	159	1,247,798	7,848	8,037	7,662

Source: Centre Area Transportation Authority, 2012.

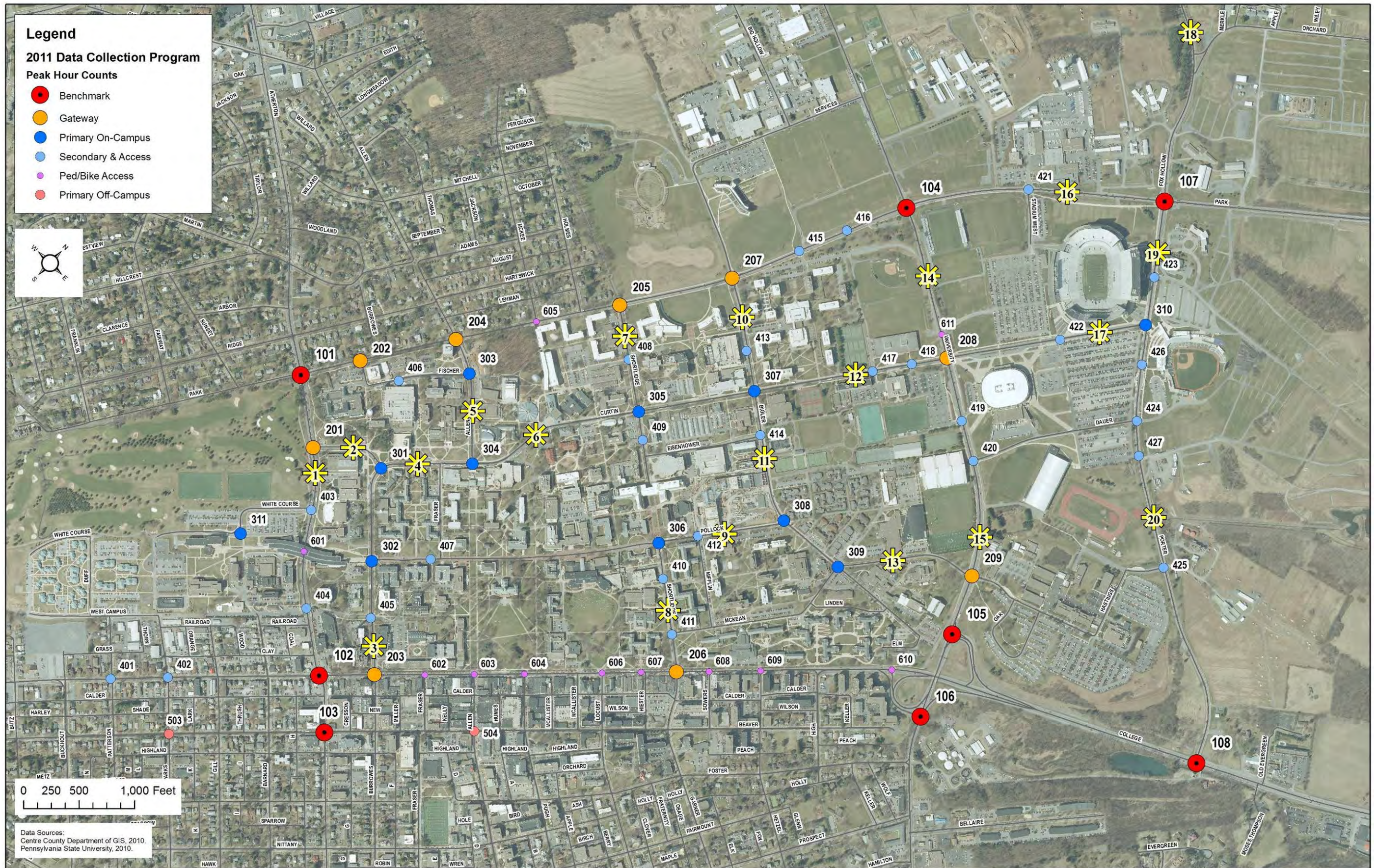


Figure 3.1. 2011 UPD Transportation Study Traffic Data Collection Program

B. Network & Link Level Analysis

B.1. 2011 Daily Traffic

Figure 3.2 illustrates the daily traffic volumes (24-hour, two-way totals) collected in 2011. Gradations of traffic volume are indicated by the box outline color, with the lowest volumes in black, middle range volumes in orange, and the highest volumes in red. As expected, the highest volumes were recorded on the peripheral arterial streets (Atherton Street, Park Avenue, University Drive). The lowest volumes were recorded on gateway roadways that connected the peripheral arterial streets with the core campus roadway system. Middle range volumes were recorded within the core of campus, where the grid of roadways is less continuous. The relatively balanced levels of daily traffic use across the campus roadways indicate an efficient network, where all roadways carry appropriate volumes without focusing traffic and overwhelming roadway capacity at any particular point.

B.2. 2011 vs. 2000 Daily Traffic by Location

Figure 3.3 compares 2011 Daily Traffic with 2000 Daily Traffic at 13 comparable locations. Indicators are provided for where traffic has increased (+), decreased (-), or remained stable (O) since 2000. Traffic volume increased at 6 locations, decreased at 4 locations, and remained stable at 3 locations. The following significant trends were noted:

- Curtin Road to Atherton Street – The 2011 daily volume on Curtin Road was nearly double the 2000 volume carried on Pollock Road, which was removed in 2002 as part of the IST Building construction. The location of Curtin Road (further north along Atherton Street than Pollock Road) and its relative lack of congestion make it a more attractive campus connection than routes that involve Park Avenue.
- Eastern Side of University Park Campus – Daily volumes on University Drive and Porter Road increased by 1,500 vehicles and 2,400 vehicles, respectively. The University's Master Plan policy of shifting parking to the periphery of campus was implemented progressively during the last 12 years with creation of the Jordan East, Stadium West, and Porter North commuter lots. Traffic patterns have shifted in response, with increases near the commuter lots and decreases at other campus locations where parking has been removed. The connection of I-99 and capacity improvements at the Park Avenue/Porter Road/Fox Hollow Road intersection have also contributed to the shifts in traffic volume.
- Shortlidge Road – On the Shortlidge Road segments connected to Park Avenue and College Avenue, daily volumes decreased by 35 to 40 percent, stemming from the conversion of Shortlidge Road to a pedestrian corridor between Pollock Road and Bigler Road in 2004. As documented in the Shortlidge Road Closure Before & After Study, the decrease represents traffic that has likely shifted to Burrowes Road, Curtin Road, and routes peripheral to campus. However, a substantial portion of the volume formerly on Shortlidge Road is now using Pollock Road and Bigler Road, as evidenced by the volume increases on these segments.



Figure 3.2. Total Daily Traffic Volumes by Location, 2011

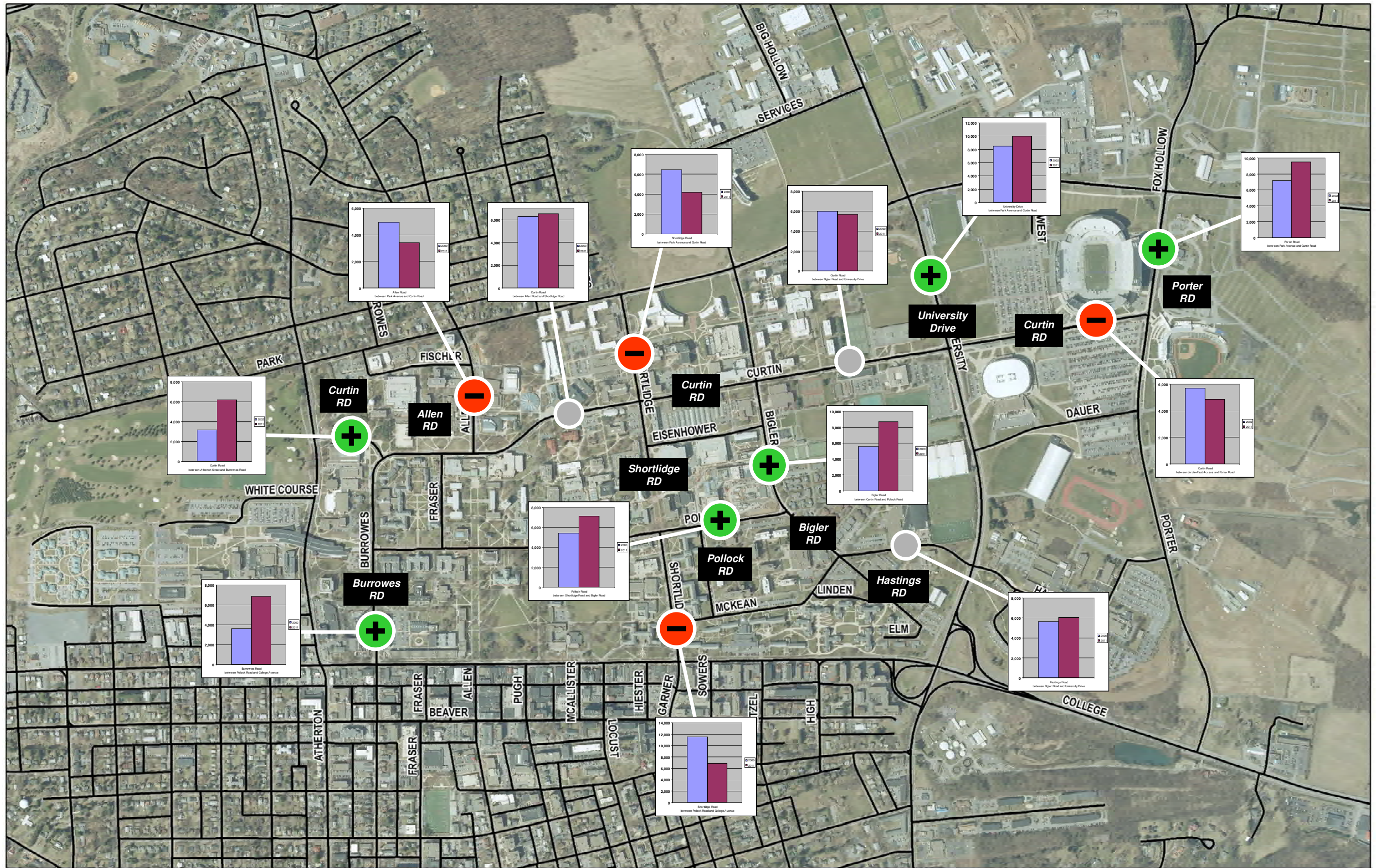


Figure 3.3. Total Daily Traffic Volumes by Location, 2011 vs. 2000

B.3. 2011 vs. 2000 Intra-Day Traffic

Figures 3.4, 3.5, and 3.6 illustrate the hourly distribution of traffic volume throughout the day at three different campus locations. The figures compare traffic volumes sampled in 2000 with those sampled in 2011 at similar locations. The figures illustrate different ways that campus traffic has changed since 2000.

B.3.a. University Drive – Increasing Traffic Volume Example

The University Drive data in **Figure 3.4** illustrates a location where traffic throughout the day has increased between 2000 and 2011, particularly during the middle of the day and in the evening hours. Spreading of traffic away from the peak and into non-peak periods is a likely response to congestion during the peak periods, especially where flexible work hours are permitted. Note that the traffic volume during the morning peak hour (7:00 AM to 8:00 AM) was nearly identical in 2000 and 2011. During the middle of the day, the pattern of hourly fluctuations remains similar and likely reflects the class schedule, which has remained relatively consistent. Campus activities after 6:00 PM appear to be generating more vehicular traffic in 2011 vs. 2000.

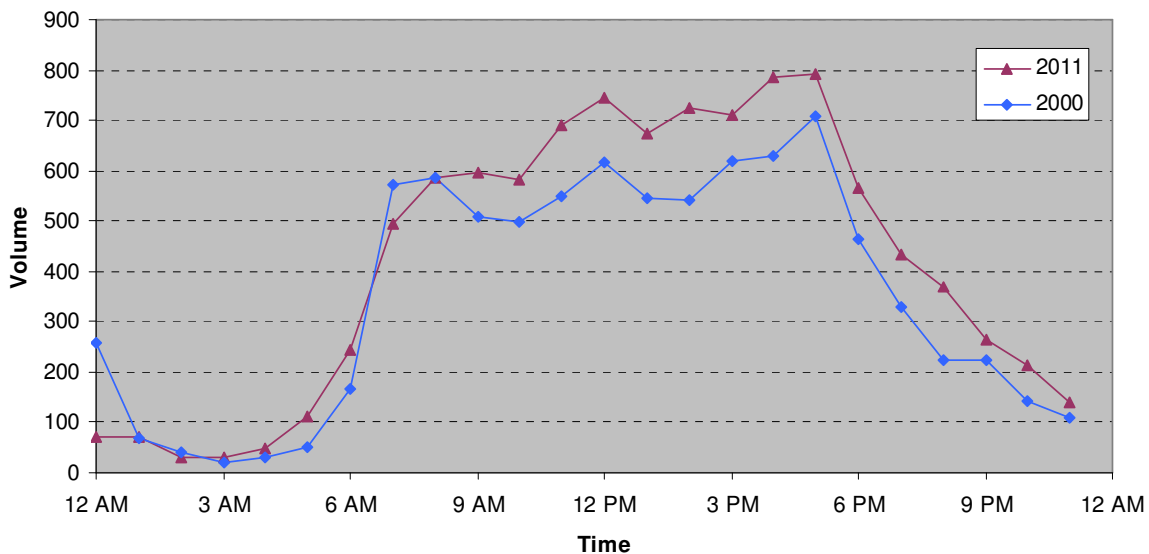


Figure 3.4. University Drive Daily Traffic, between Park Avenue and Curtin Road, 2000 vs. 2011

B.3.b. Curtin Road – Stable Traffic Volume Example

The Curtin Road data in **Figure 3.5** illustrates a location where traffic throughout the day has remained relatively consistent between 2000 and 2011, with many of the same peaking patterns. In some cases, peaks have shifted forward or back by one hour.

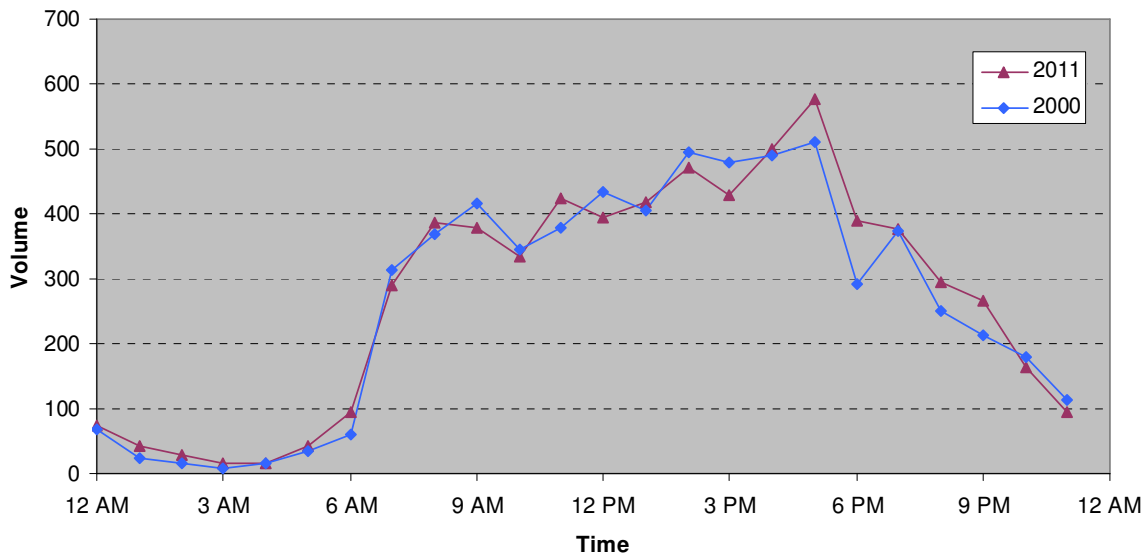


Figure 3.5. Curtin Road Daily Traffic, between Allen Road and Shortlidge Road, 2000 vs. 2011

B.3.c. Allen Road – Decreasing Traffic Volume Example

The Allen Road data in **Figure 3.6** illustrates a location a location where traffic throughout the day has decreased substantially between 2000 and 2011. Again, the peaking patterns are very similar, hour-to-hour, but the 2000 data shows stronger peaks during the AM and PM peak hours.

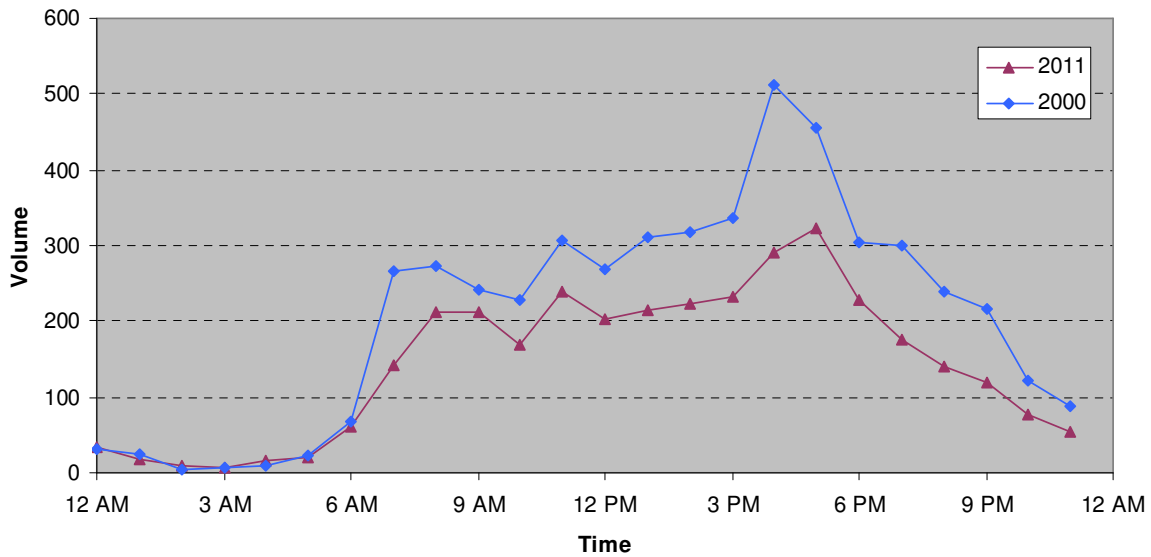


Figure 3.6. Allen Road Daily Traffic, between Park Avenue and Curtin Road, 2000 vs. 2011

B.4. AM & PM Peak Hour Traffic Use – Vehicle Bandwidth

The highest volume traffic periods of the day on roadways surrounding the University Park Campus occur during the morning (AM) and afternoon (PM) commuting periods. The level-of-use during these periods is commonly considered the most critical for identifying traffic focal points and evaluating the efficiency of the roadway network for serving motorized traffic.

Figures 3.7 and 3.8 illustrate the two-way link traffic volumes during the AM and PM peak hours, respectively. In the vicinity of the University Park Campus, the AM peak hour of motorized traffic occurs between 7:30 AM and 8:30 AM and the PM peak hour occurs between 4:30 PM and 5:30 PM. The intensity of traffic is indicated by the width and color of the band, and the same intensity scale has been used for both figures. Links connect critical breakpoints in the network, such as intersections or access points to parking facilities.

During the AM peak hour, motorized volume is most influenced by commute-to-work traffic, since most retail businesses are not yet open. Traffic intensity is highest on routes destined for the major employment centers. Related to the University, traffic intensity is most evident near the major parking facilities and the primary campus gateways:

- Atherton Street near Park Avenue, Curtin Road, and White Course Drive (accessing Nittany Deck and West Campus parking areas);
- Park Avenue near Porter Road, University Drive, and Bigler Road (access to Jordan East, Stadium West, and East Deck parking facilities);
- University Drive near Dauer Drive (access to Jordan East);
- College Avenue near Porter Road and Shortlidge Road (access to Jordan East and HUB Deck parking facilities).

During the PM peak hour, traffic activity is at its highest during the day, with commute-from-work traffic mingled with retail, recreational, social, and other activity types. Similar to the AM peak hour, traffic intensity is still evident near the major parking facilities and primary campus gateways on the north and east sides of campus. Traffic on Atherton Street and College Avenue

Comparing the two peak hours, the PM peak hour network volume is generally 30-35 percent higher than during the AM peak hour. On Atherton Street and College Avenue, which serve more commercialized areas, the volume difference between AM and PM is more pronounced. Roadways that serve a higher percentage of commuter traffic (Park Avenue and University Drive) are more comparable during the two peak hours.

Consistent with the distribution network traffic observed in the daily volumes, traffic during the peak hours is also balanced across the primary campus roadways. Primary campus roadways carry 300-500 vehicles per hour during the AM peak and 500-700 vehicle per hour during the PM peak.



Figure 3.7. AM Peak Hour Vehicular Bandwidth – Total Vehicles, 2011

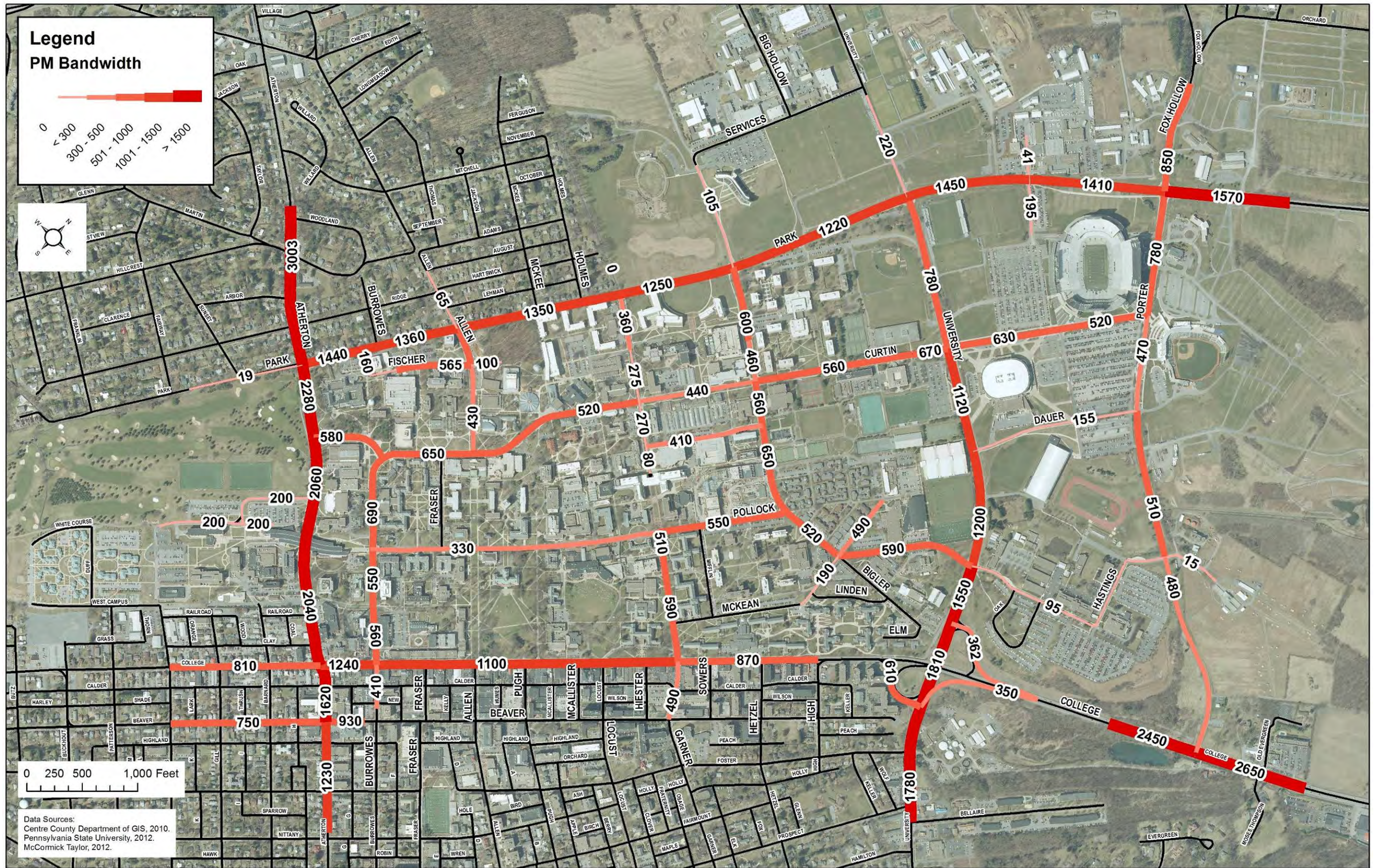


Figure 3.8. PM Peak Hour Vehicular Bandwidth – Total Vehicles, 2011

C. Intersection Level Analysis

Intersections are the critical points in any transportation network, largely because of the complexity of conflicting traffic streams and modes that all must share the right-of-way. For this reason, the following sections examine the intersection levels-of-use during the peak **periods** of motorized traffic volume—specifically 7:00 AM to 9:00 AM for the AM peak period, and 4:00 PM to 6:00 PM for the PM peak period. The peak periods were selected to include the peak hours of traffic, while also sampling demand for 30 minutes before and after the peaks. Intersections were divided into the following categories to evaluate level-of-use trends:

- Benchmark Intersections
- Gateway Intersections
- Primary On-Campus Intersections

This analysis culminates in an evaluation of “Total Campus Access,” which supplies a comprehensive measure of motorized traffic accessing the University Park Campus.

C.1. Benchmark Intersections – Regional Level-of-Use

The following eight intersections were designated as Benchmark Intersections for sampling the regional level-of-use for the transportation network:

1. Atherton Street & Park Avenue
2. Atherton Street & College Avenue
3. Atherton Street & Beaver Avenue
4. University Drive & Park Avenue
5. University Drive & College Avenue WB Ramps
6. University Drive & College Avenue EB Ramps
7. Porter Road/Fox Hollow Road & Park Avenue
8. Porter Road & College Avenue

These intersections are in the vicinity of the University Park Campus and the UPD Study Area, and traffic at these locations reflects a mix of University and community related-activity. As such, longitudinal data collected over time provides an appropriate benchmark for regional traffic growth.

C.1.a. Benchmark Peak Period Traffic Volumes, 2011 vs. 2000

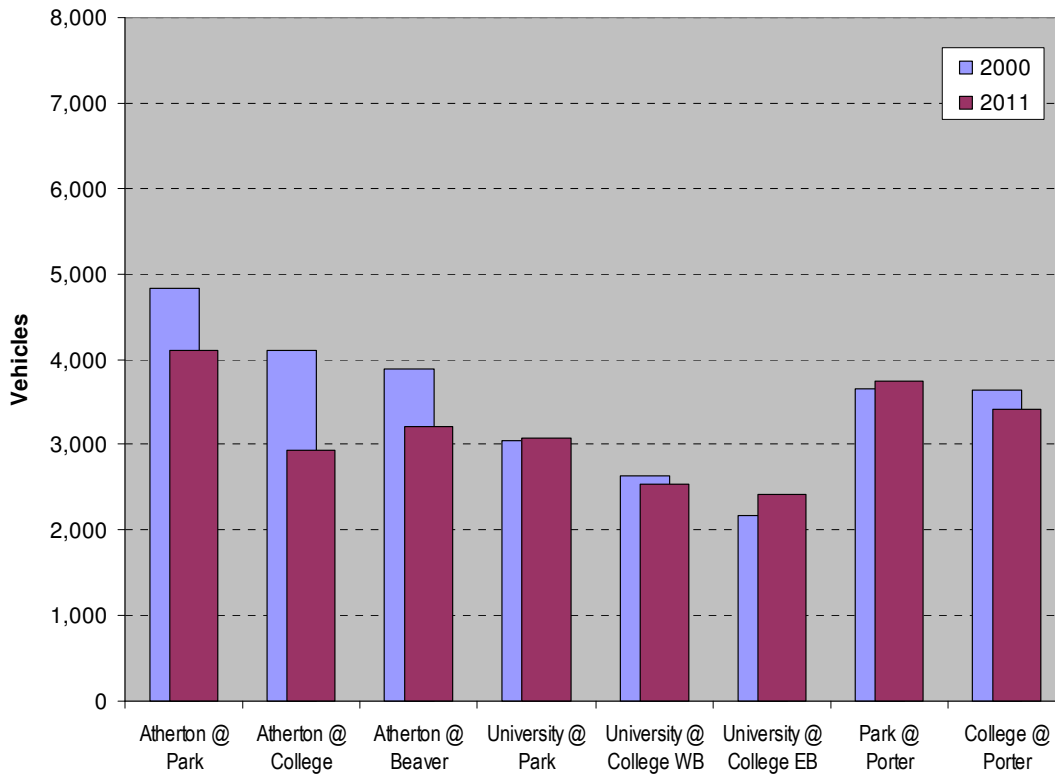
The bar graphs in **Figure 3.9** provide side-by-side comparisons of the 2000 and 2011 traffic data collected at the Benchmark Intersections during the AM and PM peak periods.

Overall, a net volume decreases of about 9 percent was observed during the AM peak period, and a decrease of about 7 percent was observed during the PM peak period, which translates to a net decrease of about 2,500 vehicles in the AM and 2,600 vehicles in the PM. Taking the AM and PM Peak Period volumes together, the composite peak period traffic volumes **decreased by approximately 8 percent** between 2000 and 2011. This local trend is consistent with trends toward decreased traffic activity at the metropolitan and statewide geographic levels. Energy prices have risen, land development activity has slowed, and the level of employment has waivered—in spite of the relatively strong local economy.

BENCHMARK INTERSECTIONS

AM Peak Period Traffic, 2000 vs. 2011

Total Vehicles, 7:00 AM to 9:00 AM



PM Peak Period Traffic, 2000 vs. 2011

Total Vehicles, 4:00 PM to 6:00 PM

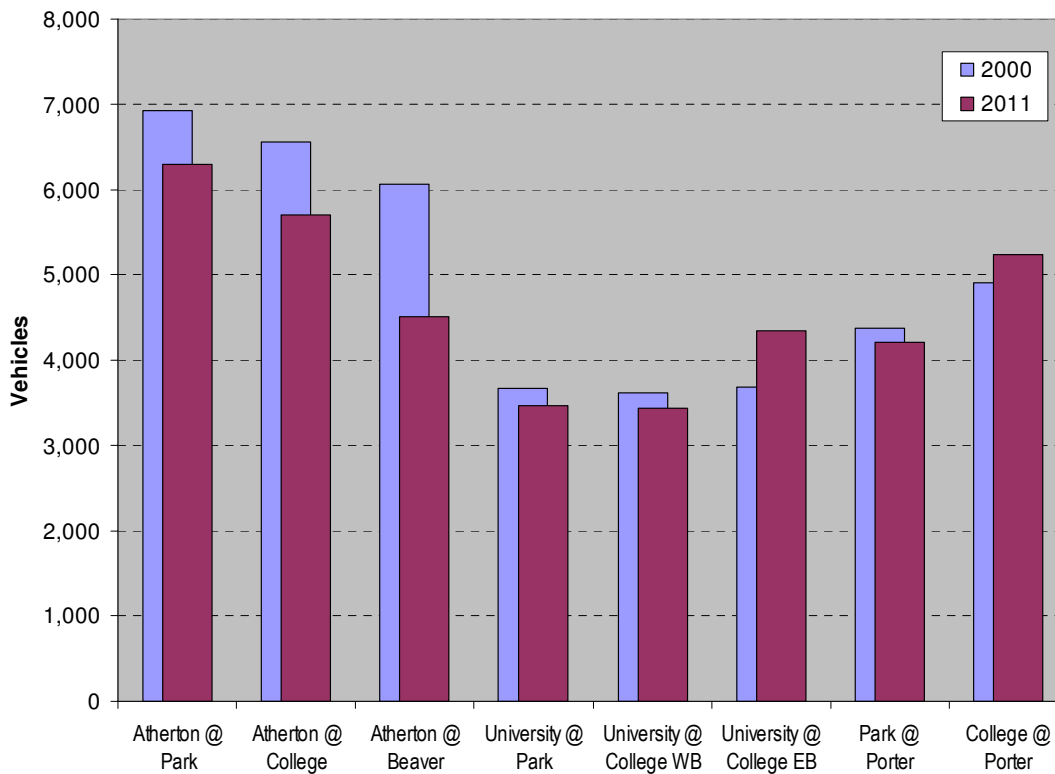


Figure 3.9. Vehicular Traffic at Benchmark Intersections, 2000 vs. 2011

The volume decrease was not uniform across all of the benchmark locations. The group of intersections along Atherton Street (west of the campus core) experienced a combined decrease of 20 percent in the AM and 16 percent in the PM. Intersections east of the campus core (Park Avenue and College Avenue corridors) were stable or experienced increases, with a composite 4 percent increase in the AM and 2 percent increase in the PM. The greatest volume increases at a single intersection were observed at intersection of University Drive and College Avenue Ramps (11% AM; 18% PM). Other significant increases occurred at the Park Avenue/Porter Road/Fox Hollow Road intersection (18% AM) and at College Avenue/Porter Road (7% PM).

The shift in traffic patterns is related to changes made in the regional and local transportation systems, including the connection of I-99 and construction of Blue Course Drive. Improved access to the State College Area via I-99 brings much more traffic to the Park Avenue and College Avenue interchanges, increasing traffic on these corridors. Meanwhile, completion of Blue Course Drive (a.k.a, “Western Inner Loop”) provided an alternative pathway for traffic oriented to/from the west and southwest, thereby reducing traffic on Atherton Street.

C.2. Gateway Intersections – Campus Access Level-of-Use

The following nine intersections were designated as Gateway Intersections for sampling the level-of-use associated specifically with access to the core of the University Park Campus:

1. Atherton Street & Curtin Road
2. Fischer Road & Park Avenue
3. Burrowes Road & College Avenue
4. Allen Road & Park Avenue
5. Shortlidge Road & Park Avenue
6. Bigler Road & Park Avenue
7. Shortlidge Road & College Avenue
8. University Drive & Curtin Road
9. University Drive & Hastings Road

These intersections are located on the nexus between the University-owned campus roadway network and the surrounding network. As such, the traffic volumes entering and exiting campus provide a gauge for traffic activity and growth associated exclusively with the University Park Campus.

C.2.a. Gateway Peak Period Traffic Volumes, 2011 vs. 2000

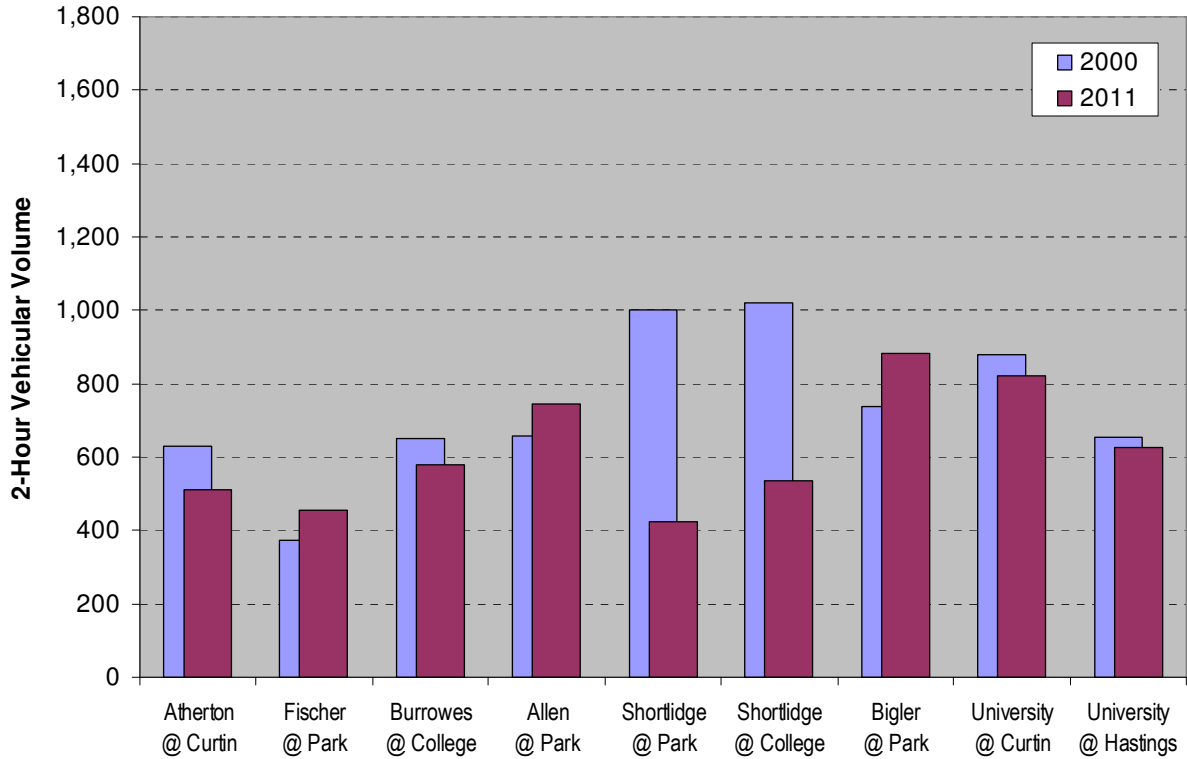
The bar graphs in **Figure 3.10** provide side-by-side comparisons of the 2000 and 2011 traffic data collected at the Gateway Intersections during the AM and PM peak periods. The volumes only include vehicles entering or exiting the campus.

