

**Feasibility Study**

# **Blair-Hunt-Morgan Connector**

**City of Raleigh, North Carolina**



**March 2008**

**Prepared for:**

City of  
Raleigh,  
North Carolina



**Prepared by:**



Kimley-Horn  
and Associates, Inc. in association with

**LandDesign.**

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**Kimley-Horn and Associates, Inc.**

Raleigh, North Carolina

(919) 677-2000

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**LandDesign, Inc.**

Charlotte, NC

**KHA # 011696006**

**March 2008**



The Blair-Hunt-Morgan Connector is identified on the Raleigh Thoroughfare Plan as a crucial link from Morgan Street to Western Boulevard and Centennial Parkway across the Dorothea Dix property. Such a connection would allow for traffic to flow north-south between Western Boulevard and Hillsborough Street just west of downtown. This connection would also relieve traffic on Pullen Road adjacent to campus or Ashe Avenue through the Pullen Park neighborhood. Developing feasible alternatives for the Blair-Hunt-Morgan Connector is a complex practice balancing the need to serve significant travel demand while considering numerous physical, environmental, historic, and community constraints.

north, Ashe Avenue, the Pullen Park Terrace neighborhood, and Centennial Parkway to the west, Blair and Umstead Drives to the south, and the Norfolk-Southern Railroad to the east.

## PURPOSE AND NEED

Southwest Raleigh's road system is largely built-out with limited potential for new roadways and connectors, especially within the I-440 Beltline. Within the study area though, three upcoming City projects will have an impact on travel patterns: the Hillsborough Street Improvement Project as it narrows that corridor from 4- to 2-lanes and installs a dual-lane roundabout at the intersection of Hillsborough Street and Pullen Road; the construction of a single-lane roundabout at the intersection of Hillsborough and Morgan Streets; and the two-way conversion of Morgan

The project study area (**Figure ES-1**) encompasses the land area roughly bounded by Morgan Street and the CSX/NC Railroad to the

**Figure ES-1.** Study Area





Street from St. Mary's Street west to Hillsborough Street. The Blair-Hunt-Morgan Connector is an important north-south link in the future transportation network for Southwest Raleigh and provide a direct connection between development in west of downtown Raleigh to NC State's Centennial Campus and the Western Boulevard thoroughfare without detrimental impacts to NC State's Main Campus, Pullen Park, or the Governor Morehead School.

## **PROJECT CONTEXT**

### *Historic and Cultural Resources*

The study area includes and is bordered by several large institutional and recreational land uses including:

- Pullen Park
- Governor Morehead School for the Blind
- Central Prison
- Dorothea Dix Hospital Campus
- State Farmers Market
- NC State University's Centennial Campus
- St. Mary's School

Twenty-two historic sites and four historic districts are located near the study area. In addition, three Raleigh neighborhoods are located adjacent to the study area:

- Boylan Heights
- Cameron Park
- Pullen Park Terrace (Kirby-Bilyeu)

Many of the homes and buildings within the historic districts are contributing structures to the districts' designations, and several structures within the Dorothea Dix have recently been judged to be eligible for historic designations. Several buildings at the Governor Morehead School and remnants of the original Central Prison may also be eligible.

While they may not be officially recognized as historic resources, the large oaks that line Umstead and Blair Drives are a valued and iconic part of the Dix campus and representative of the City of Oaks. The trees serve as natural delineations between the institutional, natural, and recreational uses. Minimizing the impact to these trees and their root systems and ensuring they will survive as a part of the campus will be crucial to garnering community support for a Blair-Hunt-Morgan Connector project.

### *Natural and Physical Resources*

A preliminary analysis of the natural resources within the project corridor study area was conducted to identify and approximate the location of various environmental features in order to assist in the location and development of the proposed roadway project.

Water resources within the project study area include Rocky Branch Creek as well as unnamed tributaries to Rocky Branch Creek and Walnut Creek. Neuse River Buffer rules will apply to the vegetated buffers 50 foot adjacent to either side of the aforementioned streams. NWI mapping does not indicate wetland areas within the study area.

A solid waste landfill operated by the City of Raleigh from 1957 to 1972, Old Raleigh Landfill #11, is located on the Dorothea Dix Hospital campus. Fill dirt was added above the capped-off landfill to construct the existing soccer fields, and additional fill was brought to the site from the Raleigh Convention Center project. During conversations with state environmental officials, concerns were raised about constructing a road on unstable capped landfill. To avoid the potential of extensive maintenance and repairs to a road built on unstable, settling ground, waste should be excavated prior to road construction.