Overall, a net volume decrease of about 12 percent was observed in the AM peak period and a net decrease of about one percent was observed in the PM peak period. Taking the AM and PM Peak Period volumes together, the composite peak period traffic volumes decreased by approximately 8 percent between 2000 and 2011. Again, the local trend toward decreased traffic activity is consistent with trends at larger geographic levels. The trends are somewhat consistent with the Benchmark Intersections; both experienced decreases. On a percentage basis, a greater decrease in traffic activity was observed at the Gateway Intersections during the AM peak period, and a greater decrease was observed at the Benchmark Intersections during the PM peak period.

GATEWAY INTERSECTIONS

AM Peak Period Traffic, 2000 vs. 2011

Total Vehicles, 7:00 AM to 9:00 AM



PM Peak Period Traffic, 2000 vs. 2011

Total Vehicles, 4:00 PM to 6:00 PM

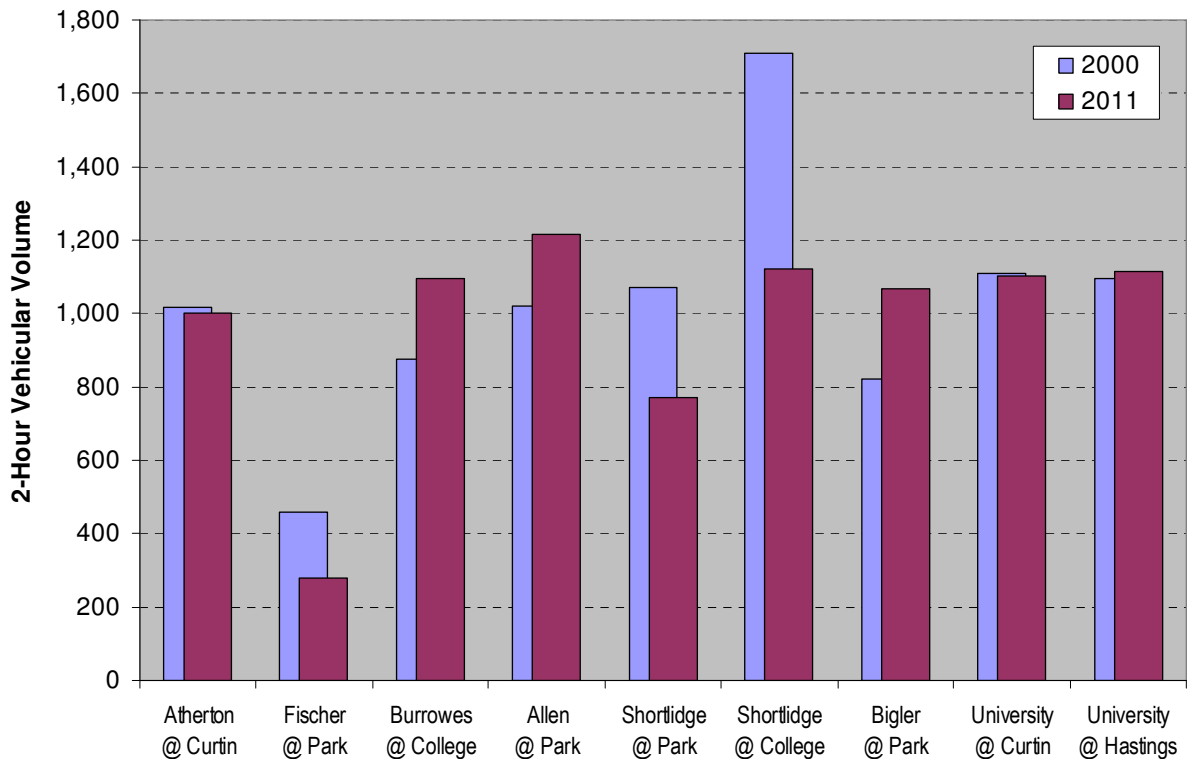


Figure 3.10. Vehicular Traffic Accessing Core Campus by Gateway, 2000 vs. 2011

The volume changes were not uniform across all intersections. The Fischer Road gateway now carries much more AM peak period traffic since the reconfiguration of the Nittany Lion Inn Parking Lot and Fischer Road in 2003. Direct access between the parking lot and Park Avenue was removed, and Fischer Road was changed from one-way out (toward Park Avenue) to two-way operation, with turn restrictions at Park Avenue. During both peak periods, substantial decreases were observed along Shortlidge Road—likely linked to the Shortlidge Road conversion to a pedestrian way. A modest increase occurred along Allen Road, as traffic shifted away from Shortlidge Road to the other north-south campus routes. The Bigler Road gateway received some of the traffic shift from Shortlidge, in addition to new traffic to/from East Deck. Other gateways were stable, having similar volumes in 2000 and 2011. Unique to the PM peak period, traffic volumes at the Burrowes Road gateway increased by about 25 percent (225 vehicles) between 2000 and 2011.

C.2.b. Gateway Peak Period Traffic Volumes by 15-Minute Interval, 2011 vs. 2000

The bar graphs in **Figure 3.11** compare the 2000 and 2011 time distributions of vehicles by 15-minute intervals during the peak periods. In addition to the reduction in total vehicular traffic, the AM graph suggests a more even distribution of traffic activity across the peak period in 2011, whereas traffic was more focused in 2000 (7:45 AM interval). A distinct peak still occurs in the 7:45 AM interval, but more traffic appears to be accessing campus later in the peak period, between 8:15 AM and 9:00 AM. The PM graph suggests a similar trend, with a more even distribution of traffic activity across the peak period. In 2011, more traffic activity was observed in the 4:00 PM and 5:30 PM intervals, while other intervals showed decreases in activity, versus the 2000 data.

Changes in class scheduling, implementation of flex hours for employees, and more use of other modes during the congested peak periods may have induced this spreading of peak traffic. Overall, this trend toward less pronounced peaks and a more even distribution of traffic will more efficiently utilize the available network roadway capacity, resulting in lower levels of congestion.

C.2.c. Gateway Peak Period Traffic Access Distribution, 2011 vs. 2000

Table 3.2 compares the percentage distribution of vehicular traffic across all of the Gateway Intersections during the AM and PM peak periods.

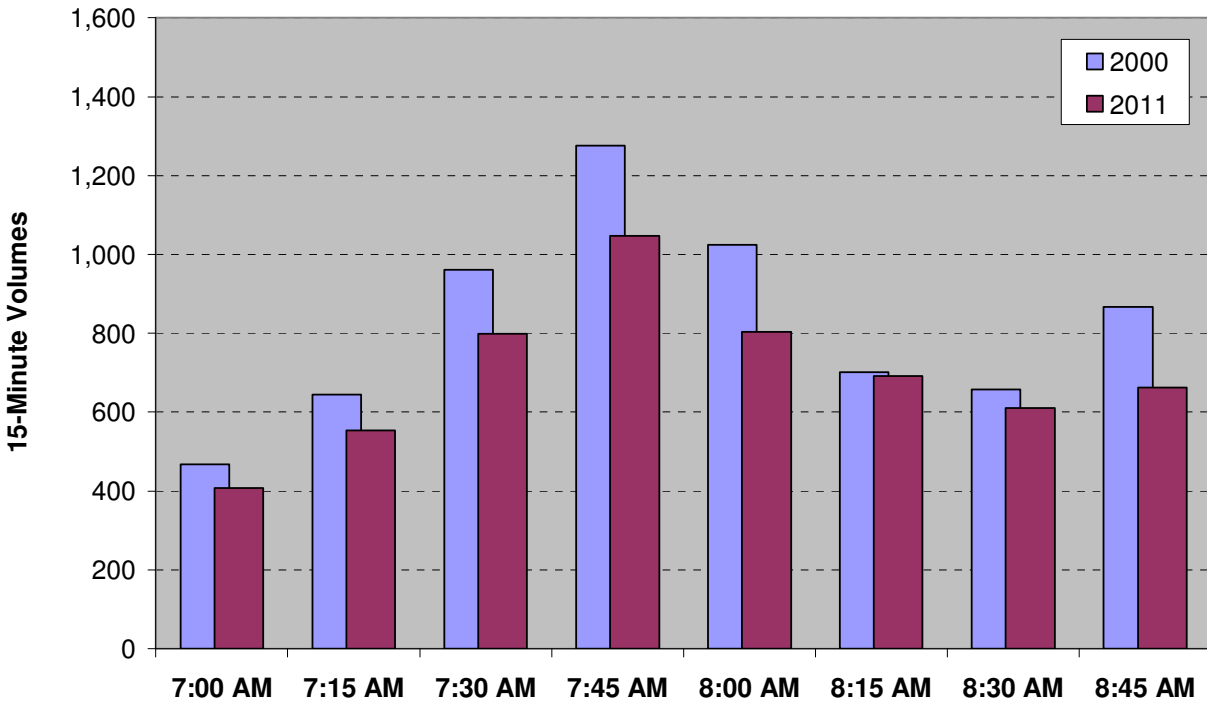
Table 3.2. Distribution of Peak Period Vehicular Traffic among Gateway Intersections, 2000 vs. 2011

	AM Peak Period		PM Peak Period	
	2000	2011	2000	2011
Curtin Road @ Atherton Street	10.0%	9.1%	11.6%	11.4%
Fischer Road @ Park Avenue	0.9%	8.1%	2.2%	3.2%
Burrowes Road @ College Avenue	10.3%	10.4%	10.0%	12.5%
Allen Road @ Park Avenue	10.5%	13.4%	11.7%	13.9%
Shortlidge Road @ Park Avenue	15.9%	7.6%	11.5%	8.8%
Shortlidge Road @ College Avenue	16.2%	9.6%	19.6%	12.8%
Bigler Road @ Park Avenue	11.7%	15.8%	8.2%	12.2%
Curtin Road @ University Drive	14.0%	14.7%	12.7%	12.6%
Hastings Road @ University Drive	10.4%	11.2%	12.5%	12.7%

GATEWAY INTERSECTIONS

AM Peak Period Traffic, 2000 vs. 2011

Traffic by 15-Minute Interval



PM Peak Period Traffic, 2000 vs. 2011

Traffic by 15-Minute Interval

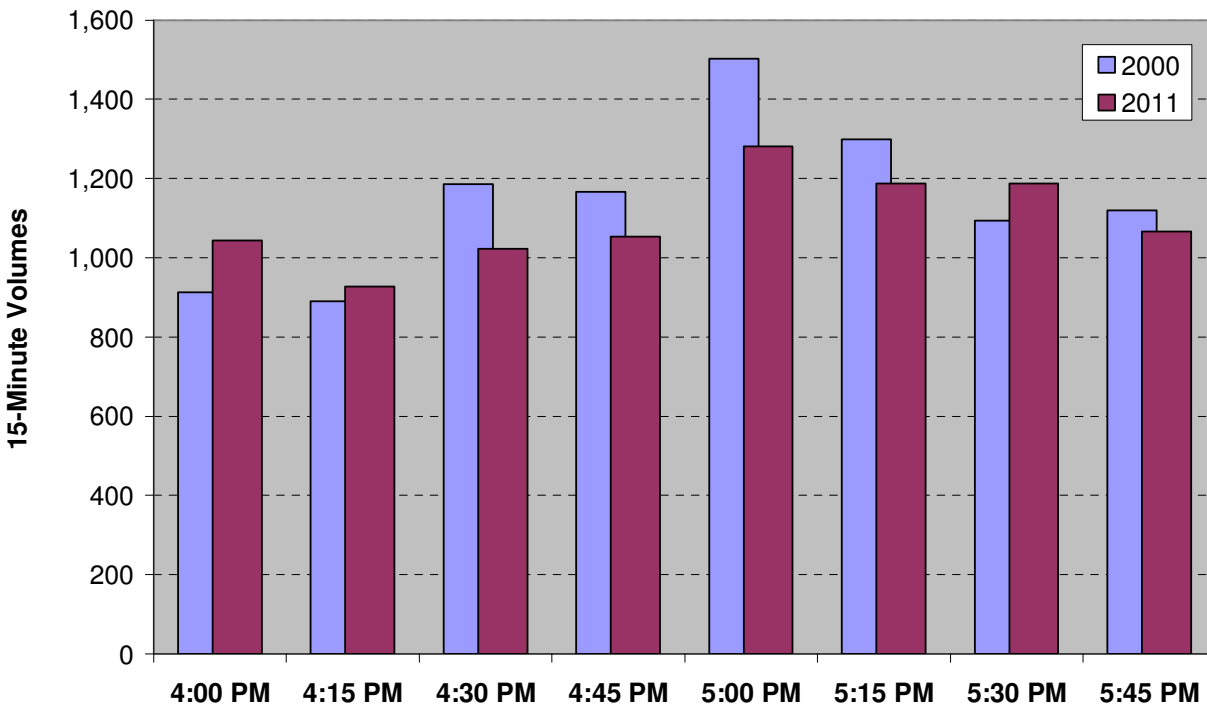


Figure 3.11. Vehicular Traffic Accessing Core Campus by 15-Minute Interval, 2000 vs. 2011

The Fischer Road gateway now carries a much higher proportion of AM peak period traffic, mostly because of the change from one-way to two-way operation. The Shortlidge Road gateways at Park Avenue and College Avenue now carry a smaller percentage of traffic, likely linked to the Shortlidge Road closure and conversion to a pedestrian way. The addition of East Deck along with traffic capacity improvements at the Park Avenue/Bigler Road intersection, have focused more traffic at the Bigler Road gateway. With the distribution percentages at other gateways fairly stable between 2000 and 2011, the resulting 2011 traffic distribution is more evenly distributed among the gateways than in 2000. This is particularly noticeable during the PM peak period when volume and congestion are at their highest levels of the day.

C.3. On-Campus Intersections – Campus Circulation Level-of-Use

The following eleven intersections were designated as Primary On-Campus Intersections for sampling the level-of-use internal to the University Park Campus roadway system.

1. Burrowes Road & Curtin Road
2. Burrowes Road & Pollock Road
3. Allen Road & Fischer Road
4. Allen Road & Curtin Road
5. Shortlidge Road & Curtin Road
6. Shortlidge Road & Pollock Road
7. Bigler Road & Curtin Road
8. Bigler Road & Pollock Road
9. Bigler Road & Hasting Road/McKean Road
10. Porter Road & Curtin Road
11. White Course Drive & Red A Lot Driveway

These intersections are exclusively within the University-owned campus roadway network. As such, the total traffic volumes are an indicator of internal traffic activity within the University Park Campus. The first nine of these intersections are evaluated as a group in the following sections. While the final two intersections have some characteristics similar to the other on-campus intersections, they are peripheral to the core of campus and are not considered alongside the other core on-campus intersections.

C.3.a. On-Campus Peak Period Traffic Volumes, 2011 vs. 2000

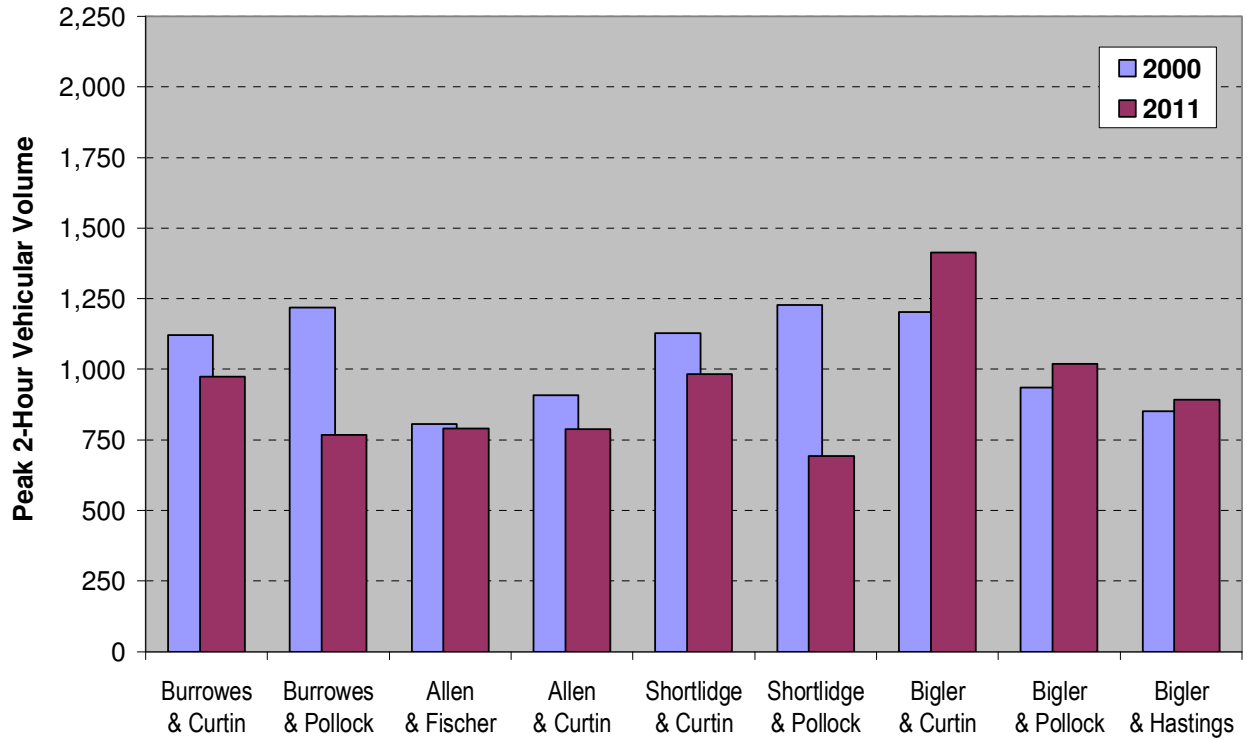
The bar graphs in **Figure 3.12** provide side-by-side comparisons of the 2000 and 2011 vehicular traffic counted at the Primary On-Campus Intersections during the AM and PM peak periods.

Overall, a net volume decrease of about 12 percent was observed in the AM peak period and a net decrease of about 7 percent was observed in the PM peak period. Taking the AM and PM Peak Period volumes together, the composite peak period traffic volumes decreased by approximately 9 percent between 2000 and 2011. During both AM and PM peak periods, the consolidation of vehicles onto Bigler Road is most evident. Volume increases were observed at Bigler/Curtin, Bigler/Pollock, and Bigler/Hastings. The most notable reductions in peak period volume occurred at the Burrowes/Curtin, Burrowes/Pollock, and Shortlidge/Pollock intersections. This reflects the impact of new kiosks along Pollock Road, which prohibit east-west cross through traffic and allow only faculty-staff permit holders to access this area until after 4:00 PM on weekdays.

ON-CAMPUS INTERSECTIONS

AM Peak Period Traffic, 2000 vs. 2011

Total Vehicles by Location, 7:00 AM to 9:00 AM



PM Peak Period Traffic, 2000 vs. 2011

Total Vehicles by Location, 4:00 PM to 6:00 PM

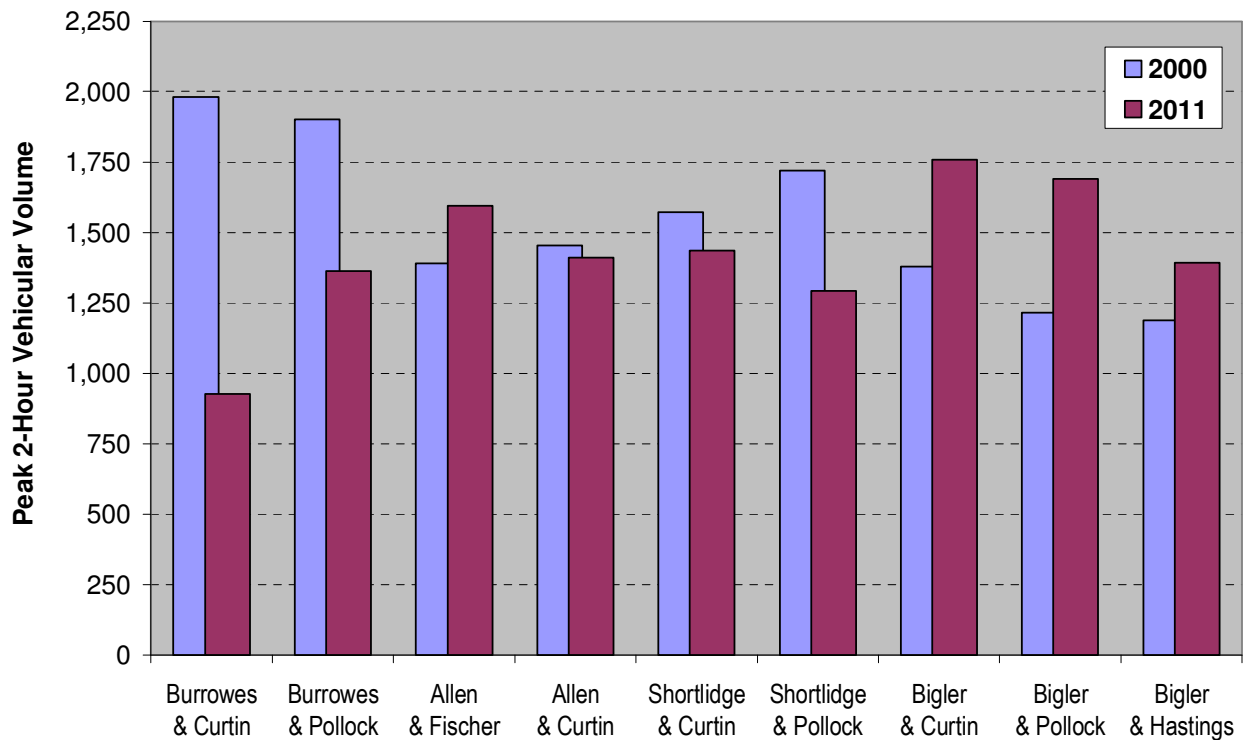


Figure 3.12. Vehicular Traffic at Primary On-Campus Intersections, 2000 vs. 2011

C.4. Total Campus Vehicular Traffic Access & Level-of-Use

The evaluation of Total Campus Traffic Access supplies a comprehensive measure of motorized traffic accessing the University Park Campus. Access to campus was defined for the following:

- **Gateway Intersections**, which capture vehicles accessing Core Campus including the Nittany, HUB, Eisenhower, and East parking decks;
- **Commuter Parking Lots** near Beaver Stadium, including Jordan East, Stadium West, and Porter North Lots;
- **Research Buildings and Student Storage Parking** that is accessed via Hastings Road, east of University Drive;
- **Parking Areas north of Park Avenue** that are accessed via Bigler Road and University Drive Extension; and
- **West Campus Parking Areas**, which are accessed via White Course Drive and West Campus Drive.

These access locations are not exhaustive but do account for 95 percent of Penn State’s managed parking spaces at University Park. As such, this comparison provides the most succinct statement about vehicular travel demand and the effectiveness of the University’s management strategies. Year 2011 traffic volume data was compiled to be comparable to the data collected in 2000. That is, for locations where data was not collected in 2000, no data from 2011 was included in the comparison. Most of the excluded locations provide access to areas of campus that are fundamentally unchanged during the last 10 years, and no significant difference in traffic volume would be expected.

C.4.a. Total Campus Peak Period Traffic Volumes, 2011 vs. 2000

Overall, the vehicular traffic volume accessing the campus **decreased by more than 10 percent** during the AM Peak Period and **increased by less than 1 percent** during the PM Peak Period. Taking the AM and PM Peak Period volumes together, the composite peak period traffic volumes **decreased by approximately 4 percent** between 2000 and 2011. The bar graphs in **Figure 3.13** provide side-by-side comparisons of the 2000 and 2011 traffic data by location for the Total Campus during the AM and PM peak periods. Volumes are grouped according to the major campus access points described above. The Core Campus Gateways have been divided according to access from Atherton Street, Park Avenue, College Avenue, and University Drive.

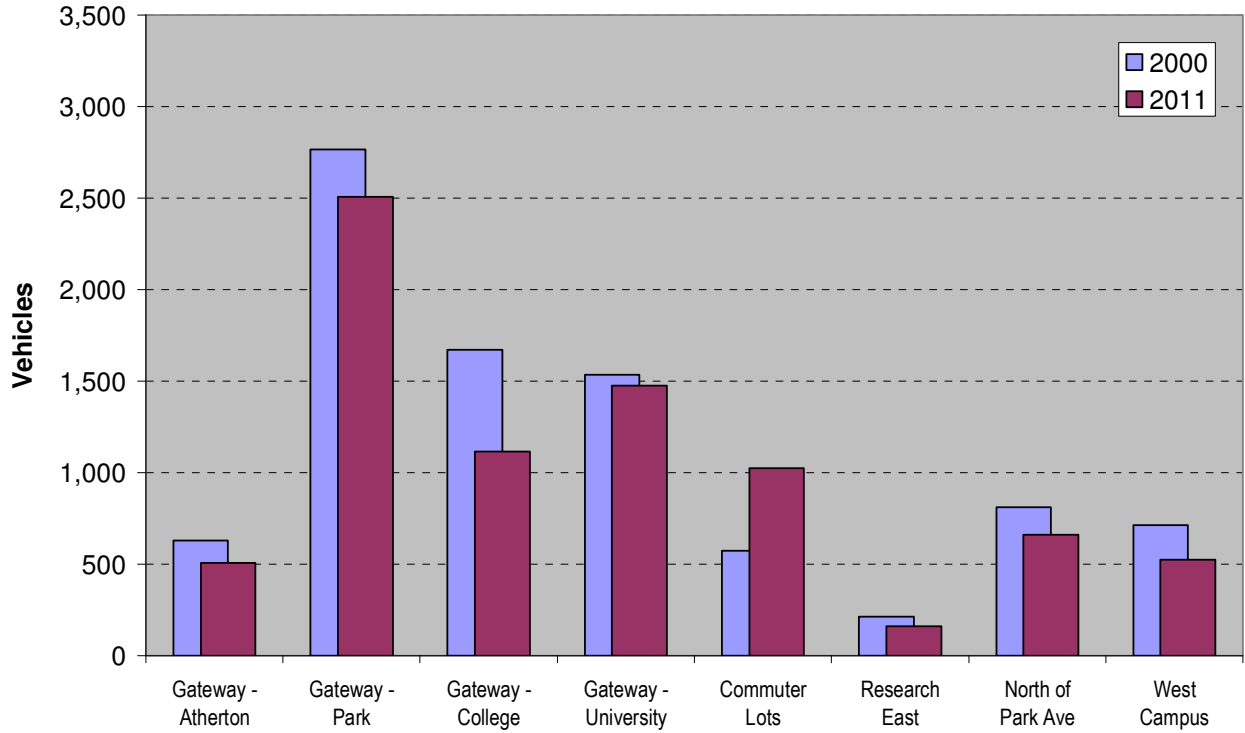
C.4.b. Total Campus Peak Period Traffic Volumes by 15-Minute Interval, 2011 vs. 2000

Examination of the time distribution of traffic during the 2-hour peak periods provides more insight about the nature of the volume increases and decreases. **Figure 3.14** summarizes the Total Campus Access volumes by 15-minute interval during the 2-hour peak periods. The most notable trend is the “spreading” of traffic volume away from the highest volume, peak intervals to the lower volume tails of the distribution. The trend occurs in both peak periods. During the AM, volumes decreased more dramatically during intervals that were highest in 2000—i.e., 7:30, 7:45, 8:00, and 8:45 AM. Meanwhile, volumes showed less change, even slight increases, during other intervals. During the PM, volume again decreased more during the peak intervals that were highest in 2000—i.e., 4:30, 4:45, and 5:00 PM. Volume increases were most noted in the earliest and latest intervals, resulting in a more uniform distribution of traffic during the 2-hour peak period and volume reductions during the highest intervals.

TOTAL CAMPUS ACCESS

AM Peak Period Traffic, 2000 vs. 2011

Total Vehicles by Access Location, 7:00 AM to 9:00 AM



PM Peak Period Traffic, 2000 vs. 2011

Total Vehicles by Access Location, 4:00 PM to 6:00 PM

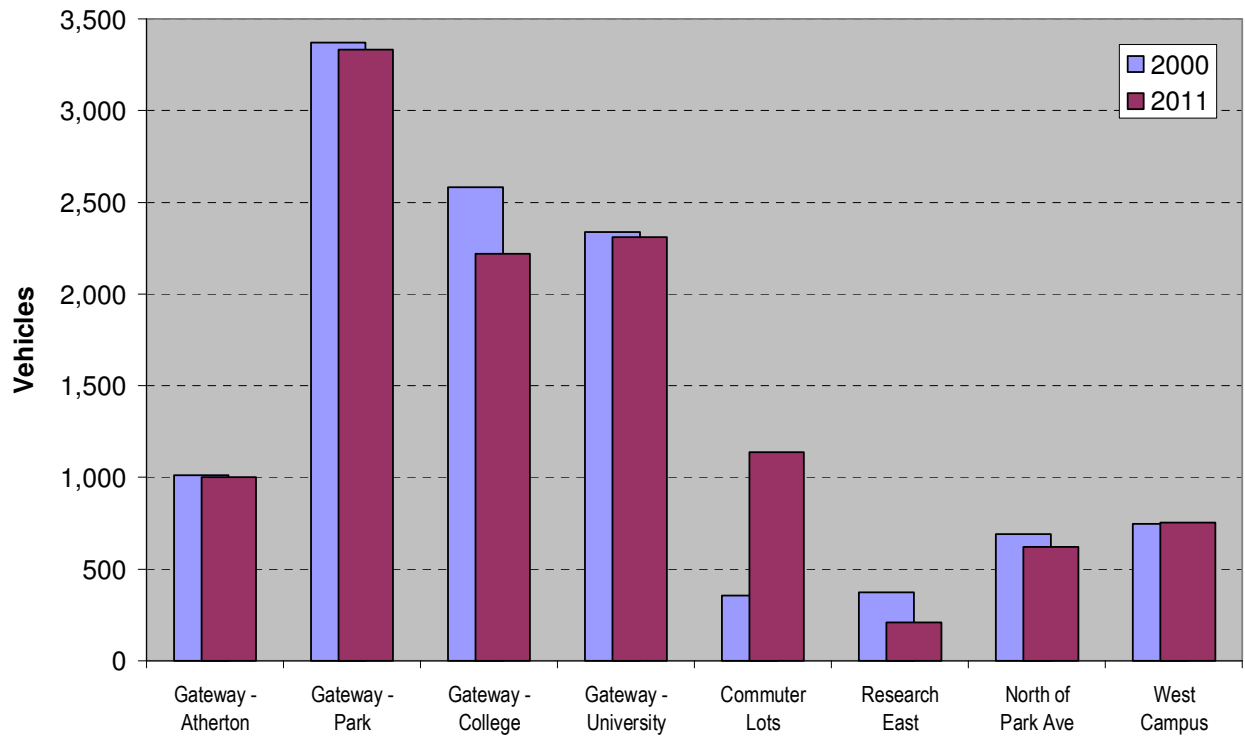
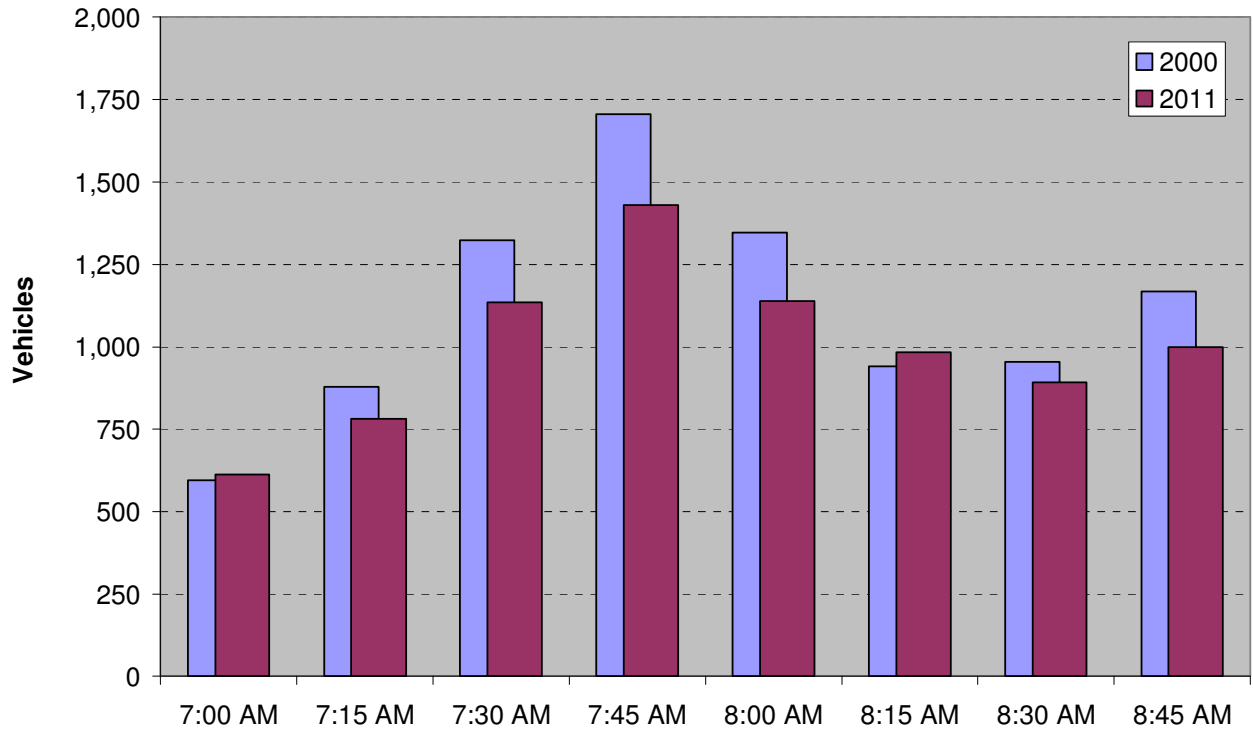


Figure 3.13. Total Campus Access Traffic by Location, 2000 vs. 2011

TOTAL CAMPUS ACCESS

AM Peak Period Traffic, 2000 vs. 2011

Total Vehicles by 15-Minute Interval, 7:00 AM to 9:00 AM



PM Peak Period Traffic, 2000 vs. 2011

Total Vehicles by 15-Minute Interval, 4:00 PM to 6:00 PM

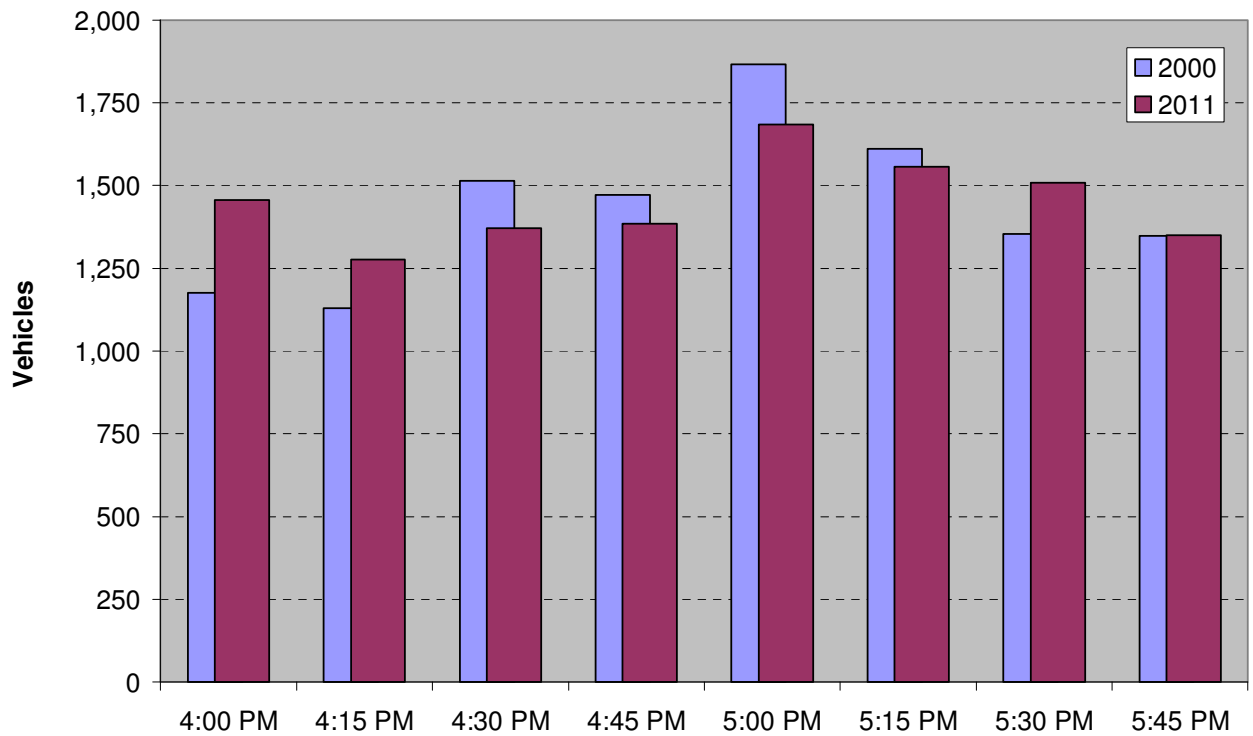


Figure 3.14. Total Campus Access Traffic by 15-Minute Interval, 2000 vs. 2011

D. Regional & Campus Transit Use

Bus transit service to the University Park Campus is operated by the Centre Area Transportation Authority (CATA) with a partnership arrangement with Penn State University. The extent of CATA's route system is shown in **Figure 13.15**. Outside of the University's "no-fare" zone, CATA's Regional Routes operate with user-paid fares and are mostly radial, connecting the community with the campus. On-campus, the Regional Routes become "no-fare" buses. The Loop and Link routes operate fare-free between all stops and provide circulator services specific to the needs of the University Park Campus. CATA designs and operates these routes in coordination with Penn State's Transportation Services office.