In addition, two rail corridors run through the project area: the NC Railroad and CSX rail lines in the east/west corridor north of Western Boulevard and the Norfolk-Southern rail line along the eastern study area limits.

## ALIGNMENT ALTERNATIVES

Numerous alignments were developed for the Blair-Hunt-Morgan Connector. Project staff reviewed the alignments and decided to carry forward with four alternatives for more detailed study, based on the benefits and impacts of each (Figure ES-2):

**Alternative #1 – Morgan Street Extension with grade separation over Western Boulevard:** This alternative extends Morgan Street over the rail lines and Western Boulevard

to the intersection of Umstead Drive at Hunt Drive. The southern segment preserves the existing Umstead and Blair segments as the westbound lane of a two-lane, median-divided segment, with the existing trees maintained inside the median. A short segment would be constructed to connect Umstead and Blair Drives south of their current intersection.

**Alternative #2 – Morgan Street Extension to Western Boulevard at grade:** This alternative extends Morgan Street over the rail lines to an at-grade intersection with Western Boulevard just west of the Motor Fuels Laboratory. The southern segment matches Alternative 1 but maintains Hunt Drive to its intersection with Western Boulevard.

**Alternative #3 – Morgan Street Extension to Ashe Avenue at grade:** This alternative

Figure ES-2. Study Alternatives





extends the east-west segment of Morgan Street to Ashe Avenue across from Dexter Place. The southern segment matches that of Alternative 2.

**Alternative #4 – Extensions to both Western Boulevard and Ashe Avenue:** This alternative looks at the transportation impacts with a combination of both connectors added to the network.

## TRAFFIC MODELING & FORECAST

Based on the currently planned improvements and population forecasts for Raleigh, the 2035 Triangle Regional Travel Demand Model was used to project the traffic volumes in the study area based on no build conditions and with the addition of the study alternatives. The Blair-Hunt-Morgan Connector was modeled as a four-lane facility, the Ashe Avenue Connector as a two-lane facility. The projections immediately showed that there is a high demand for the additional north-south link between Western Boulevard and Morgan Street, filling the new road to near capacity. Upon examination of the parallel north-south facilities from Gorman Street to Downtown Raleigh, the connector diverts approximately 16,000 to 20,000 daily trips from those streets. The results also indicated a number of trips by motorists choosing the new route because increased connectivity and travel time savings. These projections prompted the analysis to maintain the new facility from Morgan Street to Western as a four-lane facility for the forecasts.

The Ashe Avenue and the Blair-Hunt connections alone do not divert nearly the same volume of trips on their own accord, but there is an inherent demand along the Blair-Hunt segments when the direct connection to Centennial Campus at Centennial Parkway is

included. Even with this increased demand, both of these connections are expected to handle the projected traffic with two-lane facilities.

Model analyses and observations were used to help develop traffic forecasts for the four alternatives. The forecasts show that a new major connection between Morgan Street and Western Boulevard attracts a significant number of trips, forecast at 28,000 vehicles per day. A connector to Ashe Avenue does not attract similar traffic volumes, particularly as Ashe Avenue is not planned to be widened beyond its current cross-section. The new Ashe connection also does not provide an improved link between Centennial Campus and destinations east and north of downtown Raleigh.

## TRAFFIC ANALYSIS & EVALUATION

Using volumes developed from the traffic forecasts, level-of-service (LOS) and delay was evaluated for each intersection under the current and future scenarios.

**Table ES-1** details the results of the intersection analyses, organized by alternative.

**General Comments:** The proposed roundabout project at the intersection of Hillsborough Street and Morgan Street was evaluated in all four alternatives. In each scenario, the modeled and forecast volumes exceeded the capacity of a single-lane roundabout, therefore the analysis was conducted with a dual-lane roundabout configuration at this location.

The intersection of Blair Drive at Centennial Parkway operates at LOS D or E in the peak periods and includes a planned connection into Centennial Campus that would continue to Main Campus Drive.