The following evaluations of transit level-of-use are based on ridership data collected by CATA on April 21, 2011. This date was found to have daily ridership near the median for all days when classes were in session during Penn State's 2011 Fall and Spring semesters.

D.1. Transit System Ridership throughout the Day

Figure 13.16 illustrates total and directional transit ridership for each hour of the day during April 21, 2011 for all routes except the Blue and White Loops, which are evaluated separately. Ridership for these radial routes was provided in terms of "one way person trips," allowing a distinction between inbound trips (oriented toward campus) and outbound trips (oriented away from campus).

Ridership peaks most sharply in the 9:00 AM hour, with inbound trips dominating ridership. Smaller peaks are observed during midday and afternoon. The midday and afternoon peaks have a similar magnitude, but the afternoon peak is broader, extending over the two hour time period between 4:00 PM and 6:00 PM. During the midday peak, inbound and outbound trips are virtual equal, but outbound trips dominate the afternoon peak. One other minor peak is observed around 2:00 PM. After 6:00 PM, system ridership remains significant but declines steadily until service ceases at 12:30 AM, for most routes.

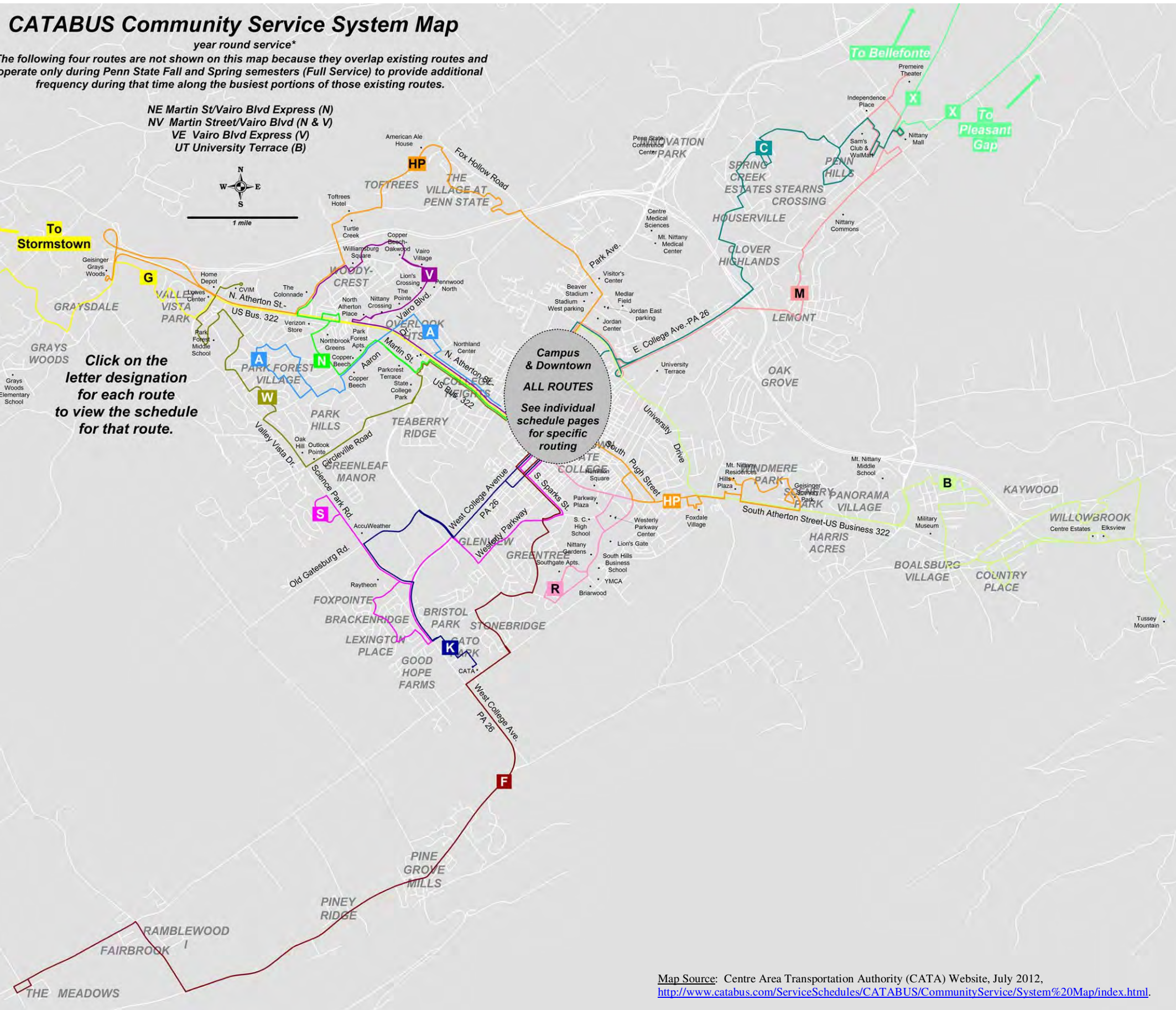


Figure 3.15. Centre Area Transportation Authority (CATA) Transit Bus System, 2011

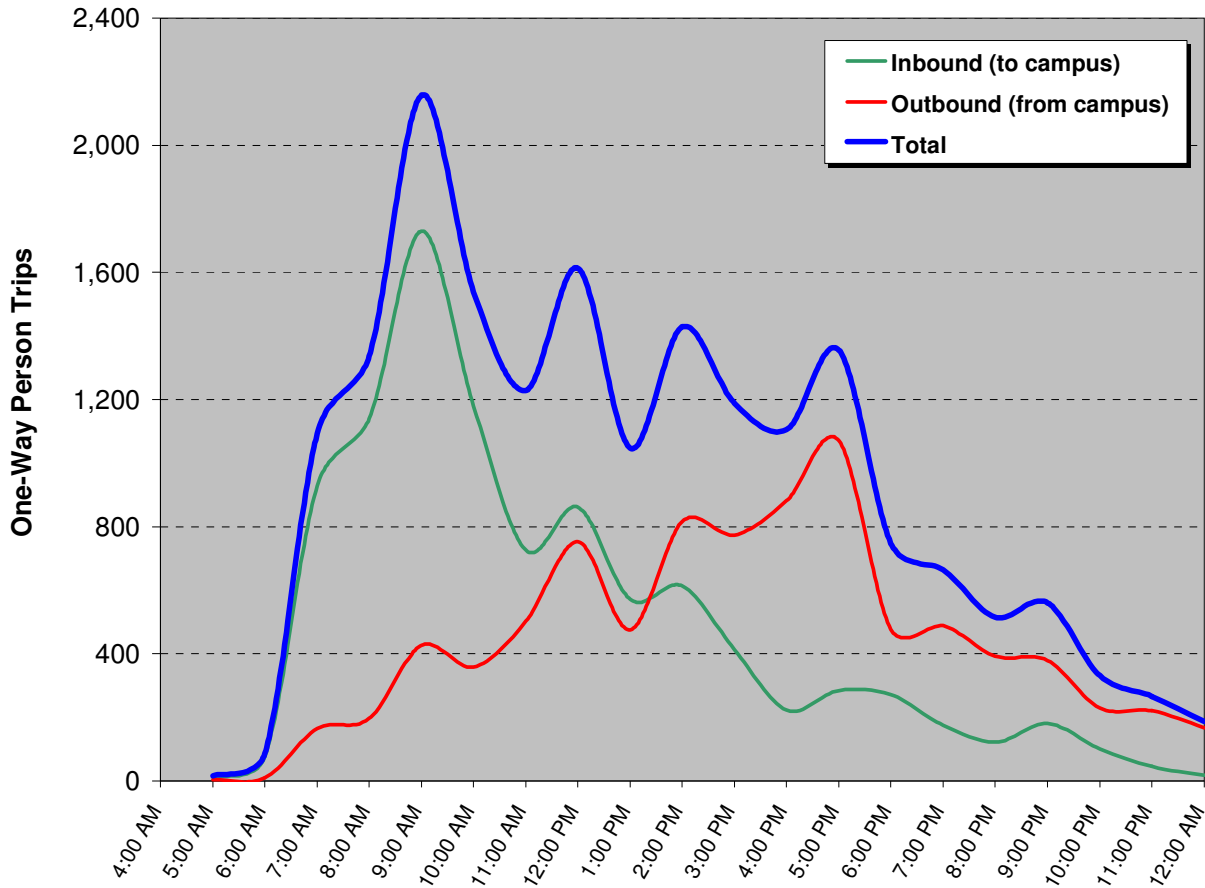


Figure 3.16. Hourly CATA Ridership by Commute Direction, April 21, 2011

Table 3.3 compares the monthly transit ridership for April 2011 to April 2002 (the first April ridership summary available after the current APC ridership tracking system was installed). From 2002 to 2011, system ridership has increased by about 10 percent, mostly on the CATA Regional Routes. A slight ridership decrease on the Loop and Links systems was observed. However, some of this decrease may have been captured on the Regional Routes, since they provide fare-free service across campus on routes that overlap the Loop and Link.

Table 3.3. CATA Transit Monthly Ridership, April 2002 vs. April 2011

	April 2002	April 2011
CATA Regional Routes	9,623	14,007
Red Link	2,731	2,308
Green Link	*	2,295
Blue Loop	9,256	8,391
White Loop	10,226	8,037
Total Loop & Link System	22,214	21,031
Total System	31,837	35,038

* Green Link was not in operation in April 2002.

D.2. Blue and White Loop Ridership

Ridership on the Blue and White Loop was summarized apart from the other routes given their nature as circulator services, as opposed to radial services. Radial services have a fairly certain center or end point that creates a distinction between inbound and outbound commuter trips. Inbound and outbound commuter trips on a circulator route depends much more on local knowledge of the service, including the primary locations available for boarding (entering the bus) and alighting (exiting the bus) in relationship to the locations of home versus work or school.

Figures 3.17 and 3.18 present an analysis of the Blue Loop route during the AM and PM peak periods, respectively. The pie charts represent the relative number of boardings (blue) and alightings (white) at each stop, with the size of the pie representing the total boardings and alightings. The symbology of the route line itself indicates the passenger load carried on the transit vehicle between stops. Darker colors and thicker lines represent higher passenger loads. During the AM peak period, boardings are heaviest at the Commuter Parking Lot stops and downtown near concentrations of student housing. Alightings are heaviest at the Curtin Road Transit Center, the Mobility Center at College/Allen, and Thomas Building. The largest passenger loads are carried between the Commuter Lots and Thomas Building and along College Avenue between stops near Atherton Hall and the Mobility Center. Minimal passenger loads are carried from the Visual Arts Building to the Commuter Lots. During the PM peak period, boardings are heaviest on campus, and alightings are heaviest at stops near student apartments, the East Halls dorm complex, and the Commuter Lots. Passenger loads are heaviest between the Curtin Road Transit Center and East Halls.

Figures 3.19 and 3.20 present an analysis of the White Loop route during the AM and PM peak periods, respectively. Similar to the Blue Loop analysis, pie charts represent the relative number of boardings (gray) and alightings (white) at each stop, with the size of the pie representing the total boardings and alightings. The color and size of the route line indicate passenger load, with darker colors and thicker lines representing higher passenger loads. During the AM peak period, the heaviest boardings occur at stops nearest concentrations of student housing, both in downtown in the Beaver Canyon and at East Halls. Alightings occur primarily on campus at the Curtin Road Transit Center, Visual Arts Building, and IM Building. Passenger loads are heaviest from the Downtown stops to the Curtin Road Transit Center. During the PM peak period, boardings and alightings are more balanced at most stops.

Comparing the Blue and White Loops, both routes are used at similar levels during the AM peak period, but during the PM peak period, the Blue Loop carries much larger passenger loads over a larger portion of the route. This may be due to longer headways and fewer transit vehicles on the White Loop route, but it is also possible that afternoon demand for White Loop services is lower than anticipated. Service adjustments may be appropriate to economize the schedule or modify the route.

For the purpose of calculating mode share, certain stops were assigned a Transit Nexus Characteristic based on the location and context of the stop, the general profile of transit users who board/alight at the stop, and the modal trip-making dynamics between the stop and campus. For instance, transit users who board at the Jordan East Lot represent secondary trips (car as the primary mode). Therefore, boardings and alightings at this stop were not counted in the transit mode share. On the other hand, transit users who board along Beaver Avenue are more likely to be apartment residents who are using the bus as the primary mode to campus. Boardings and alightings at this stop were characterized as mostly primary trips and were counted in the transit mode share. The Transit Nexus Characteristic and mode share methodology is described in further detail in **Appendix D**.

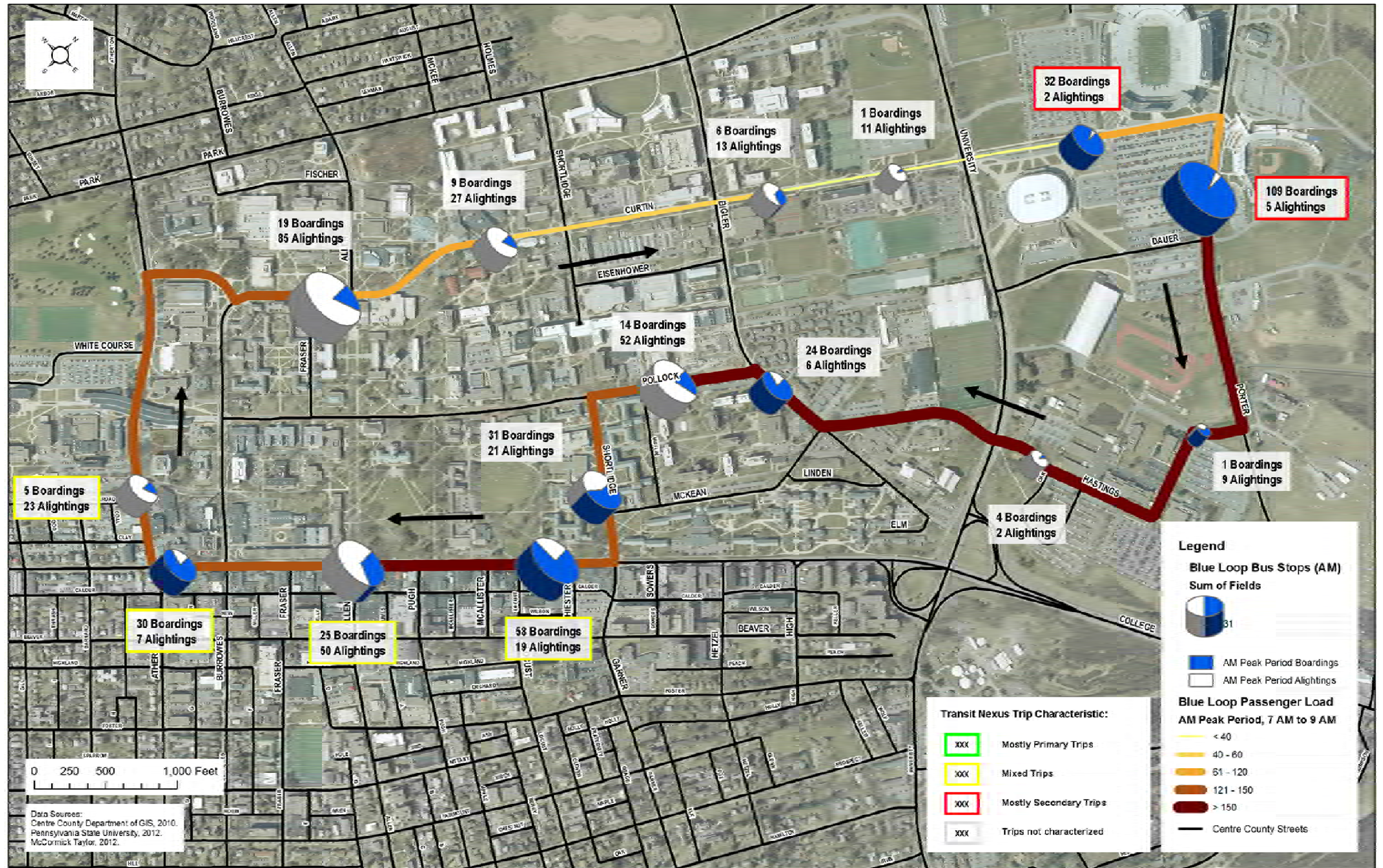


Figure 3.17. 2011 Blue Loop Passenger Load with Boardings & Alightings by Stop, AM Peak Period (7:00 AM to 9:00 AM)

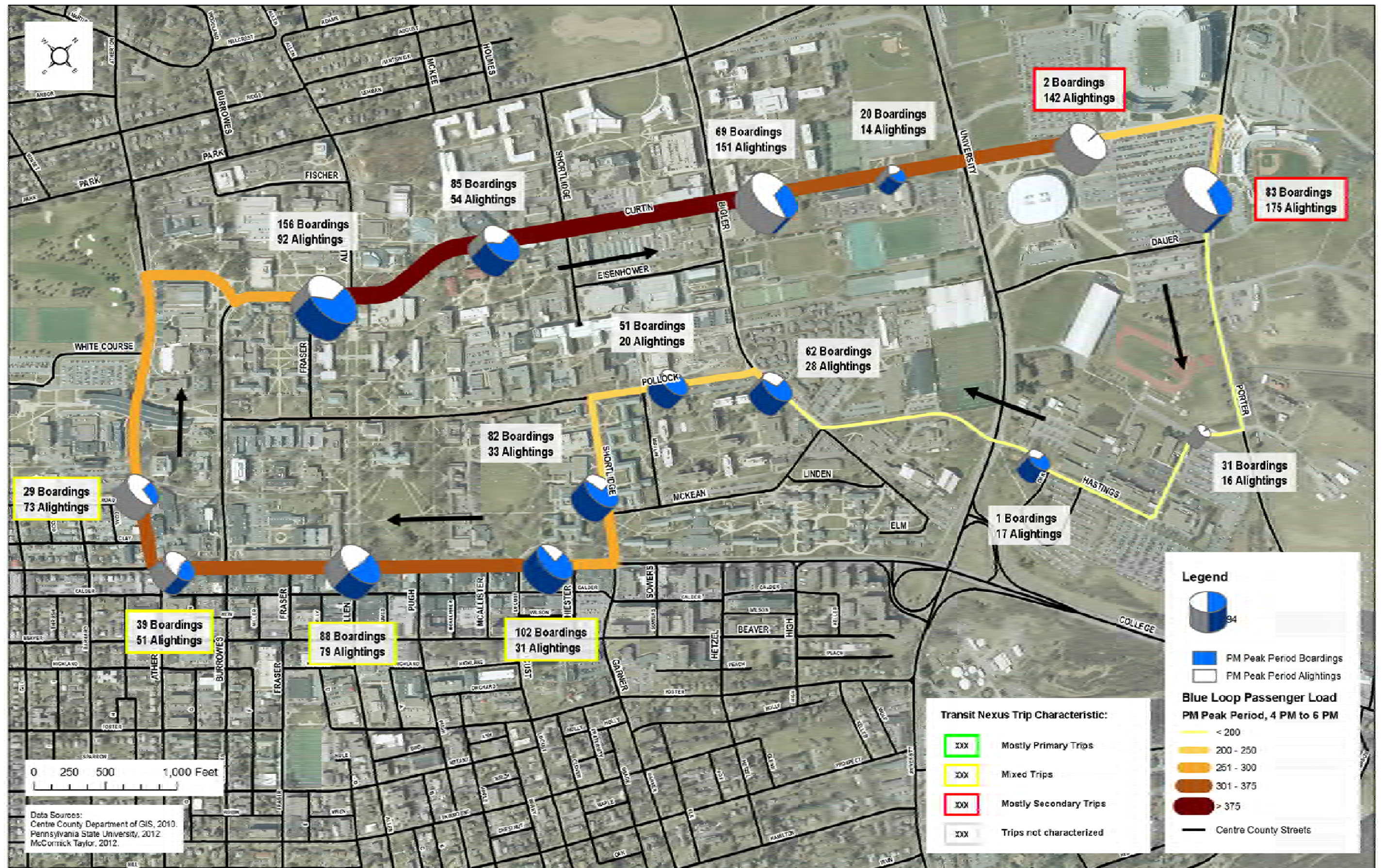


Figure 3.18. 2011 Blue Loop Passenger Load with Boardings & Alightings by Stop, PM Peak Period (4:00 PM to 6:00 PM)

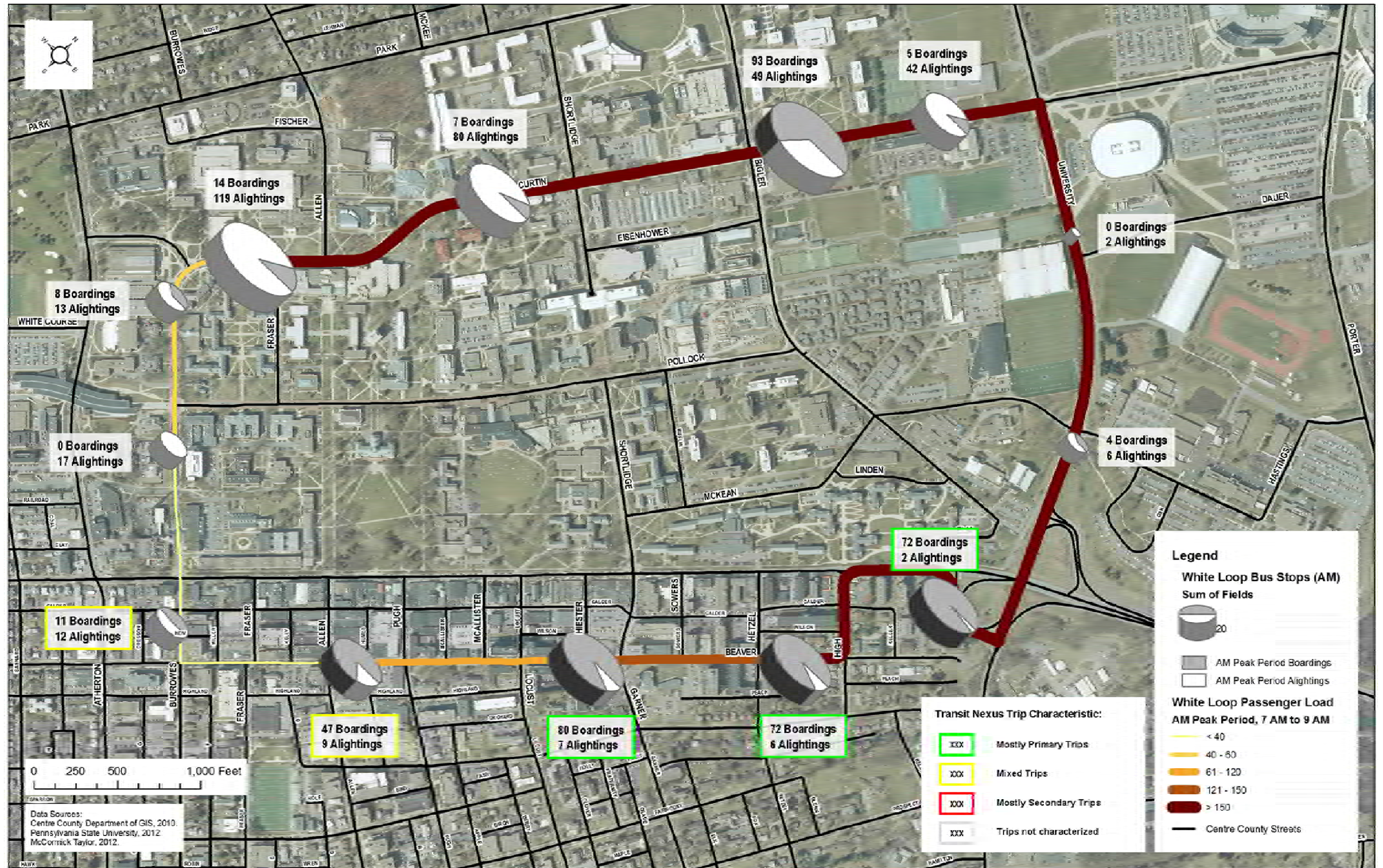


Figure 3.19. 2011 White Loop Passenger Load with Boardings & Alightings by Stop, PM Peak Period (7:00 AM to 9:00 AM)

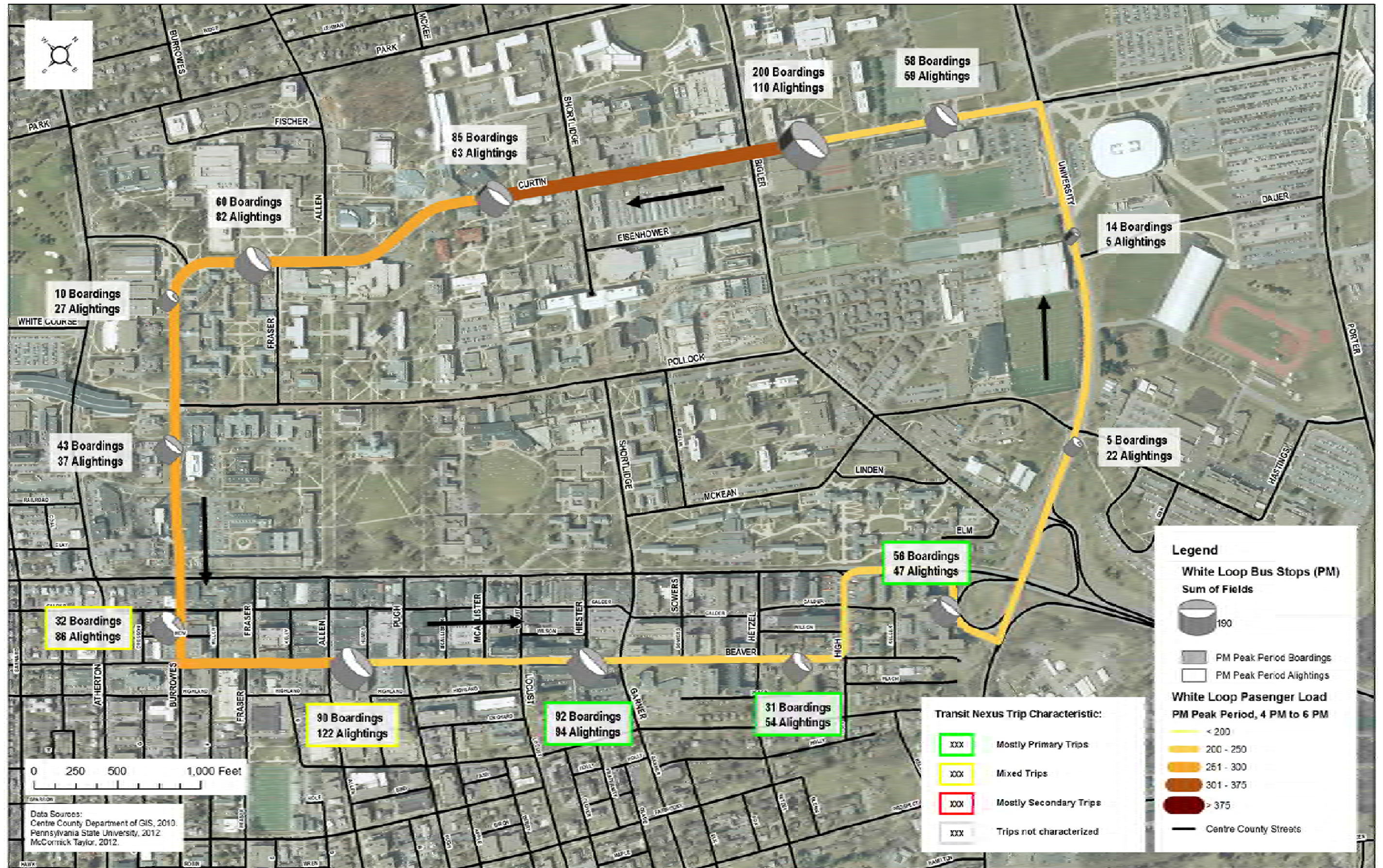


Figure 3.20. 2011 White Loop Passenger Load with Boardings & Alightings by Stop, PM Peak Period (4:00 PM to 6:00 PM)

D.3. Transit Ridership by Direction of Approach & Departure

CATA’s Regional Routes have been deliberately distributed to access the University Park Campus on different pathways. This routing method reduces the capacity burden on any one roadway or campus gateway. In general, a route will enter and exit campus via the same or similar gateway.

Figure 3.21 identifies and locates the AM transit peak, PM transit peak, and daily person loading on the various radial CATA Regional Routes that access the University Park Campus. Where the entry and exit points are different, the data was assigned to the entering gateway. The transit peak hours were the highest ridership hour within the peak periods of vehicular traffic. Based on Daily ridership, the Curtin Road gateway at Atherton Street carries the most transit passenger load, with more than 10,000 passengers per day. The Curtin Road gateway at University Drive (~3,400 passengers per day) and Burrowes Road gateway at College Avenue (~2,900 passengers per day) are moderately used. Hastings Road and Allen Road are less used. College Avenue is a special case, with the main campus interface of the NV route being along the south side of campus.

D.4. Peak Hour Transit Use – Transit Vehicle Bandwidth

Figures 3.22 and 3.23 illustrate the volume of CATA transit buses on each network link during the AM and PM peak hours. The volumes include buses from all transit routes (regional routes, Loop and Link) and are based on the route schedules and operational headways.

Curtin Road, particularly near the Transit-Center, is the most transit-intensive corridor on campus. Transit vehicle volumes were slightly higher in the PM than in the AM, but according to CATA, the data provided did not include demand sensitive “tripper” buses, which are typically used in the AM only. With trippers added, the peak hour volumes of AM and PM transit vehicle volumes would be nearly equal at about 70 vehicles per hour. This has implications for the efficiency of the transit system. System ridership peaks at a higher level in the AM than in the PM (**Figure 3.16**), even though the number of transit vehicles per hour is similar during both peaks.

D.5. Total Transit Vehicles Accessing Campus

Table 3.4 compares the average number of transit vehicle trips per day that accessed campus in 2002 vs. 2011, when Penn State classes were in session. Considering the increases in CATA’s regional ridership and stable ridership on the Loop and Link (**Table 3.3**), the decrease in vehicles accessing campus represents improved efficiency in the transit system. The efforts by the University’s Transportation Services and CATA to regularly “tweak” the service schedule in response to conferences, special events, and known transportation peaks contributes to the system efficiency.

Table 3.4. CATA Transit Vehicle Trips Accessing Campus, 2002 vs. 2011

	2002	2011
CATA Regional Routes	481	452
Loop & Link Routes	692	632
TOTALS	1,173	1,084

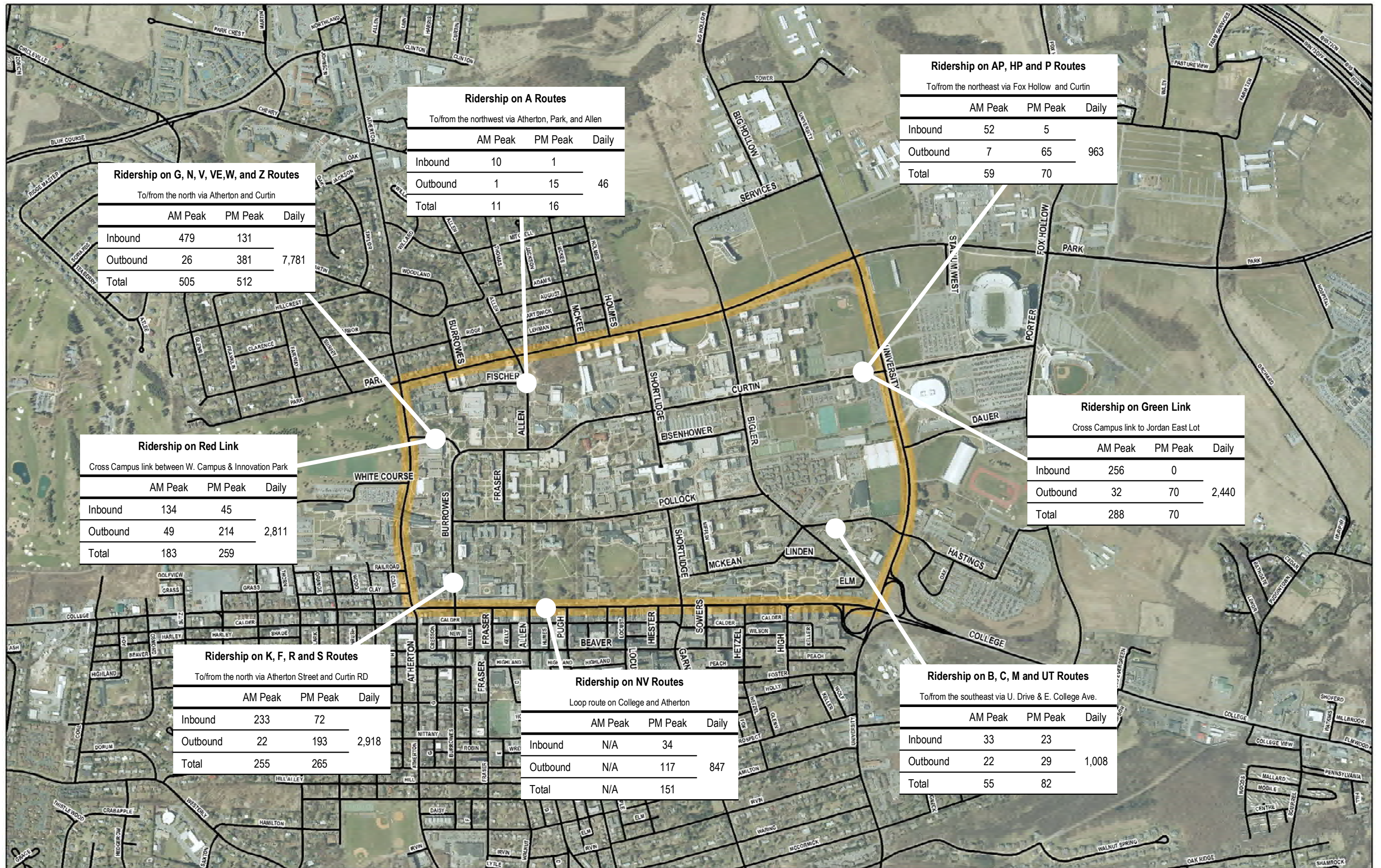


Figure 3.21. CATA Transit Ridership by Direction of Approach & Departure, 2011

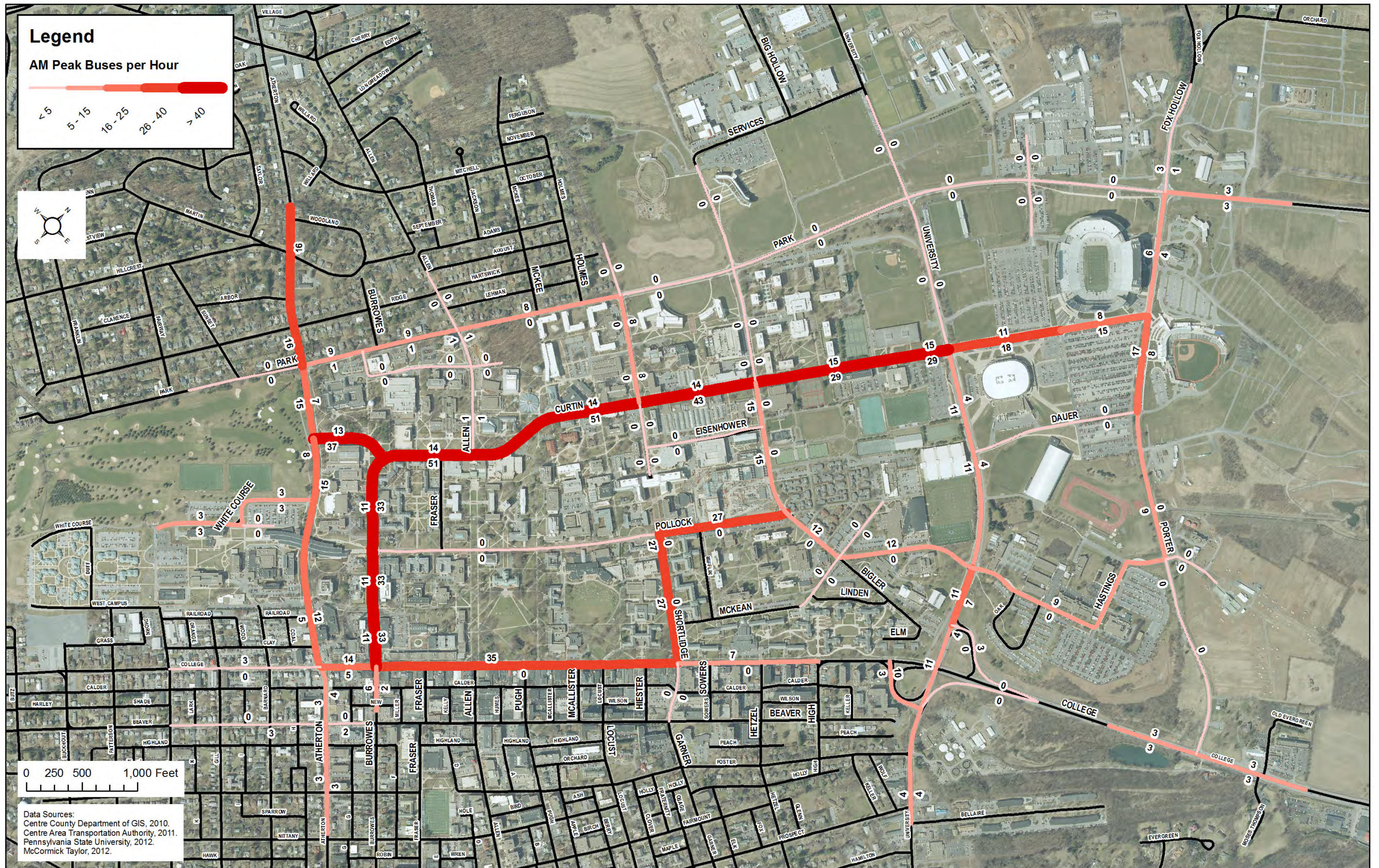


Figure 3.22. AM Peak Hour CATA Vehicle Bandwidth – Vehicles by Direction, 2011

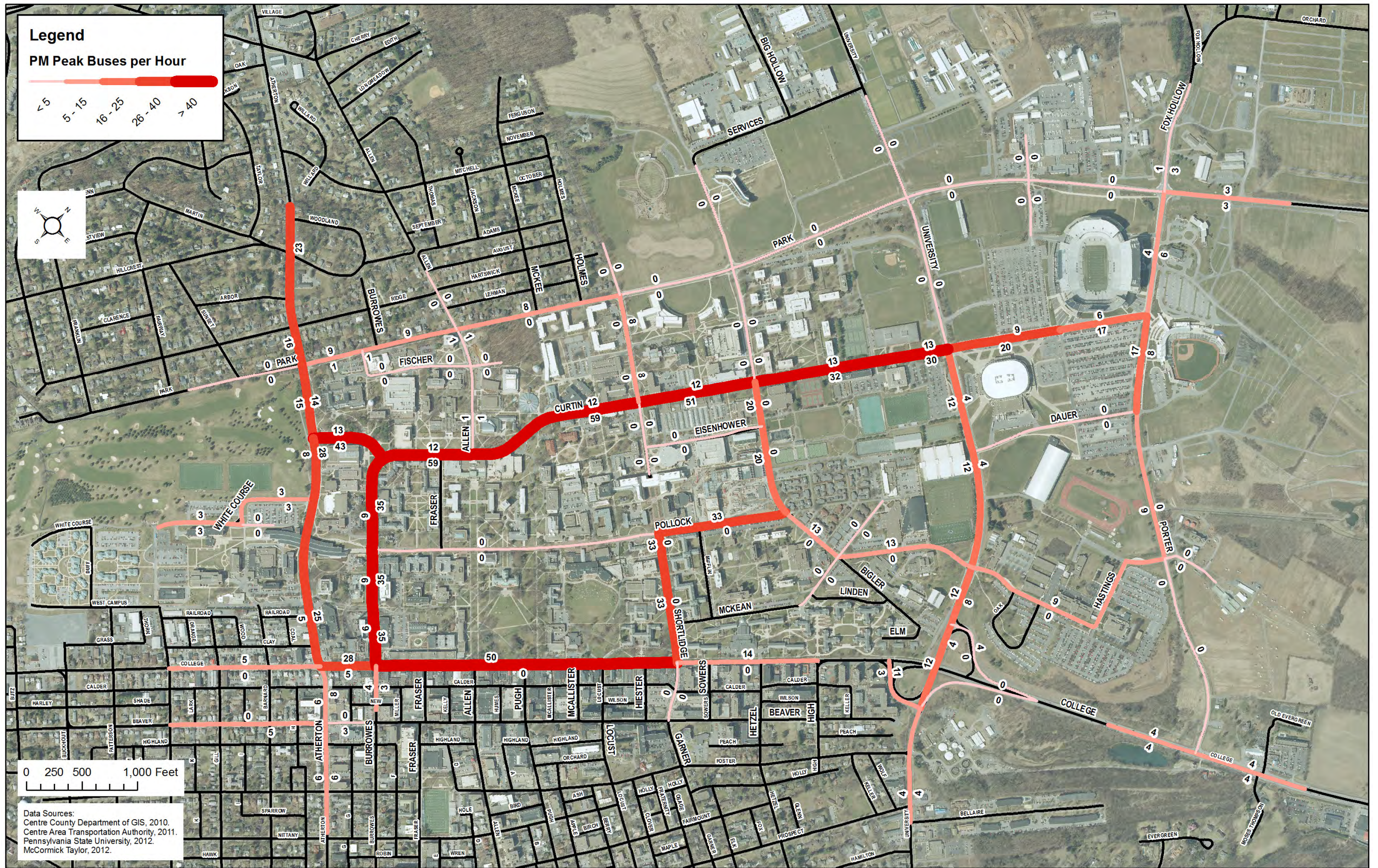


Figure 3.23. PM Peak Hour CATA Vehicle Bandwidth – Vehicles by Direction, 2011

E. University Park Shuttle Systems

In addition to the CATA transit system, other University-serving shuttle systems are operated by Transportation Services and certain academic departments. The following shuttle routes and their stops are illustrated in **Figure 3.24**:

E.1. Campus Shuttle

The Campus Shuttle is operated by Transportation Services to provide no-fare transportation around campus for faculty/staff, students, and visitors. The Campus Shuttle is operated Monday through Friday, 7:00 AM to 6:00 PM, with service at each stop once every 15 minutes. It does not operate on weekends or holidays.

Ridership on the Campus Shuttle during the 2010 Summer, 2010 Fall, and 2011 Spring Semesters is summarized by month in **Figure 3.25**. Blue bars represent monthly ridership when Penn State’s fall and spring semesters were in session for the full month. Monthly ridership values are read on the left scale (black numbers). The blue line and yellow points track the average ridership per day during that month, which is read on the right scale (blue italic numbers).

During Spring Semester 2011, the average ridership was 346 trips per day during the three full months when Penn State classes were in session.

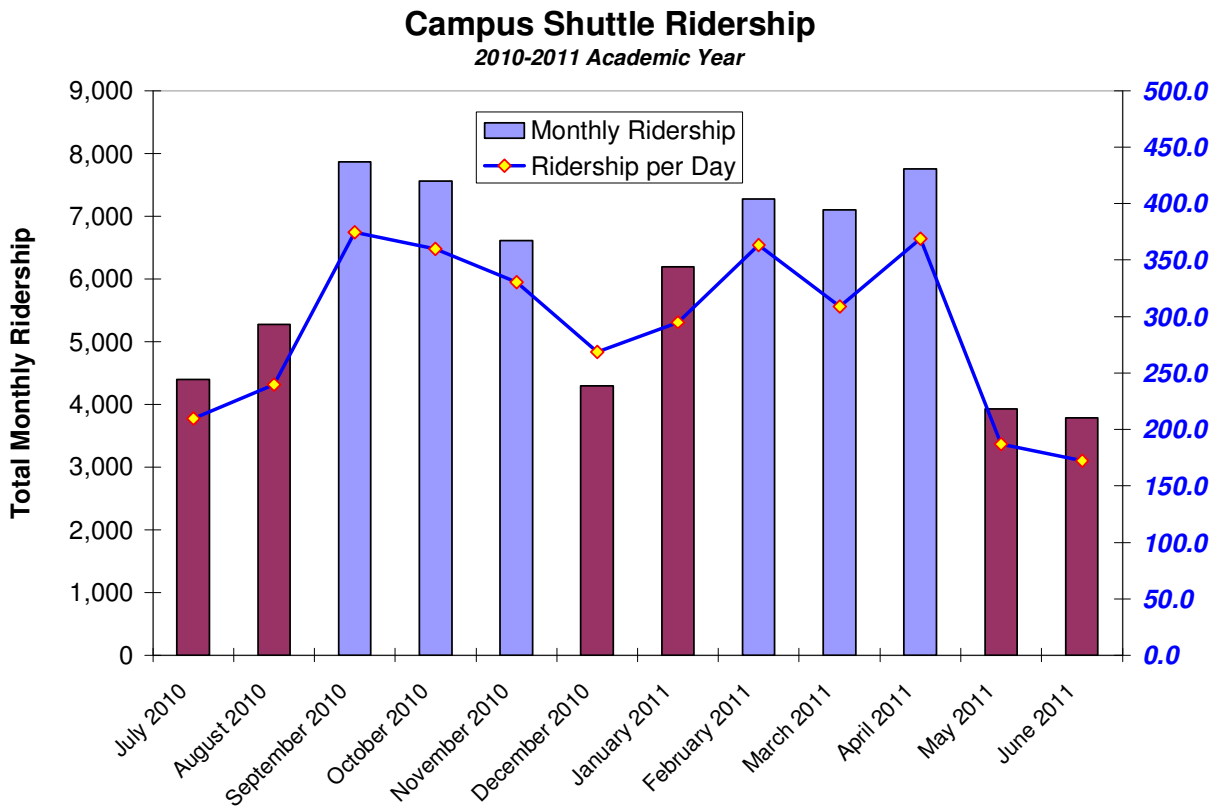


Figure 3.25. Campus Shuttle Ridership, 2010-2011 Academic Year

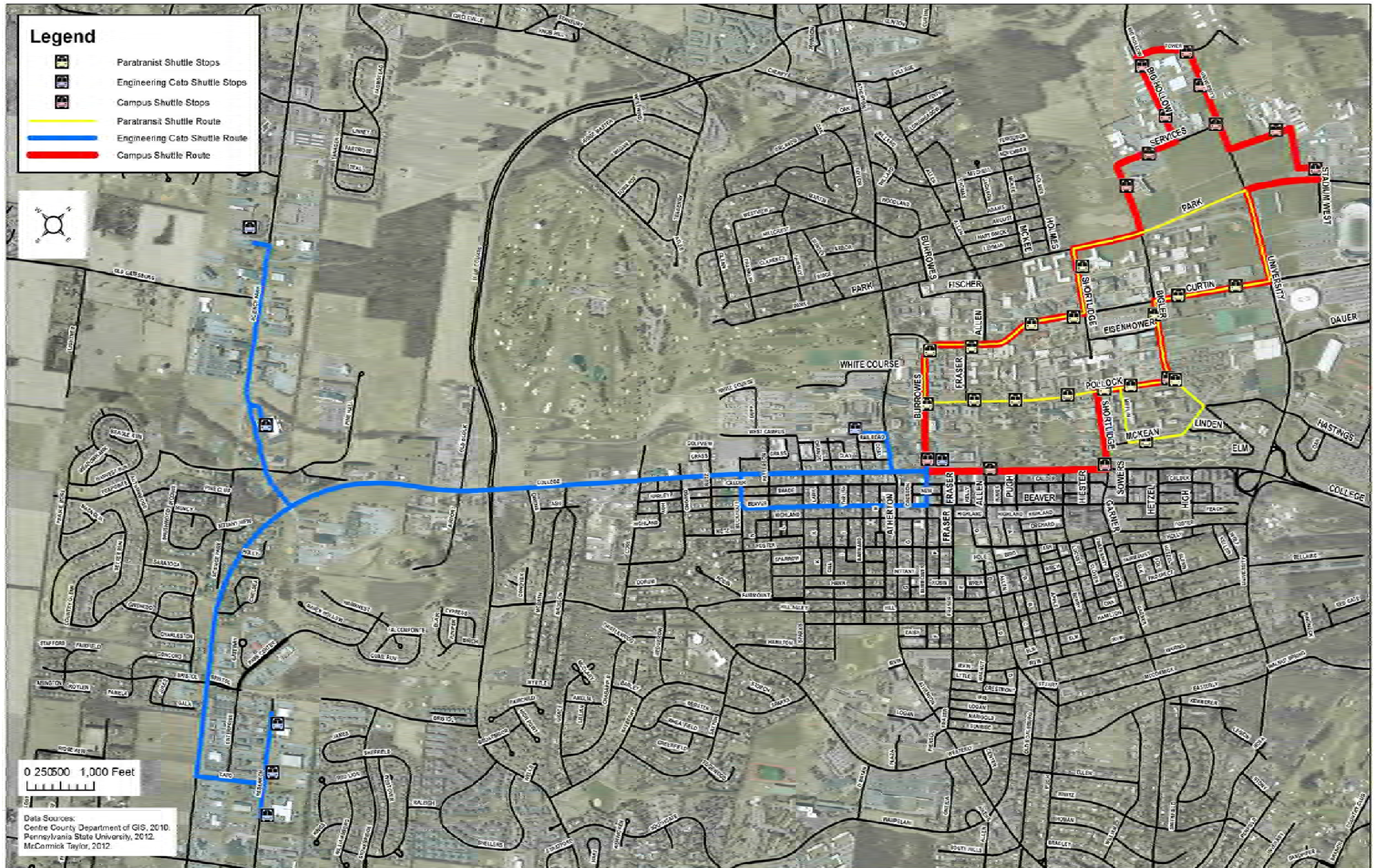


Figure 3.24. University Park Shuttle Systems, 2011

E.2. Paratransit Shuttle

The Paratransit Shuttle is a collaboration of the Office of Disability Services and Transportation Services that provides transit service for students who have temporary or permanent impairments. The shuttle was recently changed from “point-to-point” to “fixed-route” operation and no longer requires a special permit for access. As such, it augments the buses and Campus Shuttle currently running on campus. The Paratransit Shuttle is operated Monday through Friday, 7:15 AM to 6:00 PM, and service is provided at each stop every 20 minutes. It does not operate on weekends or holidays.

During Spring Semester 2011, the average ridership on the Paratransit Shuttle was 8 trips per day.

E.3. Engineering CATO Park Shuttle

The College of Engineering operates a fare-free weekday shuttle service between Foundry Park (next to Reber Building) and the North American Refractories Building in Cato Park. The shuttle also has stops at four ARL facilities in Cato Park and along Science Park Road. The Campus Shuttle is operated Monday through Friday, 8:00 AM to 4:00 PM. It does not operate on weekends, holidays, or during University closures. The shuttle departs Foundry Park on the hour and half hour beginning at 8:00 AM. The last shuttle of the day departs Foundry Park for Cato Park at 4:00 PM. The shuttle departs the North American Refractories Building in Cato Park at 15 and 45 minutes past the hour beginning at 8:15 AM. The last shuttle departs Cato Park for Foundry Park at 4:15 PM.

During Spring Semester 2011, ridership on the CATO Park Shuttle was estimated at 10 trips per day.

E.4. Hershey Shuttle

The University provides fare-free shuttle service between the University Park Campus and the Penn State College of Medicine at Hershey to transport students, faculty, and staff participating in official University research, administration, or teaching activities. Funding for the service is provided by the College of Medicine and University Park research units. Shuttle transportation operates Monday through Friday year-round, excluding holidays and campus closures. It is available on a first-come/first-served basis to those who obtain a Hershey Shuttle Pass. Capacity for the shuttle vehicle is 11 persons per trip, and riders who travel one way in the morning have first priority for return trips.

The uses two shuttle vehicles to operate both directions simultaneously: one trip between University Park and Hershey (both directions) in the AM and one trip (both directions) in the PM. The two shuttles meet in the Mifflintown area, where riders switch vehicles. In the AM, departures are scheduled at 7:00 AM from one location, with arrival at the other location occurring around 9:00 AM. In the PM, departure occurs around 4:30 PM, with arrival around 6:30 PM.

During Fall Semester 2011, when Penn State was in full session, the average ridership on the Hershey Shuttle was approximately 14 trips per day.

F. CATA Commute Vanpools

In 2007, CATA initiated their CATA Commute vanpool program, which has grown to 24 vanpools as of July 2012. For nineteen of these vanpools, Penn State University is listed as the primary commute destination, and the vanpool vehicles are parked in Penn State parking facilities. Other

vanpools include Penn State employees, although Penn State is not the primary destination. While each vanpool vehicle has a capacity of 15 members, CATA estimates that the average vanpool size is currently about 10 persons. Therefore, it is estimated that vanpools currently carry approximately 380 person-trips per day to and from the University Park Campus.

G. University Park Pedestrian Access

Figures 3.26 and 3.27 illustrate major pedestrian access points and the number of pedestrians entering and exiting the University Park Campus during the AM and PM peak periods, respectively. All locations were counted specifically for pedestrian access.

For the purpose of calculating mode share, each access location was assigned a Ped-Bike Nexus Characteristic according to the likelihood that pedestrian trips were “primary” trips—that is, the pedestrian trip was made entirely on foot and was not a secondary trip to or from a parked vehicle. Pedestrian trips to/from the State College downtown were assumed to be mostly primary trips, given the concentration of student housing that generates trips to and from the University. Pedestrian trips to/from West Campus were classified more as a mix of primary and secondary trips, given the concentration of parking on West Campus but also the presence of student housing and connection to the bike path system. Pedestrian trips to/from the Commuter Lot Areas near Beaver Stadium were considered mostly secondary trips, given the concentration of parking and long distances to uses that would generate primary pedestrian trips. The Ped-Bike Nexus Characteristic and mode share methodology is described in further detail in **Appendix D**.

H. University Park Bicycle Access

Figures 3.28 and 3.29 illustrate major bicycle access points and the number of bicycles entering and exiting the University Park Campus during the AM and PM peak periods, respectively.

Given the relatively small number of bicycle trips (compared to pedestrian trips), the distinction between primary and secondary trips was not applied to bicycle trips when calculating mode share.



Figure 3.26. University Park Pedestrian Access, 2012 AM Peak Period



Figure 3.27. University Park Pedestrian Access, 2012 PM Peak Period

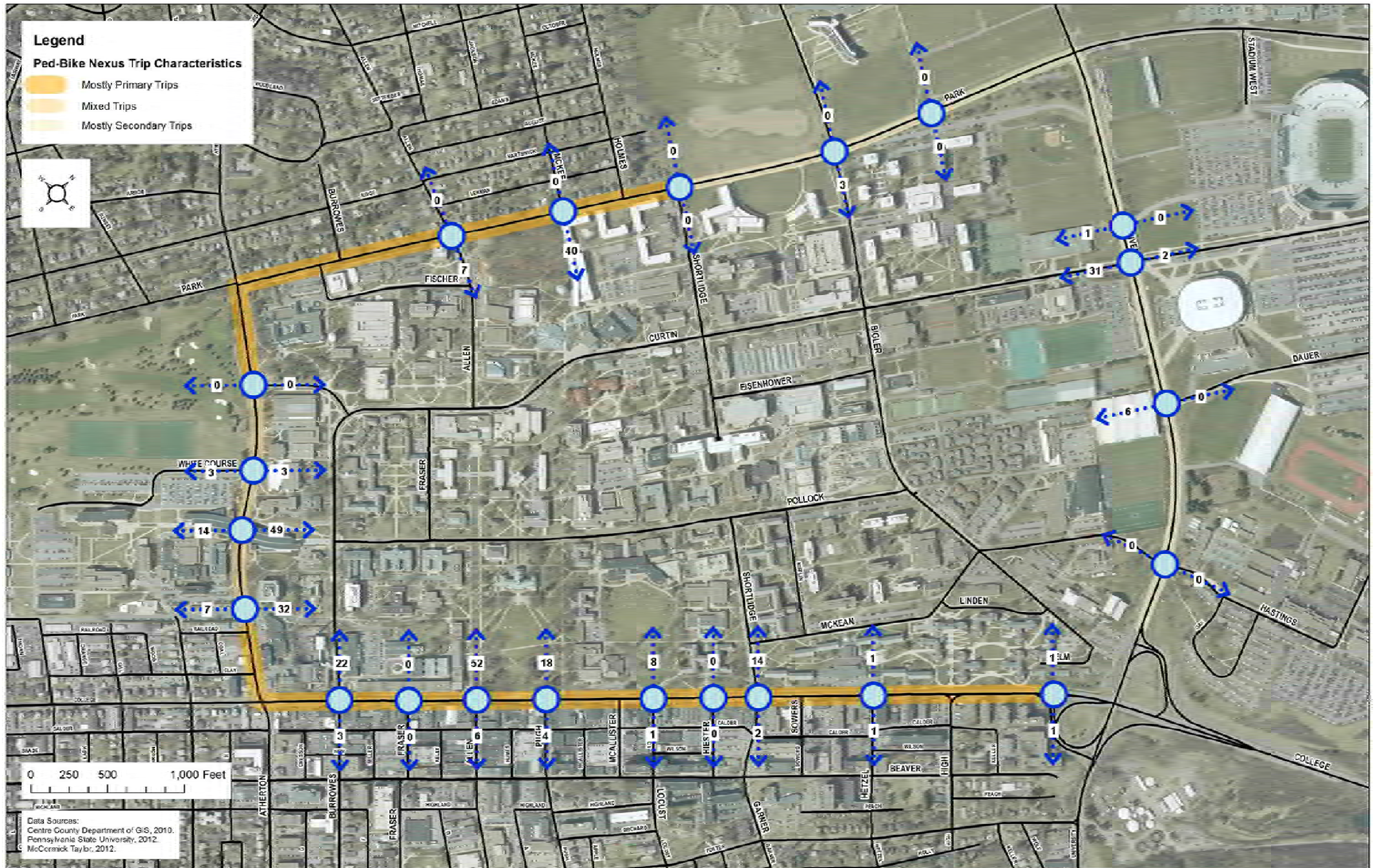


Figure 3.28. University Park Bicycle Access, 2012 AM Peak Period

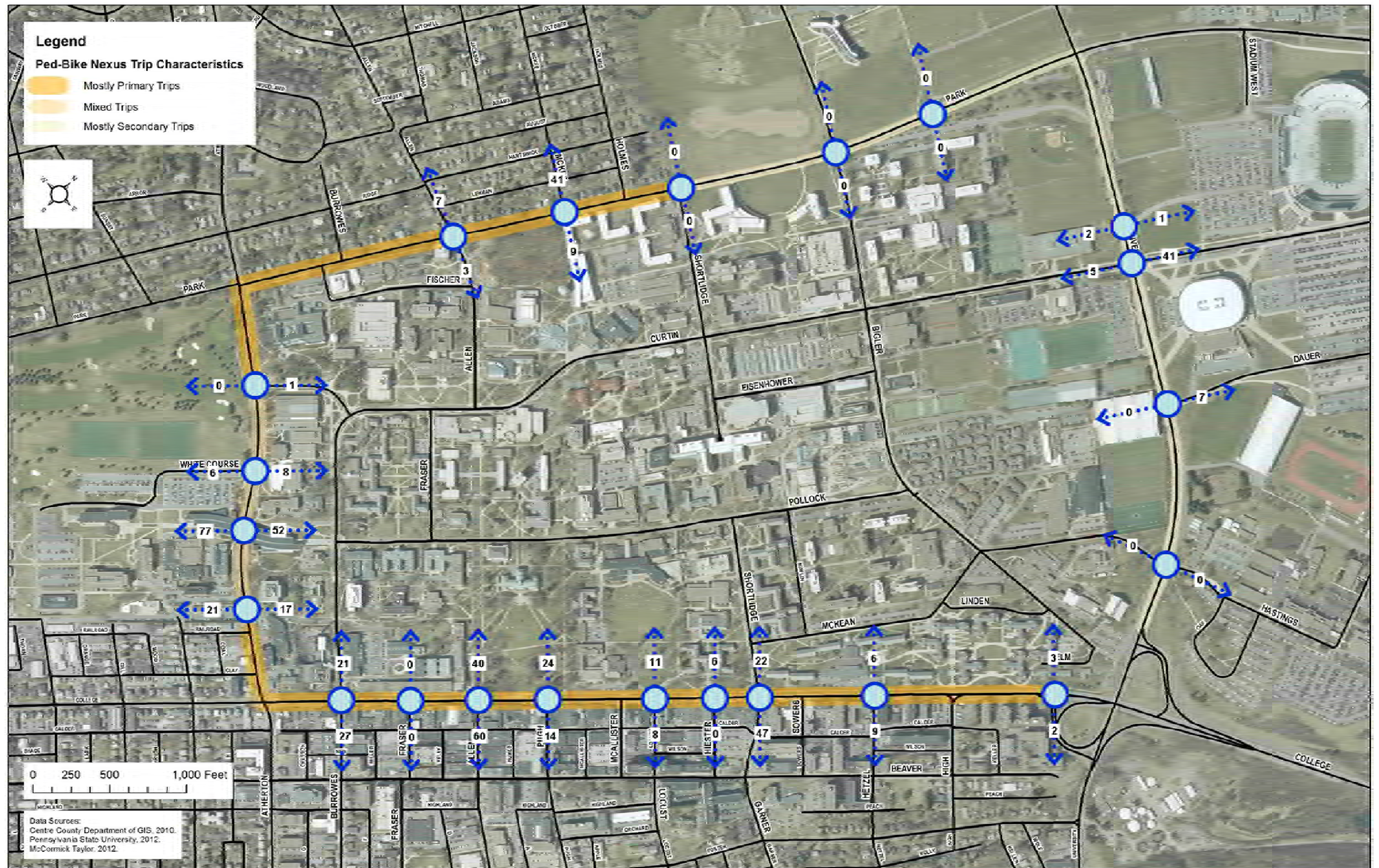


Figure 3.29. University Park Bicycle Access, 2012 PM Peak Period

I. University Park Campus Mode Share

Table 3.5 summarizes the estimated total number of person trips by mode and the mode share for trips accessing the University Park Campus. The estimates were distilled from the traffic counts, transit data, vanpool data, pedestrian, and bicycle counts completed for the UPD Update Transportation Study. The modal assumptions used to generate the trip estimates are provide in **Appendix D**.

Table 3.5. Person Trips by Mode and Mode Share for Trips Accessing University Park, 2011

Mode	Person-Trips		
	AM Peak	PM Peak	Total
Car	2,692	2,603	5,295
Bus	1,725	2,140	3,865
Vanpool	190	190	380
Walk	1,471	4,953	6,424
Bike	144	249	393
Total	6,222	10,135	16,357

Mode	Mode Share		
	AM Peak	PM Peak	Composite
Car	43.3%	25.7%	32.5%
Bus	27.7%	21.1%	22.6%
Vanpool	3.1%	1.9%	2.3%
Walk	23.6%	48.9%	40.4%
Bike	2.3%	2.5%	2.3%
Total	100.0%	100.0%	100.0%

Chapter 4. Future Year UPD Transportation Assessment

The continuing evolution of University Park's transportation environment and the future dynamics of travel are considered in this chapter, which accomplishes the following:

- Identifies the University's expected land development plans and transportation infrastructure changes for the period 2012 to 2022;
- Estimates future level-of-use of roadways in the vicinity of the University Park UPD;
- Evaluate possible impacts to the adjoining transportation system and neighborhoods, and identify recommendations internal campus roadways system and evaluate these changes for impacts on the adjoining transportation system; and
- Analyzes the travel demand management strategies that are proposed and under development by the University to reduce the number of single-occupancy vehicle trips associated with the District Plan.

A. University Park Campus & Infrastructure Development Program

Whereas the previous UPD planning period from 2000 to 2012 saw a great deal of new development and changes in the campus transportation network, the focus during the next UPD planning period is expected to be much more on maintenance, renovation, and optimization of existing facilities. Therefore, while a large part of this current Update addresses demand management policies and programs, the development of campus buildings and transportation infrastructure is ongoing, as guided by the University and Departmental master planning processes.

A.1. Building and Land Development Projects

Building and land development projects are illustrated on **Figure 4.1** in red outlines and shading. The following give a brief description of the building and land development projects. Additional information about select projects may be accessed using the links provided.

- **Moore Building Addition/Renovation**
The Moore Building Addition/Renovation and Cedar Building Renovation are currently under way. The Moore Building Addition is mostly completed, and the expected completion date for the remaining renovation is summer 2013.
<http://www.opp.psu.edu/planning-construction/projects/moore-cedar-renovations>
- **Biobehavioral Health Building**
The Biobehavioral Health Building is currently under construction. The expected completion date is November 2012. The project involved demolition of the structure between Henderson Building and Henderson South to make way for the new building. Parking next to the building will also be reconfigured.
<http://www.opp.psu.edu/planning-construction/projects/biobehavioral-health-building>
- **Health & Human Development Building Renovation and Expansion**
The Health & Human Development Building Renovation and Expansion is currently in the design stage, and is expected to be completed in 2014.

- **Conversion of Power Plant to Natural Gas**
 The Power Plant Conversion will change the plant’s fuel from coal to natural gas (CNG). As a result of the conversion, some of the existing power plan may be demolished and the site remediated for an alternative campus use. The project will result in reduced truck traffic accessing campus.
- **Bigler Fields Master Plan**
 The Bigler Fields Master Plan encompasses the construction and expansion of athletic facilities east of Bigler Road, including McCoy Natatorium, Indoor Tennis Facility, Intramural Building Addition (Phase 1), and Lacrosse Stadium. Projects will be constructed progressively with some overlap. Completion of these projects is expected by 2015.
- **South Halls Expansion & Renovation**
 The renovation and expansion of South Halls includes construction of a new dormitory building near the corner of Shortlidge Road and McKean Road. The expected completion date is December 2014.
<http://www.opp.psu.edu/planning-construction/projects/south-halls-renovation-and-additional-building>
- **Pegula Ice Arena**
 The Pegula Ice Arena is currently under construction and will contain a 5,700 seat ice hockey arena, as well as one sheets of practice ice, with an additional 300 seats. The expected completion date is October 2013.
<http://www.opp.psu.edu/planning-construction/projects/pegula-ice-arena>
- **Music Building Expansion**
 Expansion of the Music Building—in particular, replacing the Esber Recital Hall—is the top priority listed in the College of Arts & Architecture Master Plan. The project is in the concept stage, and no timeframe for construction or completion has been set.
- **Arboretum Education Center & Planetarium and Conservatory**
 As a part of the Penn State Arboretum Master Plan, these three elements are grouped as two projects—the Education Center & Planetarium and the Conservatory. The project is in concept stage, and no timeframe for construction or completion has been set.
<http://www.arboretum.psu.edu/index.html>
- **Research Greenhouse Relocation**
 The Research Greenhouses, currently located along Curtin Road, are planned to be relocated to a site north of Tower Road, between Big Hollow Road and University Drive Extension. The relocation is a precursor for completing elements of the Eberly College of Science Facilities Master Plan, including the Biochemistry & Molecular Biology Building and Chemical Engineering Building. The project is in concept stage, and no timeframe for construction or completion has been set.
- **Biochemistry & Molecular Biology Building**
 Construction of a new Biochemistry & Molecular Biology Building—as a part of the Eberly College of Science Facilities Master Plan—is one of the top priorities listed for dealing with critical needs identified in the plan. The project is in the concept stage, and no timeframe for construction or completion has been set.
<http://www.opp.psu.edu/about-opp/divisions/cpd/images/ECOS-MP-090330.pdf>

- **Chemical Engineering Building**
Construction of a new Chemical Engineering Building is also one of the top priorities listed in the Eberly College of Science Facilities Master Plan for dealing with critical needs identified in the plan. The project is in concept stage, and no timeframe for construction or completion has been set. The project is in the concept stage, and no timeframe for construction or completion has been set.
<http://www.opp.psu.edu/about-opp/divisions/cpd/images/ECOS-MP-090330.pdf>
- **HUB-Robeson Center Expansion**
The HUB Building Expansion includes three “sub-projects” that would reconfigure the Ground and First Floor of the HUB, reconfigure and expand the bookstore, and backfill existing parts of the HUB with different/renovated uses. The expected completion date is November 2014.

A.2. Transportation & Parking Infrastructure Projects

The following transportation and parking infrastructure projects are also illustrated on **Figure 4.1** in green and orange outline and shading.

Streetscape Projects:

- Shortlidge Road, from the “Gateway to the Sciences” to Curtin Road
- University Drive Extension, from Park Avenue to beyond Services Drive
- Services Drive, from Bigler Road to University Drive Extension.

Parking Projects:

- Stadium West Parking Lot Expansion
- Reconfiguration of parking at Pegula Ice Arena

Roadway & Intersection Projects:

- Reconfiguration of McKee Road bike/pedestrian crossing
- Southbound University Drive Left Turn Lane at Park Avenue intersection
- Westbound Park Avenue Right Turn Lane at Fox Hollow Road/Porter Road intersection
The two turn lane projects are “under review” according to discussions with College Township about the timing and need for the additional intersection capacity.

Other Transportation Related Projects:

- Henderson Pathway Conversion to Shared Use Path
- Health & Human Development Building Parking reconfiguration
- Mobility Center Enhancement (bus stop on College near Allen)
- Update Findlay/Johnston Commons Lots & Service Area Improvements
- Update McElwain/Simmons Pedestrian Corridor Improvements

Projects incidental to land development and building projects—including service area modifications and bike and pedestrian amenities—are expected as part of the land development plan and are not enumerated separately as transportation projects. Traffic mitigation projects that may be identified during detailed traffic impact studies are described below under the Project-Level Evaluations.