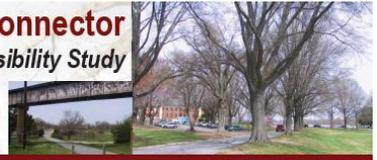
**Table ES-1. Intersection Level-of-Service Summary (2035)**

Intersection	LOS and Delay (s) by Alternatives							
	1: Morgan Street Connector: Grade-separated		2: Morgan Street Connector: Split at-grade		3: Ashe Avenue Connector		4: Both Connectors	
	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak
Blair Dr. @ Centennial Pkwy. – Signalized	D (54.9)*	<b>E</b> <b>(64.3)*</b>	D (54.9)*	<b>E</b> <b>(67.1)*</b>	D (43.7)*	D (46.7)*	D (53.7)*	<b>E</b> <b>(63.7)*</b>
Hunt Dr. @ Morgan Connector. – Signalized	D (35.1)*	D (49.3)*	--	--	--	--	--	--
Hunt Dr. @ Western Blvd. . – Signalized – U-turn option	<b>F</b> <b>(97.5)*</b> <i>N/A</i>	<b>F</b> <b>(83.5)*</b> <i>N/A</i>	<b>E</b> <b>(64.0)*</b> <i>C</i> (29.4)	D (46.5)* <i>C</i> (23.7)	D (45.1)* <i>N/A</i>	C (28.9)* <i>N/A</i>	<b>E</b> <b>(62.1)*</b> <i>C</i> (22.9)	<b>E</b> <b>(63.2)*</b> <i>C</i> (34.0)
Morgan Connector. @ Western Blvd. . – Signalized – U-turn option	--	--	C (33.1) <i>D</i> (50.2)	D (37.9) <i>D</i> (51.7)	--	--	C (32.0) <i>D</i> (40.8)	D (35.5) <i>D</i> (41.8)
Western Blvd. @ Ashe Ave. . – Signalized – U-turn option	--	--	--	--	C (23.4) <i>N/A</i>	C (34.9)* <i>N/A</i>	B (15.6) <i>B</i> (14.2)	B (16.7) <i>B</i> (16.8)
Morgan Connector or Ashe Connector @ Morgan St. . – Signalized	D (38.7)*	D (37.9)*	D (37.8)*	D (48.9)*	B (18.3)	B (16.8)	D (47.8)*	D (49.4)*
Morgan St. @ Hillsborough St. – Roundabout**	C (28.8) <i>0.883</i>	C (23.9) <i>0.943</i>	C (28.8) <i>0.883</i>	C (23.9) <i>0.943</i>	B (11.7) <i>0.593</i>	B (10.8) <i>0.660</i>	C (30.8) <i>0.904</i>	D (50.2)* <i>1.052</i>
Ashe Connector @ Ashe Ave. – Unsignalized***	--	--	--	--	E (38.1) <i>WBL</i>	F (77.1) <i>WBL</i>	A (9.7) <i>WBL</i>	B (10.8) <i>WBL</i>

\* Indicates at least one major movement operates at LOS E or F and/or reports long queues lengths

\*\* LOS and delay for unsignalized intersection are reported for the movement that experiences the greatest delay.

\*\*\* LOS and delay for roundabout are reported for the movement that experiences the greatest delay based on unsignalized intersection LOS as covered in HCM. The degree of saturation for the movement that experiences the highest delay is report below LOS and delay.



**Alternative #1:** Operations for Alternative #1 fail based on inadequate storage for heavy turning movements between the proposed connector and Western Boulevard. Because of the grade separation, a short ramp is needed to provide a roadway link between the two roadways. The intersection of the ramp at Western Boulevard fails during both peak periods and other approaches are expected to experience long queues and delays. Based on the failure of this crucial link in the alternative design, Alternative #1 was rejected as a feasible option.

**Alternative #2:** The feasibility of this alternative relies on traffic operations at the Western/Hunt intersection and the connection to Morgan Street. The alternative has the advantage that the two intersections on Western Boulevard are offset such that left turn queues do not interfere with the adjacent intersection. With all turn movements allowed in the Western/Hunt intersection, long queues occur for the westbound left turn. The railroad bridge prohibits more than one turn lane and a storage lane more than approximately 200 feet.

To alleviate the turning movement problems at the Western/Hunt intersection, westbound left-turn from Western Boulevard and southbound left-turn and through movements from Central Prison were prohibited but provided a U-turn lane at the downstream intersection. The change allows for shorter cycle lengths at both signals on Western Boulevard. With the change, the intersections at Western Boulevard and Morgan Street for the northern segment of the connector operate at LOS D or better in both peak periods.

The intersection at northern end of the connector and Morgan Street was evaluated and it is recommended that best configuration would be to carry the connector straight to join

with the existing north-south alignment of Morgan Street. The east-west segment would intersect with the route south of the Charlie Goodnight's complex.

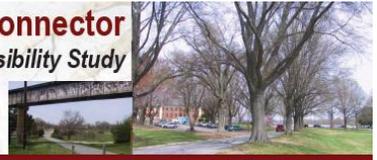
**Alternative #3:** The volumes coming to and from Centennial Campus as well as from north of the study area via Hillsborough Street are significantly lower based on forecasts for this alternative, and subsequently all intersections evaluated operate at better LOS than their counterparts in Alternative #2.