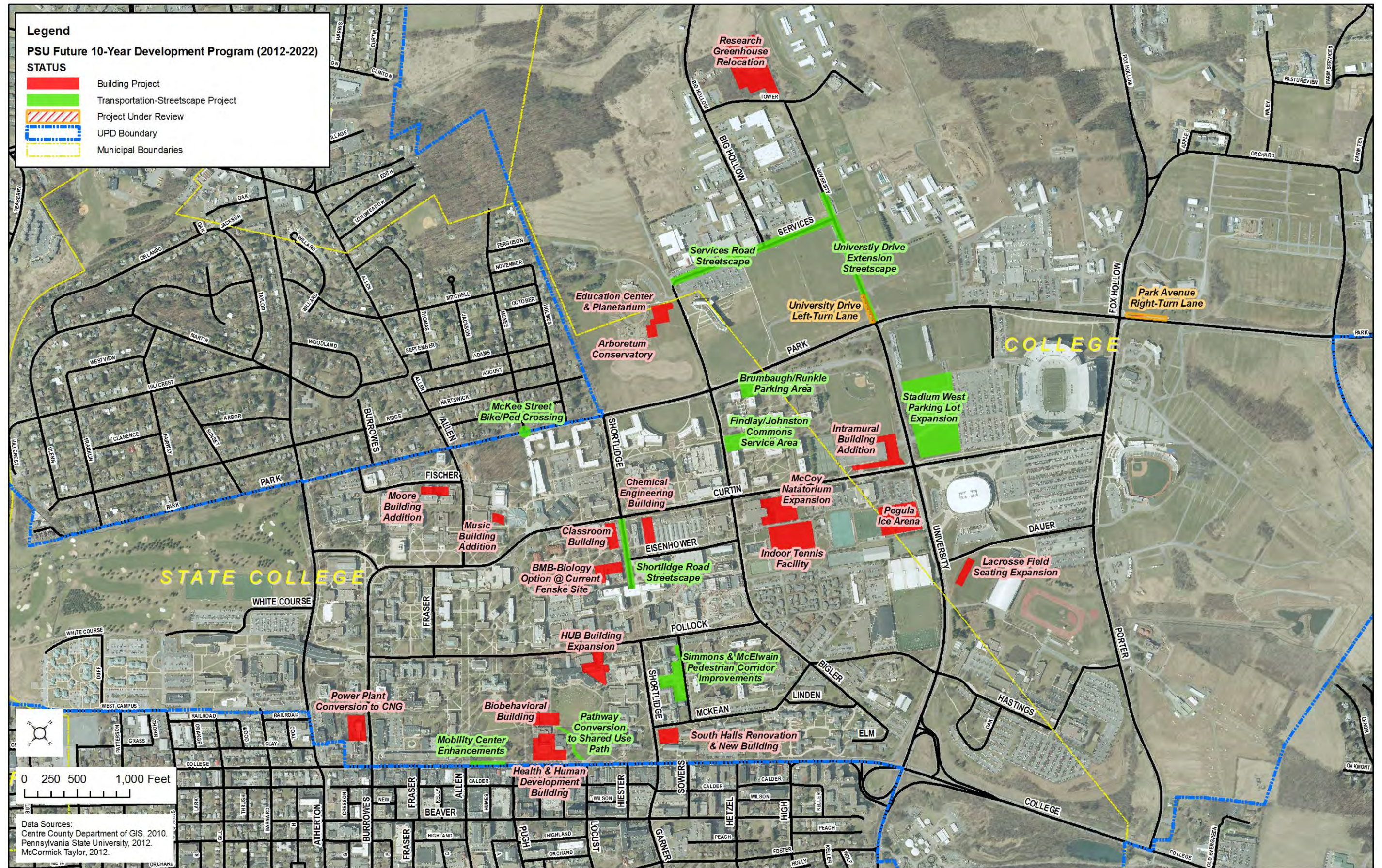


Figure 4.1. University Park 10-Year Development and Transportation Infrastructure Plan, 2012-2022

B. Future Level-of-Use and Potential Impacts

The following two sub-sections evaluate future “level-of-use” and transportation system impacts from two different perspectives. First, the project-level evaluations provide a micro-scale perspective on the localized impacts of individual University development projects. Then, the regional-level evaluation provides a broader, macro-scale evaluation of the complete University development plan.

B.1. Project-Level Evaluations

Project-level evaluations are intended to provide a higher-detail perspective on the localized impacts of individual University development projects. The University’s development plan for 2012 to 2022 (**Figure 4.1**) contains five projects that may generate new traffic sufficient to create localized network impacts and trigger the UPD ordinance requirements for additional planning or study. The evaluations identify local transportation issues, potential project impacts, and various other transportation planning elements necessary as precursors for a prospective traffic impact study.

B.1.a. Pegula Ice Arena

The Pegula Ice Arena is currently under construction and will contain a 5,700 seat ice hockey arena, as well as one sheet of practice ice, with an additional 300 spectator seats. The site is located west of University Drive, south of Shields Building and north of Holuba Hall. Weekday patron parking for the venue will be accommodated in an adjacent parking lot at the corner of University Drive and Curtin Road. Additional parking will be available in the Stadium West and Jordan East Parking Lots. Service access and parking will be accommodated in the service area south of the ice arena. Access to the service area will be provided on a new driveway connected to University Drive.

The detailed TIS for the Pegula Ice Arena project has been completed and approved by PennDOT and College Township. The TIS evaluated traffic expected during both weekday and event operation, and no transportation system investments were required to accommodate the venue and its new service access. However, the TIS did recommend that the University actively manage vehicular traffic operations at the Park Avenue/Stadium West and University Drive/Dauer Drive intersections during the event entering and exiting peaks. Management of the University Drive/Curtin Road intersection was also recommended to assist pedestrians crossing University Drive.

B.1.b. Stadium West Parking Lot Expansion

The University is evaluating concept designs and the feasibility of expanding the Stadium West Parking Lot to replace parking lost (~230 spaces) in the nearby Shields Lot when the Pegula Ice Arena was constructed. The Stadium West Expansion would include approximately 300 regular and ADA spaces and would extend west from the current lot, occupying a portion of the grass field along University Drive between Curtin Road and Jeffery Field practice fields. The event-use driveway connection to University Drive may be moved closer to mid-block but would remain gated. All weekday commuter traffic would continue to access the lot from Park Avenue.

Trip Generation & Modal Considerations

The parking lot expansion itself is not expected to generate new trips during the daily/commuter peak periods. Traffic during event peaks was evaluated as a part of the formal Pegula Ice Arena Traffic

Impact Study, which was previously reviewed and approved by College Township and PennDOT (see section B.1.a).

Potential Impacts & Solutions

No new trips are expected, and no impacts are anticipated.

B.1.c. Bigler Fields Master Plan

The Bigler Fields Master Plan encompasses the construction and expansion of athletic facilities east of Bigler Road, including McCoy Natatorium, Indoor Tennis Facility, Intramural Building Addition, and Lacrosse Stadium.

Trip Generation & Modal Considerations

The University recently concluded a study⁵ of vehicular trip generation and parking demand created by overlapping events at existing venues and the planned Bigler Fields venues, which all share the parking facilities at East Deck, Eisenhower Deck, Stadium West, Jordan East, and Porter North. The vehicular trip generation was estimated according to spectator capacity, the amount of that capacity that is used, and how many spectators arrive by each mode. **Table 4.1** summarizes the parking demand (i.e., vehicular trip generation) for each University Park venue. Beaver Stadium football events were not included in the analysis.

Table 4.1 Estimated Event Parking Demand for University Park Venues
(vehicles)

Venue	Sell-Out	Average
Bryce Jordan Center	6,104	2,100
Eisenhower Auditorium	950	450
Medlar Field at Lubrano Park	2,000	261
Pegula Ice Arena	5,700	3,800
Intramural Building Expansion	570	164
Lacrosse Stadium	380	270
Aquatics Center	1,330	158
Indoor Tennis Facility	228	20
Field Hockey Field	380	143
Beard Softball Stadium	434	205
Multi-Sport Facility	950	818
Jeffrey Field (Soccer)	1,900	736

Source: Timothy Haahs and Associates, Inc., 2012.

Potential Impacts & Solutions

Using the 2011 Penn State event schedule to identify real instances of overlapping events, the parking demand study concluded that the existing parking supply is sufficient to accommodate most identified scenarios of overlapping, average-attendance events. However, when hypothetical event

⁵ TimHaahs Engineers & Architects, McCormick Taylor, “The Pennsylvania State University Ice Arena and Athletic Facilities Parking and Traffic Study Final Report”, May 25, 2012, Table 6, p. 9.

scenarios were run with one or more of the overlapping events as sell-outs, parking shortages were identified.

The analysis of the operational traffic impacts for overlapping events is complicated by the many permutations of transportation conditions that may exist on any given day. Scenario-based methods may be useful, but event traffic planning is typically handled best on a case-by-case basis by trained personnel who understand the local conditions, constraints, and resources for managing traffic. The University should continue its strategy of actively managing traffic by deploying personnel in the field to manage the unique patterns and peaks of campus and event generated traffic. This strategy is both flexible and effective, both in terms of cost and operational responsiveness to the always evolving transportation needs of the University.

B.1.d. Penn State Arboretum

Ongoing implementation of the Penn State Arboretum Master Plan during the next 10 years is expected to include development of the Education Center, Planetarium, and Conservatory.

Trip Generation & Modal Considerations

The trip generation for these facilities depends on the nature and scale of activities, as well as the travel modes used by patrons arriving at the facilities. As an alternative, the vehicular trip generation estimate may be based on capacity-usage of the Arboretum’s 100-space parking facility and 100% turnover of each space during the peak hour. **Table 4.2** summarizes the trip generation estimate using these parking and turnover assumptions.

**Table 4.2 Trip Generation for the Penn State Arboretum
Education Center, Planetarium, and Conservatory**

# of Parking Spaces	AM Peak Hour New Trips		PM Peak Hour New Trips	
	Inbound	Outbound	Inbound	Outbound
100	100	100	100	100

The Campus Shuttle provides access to the Arboretum via a stop along Bigler Road, between the Arboretum and Katz Law School Building. Off-road walking path connections and on-road bicycle access are also available. While these alternative modes may be accessible to those on campus, they do not provide likely alternatives for those arriving at the Arboretum from other locations.

Potential Impacts & Solutions

A planning-level evaluation of weekday AM and PM peak hour traffic operations with the trip generation above indicates that PennDOT’s turn lane warrants are close to being met for a 100-foot (minimum) westbound right-turn lane on Park Avenue approaching the Bigler Road intersection. Updates to the signal timing and coordination parameters for certain signals along Park Avenue may be required. Otherwise, traffic impacts requiring mitigation beyond the Park Avenue/Bigler Road intersection are not anticipated.

B.1.e. Conversion of Power Plant to Clean Natural Gas

The Power Plant Conversion will change the plant’s fuel from coal to natural gas (CNG). Coal is currently delivered to the plant using 20 to 25 heavy trucks per day (40 to 50 total trips), when Penn State classes are in session. This amounts to more than 6,400 truck trips per year. Coal trucks arrive from the east on College Avenue, turning right onto Burrowes, and then left into the Steam Plant. They depart the plant via Burrowes Road and Beaver Avenue on their return trip. With the conversion to natural gas, these truck trips would be eliminated, and the project will reduce truck traffic circulating through the State College Downtown and University Park campus.

B.2. Regional-Level Evaluation

B.2.a. Centre County Travel Demand Model

The Centre County Travel Demand Model (CCTDM) is a computerized representation of the transportation system that estimates demand for travel, translates that demand into trips, and allocates the trips to the available transportation modes and facilities.

The first generation of the model was created in 1990 to support the Centre Region’s Regional Transportation Plan. The model has since been updated to incorporate new Census and traffic planning data, according to the requirements for traffic and air-quality analyses. The model coverage area was expanded several times according to the needs of large highway projects, including Corridor O and the South Central Centre County Transportation Study (SCCCTS). The model is currently undergoing a significant revision for the Centre County MPO’s Long-Range Transportation Plan update. At the time when this UPD Transportation Update was prepared, results from the CCTDM had yet to reach final status.

By permission of the Centre County MPO, the CCTDM was provided to the University for its use in this UPD Transportation Update. However, all results quoted in this version of the report are considered preliminary until the final CCTDM is released.

Figure 4.2 illustrates the modeled area covered by the preliminary CCTDM provided for the University’s use. Travel is simulated in all parts of Centre County using 330 traffic analysis zones (TAZs). Travel outside of Centre County is accounted for through 26 external stations, where major roadways cross the county boundary. The modeled roadway network includes all limited-access highways and arterial roadways, as well as most collectors and some local roadways. Local roadways and driveways not explicitly modeled in the network are represented using “centroid connectors” which provide the link between land uses and the roadway network. The CCTDM has been designed and calibrated as a regional travel model, but does include some more detailed features that model delay and turning restrictions at intersections. The model simulates vehicular and transit modes only; pedestrian and bicycle modes are not a part of this version of the model.

Figure 4.3 illustrates the modeled area surrounding the University Park Campus, including the UPD Study Area. Thirteen TAZs are used to represent the specific UPD Study Area, which includes University Park from West Campus to Porter Road. The major roadways surrounding campus—Atherton Street, Park Avenue, College Avenue, University Drive, and Porter Road—are all explicitly modeled. In addition, the cross-campus streets of Curtin Road, Burrowes Road, Allen Road, Shortlidge Road, Bigler Road, and Hastings Road are all explicitly modeled. Pollock Road between Shortlidge Road and Bigler Road is modeled, but the access-controlled segment between Shortlidge Road and Burrowes Road is not modeled. Connections to the major parking facilities are generally represented using centroid connectors.

B.2.b. Trend Scenario Forecasts

The CCTDM generates travel activity based on demographic input variables (population, employment, etc.) that are compiled for each TAZ. Demographic inputs for the Base scenario represent current conditions and are largely derived from U.S. Census data. Demographic inputs for Future scenarios are forecasted to describe conditions expected in the future, assuming a certain set of forward-looking trends. Future scenarios may simply reflect the continuation of present trends—i.e., Trend Scenario. New policies and economic realities that would change the present trends may also be arranged to create other, alternative scenarios.

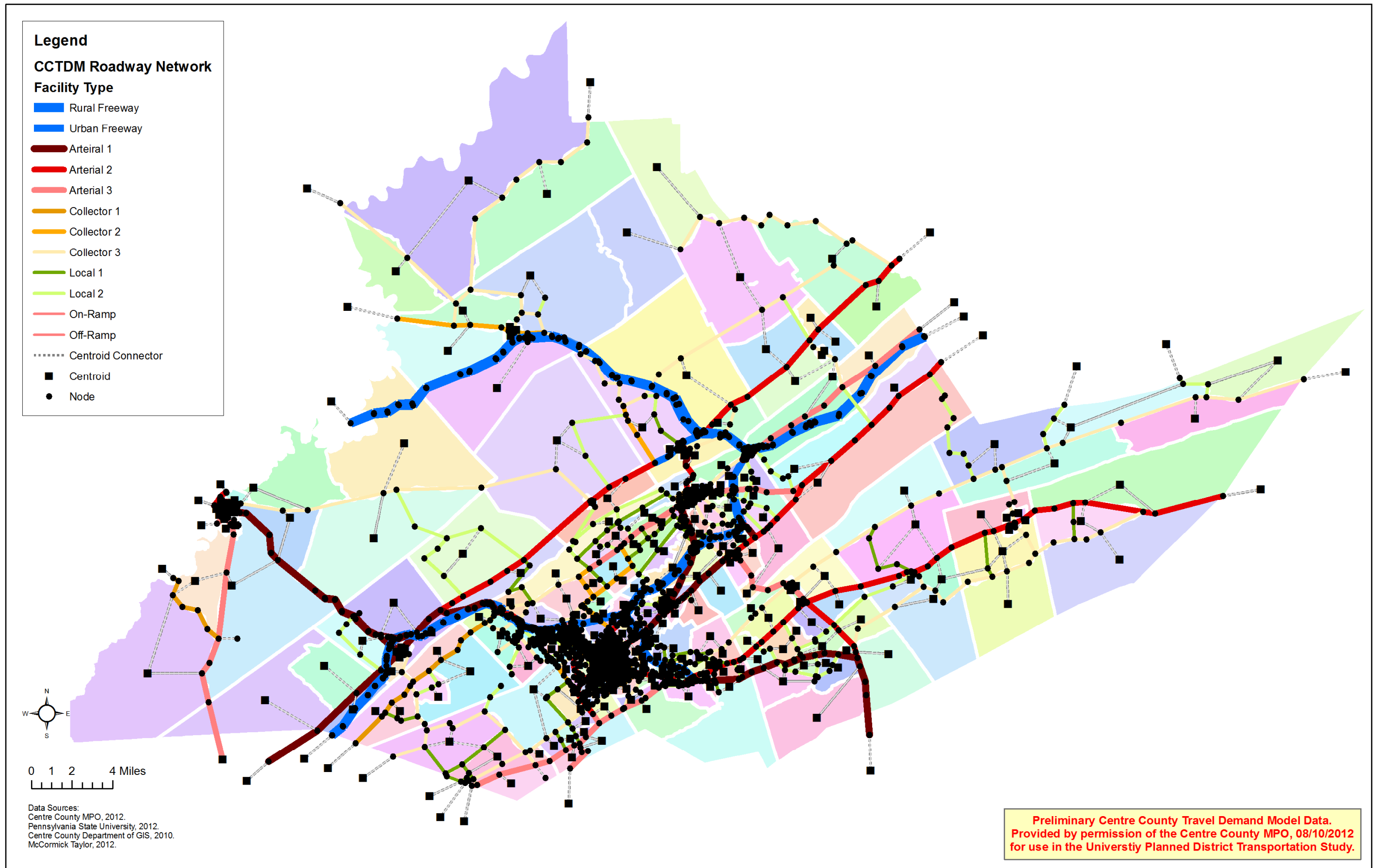


Figure 4.2. Model Coverage Area for the Centre County Travel Demand Model

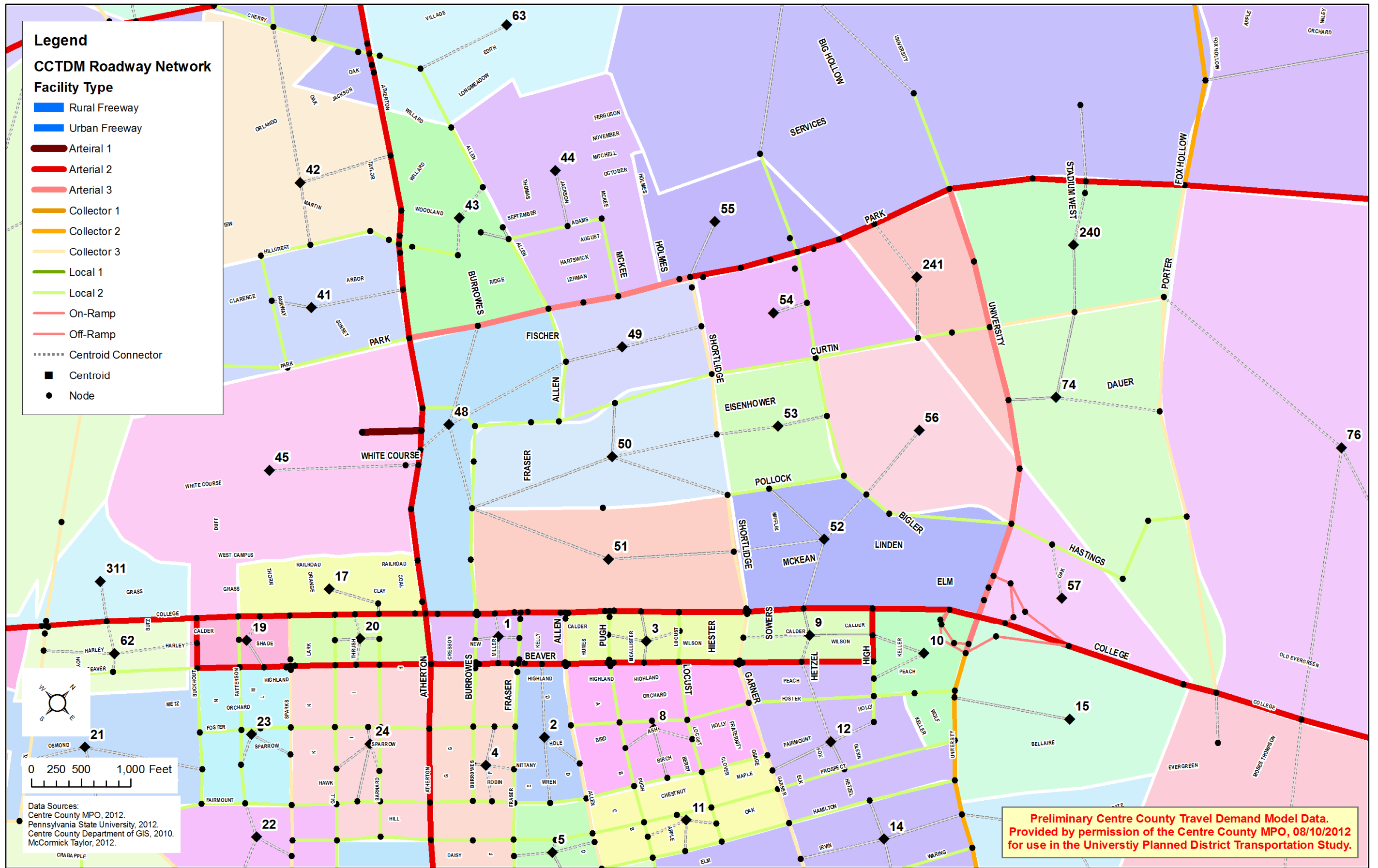


Figure 4.3. Detail of Model Coverage Area in the UPD Study Area

Table 4.3 gives the demographic inputs for the CCTDM Base (2008) and Future Trend (2040) scenarios for the University Park TAZs. Note that the only changes in the demographic inputs between Base and the Future Trend scenarios were accounted in West Campus (TAZ 45). The demographics in all other TAZs were assumed to remain at Base Year levels.

**Table 4.3. Demographic Input Variables for the Centre County
Travel Demand Model, University Park Campus TAZs**

	Demographic Variable	Model Base Year (2008)	Model Future Year (2040)
Population	Total Population	14,283	14,568
	Household Population	1,418	1,703
	Grp Quarter Population	12,865	12,865
	Total Household	637	761
	Average Household Size	2.24	2.25
	Vehicles per Household	1.38	1.38
	Workers per Household	1.43	1.43
	Average Household Income	60,855	60,855
	Public School Enrollment	0	0
Employment	Agriculture, Forestry, Fishing and Hunting	14	14
	Construction	0	0
	Manufacturing	24	24
	Wholesale and Retail	64	74
	Transportation and other Utility	7	7
	Information	20	20
	Finance	0	0
	Professional Services	20	20
	Education and Health Care	20,609	20,616
	Art/Recreation	115	119
	Other Services	31	31
	Public Administration	75	75
	Total Employment	20,979	21,000

Notes:

Demographics were compiled for TAZs 45, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 73, 74, 75, 76, 240, and 241. Some of these TAZs contain non-University uses.

It is noted that the preliminary version of the CCTDM provided for the UPD Update uses 2040 demographics to directly estimate Future Year 2040 travel. Therefore, for the purposes of the UPD Update, the 2040 estimates of travel have been factored uniformly to obtain Future Year 2022 estimates, to match with the UPD Update Horizon Year. The following sub-sections make use of this factoring method to derive trips and traffic volumes expected by 2022.

B.2.c. Vehicular Trip Estimation – Base vs. Trend Scenario

Table 4.4 provides a summary of the CCTDM’s estimates of Base Year (2008) and Future Trend (2022) vehicular trips accessing the University Park TAZs. The table summarizes trips for three different time periods:

- Daily – 24-hour period
- AM Peak Period – 3-hour period from 6:00 AM to 9:00 AM
- PM Peak Period – 3-hour period from 3:00 PM to 6:00 PM

Overall, this 2022 Trend forecast indicates an average increase of 2 to 3 percent in the total number of trips accessing the University Park TAZs. These increases are not allocated evenly across the campus. The number of trips accessing to the Core Campus and West Campus TAZs are forecasted to increase, while trips accessing the East Campus TAZs are forecasted to decrease.

Growth in trip-making is related both to demographic changes as well as ongoing trends in personal transportation over time. While the demographics in most campus TAZs show little growth in this Trend scenario, other travel trends may still increase trip-making over time. Trend assumptions, which are generated from past trends, indicate that increasing income levels and more personal vehicle availability point to trip growth—even if population and/or employment remain constant. On the other hand, lower income and less vehicle availability points to trip reductions. Another strong trend in personal transportation is toward fewer occupants per vehicle, which tends to increase trips over time.

These trends may partially explain the trip estimates for the University Park TAZs. Penn State employees that park in the Core Campus zones are generally higher ranking in their departments and have higher income levels. At higher income levels, there is typically more disposable income and more vehicle availability, which tends generate more trip-making. One constraint that is overlooked by the model is the availability of parking in the Core Campus. Without an increase in parking, trip growth would be more a function of intra-day trips (in and out activity) or pick-up/drop-off trips

On the other hand, Penn State employees and students that park in the Commuter Lots generally have lower income levels, less vehicle availability, and more incentive to increase their occupants per vehicle (rideshare, carpool, vanpool, etc.). In this Trend Forecast, these factors have resulted in reduced trip-making associated with the Commuter Lot TAZs. To a certain degree, these trends are likely to continue or strengthen as a result of the University’s travel demand management programs.

Table 4.4. Summary of CCTDM Trips Accessing University Park TAZs

TAZ	Description	Daily, 24-Hour Period				AM Peak Period				PM Peak Period			
		2008 Base	2022 Future (Derived)	Difference (2008-2022)	% Difference (2008-2022)	2008 Base	2022 Future (Derived)	Difference (2008-2022)	% Difference (2008-2022)	2008 Base	2022 Future (Derived)	Difference (2008-2022)	% Difference (2008-2022)
WEST CAMPUS - West of Atherton Street													
45	West Campus	9,866	10,712	846	8.6%	2,995	3,264	269	9.0%	2,361	2,563	202	8.5%
CORE CAMPUS													
48	West of Burrowes & Allen - Park to College	13,461	13,716	255	1.9%	3,955	4,034	79	2.0%	3,189	3,250	61	1.9%
49	North of Curtin - Allen to Shortlidge	3,919	4,052	133	3.4%	1,028	1,067	39	3.8%	902	933	31	3.5%
50	Burrowes to Shortlidge - Curtin to Pollock	9,247	9,497	250	2.7%	1,658	1,706	48	2.9%	2,051	2,105	54	2.6%
51	Burrowes to Shortlidge - Pollock to College	10,416	10,620	204	2.0%	2,521	2,571	50	2.0%	2,405	2,450	45	1.9%
52	Shortlidge to University - Pollock/Hastings to College	8,193	8,555	362	4.4%	1,854	1,928	74	4.0%	1,808	1,886	78	4.3%
53	Shortlidge to Bigler - Curtin to Pollock	2,796	2,865	69	2.5%	568	585	17	2.9%	634	649	15	2.4%
54	Shortlidge to SCB Line - Park to Curtin	9,123	9,381	258	2.8%	2,148	2,198	50	2.3%	2,045	2,101	56	2.7%
56	Bigler to University - Curtin to Hastings	2,687	2,809	122	4.5%	754	790	36	4.8%	642	669	27	4.1%
241	SCB Line to University - Park to South of Curtin	1,979	2,108	129	6.5%	381	412	31	8.1%	430	459	29	6.6%
NORTH CAMPUS - North of Park Avenue													
55	Arboretum/President's House	50	52	2	3.0%	12	12	0	3.1%	12	12	0	3.1%
73	North and east of Arboretum	4,746	5,008	262	5.5%	1,037	1,122	85	8.2%	1,075	1,138	63	5.9%
75	Fox Hollow to US 322 - Park to US 322	482	491	9	1.9%	127	129	2	1.8%	110	112	2	2.0%
EAST CAMPUS - East of University Drive													
57	University to Porter - Hastings to College	4,123	3,958	-165	-4.0%	1,399	1,329	-70	-5.0%	981	939	-42	-4.3%
74	University to Porter - Curtin to Hastings	10,512	10,200	-312	-3.0%	3,473	3,332	-141	-4.1%	2,493	2,410	-83	-3.3%
76	Porter to Orchard - Park to College	1,811	1,692	-119	-6.6%	510	463	-47	-9.3%	420	390	-30	-7.1%
240	Univeristy to Porter - Park to Curtin	2,105	1,979	-126	-6.0%	719	666	-53	-7.4%	503	470	-33	-6.5%
TOTALS		95,516	97,693	2,177	2.3%	25,139	25,606	467	1.9%	22,061	22,536	475	2.2%

B.2.d. Vehicular Traffic Volume Assignment – Base vs. Trend Scenario

Figures 4.4, 4.5, and 4.6 illustrate the degree of change in vehicular traffic volume that is forecasted to occur by 2022 during the Daily, AM peak, and PM peak periods. Extreme or illogical changes in the model volumes, particularly on campus or local roadways, are expected because this is where traffic is loaded onto the model network. Such is the case on some Core Campus roadways—Curtin, Pollock, Burrowes, Allen, Shortlidge, Bigler, Hastings, and Porter Roads. Volumes and volume changes become more realistic and reliable on the collector and arterial streets—Atherton Street, Park Avenue, University Drive, College Avenue, and Beaver Avenue. Anomalies do occur. For instance, the model of Daily traffic has likely under-assigned traffic to University Drive between Park Avenue and Curtin Road and over-assigned traffic to a parallel route, Porter Road. The net effect is a minimal traffic volume change when looking at University Drive and Porter Road as alternative routes.

The modeled traffic volume changes are related to the trip-making observed at the TAZs. As shown in **Table 4.2**, trip-making for the University TAZs is forecasted to increase by only 2 to 3 percent, while traffic volumes are increasing by more than 10 percent on most links within the UPD Study Area. This indicates that, while the University is contributing to growth, traffic volume increases are being driven by demographic growth beyond the University.

Therefore, the following evaluations are not presented as a statement of impacts and issues to be resolved by the University. Rather they are provided for the benefit of coordinated transportation planning among the University, municipalities, MPO, and other agencies responsible for future roadway system investments.

B.2.e. Roadway Volume-to-Capacity Evaluation

Roadway segments within the UPD Study Area were evaluated according to the ratio of traffic volume to roadway capacity—i.e., the “volume-to-capacity” or “VC” ratio. The VC ratio is used extensively in transportation planning analyses to evaluate the performance of roadway segments and intersections. At low VC ratios (0 to 0.50) congestion is usually minimal. Congestion becomes more evident as the VC ratio increases from 0.50 to 0.80, and roadway performance deteriorates substantially as the VC ratio approaches 1.00. VC ratios over 1.00 indicate where the demand for travel exceeds the capacity of the roadway and congestion is likely to be severe.

Figures 4.7 and 4.8 illustrate “segments of concern” where the VC ratio exceeds 0.80 (red). The yellow highlighting indicates where the 0.80 threshold is exceeded for the first time between 2008 and 2022. The modeled VC Ratios for the other red segments exceeded the 0.80 threshold prior to 2008. The following “segments of concern” are noted:

- Park Avenue, from Bigler Road to the Hospital Drive intersection
- University Drive, near the interchange with College Avenue
- Curtin Road, on various segments between Atherton Street and Porter Road
- Burrowes Road, between Curtin Road and College Avenue
- Bigler Road/Pollock Road/Shortlidge Road cross-campus corridor, between Curtin Road and College Avenue
- Hastings Road, between McKean Road and University Drive

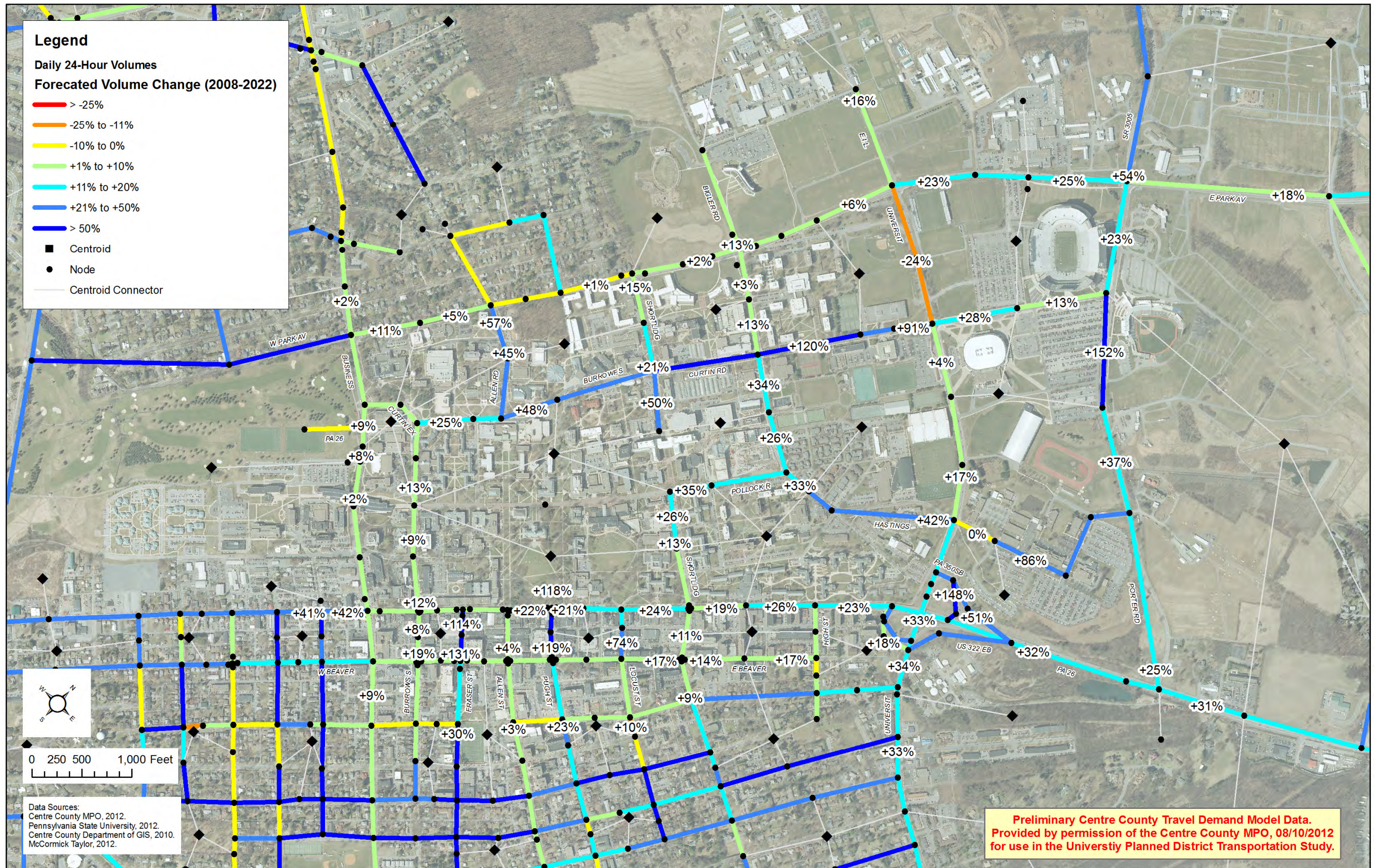


Figure 4.4. Forecasted Daily Traffic Volume Change, 2008-2022

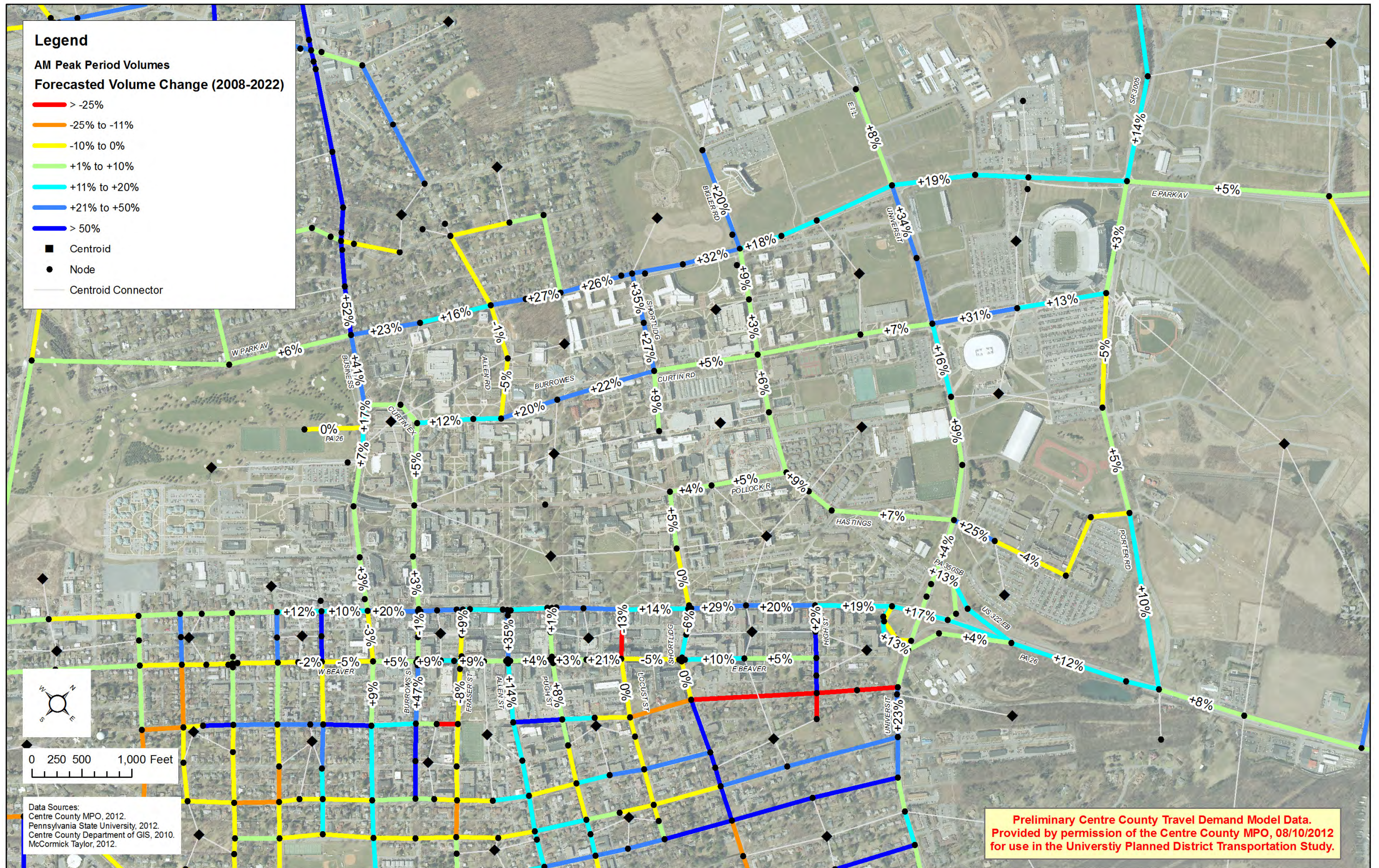


Figure 4.5. Forecasted AM Peak Period Traffic Volume Change, 2008-2022

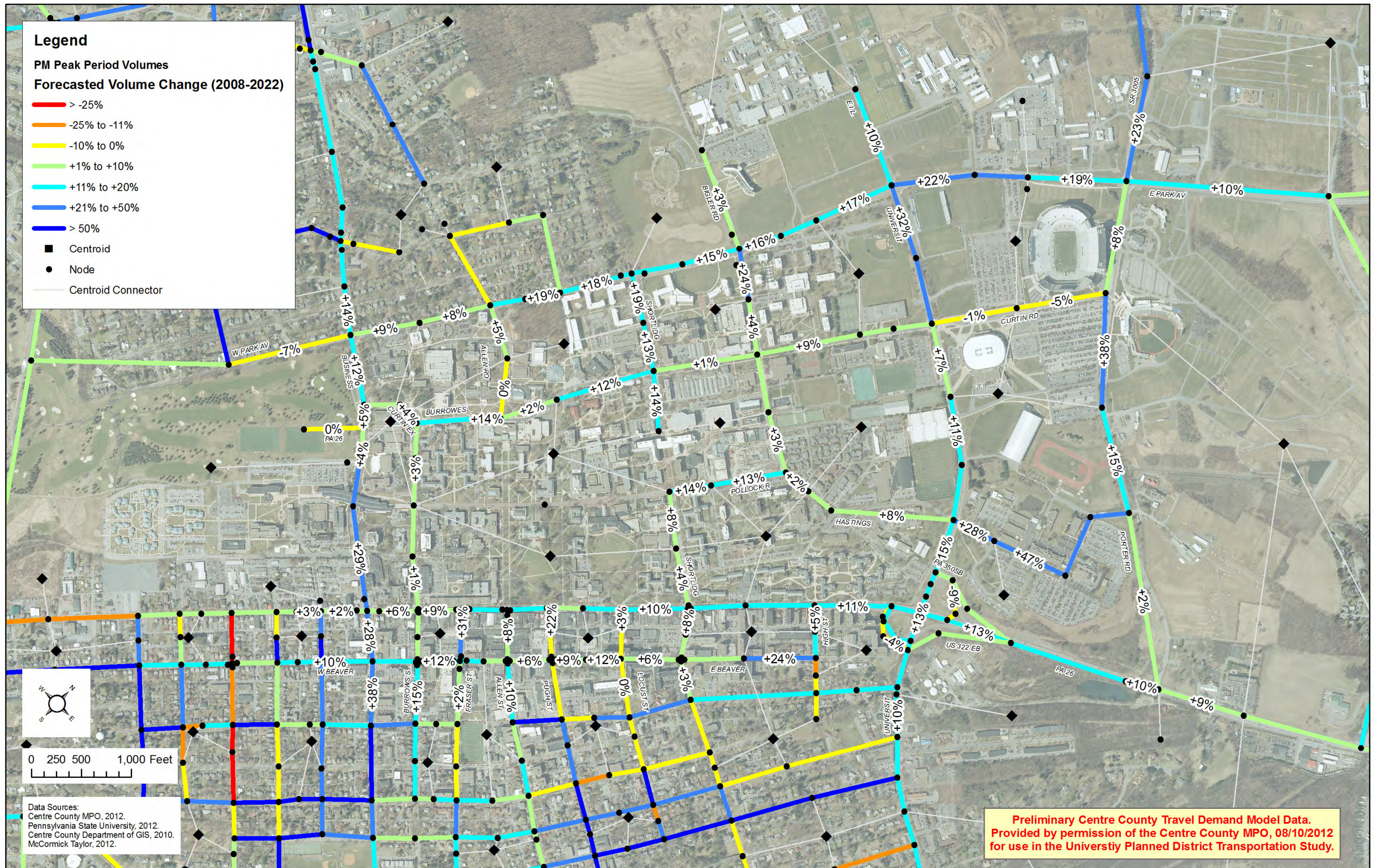


Figure 4.6. Forecasted PM Peak Period Traffic Volume Change, 2008-2022

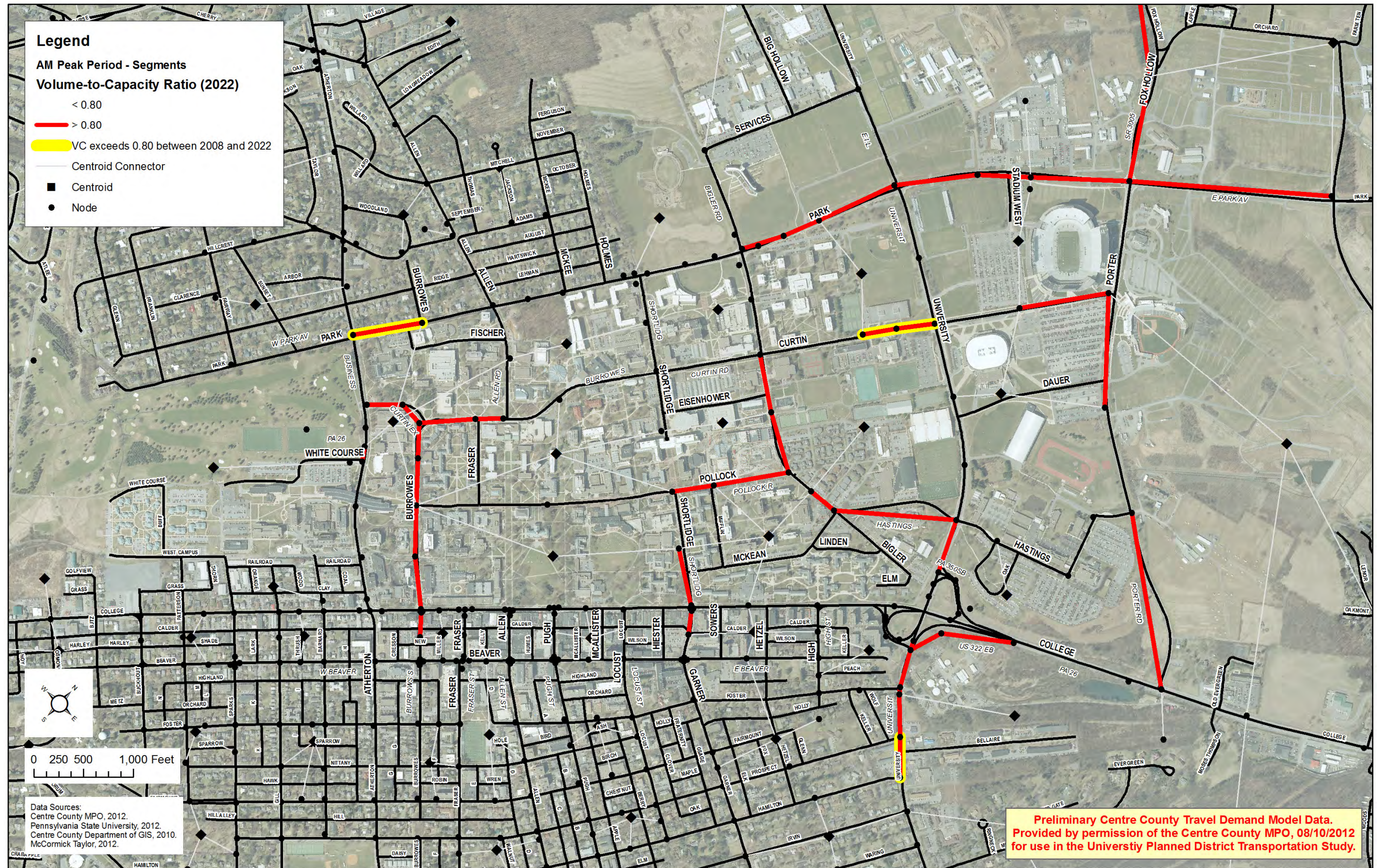


Figure 4.7. Projected Segments of Concern for the AM Peak Period

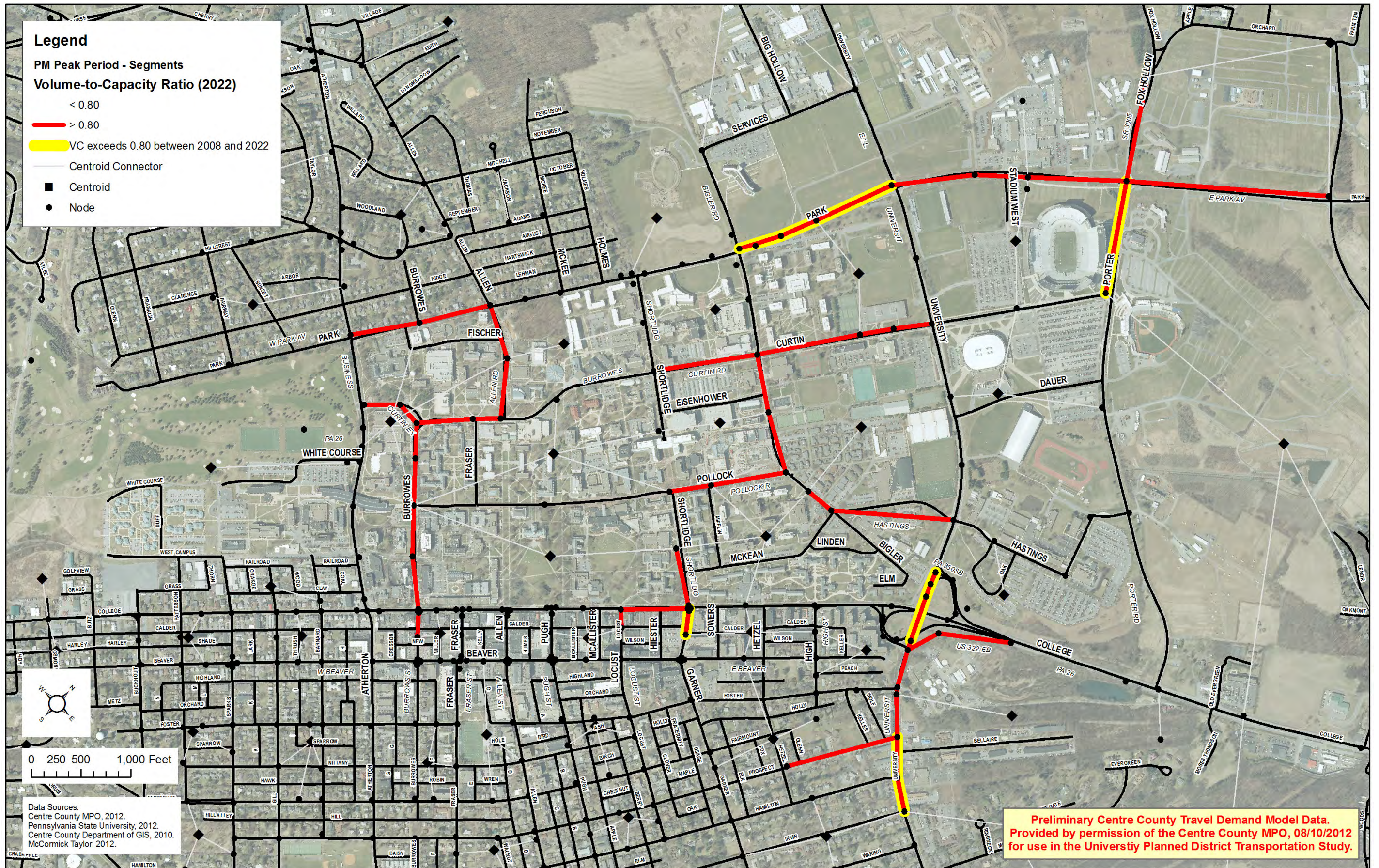


Figure 4.8. Projected Segments of Concern for the PM Peak Period

Chapter 5. Future Transportation Demand Management Opportunities

Through the offices of Transportation Services, Parking, and Campus Planning+Design, the University maintains active and ongoing efforts to enhance existing programs, create new programs, and identify emerging opportunities for managing transportation demand. The primary goal of these efforts is to reduce the number vehicle trips to the campus, particularly single-occupancy vehicle trips. This effort is not only in the best interest of the community, but also the best interest of the University. For instance, a decrease in vehicular trips by simple reduction or shifts to other modes translates to a reduced need for parking, which is an expensive capital and maintenance concern. The following sections address the University's current and future approaches that address the issue of travel demand management.

A. The Intermodal Transportation Plan for University Park

The Intermodal Transportation Plan is the University's ongoing effort to plan comprehensively for transportation at the University Park Campus. The effort grew out of the 1999 Master Plan and has included outreach to community and regional planners. The Plan's purpose is to develop a 10-year comprehensive Intermodal Transportation Plan for the University Park Campus that:

- Identifies the facilities, programs and policies to serve the transportation needs of a diverse community.
- Guides capital investment decisions.
- Guides transportation programs including operations, maintenance, transportation demand management strategies and facilities planning and design.
- Ensures a supportive relationship with surrounding community objectives such as safety, security, accessibility, environmental sustainability, and livable neighborhoods.

The Vision Statement for the Plan indicates the following key themes:

Develop an environmentally responsible Intermodal Transportation Plan that is customer focused, financially sustainable, and supports a balanced mix of travel choices to serve the diverse needs of the University community.

Quality is critical to the success of the Intermodal Transportation Plan. All travel choices will be well managed, effective, efficient, predictable, comfortable, accessible, and safe.

The following five goals frame the key issues, then each goal is accompanied by a list of strategies to focus the plan on specific efforts and measurable outcomes:

Goal 1: Meet the evolving demands of a diverse population by encouraging an optimal mix of travel choices to get to, from, and through campus. Minimize capital expenditures for new parking facilities.

Strategies

- a. Determine appropriate metrics and measure current travel modes
- b. Forecast demand by mode without changes
- c. Develop a target for what the mode mix should be

- d. Develop programs to achieve the desired mix
- e. Develop businesses case to fund each program
- f. Implement Intermodal Transportation Plan: Phase II

Goal 2: Develop and maintain a financially sustainable model that encourages and supports an optimal mix of travel choices.

Strategies

- a. Develop a new financial model utilizing user fees and other revenue sources
- b. Identify new revenue sources and expenses
- c. Develop metrics to track success of goal and strategies

Goal 3: Reduce environmental impact of transportation.

- Reduce miles driven
- Increase use of low-impact transportation options such as bicycling and walking
- Reduce single occupancy vehicles
- Increase bus commuting on campus
- Reduce the need for increases to impervious surface, infrastructure, and use of land

Strategies

- a. Advance LEED (Leadership in Energy and Environmental Design) goals
- b. Reduce fuel consumption
- c. Reduce greenhouse gas emissions
- d. Reduce impervious surface
- e. Preserve land for other uses
- f. Develop metrics to track success of goal and strategies

Goal 4: Accommodate transportation and parking for all events on campus.

Strategies

- a. Create a policy to coordinate event transportation needs
- b. Identify surge parking inventory for events
- c. Develop metrics to track success of goal and strategies
- d. Coordinate with University's Emergency Plan

Goal 5: Coordinate transportation with land use patterns on campus and in the community.

Strategies

- a. Develop procedures for locating transportation facilities in the community to reduce dependence on single occupancy vehicles (e.g. transit stations, park and ride lots, etc.)
- b. Coordinate planning and projects with local municipalities to provide optimal shared transportation opportunities for new construction, renovation, etc.

Many of the Intermodal Plan's goals call for the development of metrics and benchmarks for evaluating the plan's success. The Benchmark and metrics developed thus far explore demographic trends, the use of travel modes, employees flexibility for changing modes, campus transportation facilities, and the perception, knowledge and satisfaction with transportation programs.

B. 2011 University Park Campus Transportation Survey

One of the first steps undertaken to support the Goals of the Intermodal Transportation Plan was a University-wide survey of individual transportation travel patterns, habits, perceptions, and flexibility for changing modes. The 44-question survey was completed in Fall 2011 via an online portal, with more than 10,000 total responses compiled from faculty, staff, and students. Text of the survey and the Executive Summary of results are included in **Appendix E**. This is the first comprehensive transportation survey completed by the University, and it is expected that the results will be updated periodically to gauge the effectiveness and appeal of new programs. Survey results and cross-tabulations are expected to inform the enhancement of existing programs and create priorities for new programs that efficiently target individuals willing to change travel modes or behavior.

C. Existing Demand Management Programs

Most all of the travel demand management programs that are currently in operation will be sustained or enhanced in the future:

- Rideshare Matching Program – The University offers this program to employees through Penn State’s contract with CATA for transit services. The program is administered by CATA, and Penn State employees may register at no charge. The program includes a Guaranteed Emergency Ride Home program and four one-day parking permits at no charge annually. Currently there are 1,023 participants.
- Ride for Five Program – The University offers a discounted mass transit pass to full time employees who agree to give up their daytime parking permit. Employees with a Ride for Five pass may utilize any CATA route with their pass. Currently, the employee pays \$5 per month (pre-tax, payroll deducted) and the Parking Office subsidizes the remaining monthly fee (\$42) per pass to CATA. Participants of this program also receive four one-day parking permits at no charge annually. Currently there are 887 participants.
- Vanpool Program – The University turned over operation and administration of their vanpool program to CATA, which allowed CATA to initiate a Centre Region vanpool program. Currently, the program has 19 vanpools associated with Penn State University. The program includes a Penn State Parking Pass for the vanpool vehicle, an Emergency Guaranteed Ride Home Program for all participants, and four one-day parking permits at no charge annually for each participant.
- Online Student Rideshare Program – Initiated a rideshare program targeted for students via Alternetrides.com, a website program utilized by many universities to encourage carpooling. Anyone interested in a carpool may post their desired origin and destination, and others may browse the postings for an appropriate match.
- Campus Transit Service – Through a contract with CATA, the University provides circulator transit service within a “no-fare” zone that encompasses the UPD Study Area. The service includes two Loop and two Link Routes as well as community regional routes within the no-fare zone. Late Night Loop service is also provided by Penn State on Thursday, Friday, and Saturday nights, as a transportation option to the passenger car.

- Campus Shuttle Systems – The University operates four campus shuttle systems:
 - No-fare Campus Shuttle on 15-minute headways and accesses areas of campus not served by the campus bus service. Also provides for additional ADA needs not covered by the Paratransit Shuttle.
 - Paratransit Shuttle on campus that provides a fixed route service for all riders with both permanent and temporary disability needs. This eliminates the need for the users to either drive directly to their buildings or be dropped off by someone repeatedly throughout the day.
 - Engineering Shuttle that provides fixed route weekday service to CATO Park and Penn State buildings along Science Park Road.
 - Hershey Shuttle with service between the University Park campus and the Hershey Medical Center on weekdays, which reduces single occupant vehicle movement between campus and Hershey and reduces parking requirements.
 - Library Building Employee Bus Passes – The University provides CATA bus passes for Penn State employees working in the Library Building at CATO Park, as an alternative to using a personal vehicle from campus.
- Weekend and School Break Bus Services – The University works closely with Fullington Bus Company to provide weekend and school break express bus service to New Jersey/New York and Washington DC/Baltimore areas. Fullington also provides express service to Pittsburgh, Harrisburg, and King of Prussia as well. These transit services have been successful in reducing the need for students to use a passenger car or bring a car to campus. The services are available to the university and public as well.
- Event Transit Service – The University coordinates Event Transit services for football games and other large-scale events:
 - During large attendance events or inclement weather, the University coordinates bus service through local vendors to operate a shuttle service from peripheral lots to the venue to reduce traffic congestion and parking demand. When used, the shuttle systems were well-received and highly used by event patrons.
 - The University works closely with Fullington Bus Company and CATA to accommodate the PSU Football Express and CATA Football Shuttle, respectively. The two systems provide transit bus services between peripheral parking locations and the Beaver Stadium area, with the goal of reducing traffic congestion and parking demands on gameday. Fullington’s Service focuses on the northwestern side of State College, extending to the Penn State Altoona campus. CATA’s service works on their existing transit routes on the southeastern side of State College. The shuttles are growing in ridership and provide efficient transportation alternatives to personal vehicle travel.
- Master Plan Bicycle Program – The University has revised the bicycle plan to reduce the “no-ride” zone and open up more of the campus via shared use paths. The University

requires that bicycle amenities be added to all new construction projects. Recent efforts have created new and expanded bike plazas at Thomas Building, Willard Building, and the HUB, as well as new covered bike storage facilities at the Stadium West Commuter Lot.

- Operates a Limited-Access Roadway Strategy for Core Campus – Vehicle trips are controlled at the two Pollock Road Kiosks, which reduces cross traffic and unauthorized vehicles from the core of campus with heavy pedestrian traffic.
- Commuter Parking Structure – A parking permit structure is maintained with lower cost commuter parking lot permits, which encourages “one-trip-in/one-trip-out,” where commuters park their car and use transit, walking, and bike modes during the day.
- Conference Parking Permits – The University offers a conference permit program to coordinate and manage non-University traffic on campus.
- Visitor Parking Accommodations – The University accommodates visitors with hourly parking available in the HUB Deck, East Deck, and Nittany Deck. Daily parking is also available to visitors in the commuter lots.

D. Creating New Demand Management Programs

The following potential new travel demand management programs are currently being studied by the University:

- Bikeshare Program – Bikeshare programs provide a fleet of bicycles that may be checked-out and used for period of time, typically within a defined usage area. The concept has been gaining in popularity on university campuses in the United States. Penn State students and local bicycling advocates have been promoting bikeshare at University Park, and a small, student-run program with 12 bikes has been in operation on campus for the last two years. Learning from the lessons of this program and national experience with bikeshare, the University has developed a phased implementation concept that starts with a fleet of about 50 bicycles available for sign-out through 8 campus locations. Expansion of the program would increase the number of bicycles and the number of locations where they may be signed-out. Pre-registration for the program would be available to full-time students, faculty, staff, and overnight guests at hotels. The program is being readied for implementation, perhaps during the 2012-13 academic year.
- Carshare Program – Carshare programs provide a fleet of cars on campus that may be checked-out for intra-day trips for personal business that would otherwise require an individual to have access to a personal vehicle. Carshare fills a transportation gap for individuals would relinquish their parking permit and use other modes for the commuter to work, but need to make the occasional personal trip during the workday. Penn State is formulating various carshare concepts to determine if this is a viable program for the University Park campus.
- Occasional-Use Parking Permits – This permitting strategy provides an option for those faculty, staff and/or students who typically walk, bicycle or carpool to work but occasionally would like to drive. Participants in the program would relinquish their full-time parking

permits in exchange for access to the less-expensive occasional-use permit program. The University is reviewing case studies of similar campus programs to identify issues and benefits for implementation at University Park.

- Expansion of Discounted Mass Transit Pass Program (Ride for Five) – With nearly 900 participants, the Ride for Five Program has been one of the University’s most successful demand management programs. An expansion of the program is under consideration and may include part-time faculty and staff, graduate and/or undergraduate students who meet certain criteria (e.g., no transit pass available through their apartment complex). Administration of the program is a key hurdle. The results of CATA’s Universal Transit Access Study (discussed later in this section) may impact how Ride for Five is expanded.
- Integrated Access Management – The University has conceptualized an integrated access program with benefits for multiple modes of travel. The current set of independent programs has few cross-modal options that provide flexibility for individual situations or unpredicted travel needs. The University is considering the administrative and fiscal impacts of such a system, including compatibility with the existing parking permit pricing structure.
- Park and Ride Facilities – With recent increases in gas prices, the regional interest in carpools and vanpools has increased substantially. The CATA Commute Vanpool program has obtained great interest in additional vanpools which requires additional vehicles and staff time to meet the demands. Penn State has mapped the home addresses of its current parking permit holders (**Figure 4.9**) to identify strategic locations for investments in park and ride facilities that would likely serve their employees. The University already incentivizes park and ride by providing four no-charge parking permits for the commuter lot to all users of the Rideshare program.
- Walking/Bicycling Zone – Home address mapping of current Penn State employees reveals that 56% of those living within ½ mile of campus hold a parking permit, and 66% of those living with 1 mile hold a parking permit (**Figure 4.10**). The Walking/Bicycling Zone Program would provide incentives for those who relinquish their parking permits in favor of other modes of travel. The feasibility and interest in such a program is being cross-checked with preference data from the travel survey. Such a program would benefit from being part of an Integrated Access Management program with multiple mode alternatives.
- Pursue Grant Funding for Transportation Alternatives – Grant funding for research and development of multi-modal travel management programs would be pursued by Penn State and/or in partnership with CATA.
- Enhanced Shuttle Services – With continued expansion of University athletic, artistic, cultural, and conference venues, customized shuttle services are becoming desirable for large university events to reduce or contain unnecessary circulating traffic. The University has employed such shuttle services for football games and for hockey to a lesser extent, using internal and contracted services. The response from patrons has been largely positive. The University plans to employ this type of transportation for large and/or overlapping events on a case-by-case basis.

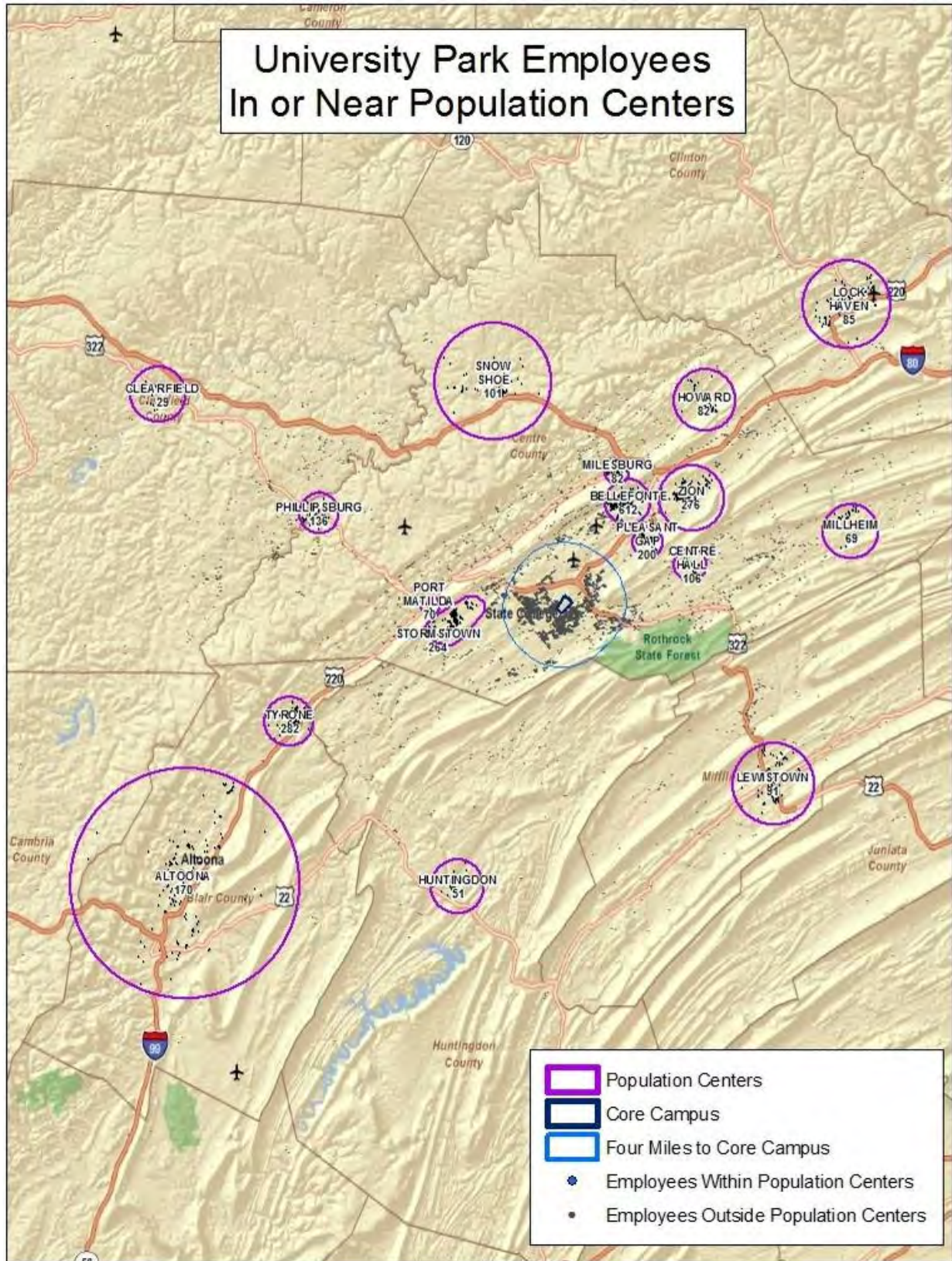


Figure 4.9. University Park Employees in or Near Population Centers, 2011

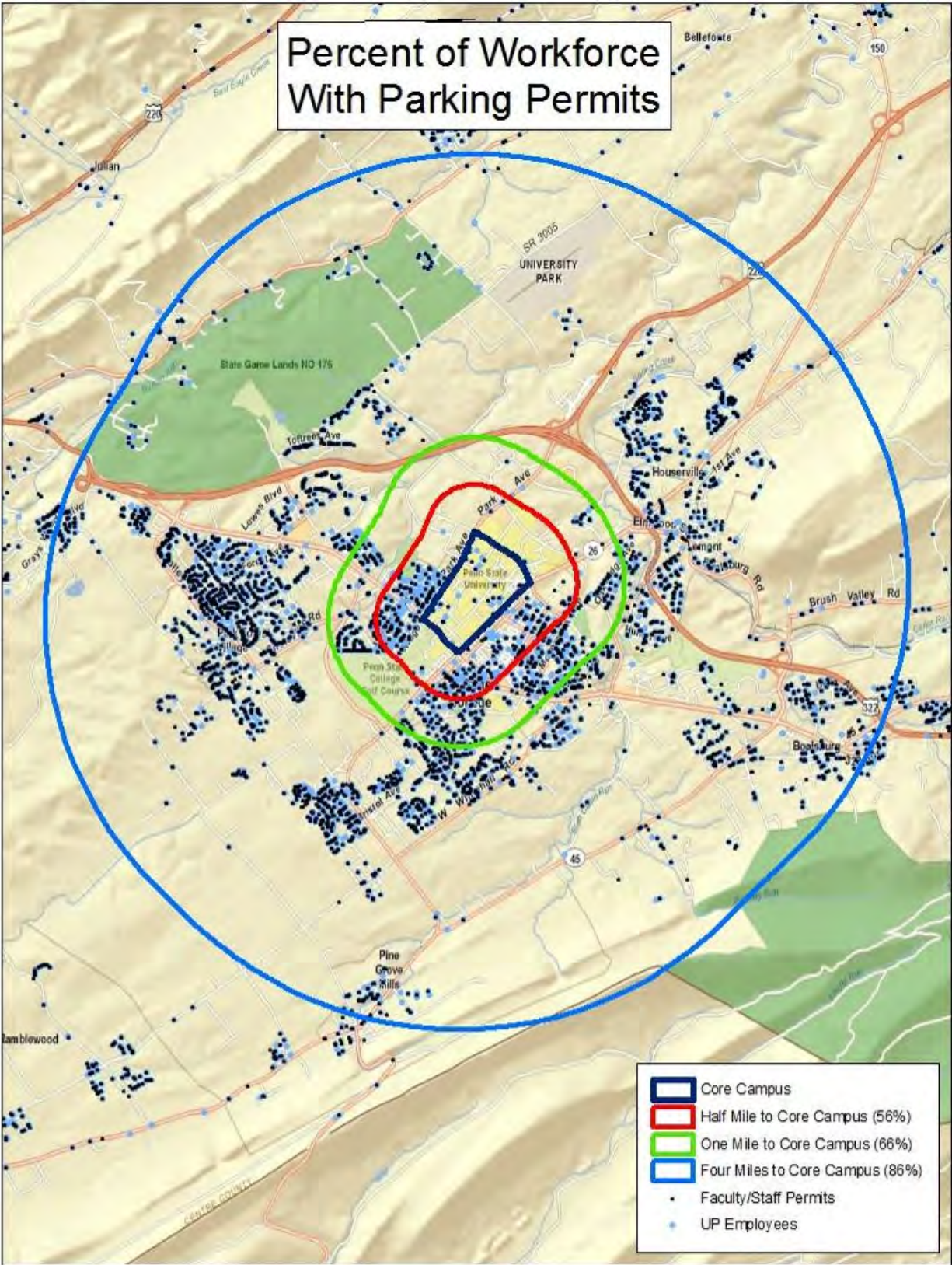


Figure 4.10. Percent of University Park Employees with Parking Permits, 2011

E. Other Transportation Management Opportunities

E.1. Universal Transit Access⁶

Universal transit access is generally defined by a network of public transportation services funded in full by some mechanism other than the payment of a fare by the passenger at the point of service. It is a transportation demand management strategy commonly used in cities and towns that host colleges and universities. Hence, it is sometimes referred to as a university pass or “u-pass” system; in these instances, a student and/or faculty identification card often functions as a transit pass to allow cardholders to board a vehicle without paying a fare.

The following areas are examples of those employing some form of universal transit access as a means to promote the use of public transportation:

Pennsylvania Examples:

Altoona, PA
Pittsburgh, PA
Indiana, PA

Other National Examples:

Ithaca, NY
Chapel Hill, NC
Gainesville, FL
Milwaukee, WI
Ames, IA
Urbana-Champaign, IL
Palo Alto, CA

The State College, PA area shares similarities with many of these transit-intensive areas. CATA, established in 1974, provides about 7.2 million annual trips, 1.9 million annual miles of service, and 156,000 annual hours of service to about 112,000 residents spread over a service area of 135 square miles. This service area consists of the Boroughs of Bellefonte and State College, and the Townships of Benner, College, Ferguson, Halfmoon, Harris, Patton, and Spring. The service area also includes the University Park campus of the Pennsylvania State University, a large academic and research institution of about 45,000 students and 15,000 employees.

CATA has been awarded funding through the Pennsylvania Community Transportation Initiative (PCTI) to complete a feasibility study of Universal Transit Access for the State College Area. The purpose of the study is to determine what impacts could be expected, what costs would be incurred, and what benefits would accrue if universal transit access were implemented in this particular local application. The results of CATA’s study, including the recommended operational details, may have a significant impact on the cost and level of transit service provided to Penn State.

E.2. University Park Event Scheduling System

The University is developing a campus-wide scheduling tool for internal Penn State use that will integrate scheduling of activities and events for all University Park venues in one central place. For the purposes of transportation, the tool will assist in the coordination of traffic management activities and help to eliminate the over-scheduling of venues, which could lead to unintended parking or traffic problems.

⁶ Excerpt from the Request for Proposals, Consultant Services, State College Area Universal Transit Access Study, Centre Area Transportation Authority (CATA), December 19, 2011.

Chapter 6. Technical Summary of Major Findings

- This Update of the District Plan Transportation Study fulfills the ordinance requirements for the planning period from 2012 to 2022. The District Plan Transportation Study is a UPD ordinance requirement that is to be prepared every tenth year as a planning tool to document travel trends and identify potential transportation effects of projected development and activities within the district during the next 10-year period.
- The previous UPD District Plan Transportation Study was completed in 2000 and provided a mostly forward-looking evaluation of vehicular traffic impacts related to network alternatives to be implemented by 2010. The current Update is both forward-looking and backward-looking, analyzing travel trends observed during the last 10 years as well as changes forecasted to the future 2022 Horizon Year. It also presents a broader, multi-modal perspective on the University's diversified transportation system. As such, this Update meets and exceeds the UPD ordinance requirements, which focus heavily on impacts to vehicular travel.