Along Ashe Avenue, turning movements at Western Boulevard could be handled by a signalized intersection but would require dual-left turn lanes on eastbound Western Boulevard and southbound Ashe Avenue. Improvements to widen of the southbound approach would likely require a taking of the gas station on the northeast corner of the intersection. The short street connection just to the east would need to remain in the future but be converted to one-way operation northbound.

The intersection at Ashe Avenue and the new connector would experience moderate delay overall if controlled as a four-way stop. It is recommended that the new connector include a westbound through-right turn bay and a short northbound right-turn bay.

The other intersections in the scenario operate well in both peak periods. Based on volumes, it is recommended that the east/west portion of Morgan Street be extended to create the Ashe Connector, with north/south segment of Morgan teeing into the extended street.

**Alternative #4:** With the combination of both new links added to the transportation network, the intersections for the southern portion of the connector operate similar to those in



Alternative #2. Operations on Ashe Avenue are improved as the majority of motorists choose to use the Morgan Street Connector.

The intersection where the Morgan and Ashe connectors meet Morgan Street is expected to operate at LOS E in the AM and PM peak periods without extensive improvements. While the T-intersections evaluated in the previous alternatives can handle the heavy turning movements relatively well, operations for certain movements fail at the creation of a four-way intersection with heavy volumes on the northbound through, southbound left, and westbound left movements. The analysis incorporated logical trip diversions through the study area, the prohibition of northbound and eastbound left-turn movements, and options for a discontinuous alternative, all in attempt to improve operations at the intersection. To operate efficiently and improve LOS to D, improvements would include widening Morgan Street into existing development with likely impacts and a wider bridge section.

## **DESIGN CONSIDERATIONS**

A review of the topographical information show that an overpass of the railroad is more feasible considering the elevations on either side of the rail line. The connector would be able to meet grade with on the north side with an approach grade of approximately 5% (7% maximum grade for urban arterials in rolling terrain). With maximum grade of the south side, the bridge structure would be approximately 600 feet long, but could be shortened if fill and retaining wall were used for the approach on the south side.

The feasibility of tunnel options to cross the rail line was also evaluated. Upon review, the tunnel option would be favorable on the south

side of the tracks because of topography, but the elevations and development on the north side would make such an option difficult. With a straight connection, the connector would not be able to tie back into existing grade of the north-south portion of Morgan Street until midway between Tryon Hills Road and Whitley Street. If the tunnel were routed to the west where the elevation is lower than the rail, the connection would tie back to the existing Morgan Street just north of Tryon Hills Road (near Irregardless Restaurant) and at the start of the east-west segment. The impact of carrying these retaining walls into the community area north of the tunnel would affect several businesses and offices, as well as cut off access to certain parcels. Another logistical hurdle to constructing a tunnel under an operating rail line would be the requirement to provide a detour alignment for rail traffic. These impediments make the option impractical, expensive, and considerably difficult.

For the Ashe Avenue Connector options, the topography of the area north of the rail line and south of the office building located at 905 Tryon Hill Drive would mean that the area would need to be filled (with or without retaining walls) for the new street connection. The Ashe Avenue connection would also mean the taking of the Pullen Park Lofts apartment complex and likely the office building at 905 Tryon Hill Drive.



## **FINDINGS & CONCLUSIONS**

In looking at the project alternatives, the traffic analysis clearly showed that Alternative #1 would not be feasible. Alternative #4 also seems an unlikely candidate because of intersection operations at Morgan Street and the termini of the new connectors.

**Alternative #2** provides the greatest traffic benefits as a direct connection from Morgan Street to Centennial Parkway. Construction of a four-lane segment from Western Boulevard to Morgan Street and an improved two-lane median-divided segment across the Dix campus would help meet the future traffic demand and suit the context of the project. While a tunnel option is feasible, construction of a rail overpass for the new connector is expected to create fewer impacts to the commercial land uses north of the rail line. Selection of this option though would require a sizable budget with the construction of a rail overpass and retaining walls for the section south of the rail corridor.

**Alternative #3** does not serve the intended purpose to better link Centennial Parkway and Campus to downtown. This alternative would serve as a capacity improvement to the existing transportation network, but the model results show it does not fully serve a greater demand between Western Boulevard and Morgan Street. The existing bridge on Ashe Avenue, without improvements and widening, creates a choke point in the route that limits the effect of the new Ashe Connector to serve the full demand of a new north-south link. While the Ashe Avenue Connector provides a long-needed link between Ashe Avenue and Morgan Street, the improvements would likely create a substantial impact to local institutions, residents, and business. The option also would

funnel traffic along the borders of Pullen Park, Governor Morehead School, and the Pullen Park neighborhood where recent traffic calming efforts have been focused to reduce and slow cut-through traffic.