University Park Campus Development & Investment, 2000-2012

- The University made considerable investments in campus facilities and infrastructure projects between 2000 and 2012, guided by the 1999 University Park Campus Master Plan. The scale and scope of these projects is particularly relevant to this UPD Update, since they have significantly changed the landscape of University Park.
 - Taken together, new buildings and additions added approximately 3.8 million gross square feet of floor area in the UPD Study Area. *Development on this scale has the potential to greatly increase the University's travel demand footprint.*
 - The University's commensurate investment in the transportation infrastructure focused on Master Plan goals to reduce vehicular travel demand and access to the Core Campus, thereby creating space and incentives for other modes of travel. As such, the physical transportation system serving vehicular, transit, pedestrian, and bike modes has been substantially changed since 2000. *At times, the University's approach to managing the roadway network has been perceived as a threat to the Community's vehicular mobility.*

Base Year UPD Transportation Assessment

- The Base Year analysis of 2011 travel conditions evaluated "level-of-use" for the primary travel modes serving the University Park campus—car, transit, vanpool, walk, and bike. Backward-looking comparisons were completed against year 2000 data, where available.
- Benchmark Locations surrounding the campus were designated at the edges of the UPD Study Area where Community and University traffic mixes. These locations were studied to establish a reference point, since traffic volumes and patterns at these locations were considered indicative of the larger region. Between 2000 and 2012, vehicular traffic volumes decreased by about 9 percent during the AM Peak period and decreased by about 7 percent during the PM peak period. When the AM and PM data are combined using a volume-weighted average, vehicular traffic volumes decreased by about 8 percent during the AM and PM peak periods.

- The Benchmark Locations west of campus, along Atherton Street, displayed even greater increases, while locations east of campus along University Drive and Porter Road displayed stable or slight increases in traffic volumes. The vehicular volume changes are consistent with recent roadway network changes, such as the Blue Course Drive and I-99 connections, as well as the University’s emphasis on commuter lot parking on the east side of campus.

- Gateway Locations represent the major access points to the core area of the University Park Campus along Atherton Street, Park Avenue, College Avenue, and University Drive. Between 2000 and 2012, vehicular traffic volumes decreased by about 12 percent during the AM peak period and decreased by about 1 percent during the PM peak period. When the AM and PM data are combined using a volume-weighted average, vehicular traffic volumes decreased by about 8 percent during the AM and PM peak periods.

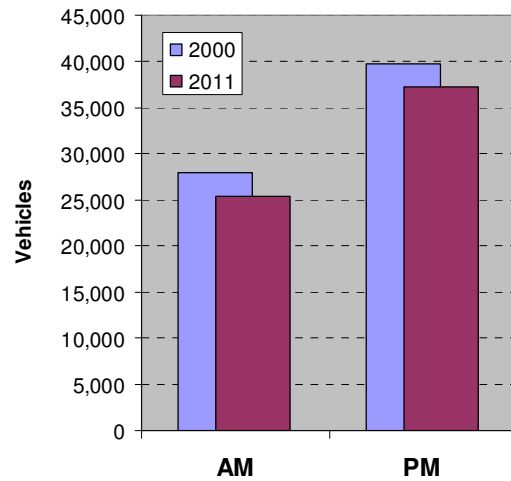
- The conversion of Shortlidge Road to a pedestrian mall induced volume decreases at the Shortlidge Road Gateways along Park Avenue and College Avenue. Meanwhile, the construction of East Deck, the extension of Curtin Road to Atherton Street, and reconfiguration of Fischer Road led to volume increases at these gateways. The net effect has been a shift in vehicular traffic volume among the various gateways.

- Between 2000 and 2012, traffic volume at the Gateways has “spread” away from the peak hours. Peak hour volumes decreased during the AM between 7:30 AM and 8:30 AM and during the PM between 4:30 PM and 5:30 PM. The net effect is a more even distribution of traffic and more efficient use of the system throughout the day. This phenomenon is likely influenced by how classes, activities, and events are scheduled. Drivers may also be eliminating peak trips or modifying their travel routines to avoid campus during periods of known congestion.

- The evaluation of Total Campus Traffic Access supplies the most comprehensive measure of the University’s vehicular level-of-use. The evaluation isolates vehicular traffic accessing University uses within the UPD Study Area, including the Gateway Locations, Commuter Parking Lots, West Campus, and uses north of Park Avenue accessed from Bigler Road and University Drive. Taking all campus access locations together, between 2000 and 2011, vehicular traffic volumes

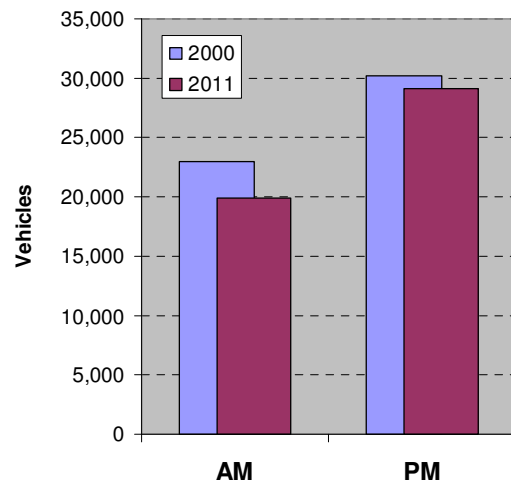
Benchmark Intersections

All Locations, 2000 vs. 2011



Gateway Intersections

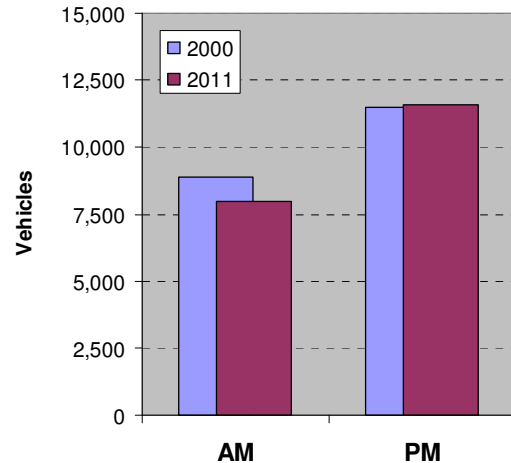
All Locations, 2000 vs. 2011



decreased by more than 10 percent during the AM peak period and increased by about 1 percent during the PM peak period. When the AM and PM data are combined using a volume-weighted average, vehicular traffic volumes decreased by about 4 percent during the AM and PM peak periods.

- In light of the land development added to the University Park campus between 2000 and 2011, the overall decrease in traffic volume indicates Penn State’s successful management of their vehicular travel demand, even to the point of reducing vehicular traffic impacts on the roadway network. This result is attributed to the University’s investments in infrastructure and programs that have strengthened other modes, provided affordable modal alternatives, encouraged mode shifts, reduced the need to travel, and dispersed travel to off-peak times of the day.

Total Campus Traffic Access
All Locations, 2000 vs. 2011



- Transit ridership on the Loop, Link, and CATA Regional Routes totaled more than 35,000 trips per day in 2011 when Penn State classes were in session. This represents a 10 percent increase in trips by the transit mode between 2000 and 2011. At the same time, the number of CATA transit vehicle trips accessing campus decreased by about 7 percent.
 - Curtin Road between Atherton Street and University Drive is the most transit-intensive corridor on campus, carrying more than 70 transit buses per hour, including tripper buses, during the peak periods. The Curtin Road Gateways at Atherton Street and University Drive, taken together, accommodate more than half of all transit vehicles trips accessing campus.
- The University operates four shuttle systems that augment CATA’s transit routes and fill specialized roles in providing comprehensive access to the campus and reducing the need for personal automobile travel. The following table summarizes the daily ridership on the shuttle systems during the Spring 2011 semester when Penn State classes were in session.

Shuttle System	Daily Trips
Campus Shuttle	346
Paratransit Shuttle	8
Engineering CATO Park Shuttle	10
Hershey Shuttle	14
Total Trips	378

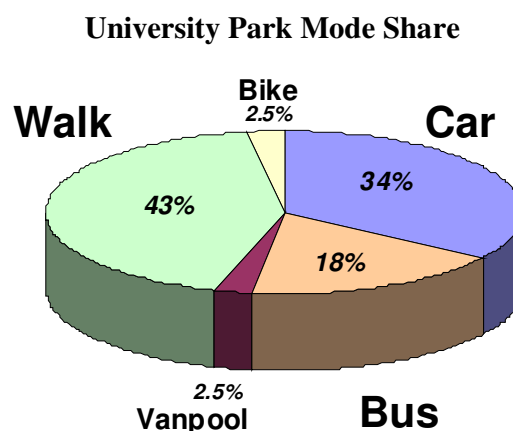
- Since 2007, CATA has administered the former University vanpool program, now referred to as CATA Commute. At latest count, 19 vanpools carrying an average of 10 commuters per van have Penn Sate University as the primary commute destination.

- The number of pedestrians and bicycles accessing campus were counted at major gateway points in April 2012 during the AM and PM peak periods. Taken together, the walk and bike modes accounted for more than 16,000 trips during the AM and PM peak periods. The table below summarizes the total volumes entering and exiting the campus.

	AM Peak Period (7:00 AM to 9:00 AM)			PM Peak Period (4:00 PM to 6:00 PM)		
	Enter	Exit	Total	Enter	Exit	Total
Pedestrians	2,921	578	3,499	3,903	7,732	11,635
Bicycles	314	41	355	225	372	597

It is noted that these volumes represent both “primary trips,” where no other modes are part of the trip (car or transit) and “secondary” trips, where another mode was first used to reach campus.

- The mode share for trips accessing the University Park UPD was estimated using the AM and PM peak period data, which encompasses the four traditional hours of highest travel during the day. The pie chart illustrates mode share percentages according to the number of person-trips per by mode. More than 66% of University Park trips are on modes that do not involve a personal automobile. The walk mode carries the highest proportion of trips (43%), with car (34%) and bus (18%) as the other major modal choices.



Future Year UPD Transportation Assessment

- Compared to the scope and scale of new buildings and structural changes completed from 2000 to 2012, the University’s investments during the next 10 years are expected to be much more focused on maintenance, renovation, optimization, and expansion of existing facilities and programs. The future level-of-use and potential impacts to the transportation system of the University’s 2012 to 2022 development program were evaluated from two different perspectives.
- Project-level evaluations provide a micro-scale perspective on the localized impacts of individual University development projects. Five of the identified projects may generate new traffic sufficient to create localized network impacts and trigger the UPD ordinance requirements for additional planning or study:
 - Pegula Ice Arena – The detailed traffic impact study for the Ice Arena has been completed and approved. Management of event transportation operations will be provided, but no other roadway system improvements were required. Construction of the arena has commenced.
 - Stadium West Parking Lot Expansion – The expansion of up to 900 new parking spaces may generate about 200 new trips during each of the AM and PM peak periods. A detailed traffic impact study will be required. Roadway impacts requiring a new right-turn lane are likely at the Park Avenue/Stadium West intersection.

- Bigler Fields Master Plan – The plan encompasses construction and expansion of athletic facilities east of Bigler Road, including McCoy Natatorium, Indoor Tennis Facility, Intramural Building Addition, and Lacrosse Stadium. A recent study of event parking for overlapping events indicated the need for additional parking. This conclusion is part of the justification for expanding the Stadium West parking lot. The University will continue to refine its strategy of actively managing event traffic on a case-by-case basis by deploying personnel in the field.
- Penn State Arboretum Education Center, Planetarium, and Conservatory – These three elements of the Penn State Arboretum Master Plan are scheduled for construction during the next 10 years. Based on the parking available at the Arboretum, a maximum of 200 vehicular trips per hour may be generated for any given program. A detailed traffic impact study may be required. Roadway impacts are possible, but not likely, at the Park Avenue/Bigler Road intersection.
- Conversion of Power Plant to Clean Natural Gas – The conversion will change the plant’s fuel from coal to natural gas. The conversion will eliminate 40 to 50 coal delivery truck trips per day and (14,000 truck trips per year) on the campus and Downtown State College roadway network.
- The regional-level evaluation provides a broader, macro-scale evaluation of the complete University development plan. Trend travel forecasts from the Centre County Travel Demand Model were used to assess future level-of-use on the UPD Study Area roadways.
 - Within the model, University Park trips are forecasted to increase by 2 to 3 percent from 2012 to 2022. At the same time, traffic loads in the UPD Study Area are shown to increase by much greater percentages, indicating that the University’s trip-making will not drive future increases in traffic or the need for significant capacity-adding roadway projects.

Travel Demand Management Programs

- The University is committed to maintaining, enhancing, and identifying emerging opportunities to manage its travel demand. The Intermodal Transportation Plan for University Park is an outcome-based comprehensive plan for with metrics for evaluating travel demographics, modes, facilities, perception/knowledge, and the flexibility for modal changes.
 - The Plan’s emphasis is on reducing the number of vehicle trips, particularly single-occupancy vehicle trips, frequently by incentivizing alternative modes. The Ride for Five, Rideshare, and Vanpool programs are successful examples of programs that will be maintained with plans for expansion and refinement during the next 10-years.
- In 2011, the University conducted its first Campus Transportation Survey. The 44-question survey was completed via an online portal, with more than 10,000 total responses compiled from faculty, staff, and students. It will be repeated periodically to gain feedback on the success and progress of the Intermodal Transportation Plan. Using the survey and other workforce distribution data, the University is conceptualizing new travel demand reduction programs that better target populations with reasonable ability and willingness to participate.
- Several new travel demand management and modal enhancement programs are currently in the concept stage. Some programs, such as the University’s bikeshare program, are being readied for

implementation, perhaps during the 2012-13 academic year. Carshare and an “occasional-use” parking permit program are also under consideration.

- The University is developing a campus-wide scheduling tool that will integrate scheduling of activities and events for all University Park venues in one central place. The tool will not only help in the coordination of event traffic management activities but also in the tweaking the supply of campus transit (Loop, Link, and shuttles) and managing the demand for parking. It is hoped that situations that exceed travel and parking capacity demand can be avoided by using the tool for advance planning.

PENN STATE UNIVERSITY PLANNED DISTRICT TRANSPORTATION STUDY

Appendix A

Listing of University Park Facilities & Land Development Projects, 2000-2012

New Buildings & Facilities

IST Building
White Course Apartments
Child Care Facility at Hort Woods
Pasquerilla Spiritual Center
Stuckeman Family Building
Berkey Creamery
Food Sciences Building
Business Building
Forest Resources Building
Penn State Arboretum & H.O. Smith Botanical Gardens
Katz Building (Law School)
Hintz Alumni Center
Bank of America Building
Millennium Sciences Complex
Life Sciences Building
Chemistry Building
Student Health Center
Eastview Terrace
Blue Band Building
Landscape Facility at Tower Road
Bennett Child Care Center
Eva J. Pell Laboratory for Advanced Biological Research
HUB Robeson Center
Lasch Building
North Frear Building Addition

Facility Expansions & Modifications

Moore Building Addition
Borland Laboratory Renovation/Reconfiguration
Beam Hall Conversion to Dormitory
Redifer Commons Expansion
Pollock Landscape Facility Expansion
Utilities buried along Park Avenue
Foundry Park Relocated/Reconfigured

Athletic & Recreational Facilities

Lacrosse Field
Medlar Field at Lubrano Park
Jeffery Field Bleachers
Beaver Stadium East & South Expansions
Beard Softball Stadium

Rec Hall Fitness Center
Golf Team Clubhouse
Renovate West Campus Athletic Fields
Field Hockey Field
North Halls tennis and handball courts removed; basketball courts reconfigured

Facilities Removed

Engineering Units D & E
Phi Delta Theta fraternity
Mitchell Building
Park Avenue Building
Paul Robeson Cultural Center
Eastview Terrace Residences
Graduate Circle Apartments
Campus Cottages
Greenberg Indoor Field
Penn State Baseball Stadium (converted to athletic fields)
Street Hockey Rinks along Bigler Road
Tennis Courts at corner of Bigler Road/Pollock Road
Tennis Courts at North Halls

PENN STATE UNIVERSITY PLANNED DISTRICT TRANSPORTATION STUDY

Appendix B

Listing of University Park Transportation & Parking Projects, 2000-2012

TRANSPORTATION PROJECTS

Roadway Connections

- Curtin Road Extension to Atherton Street from Burrowes Road
- White Course Drive connection to Atherton Street
- Pollock Road connection removed between Atherton Street and Burrowes Road
- Shortlidge Road conversion to pedestrian way between Pollock Road and “Gateway to the Sciences”
- Rittenour Way connection, between Brown C Parking (Osmond Building) and Ritenour Building
- Roadway behind Computer Building closed, between Eisenhower Road and Curtin Road
- I-99 underpass connection to Innovation Park
- Nittany Lion Inn connection to Atherton Street removed and connected to Curtin Road Extension

Roadway Reconstruction and Capacity Expansion

- Curtin Road reconstruction, between Burrowes Road and University Drive
- Tower Road paved, north of the Landscape Facility
- Porter Road widening with center turn lane, between Curtin Road and College Avenue

Intersection Projects

- Traffic signals installed on Atherton Street at Curtin Road Extension and White Course Drive, with integration of signals into State College Borough’s coordinated signal system
- Fischer Road and intersection at Park Avenue converted from one-way operation to two-way operation, with right-in/right-out operation at Park Avenue
- Traffic signal added on Park Avenue at Stadium West/OPP Driveway
- Coordinated signal system hardware installed along Park Avenue at the University Drive and Fox Hollow Road/Porter Road signals
- Porter Road/Curtin Road intersection control changed to All-Way Stop
- Left-turn phase added at University Drive/Hastings Road intersection
- Leading pedestrian interval added at Park Avenue/Allen Road intersection
- University Drive/Curtin Road protected turn phases removed for westbound Curtin Road left-turn and northbound University Drive right-turn; signal timings revised; signal incorporated into College Township’s coordinated signal system
- Park Avenue/Fox Hollow Road/Porter Road turn lanes added on northbound Porter Road and southbound Fox Hollow Road; signal phasing/timing updated; pedestrian signals added
- Park Avenue/Hospital Drive intersection widened with additional eastbound and westbound through lanes
- Park Avenue/Bigler Road traffic signal updated with new hardware, and mast arms
- Park Avenue/Bigler Road intersection widened with northbound Bigler Road left-turn lane

Access Control Projects

- Fraser Street restricted access, between West Halls parking and Curtin Road
- Pollock Road Kiosks added near Burrowes Road and Shortlidge Road
- Expanded hours when traffic is restricted on Pollock Road
- HUB Deck controlled access implemented
- Brown A Parking Lot Kiosk added near Burrowes Road between Reber and Deike Buildings
- West Campus Kiosk added along White Course Drive
- Traffic circulation and access changes around Engineering Units

PARKING PROJECTS

Parking Additions

- East Deck
- Nittany Deck Expansion
- Nittany Lion Shrine parking tray (metered)
- Tray of parking next to Nittany Deck for visitors to labs in Moore Building
- Lot added between Pond Lab and Oswald Tower
- Parking expanded near Beard Softball Stadium
- Orange G Parking Lot added at the south end of Bigler Road
- ADA Parking Lot added at the Bryce Jordan Center
- Porter North Parking Lot (Medlar Field at Lubrano Park)

Parking Reconfigurations

- Nittany Lion Inn Parking Lot reconfigured, with changes in access to Park Avenue
- Parking in front of Stuckeman Family Building reconfigured
- Parking between Patterson Building and Pavillion Theatre reconfigured; meters removed
- Parking near Armsby Building reconfigured/reduced
- Brown A Parking reconfigured
- Parking between IST Building and Rec Hall moved/reconfigured (Rec Hall Fitness Center)
- Graduate Circle parking reconfigured and expended to serve as student storage parking
- Parking and access reconfigured in front of Pollock Library
- Material Research Lab and Land & Water Building parking lot upgraded
- Stadium West Parking Lot converted from event to daily-use design

Parking Removals

- Rec Hall Parking Lot removed
- Part of West Campus parking lot removed (IST Building)
- Lots along Pollock Road removed (IST Building)
- Lot behind Moore Building removed (Moore Building Expansion)
- Lot along Allen Road removed (Child Care Facility at Hort Woods)
- Lot along Allen Road removed (Pasquerilla Spiritual Center)
- Lots along Bigler Road removed (Bank of America Building, Student Health Center)
- Parking at McElwain and Simmons Commons service areas removed and replaced with turf
- Student Storage parking (Lot 83) removed (Katz Law School Building)

Regional Transportation System

- Blue Course Drive (Western Inner Loop) constructed

- Corl Street closed between College Avenue and Teaberry Ridge
- I-99 connected from Bald Eagle to I-80 with new Park Avenue Interchange
- Toftrees Avenue extended from Cricklewood Drive to Fox Hollow Road
- Martin Street Connected from Aaron Drive to Atherton Street, opposite Vairo Boulevard
- Transit Signal Priority system implemented on North Atherton Street

PENN STATE UNIVERSITY PLANNED DISTRICT TRANSPORTATION STUDY

Appendix C

Listing of University Park Pedestrian, Bicycle & Transit Projects, 2000-2012

Pedestrian & Bicycle Projects

- Added signalized pedestrian crossing at Bus Station
- Fisher Plaza pedestrian pathways reconfigured
- Sidewalks along Atherton Street reconfigured, between Park Avenue and Bus Station
- Pedestrian and bicycle overpass across Atherton Street integrated with IST Building
- East Sub-Campus pedestrian and bike pathways
- Reconfigured walkways adjacent to Freer, Armsby, and North Freer Buildings
- Added new pathway connections around Old Main
- Added new pathway near Theatre Building
- Plaza and walkways at Atherton Hall/Schryers Honors College Office
- Added pedestrian pathway connection from Katz Law School Building to Park Avenue
- Added pedestrian pathway connection from Research Buildings to University Drive
- Shortlidge Road conversion to pedestrian way between Pollock Road and “Gateway to the Sciences”
- New sidewalk added:
 - Along north side of Park Avenue from Shortlidge Road to Fox Hollow Road
 - Along south side of Park Avenue from Shortlidge Road to Katz Law School pathway
 - Along north side of Park Avenue from University Drive to Fleet Services driveway
 - Along west side of University Drive from Park Avenue to Curtin Road
 - Along south side of Curtin Road, from Jordan East Access to Porter Road
 - Along east side of Bigler Road, from Park Avenue to Katz Law School Building
 - Along both sides of Curtin Road Extension, from Atherton Street to Burrowes Road
 - Along west side of Bigler Road, from McKean Road to Linden Road
 - Along both sides of Serviced Drive, from Bigler Road to Big Hollow Road
- Bike courts added:
 - HUB Plaza (2 courts)
 - Willard Plaza (3 courts)
 - Bouke Building (1 court)
 - Thomas Building (1 large court – 140+ bikes)
- Added bike climbing lanes on Burrowes Road and Shortlidge Road (uphill side only)
- University Drive/Curtin Road pedestrian improvements studied and implemented—shortened pedestrian crossing distances, replaced pedestrian buttons, added pedestrian signal heads with countdown timers, added leading pedestrian interval, simplified signal phasing
- Bicycle pathway underpass to Innovation Park
- Improved pedestrian crossing treatments throughout campus:
 - Piano key mid-block crossings
 - Concrete crossings at mid-block, intersections, and bus pull-offs
 - Speed tables on Curtin Road, Pollock Road, and Shortlidge Road

Streetscape Projects

- Pollock Road, between Burrowes Road and Bigler Road
- Shortlidge Road, between Pollock Road and College Avenue
- McKean Road, between Shortlidge Road and Bigler Road
- Curtin Road, between University Drive and Porter Road

Transit Projects

- Curtin Road Transit Center, including bus shelters and electronic arrival/departure board
- Renovated and expanded Mobility Center along College Avenue at Allen Street
- Bus pull-offs added:
 - University Drive, north of Park Avenue
 - Services Drive
 - Curtin Road at Stadium West Parking Lot
 - Curtin Road at East Halls
 - Curtin Road at Visual Arts
 - Hastings Road near research buildings
 - Hastings Road near Student Storage Parking
 - Shortlidge Road at White Building
 - Bigler Road at Computer Building
 - Beaver Stadium along Curtin Road and Porter Road
 - Beard Softball Stadium
 - Porter Road at Jordan East Lot
- Bus turnaround off of Park Avenue at the Equine Facility (football event transit)

PENN STATE UNIVERSITY PLANNED DISTRICT TRANSPORTATION STUDY

Appendix D University Park Mode Share Methodology & Assumptions

The University Planned District (UPD) Transportation Study contains an estimation of Mode Share for the University Park Campus, using a variety of traffic, pedestrian, and bicycle counts, as well as transit ridership and vanpool data from the Centre Area Transportation Authority (CATA). Modal trips to the University Park campus were isolated and then converted into “person-trips” for the mode share calculation. The following documents the methodology and assumptions used to calculate person-trips by mode.

Personal Vehicle Traffic Trips

The number of personal vehicles accessing the campus was counted during the AM and PM peak periods at the intersections and driveways serving the Core Campus and primary commuter parking facilities. The locations included in the mode share analysis are identical to those considered for the Total Campus Access evaluation, which encompassed the following:

- **Gateway Intersections**, which capture vehicles accessing Core Campus including the Nittany, HUB, Eisenhower, and East parking decks;
- **Commuter Parking Lots** near Beaver Stadium, including Jordan East, Stadium West, and Porter North Lots;
- **Research Buildings and Student Storage Parking** that is accessed via Hastings Road, east of University Drive;
- **Parking Areas north of Park Avenue** that are accessed via Bigler Road and University Drive Extension; and
- **West Campus Parking Areas**, which are accessed via White Course Drive and West Campus Drive.

To convert the counts of vehicles to person-trips, the assumption of 1.186 persons per vehicle was used, as developed from U.S. Census 2000 data for Centre County, Pennsylvania (SF3 Dataset, Table P035, Private Vehicle Occupancy for Workers 16 Years and Over), as follows:

P035: PRIVATE VEHICLE OCCUPANCY FOR WORKERS 16 YEARS AND OVER [10], Centre County, PA				
Total:	63,097			
Total Car, truck, or van:	49,410			
Other means (including those who worked at home)	13,687			
			Occupancy	Weighted Occupancy
Total Drove alone	42,116		1.0	42,116
Total Carpooled:	7,294			
In 2-person carpool	6,110		2.0	12,220
In 3-person carpool	799		3.0	2,397
In 4-person carpool	249		4.0	996
In 5- or 6-person carpool	57		5.5	314
In 7-or-more-person carpool	79		7.0	553
Auto Occupancy Calculation	Total Weighted Occupancy			58,596
	Weighted Average Occupancy			1.186

Person-trips for the personal vehicle (car) mode were calculated by multiplying the total number of vehicles accessing campus (entering and exiting) by the weighted auto occupancy.

Vanpool Trips

CATA took over operation of the University’s vanpool program in 2006 and formed the region’s public vanpool program, now named CATACommute. CATA’s vanpool coordinator provided vanpool participation data for the 2011 fiscal year, which included 19 vanpools with an average ridership of 10 persons per vanpool.

Person-trips for the vanpool mode were calculated by multiplying the number of vanpools by the average occupancy by two (to account for the entering and exiting trips).

Pedestrian and Bicycle Trips

As part of the UPD Transportation Study, pedestrians and bicycles accessing campus during the AM and PM peak travel periods were counted at the major gateways. The gateway locations are identified within the report with summaries of the pedestrian volumes (Figures 3.28 & 3.29) and bicycle volumes (Figures 3.30 & 3.31).

While all pedestrians and bicycles accessing the Core Campus were counted at the studied locations, not all of these trips can be accounted as “primary” trips—i.e., trips that were made entirely by the walk or bicycle mode. Depending on the campus access point, it is more or less likely that these are “secondary” trips, with a different primary mode involved. For instance, it is very likely that pedestrians accessing campus from the east along Curtin Road represent secondary trips, with the car mode providing the primary trip to a commuter parking lot. Plus, there are very few residential or even commercial land uses within typical walking distance on the east side of campus.

To account for primary versus secondary trips, each gateway was assigned a Ped-Bike Nexus Characteristic based on the locations of parking and the trip making dynamic that drive pedestrian and bicycle trips across the nexus. The Ped-Bike Nexus Characteristic is shown on the report figures showing the pedestrian and bicycle volumes. The following assumptions were used:

Mostly Primary Trips	95% of the pedestrian and bike trips were considered Primary Trips
Mixed Trips	50% of the pedestrian and bike trips were considered Primary Trips
Mostly Secondary Trips	10% of the pedestrian and bike trips were considered Primary Trips

Only primary trips were counted in the mode share calculation. Therefore, person-trips for the pedestrian and bicycle modes were calculated by first factoring the pedestrian and bicycle counts at each location by the Ped-Bike Nexus Characteristic, and then adding up the factored totals for all locations.

Transit Trips

CATA provided transit ridership data for regional routes as well as the campus Loop and Link routes, which primarily serve University Park and the State College Downtown. CATA’s regional route and Link systems are set up as radial routes, with the University and State College central business

district at the center of the system and home locations more toward the periphery. As such, the CATA data includes mostly primary trips related to the University but also some Non-University trips. As such, this analysis of mode share assumes that 90 percent of the inbound and outbound trips, as accounted by the CATA data collection system, are primary trips to and from the University. Person-trips on the CATA regional and Link routes were calculated by multiplying the total inbound and outbound trips provided in the CATA data by 0.90.

The Loop routes, on the other hand, are circulator routes that serve a variety of primary, secondary, and internal trip types that are mixed on the same route. For instance, many primary trips on the Loop routes originate at student residences (both on and off campus) and travel to stops at the center of Core Campus. Secondary trips on the Loop routes originate at commuter parking lots (car as the primary mode) and travel to stops at the center of Core Campus. Still other “internal” trips travel between different parts of the Core Campus. Each of these three trip types are mixed on the Loop routes, and assumptions about the distribution of primary, secondary, and internal trips are necessary for an accurate accounting of mode share.

To account for primary the various trip types, certain stops along the Blue and White Loop routes were assigned a Transit Nexus Characteristic, based on the location and context of the stop, the general profile of transit users who board/alight at the stop, and the modal trip-making dynamics between the stop and campus. It was not necessary to assign a Transit Nexus Characteristic to each stop. Rather, characteristics were assigned only where strong trends were known. For instance, transit users who board at the Jordan East commuter parking lot represent secondary trips almost exclusively, with car being the primary mode. Therefore, boardings and alightings at this stop were characterized as mostly secondary trips and were not counted in the transit mode share. On the other hand, transit users who board along Beaver Avenue at Heister Street and Garner Street are likely to be apartment residents who are using the bus as the primary mode to campus. Boardings and alightings at this stop were characterized as mostly primary trips and were counted in the transit mode share. Other Loop stops, such as the stop at Rider Building along Burrowes Road, are likely to accommodate a diverse mix of trip types, considering the nearby location of commercial business, residences, and University uses. These stops were not characterized, assuming that boardings and alightings represented either internal trips or trips that were characterized at the other stops.

The assigned Transit Nexus Characteristics are shown on the report figures illustrating passenger load on the Blue and White Loop routes (Figures 3.19, 3.20, 3.21 & 3.22). The following assumptions were used:

Mostly Primary Trips	90% of boardings & alightings were considered Primary Trips
Mixed Trips	50% of boardings & alightings were considered Primary Trips
Mostly Secondary Trips	5% of boardings & alightings were considered Primary Trips

Only primary trips were counted in the mode share calculation. Therefore, person-trips for the Blue and White Loop routes were calculated by first factoring the boardings and alightings at each stop by the Transit Nexus Characteristic, and then adding up the factored totals for all stops.

PENN STATE UNIVERSITY PLANNED DISTRICT TRANSPORTATION STUDY

Appendix E
2011 University Park Campus Travel Survey & Executive Summary

Notes about the conditional display of questions based on respondents' prior answers are shown in brackets. Answer options offered as checkboxes (allowing respondents to select more than one response) are denoted here with a . Answer options implemented either as radio buttons or as part of a dropdown list in the online survey (allowing respondents to select only one response) are denoted with a . Questions that were required for respondents to continue are denoted here with an asterisk.

+++++

Welcome to the 2011 Campus Travel Survey!

In order to better understand the commuting patterns of the University community, the Intermodal Transportation Plan Committee is inviting you to participate in this survey.

The survey should take less than 15 minutes to complete. Doing so is entirely voluntary, and we assure you that all responses are confidential and the results will only be published in the aggregate, without connection to any individual.

Please answer the questions based upon your typical travel habits during the semester.

As a token of our appreciation, participants will be eligible to win one of two iPod Touches. When you complete the survey, your Penn State Access ID will automatically be entered into the drawing. No data will be associated with your Penn State Access ID.

Thank you for participating!

Q01: What is your primary role at Penn State at University Park?*

- Undergraduate student (including Post-bac)
- Graduate student
- Faculty
- Staff (including exempt, non-exempt, technical service, wage payroll)
- Post doc
- Visiting Scholar
- Recent graduate
- Retiree
- Other: _____

[If student]

Q02: What year are you?*

- Freshman
- Sophomore
- Junior
- Senior
- Fifth-year senior
- Non-degree student
- Graduate
- Visiting / exchange student
- Other: _____

[If employee or grad student]

Q03: Where is your office, lab, or department? (Where you usually spend your time when you travel to campus)

***Pull down list of campus buildings; include "Outside State College Area" as an option

[If located outside of State College, ask this question, and then skip to end, to "Optional" page.]

Q04: Where outside of the State College area is your office, lab, or department?

Q05: What days during the semester do you normally travel to campus for school or work? (If you went to a University office or lab that is off-campus, but within the downtown area of State College, please count that as well.)* Check all that apply.

- Monday
- Tuesday
- Wednesday
- Thursday
- Friday
- Saturday
- Sunday

Q06: What time do you typically arrive at your first destination? (Pull Down Selections)

	Before 6am	Between 6am and 7am	Between 7 am and 8am	Between 8am and 9 am	Between 9am and 10am	Between 10am and 11am	Between 11am and Noon	Between Noon and 3pm	Between 3pm and 5pm	After 5pm
Monday	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Tuesday	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Wednesday	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Thursday	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Friday	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Saturday	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Sunday	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q07: What time do you typically depart from campus for the final time? (Pull Down Selections)

	Before noon	Between Noon and 3 pm	Between 3pm and 4pm	Between 4 pm and 5pm	Between 5pm and 6 pm	Between 6pm and 7 pm	After 7 pm
Monday	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Tuesday	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Wednesday	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Thursday	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Friday	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Saturday	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Sunday	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q08: How many trips do you typically make to and from campus each day? Include mid-day errands or lunch trips that take you off campus.

- One
- Two
- Three
- Four or more

Q09: How do you typically get to campus? Please select to mode you use most often on each given day.

- Drive alone in a car (or other vehicle)
- Bike
- Walk
- Motorcycle or scooter
- Carpool or vanpool with others also going to campus (either as driver or passenger)
- Get a ride (someone drops you off and continues on elsewhere)
- Bus
- Combination of Bus and Bike
- Shuttle
- Other: _____

Q10: Does your mode of transportation change according to the weather?

- Yes
- No

Q11: If yes, to what mode do you change?

- Bike
- Walk
- Motorcycle or scooter
- Drive alone in a car (or other vehicle)
- Carpool or vanpool with others also going to campus (either as driver or passenger)
- Get a ride (someone drops you off and continues on elsewhere)
- Bus
- Combination of Bus and Bike
- Shuttle
- Other: _____

[If checked carpool in Q09]

Q12: During the times that you carpool, how many total people are in your carpool or vanpool (including yourself)?

- 2 (you plus one other person)
- 3 people
- 4 people
- 5 people
- 6 people
- 7 people
- 8 or more

[If checked motorcycle, drove alone, carpoled, or got a ride in Q09]

Q13: Where do you (or whoever drove you) park at your destination?

- Penn State Parking Lot or Deck
- Innovation Park
- CATO Park / Bristol Park
- Science Park
- Downtown
- I was dropped off (and the driver went elsewhere)
- Other: _____

[If checked drove alone, carpoled, or got a ride in Q09]

Q14: What type of car or vehicle do you ride in on your way to campus? (If it was different on different days, please indicate what you use most often.)

- SUV
- Truck
- Van or minivan
- Stationwagon / Crossover
- Other car (sedan, etc.)
- Other: _____

[If checked motorcycled, drove alone, carpoled, or got a ride in Q09]

Q15: Is the vehicle you typically take to campus a hybrid, alternative fuel, or electric vehicle?

- No, it is a regular gasoline or diesel vehicle, or

Yes, it was:

- Hybrid
- Plug-in hybrid
- All electric
- Biodiesel
- Natural gas
- Hydrogen fuel cell
- Other: _____

[If checked bus in Q09]

Q16: What bus service do you typically use to get to campus?

- CATABUS (formerly Centre Line)
- Campus Loop/Link
- Campus Shuttle
- CATA Ride (ADA Service)
- Private Apartment Complex Bus
- Other: _____

[If used CATABUS in Q16]

Q17: Which CATABUS route did you ride on your way to campus last week? (Check all that apply.)

- A Park Forest
- AP Airport
- B Boalsburg
- C Houserville
- F Pine Grove
- G Gray's Woods
- H Toftrees
- K Cato Park
- M Nittany Mall
- N Martin St. / Aaron Dr.
- NV Martin St. / Vairo Blvd.
- P Medical Ct. / Scenery Pk.
- R Waupelani Dr.
- S Science Park
- UT University Terrace
- V Vairo Blvd.
- VE Vairo Blvd. Express
- W Valley Vista
- X Bellefonte / Pleasant Gap
- Z Stormstown

[If used CATABUS in Q16]

Q18: How do you typically pay for CATABUS?

- One Pass
- Token
- Penn State Ride for Five Pass
- Apartment Pass
- Paid cash
- Other: _____

Q19: Do you typically store a bike on campus?

- Yes, on a bike rack
- Yes, at a residence hall storage room / locker
- Yes, in my room or office
- No
- Other: _____

Q20: How often do you typically ride a bike to campus?

- Almost every day
- A few times a week
- A few times a month
- A few times a year
- Never

Q21: How long does it usually take you to get from home to your location on campus?

- Less than 10 minutes
- More than 10, but less than 15
- More than 15, but less than 30
- More than 30, but less than 1 hour
- One hour or more

Q22: How many miles would you estimate it is from where you're living to the University Park campus (one-way)?

- Less than a mile
- Between 1 and 2 miles
- Between 2 and 4 miles
- Between 4 and 10 miles
- Between 10 and 30 miles
- Over 30 miles

Q23: After arriving on campus, how do you typically get around campus (or off campus)?

	Never	Very rarely	Sometimes	Fairly often	Very often	Always
Walk	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Bike	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Bus	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Campus Shuttle	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Private Vehicle	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Department Vehicle	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q24: Please provide one answer for each of the following:

	Yes	No	Maybe	Don't Know
I have ridden a CATA bus.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
CATA buses stop close to where I'm living.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
CATA buses stop close to where I usually go on campus.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I know the cost to ride a CATA bus from home to campus.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I have used the CATA bus bike racks	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Riding a CATA bus takes too long	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I would ride CATA, or ride more often, if it cost me less.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I would not ride CATA more, even if it were free for me.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I would ride my bike to campus if there were better facilities (indoor parking, changing rooms, bike lanes, etc.)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I would use a vanpool/carpool if there were more convenient times.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I would use a vanpool/carpool if offered for part of the week.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I would use a vanpool/carpool if there were more convenient times.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I would possibly consider alternative ways to get to campus other than driving my own vehicle (bus, car/vanpool, bike, walk, etc.)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q25: Would the following factors encourage you to use a bus as your primary means of travel to campus (3 or more days per week)?

	Yes	No	Maybe	Don't Know
Reduced pass costs	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Increased frequency of departures	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reduced bus travel time between home and campus	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A bus stop closer to your home	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Expanded hours of service	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Service to my neighborhood	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A bus stop closer to my destination	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q26: Would you ride CATA to and from campus each day if there was no cost to you?

- Yes, I would ride from my home
- Yes, I would drive to a park and ride lot and ride into campus
- No, I would continue to use a different method of travel
- Not sure

Q27: If CATA off-campus bus routes were free to you, how many times per week do you think you would commute to campus?

- None
- 1-3 roundtrip per week (e.g. to and from campus one day)
- 4-7 roundtrips per week

Q28: Are you familiar with any of these programs?

	It's new to me	I've heard of it, but never used it	I've used it
Ride for Five Pass	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Emergency Ride Home Program Rideshare members	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
CATA Commute Rideshare Program	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
CATA Commute Van Pool Program	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Student AlterNet Rideshare Program	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Fullington Express Buses to NYC, DC, Pitt, Philly	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
CATA One Pass	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Loop / Link Routes	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
University ADA Point-to-Point Service	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
CATA Ride	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
University Bicycle Program	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Staff Shuttle	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
No-fare CATA Bus on campus	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q29: Would you consider joining a vanpool to travel to campus each day?

- Yes
- No
- Not sure

Q30: If available, would you consider using an Occasional Use Parking Pass that would allow you to park on campus a certain limited number of days each week/month?

- Yes
- No
- Not sure

Finally, this section asks a few questions about you. We use this information to help understand travel choices and how the people taking the survey might represent University Park as a whole. Your answers are confidential and will not be used for any other purposes.

Q31: How many years have you been at University Park (in any role)?

- 0-5
- 5-10
- 10-20
- 20+

Q32: Where do you live?

- On the University Park campus
- Off-campus in the State College area
- Outside of the State College area

Q33: What is your zip code?

Zip code: _____ (pull down?)

[If resides on campus]

Q34: In which residence hall do you live?

[Dropdown list:]

- North Halls
- East Halls
- South Halls
- Pollock Halls
- West Halls
- East View Terrace
- Nittany Apartments
- White Course Apartments

[If resides off campus]

Q35: Which intersection is near home? (Please answer for where you live locally. This information will only be used to calculate the approximate distance you travel to campus. It will be kept confidential and will not be used in any other way.)

Your street: _____

Nearest cross-street: _____

POTENTIAL CLICKABLE MAP?

Q36: Do you currently have a Penn State University Park parking permit?

- No
- Yes

[If living off campus]

Q37: How many people in your residence, including yourself, have a University Parking Permit?

- 0
- 1
- 2
- 3
- 4 or more

[If living off campus]

Q38: How many people of each category are there where you live (including yourself)? (Please answer for where you live locally.)

Faculty: _____

Staff: _____

Undergraduate: _____

Graduate: _____

Q39: Do you currently have a Centre Region Bike Permit?

- Yes
- No

Q40: Do you currently have any type of CATA Bus Pass?

- Yes
- No

[If has parking permit]

Q41: Which type of parking permit do you have?

[Dropdown list:]

- Student Commuter permit
- Student Resident permit
- Student Off-Campus Storage
- Faculty/Staff Reserved Lot permit
- Faculty/Staff Orange Open Lot permit
- Faculty/Staff Commuter Permit
- One day permit
- No permit/Pay hourly parking
- Vanpool permit
- Official PSU Business Permit
- Retiree permit
- Faculty/Staff any area permit

[If indicated that work/school location is outside State College (in Q04)]

Q42: Since your office or department is outside of State College, we do not need any further information from you at this time. But thanks for volunteering to participate! You are still eligible to enter the drawing for an iPod Touch, if you wish.

[If indicated that recently graduated (in Q01)]

Q43: Since your office or department is outside of State College, we do not need any further information from you at this time. But thanks for volunteering to participate! You are still eligible to enter the drawing for an iPod Touch, if you wish.

Q44: Optional: Is there anything else you would like to tell us about transportation at University Park? We welcome any additional comments in the space below.

Fall 2011 Transportation Survey
The Pennsylvania State University

Executive Summary

August 27, 2012

Data Analyses and Written Summary by:
Brittany Bloodhart, Ph.D.
Department of Psychology
The Pennsylvania State University

Overview

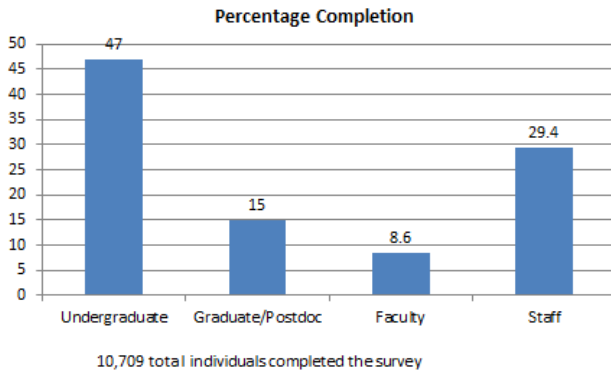
The information described herein contains results from the survey given to members of the Penn State University community in the Fall 2011 about current transportation habits, awareness of transportation options, and attitudes about changing transportation behaviors. The survey was developed by the University Intermodal Transportation Committee and administered through the Penn State Survey Research Center. The following analyses, executive summary, conclusions and suggestions were conducted by the author, independently contracted by the Department of Transportation Services for this work.

Participants

A total of 10,709 individuals associated with Penn State University at the University Park campus completed the Transportation Survey between October 25 and December 12, 2011. Of these, 47% were undergraduate students, 15% were graduate students or post-docs, 8.6% were faculty, and 29.4% were staff. Participants were recruited to take the survey via an email sent from the Interim Senior Vice President for Finance & Business in exchange for the opportunity to win an iPod Touch. The purpose of the survey was described as helping to inform the Intermodal Transportation Committee “about present and projected commuting patterns so they can better plan for the future transportation needs of the University community.” The survey took approximately 10-20 minutes to complete. Participants were given the opportunity to provide open-ended feedback at the end of the survey.

The following results are divided among staff, faculty, graduate students/post docs and undergraduate students at the university. There were 80 people (0.7% of the survey) who did not fit into one of these categories. Eleven of these individuals identified themselves as visiting scholars, 4 as recent graduates, 3 as retirees, and 56 as “other”. Based upon the needs of the transportation committee and the small percentage of respondents that these individuals represent, these individuals were dropped from the analyses conducted in this report.

Completion of Survey



According to the Penn State University Fact Book (<http://www.budget.psu.edu/factbook/>), there were 38,954 undergraduate students and 6,240 graduate students/post docs enrolled at the University Park campus of Penn State University in the Fall semester 2011. There were 3,386 full-time and 1,139 part-time faculty and 8,794 full-time and 782 part-time staff, all at the University Park campus.

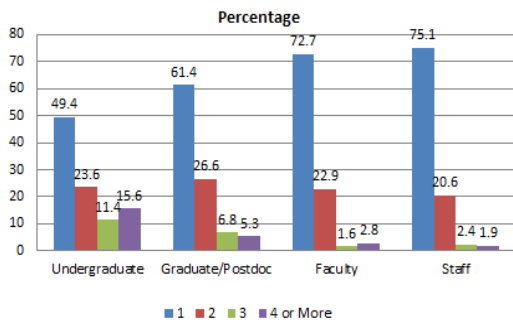
General Statistics

Parking Permits

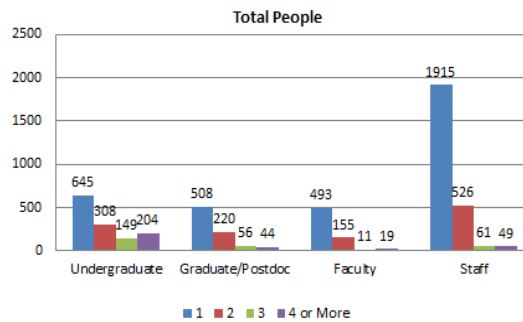
Of those responding to the survey, a total of 42.8% individuals hold university parking permits (5,480 of respondents). The majority of parking permits are held by staff (44%) as compared to undergraduates (16%), graduate students/post docs (12%), and faculty (11%). Within each group, 77.2% of staff have parking permits, while 65.5% of faculty, 41.8% of graduate students/post docs, and 17.4% of undergraduates have parking permits.

A fairly sizeable portion of survey participants (33%; 1,814 people) said that multiple people living in their residence hold parking permits. Some of these numbers may be redundant if the “others” in the residence also took the survey, however the size of this overlap is unable to be estimated. This may be particularly true of students living together in the same residence. Accordingly, 50.6% of undergraduates (661) and 38.6% of graduate students/post docs (320) said that 2 or more individuals in their residence had parking permits, while 27.3% of faculty (181) and 24.9% of staff (636) said this. Similarly, over 15% (200) of undergraduates reported that 4 or more people in their residence held parking permits, while all other groups had less than 50 people per group report this.

Multiple Parking Permits



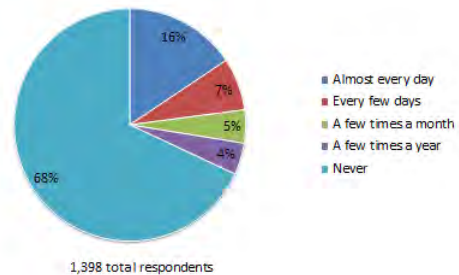
Multiple Parking Permits



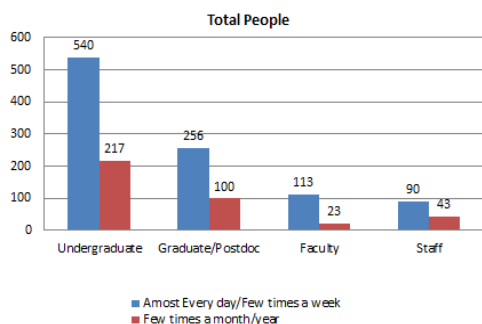
Biking

The majority of survey respondents (68.1%) said that they never ride a bike to campus. Of those that do (1,398), most ride every day (48.9%), rather than a few times a week (22.9%), month (14.4%) or year (13.8%). Graduate students/post docs are more likely to ride a bike every day or every few days (16%, 256 people) than undergraduates (10.8%, 540 people), faculty (12.4%, 113 people), or staff (2.9%, 90 people). The majority of people who store their bikes on campus use a campus bike rack (86%).

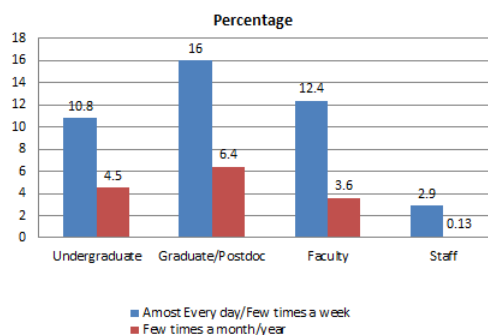
Ride Bike to Campus



Ride Bike to Campus



Ride Bike to Campus



Of those responding to the survey, a total of 14.7% of respondents (1,579 individuals) hold university bike permits. The majority of bike permits are held by undergraduates (42%; 662 people), compared to graduate students/post docs (28%; 443 people), staff (17%; 268 people), and faculty (13%; 208 people). Within each group, graduate students/post docs are more likely to get a bike permit (27.1%), than faculty (22.7%), undergraduates (13.3%), and finally staff (8.6%).

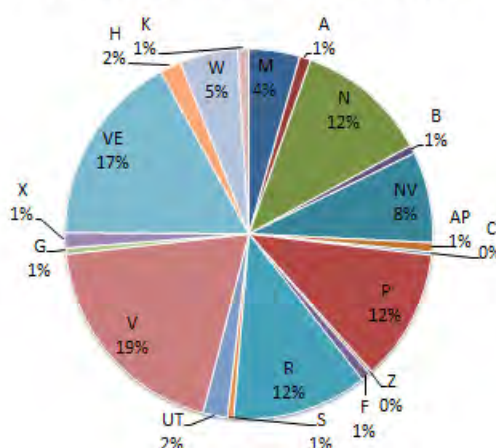
CATA Busses

Of those responding to the survey, a total of 14.2% of respondents (1,521 individuals) hold CATA bus passes. The majority of bus passes are held by undergraduates (52%; 793 people), compared to graduate students/post docs (23.6%; 360 people), staff (14%; 212 people), and faculty (9%; 141 people). Within each group, graduate students/post docs are more likely to get a bus pass (22.5%) than undergraduates (15.9%), faculty (15.4%), and finally staff (6.8%).

Approximately 31% of respondents said they use the bus system to get to campus. Of the types of bus systems used to get to campus, the majority of respondents who take the bus ride the Loop/Link (45.1%) or the CATA bus system (43.4%). Very few respondents said they use the Campus Shuttle (0.7%) or the CATA ADA service (0.3%). Undergraduates are most likely to use the Loop/Link, while all other groups are most likely to use the CATA bus to get to campus. Students are most likely to pay for the CATA bus with an apartment pass (9.3% of undergraduates and 7.8% of graduate students/post docs). Others are mostly likely to pay for the CATA bus using the Ride for Five program (7.7% of faculty and 3.4% of staff).

The majority of CATA bus riders who completed the survey use the V and VE routes. The least used routes are the AP and Z routes (see table below for full information).

Use of CATA bus Routes



Bus Route	Number of People using this route (in survey)	Proportion of route used compared to all other routes
A	28	1.1%
AP	2	.09%
B	19	.8%
C	8	.3%
F	19	.9%
G	15	.6%
H	47	2.1%
K	24	1.1%
M	108	5%
N	281	13%
NV	193	8.9%
P	28	12.9%
R	287	13.3%
S	15	.6%
UT	52	2.4%
V	464	21.5%
VE	408	18.9%
W	124	5.7%
X	33	1.5%
Z	7	.3%

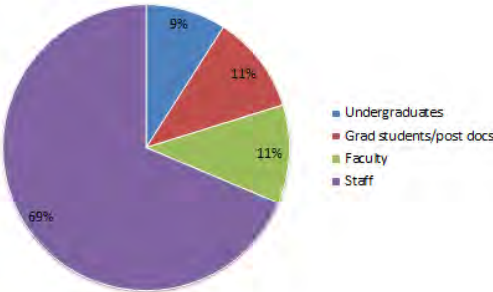
*Percentages in graph are rounded. See table for exact percentages.

Van Pool and Individual Carpool

The survey did not contain questions to ascertain whether respondents have ever used a Van Pool service or carpool on their own, or how often they use these types of transportation. Assessing the type of transportation most commonly used on Mondays and Wednesdays (the two most frequent or regular travel days to campus), the survey indicates that approximately 10% of respondents either use a Van Pool or carpool to campus (around 775 people). Of these individuals, approximately 9% are undergraduates, 11% are graduate students/post docs, 10.5% are faculty, and 69% are staff.

Very few people (24) responded to the question about how many individuals they carpool or van pool with. Fourteen of the 24 said that they do not ride with anyone, making data impossible to interpret. It is possible that the placement of the question dissuaded people from answering or there was a system error in directing people who said that they used a car or van pool toward this question.

Use of Van Pool / Carpool



Hybrid Vehicles

The majority of cars driven to campus were reported to be regular gasoline or diesel vehicles (96.3%, 5592 vehicles) as opposed to hybrid, electric, or alternative fuel vehicles (3.7%, 212 vehicles; 4905 people who said they drive a motorized vehicle to campus did not report type of

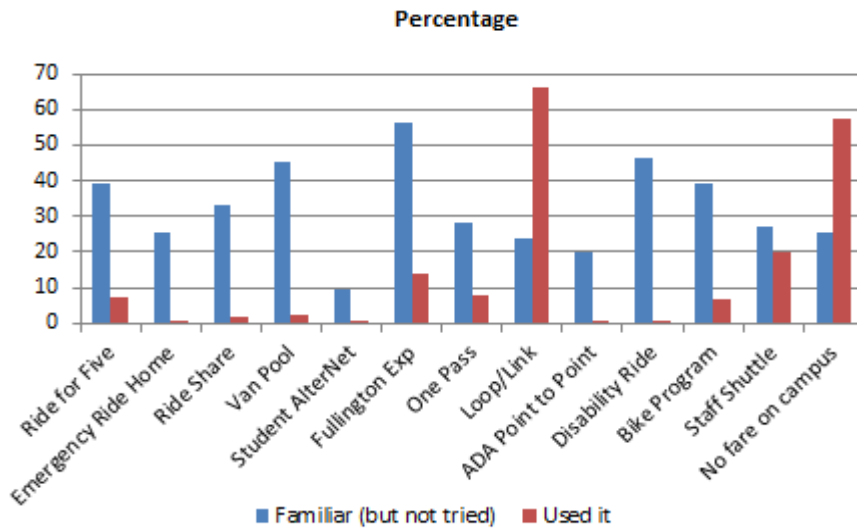
vehicle). Staff drive the majority of hybrid vehicles (33.5%; 71 cars), compared to faculty (24.5%; 52 cars), undergraduates (24.5%; 52 cars) and graduate students/post docs (16.5%; 35 cars; 2 respondents who said they drive a hybrid vehicle did not report their role at the university). Within each group, faculty are most likely to have a hybrid vehicle (5.7%), then staff (2.3%), graduate students/post docs (2.2%), and finally undergraduates (1%). This may be based on both income (ability to afford a hybrid vehicle) and knowledge or concern about the environment.

Familiarity with Transportation Programs

Overall Familiarity

In general, respondents tend to be most familiar (either saying they have heard of the program or used it before) with the Loop/Link, No Fare on Campus, the Fullington Express, and the Ride for Five program. They are least familiar with Student AlterNet, the ADA Point-to-Point program, Emergency Ride Home, and One Pass.

Familiarity with Transport Options



Familiarity by Demographic

Staff tend to be most familiar with the various transportation options provided at Penn State. However, certain groups tend to be more familiar with specific programs. See table below for average familiarity with each program, by group. The number of days respondents commute to campus affects familiarity with transportation programs. Across all four groups, the more days individuals spend traveling (or likely working) on campus, the more familiar they are with all transportation programs. Familiarity with programs is not affected by the time/distance traveling to campus or having a consistent vs. inconsistent work schedule (arriving and departing campus).

Average Familiarity with Transportation Programs, by group

Program	Undergrad	Grad/Post doc	Faculty	Staff
Ride for Five	1.17-	1.46	1.75	1.83+
Emergency Ride Home	1.08-	1.14	1.23	1.52+
Rideshare	1.14-	1.22	1.33	1.67+
Van Pool	1.18-	1.30	1.46	1.89+
Student AlterNet	1.06	1.07	1.11	1.15
Fullington Exp	1.92+	1.82	1.81	1.79
One Pass	1.43	1.65+	1.36-	1.36-
Loop/Link	2.75+	2.67	2.31-	2.43
ADA Point to Point	1.14-	1.19	1.24	1.28+
CATA Disability	1.34-	1.47	1.52+	1.55+
Bike Program	1.49-	1.46-	1.54	1.59+
Staff Shuttle	1.24-	1.28	1.66	2.24+
No Fare on Campus	2.57	2.62+	2.20-	2.22-

1 = Not familiar, 2 = Heard of it but never used it, 3 = Used it

Scores below 1.5 indicate that most individuals have not heard of the program.

Scores between 1.5 and 2.5 mean most people have heard of it but never used it.

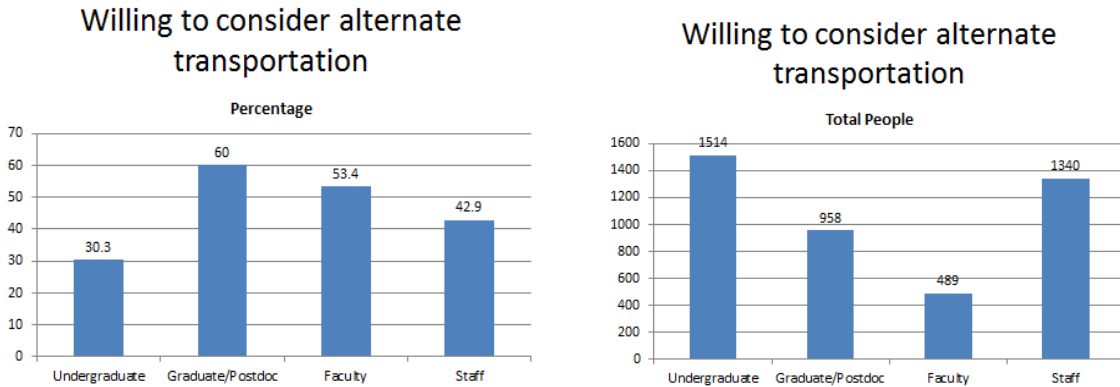
Scores above 2.5 mean most people in the group have used the program.

- = Have heard of this program least compared to other groups

+ = Have heard of this program most compared to other groups

Willingness to Change Transportation Behaviors

A total of 40% (4,301) of people taking the survey said they would be willing to consider alternate forms of transportation to campus instead of driving a car. Graduate students/post docs (60%, 958 people) and faculty (53.4%, 489 people) are more likely to say yes to this question than any other answer. However, these groups also make up the two of the smaller populations on campus. Although only 30.3% of undergraduates respond “yes”, this accounts for 1,514 individuals. Likewise, 42.9% of staff say they are willing to consider alternate forms of transportation, but this accounts for 1,340 individuals. The following will include both percentages and raw numeric counts, when appropriate, of willingness to change transportation behavior among these four groups.

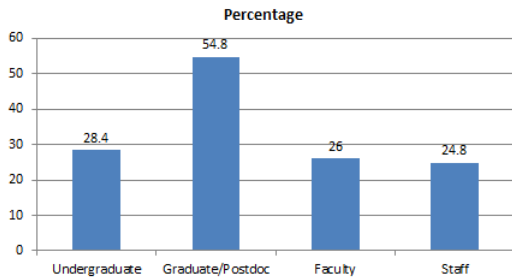


Taking the Bus

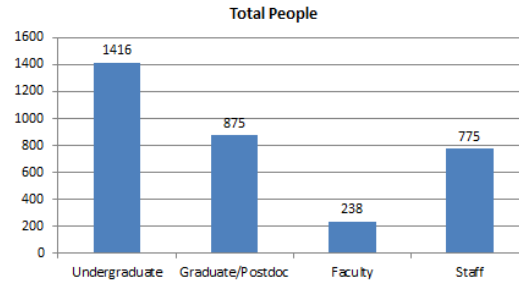
Graduate students/post docs are the group most likely to report they are willing to take the bus. When asked if they would take the bus if it cost less, graduate students/post docs were the most willing to say yes (43.5%, 635 people), as compared to undergraduates (15.9%, 794 people), faculty (10.8%, 99 people), and staff (10.6%, 330 people). Graduate students/post docs are also the group most likely to say yes when asked if they would take the bus from their home to campus if bus passes were free (54.8%, 875 people), compared to undergraduates (28.4%, 1416 people), faculty (26%, 238 people), and staff (24.8%, 775 people). Undergraduates and graduate students/post docs were more likely to say they would take the bus 4-7 trips per week, while faculty and staff were more likely to say they would take the bus 1-3 trips per week.



Willing to take the bus from home (if free)

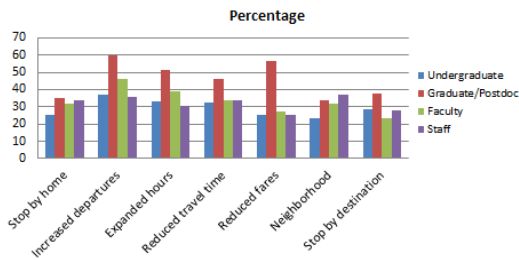


Willing to take the bus from home (if free)

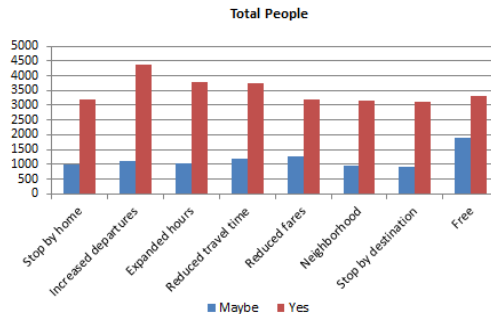


Survey participants also reported whether certain factors would encourage them to take the bus as opposed to driving a car. The overall majority of respondents said that a bus stop closer to home (42.4%) would encourage them to take the bus, followed by increased frequency of departures (40.9%), expanded hours of service (35.5%), reduced travel time between home and campus (35%), reduced fares (30%), increased service to their neighborhood (29.5%), and a stop closer to their destination (29.3%). It should be noted that these percentages overlap because people likely responded that they would take the bus for multiple reasons.

Willing to Take the Bus if...



Willing to Take the Bus If...



Van Pool Program

Zip codes were used to identify areas in which larger numbers of respondents lived. Based on geographic analyses, groups of areas were formed in which more than 10 people lived. These areas were then clustered based on common travel routes to University Park. The table below depicts the 15 total cluster areas. The large majority of individuals living outside of State College and University Park in these clusters are staff, although these totals include some faculty and students. No group (e.g., faculty or students) was more or less likely to say that they would be willing to try a Van Pool program than any other group. Individuals were thus combined across roles for the following analyses.

The areas in which the most people who said they would be willing or maybe willing to participate in a Van Pool program are Bellefonte, Altoona, and Lock Haven. The Centre Hall area has a larger total than Lock Haven, but more individuals responded “maybe” in Centre Hall, while more individuals in the Lock Haven area responded “yes”. However, if four Van Pool routes were available, Centre Hall should be added. Depending upon availability of vans, routes, and times, other areas may be able to be added to these groupings.

In general, the further away individuals lived from campus, the more willing they were to try a Van Pool program, with those living over 30 miles away being the most willing. The number of

days commuting to campus did not affect willingness to try this program.

Area	“Maybe”	“Yes”	Total
Altoona, Holidaysburg, Tyrone	63 (26%)	81 (33%)	144 (59%)
Lewistown, Reedsville, Milroy	34 (38%)	35 (39%)	69 (78%)
Philipsburg, Ocoola Mills, Houtzdale	31 (29%)	37 (35%)	68 (64%)
Bellefonte, Milesburg	273 (38%)	115 (16%)	388 (54%)
Lock Haven, Beech Creek, Howard, Blanchard, Mill Hall	44 (28%)	60 (38%)	104 (66%)
Clarence, Snow Shoe	20 (55%)	6 (16%)	26 (72%)
Centre Hall, Millheim, Aaronsburg, Spring Mills	92 (40%)	49 (21%)	141 (61%)
Clearfield, Morrisdale	13 (39%)	14 (42%)	27 (82%)
Pine Grove Mills, Penns. Furnace	31 (32%)	15 (16%)	46 (48%)
Warriors Mark, Spruce Creek	19 (33%)	7 (12%)	26 (49%)
Huntingdon	8 (26%)	11 (35%)	19 (61%)
Boalsburg	49 (30%)	20 (12%)	69 (42%)
State College / Univ. Park	1342 (25%)	602 (11%)	1944 (36%)
Port Matilda	86 (31%)	23 (8%)	109 (39%)
Lemont	22 (28%)	4 (5%)	26 (33%)

Percent values represent the proportion of individuals who were willing to give a “maybe” or “yes” response compared to all individuals who took the survey living in that specified area.

Changing Behavior by Demographic

As reported above, graduate students/post docs and faculty are more willing to change transportation behaviors than undergraduates and staff. However, undergraduates and staff have larger populations, meaning these are still good groups to target. Controlling for these groups, arriving and departing campus at a consistent time every day predicted willingness to consider alternative forms of transportation other than driving, but in different ways. People who arrive on campus at a consistent time every day are more likely to consider alternate transport than people who arrive inconsistently. However, people who depart at inconsistent times are more likely to consider alternate transport than people who depart consistently. The distance/time spent traveling to campus, the number of parking permits within one residence, and the number of days spent traveling to campus did not affect willingness to consider alternate forms of transportation other than driving.

Changing Behavior due to Weather

Approximately 27% of survey respondents say that they change their mode of transportation to campus according to the weather. Undergraduates (35%) and graduate students/post docs (36%) are more likely to change with weather than faculty (28%) or staff (14%). The number of parking permits within a residence does not affect changing behavior according to weather. It is not completely clear how individuals change transportation due to weather, as “weather” was not clearly defined and it appears individuals interpreted this term differently. For example, a portion of the total survey respondents say they change their mode of transportation to biking (3%), walking (7%), or riding a motorcycle (1%), while another portion of total survey respondents say they change their mode of transportation to driving (4%), getting a ride (2.5%) or taking the bus (9%) when the weather changes. It appears that the first group interpreted “weather” as nice weather, and the second group as bad weather. Suggestions for improving this question are listed in the last section of this report.

Recommendations for Future Surveys

1. Instead of asking participants to check off all possible options, ask them to check the most frequent option, then perhaps the 2nd or 3rd most frequent.
 - a. Alternately, you could ask about the least frequent if this is of interest.
 - b. This would apply to questions such as what people's patterns are on different days of the week or type of transportation options used.
 - c. This makes data analysis easier and cuts out redundant or useless information.
 - d. For example:

“Do you normally arrive at the same time every day to work or does it vary?”

If it varies:

“What is (around) the most common time you arrive to work?”

“What is (around) the second most common time you arrive to work?”
 - e. Give options in blocks that are useful for you to know (morning shift vs. afternoon vs. evening, or 6 am – 8 am, 9 am – 11 am, etc.). This also goes for things like transportation options – do you care if people drive a car vs. truck, or can you lump these options together?
2. Make questions about attitudes and beliefs more than 3 point scales (i.e., no / maybe / yes).
 - a. This helps expand your knowledge about what people are really willing to do (e.g., if someone responds “maybe”, which a large majority of participants did, what does that mean? Will they actually do something or are they just saying that?)
 - b. I would suggest using an even numbered scale, so that it forces people to choose whether they are slightly more willing or unwilling (many survey respondents like to take the easy way out by choosing the middle/neutral of the scale).
 - c. For example:

“How willing would you be to use a Van Pool program once a week between your home and campus?”

0 -----1----- 2 -----3-----4-----5-----6-----7
(definitely not willing) (definitely willing)
 - d. NOTE: if you are going to use a No/Maybe/Yes format, always list these options in this order. Similarly, any time you have a scale of options, always list the least likely to the left and increase options as you move to the right of the page. This is what survey takers expect and helps decrease confusion, particularly if participants are not carefully reading each page.
3. Alternately, ask people what prevents them from using programs.
 - a. This helps to know exactly which things you should (if you can) focus on improving.
 - b. For example:

“The primary reason I don't ride the bus is _____” (allow only one choice)
 - c. You could also include a second question (“The second most important reason why I don't ride the bus is...”)
 - d. Potentially use the open-ended data from the previous year to help inform possible answer choices to let respondents choose from.
4. Define “weather”. It seems from the current study as though “weather” was interpreted differently by different people.
 - a. “Nice weather” (warm, sunny, or simply not “bad” weather).

- b. “Bad weather”: behavior might change depending on whether it’s snow, rain, ice, or just cold or cloudy. Additionally, people might chose to walk or bike *less* when it’s very hot outside.
 - c. For example:
 “Does your mode of transportation usually change when it’s snowing compared to your normal mode of transportation?”
 If yes:
 “What kind of transportation do you use when it’s snowing?”
 - d. Consider why you want to ask this question. If it’s for potentially getting people to use temporary parking permits, ask whether they would use a temporary pass if they could still park on snowy days (i.e., be specific). However, consider that on “bad weather” days, all those people will want to use parking in addition to those with permanent passes.
5. Solicit more information from people with multiple parking permits.
 - a. Find out why people have multiple permits (using choice options, not open ended responses)
 - b. Find out what conditions would encourage people to combine/give up permits
 - c. For example:
 “Would you be willing to give up one of your permits if…”
 - d. Provide a list of possible incentives that you could actually potentially provide (otherwise this information is not useful)
 6. Include other types of demographic information.
 - a. Salary is likely a strong predictor of transportation behavior.
 - b. For staff – do they sit at a computer or not / have regular access to email (for a way to disseminate information)? If not, where do they get their information? Where would they read something during their work shift?
 - c. Again, provide choices, rather than allow open-ended comments (unless you have no idea what common responses would be and want to spend the time coding this data).
 7. Consider some form of verbal or written commitment about changing transportation behavior.
 - a. Psychology studies show that if people say they will do something, it increases their likelihood of doing it, even if they don’t want to.
 - b. For example:
 “Are you willing to help Penn State meet our environmental initiatives by changing your transportation options one day a week?” [check yes or no].
 - c. Depending on IRB approval, you maybe be able to link people to a website where they can sign a public agreement (like an online petition).
 8. Use the survey to connect people to alternate transportation options.
 - a. Ask people to give their contact information on a separate survey site if they are willing to be contacted about transportation programs.
 - b. Ask people if they would like to receive more information about certain programs. If they say yes, either link them to a website with information about that specific program or obtain their email address for later contact
 9. Keep people from participating twice by including a statement that says “Multiple entries will not improve your chances of winning the _____ [prize].”
 - a. You would be surprised how many people will do this.

- b. This helps cut out redundancy in the data.
10. Do away with the “other” option in most places.
 - a. There are too many responses to code these and they do not generally form any meaningful category.
 - b. Instead, force people to choose another option (if that makes sense, such as in “most frequent” types of questions) or allow them to check other but don’t have an open responses following.
 11. Add a timer to the survey to screen out people who did not legitimately take the survey.
 - a. Have a couple of reliable people do a trial test to see about how long it should take. If respondents complete the survey in an unreasonable amount of time (very short or very long), drop them from the analyses.
 - b. Alternately or in addition, you can add one “trick” question to see if people are actually reading the questions.
 - c. For example:
 “How willing would you be to receive a free parking pass for a year in a lot adjoining your office or residence?” (expect all people to say very willing)
 Everyone who does not answer this way would be dropped.
 12. Include other potential predictor variables (i.e., questions that would help you figure out who, when, why, or how people might change their transportation behaviors).
 - a. What are other predictors of getting people to participate in the programs?
 - b. Peer knowledge or peer participation? Having access to email? Working in an office space vs. not? Being concerned about the environment?
 - c. In particular, think about if you were going to promote a program, what might you do? Then ask people if they have experience with these things and see if it actually predicts more participation in the programs.
 - d. For example, if you think putting up flyers about the programs would help, ask people if they have ever seen a previous flyer for a program. If so, you can test whether seeing the flyer had an effect on those people’s behavior.
 - e. If you want to try an environmentally-based campaign, see if people who already care about the environment are already using alternative forms of transportation compared to people who do not care.
 13. Differentiate between certain types of transportation
 - a. If you want to know the difference between people who carpool or vanpool, make sure to make these separate options/choices.