Based on the consideration of the purpose and need, traffic analysis, and design, Alternative #2 with a rail overpass is recommended for future consideration in the City of Raleigh's development of a Blair-Hunt-Morgan Connector corridor.



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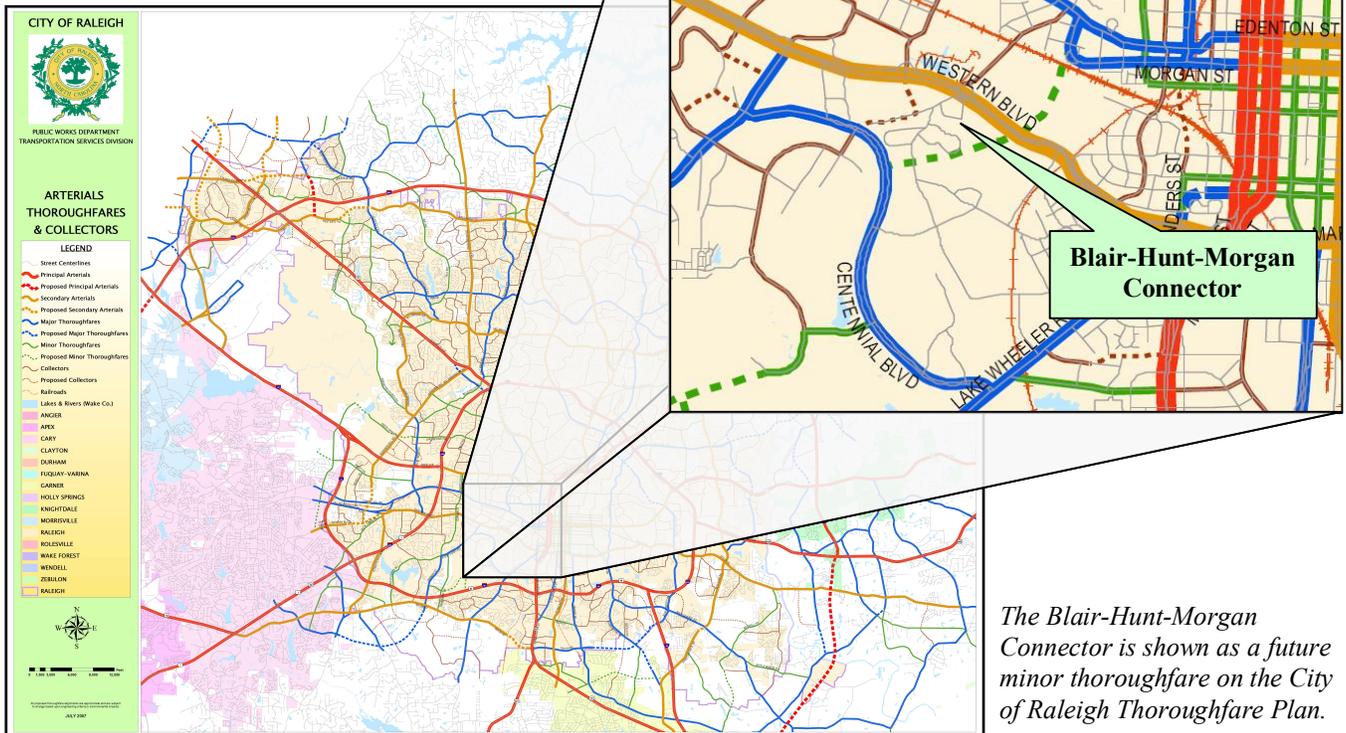
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## INTRODUCTION

West Raleigh is an area distinguished from the rest of the city by large institutional land uses. The community is anchored by NC State University, the state's largest educational institution. Yet surrounding NC State's Main, Centennial Biomedical, and Centennial Campuses are a variety of state-, city-, and privately-owned properties: Meredith College, Pullen Park, Dorothea Dix Hospital, Governor Morehead School for the Blind, Central Prison, the State Fairgrounds, Carter-Finley Stadium, and the RBC Center. Along with established streetcar-suburb neighborhoods and newer student housing, the area is fully developed with a network of arterials that create an approximate grid network based on 1/2-mile spacing. Yet between downtown Raleigh and NC State, a crucial north-south link is missing in the network.

The Blair-Hunt-Morgan Connector is identified on the Raleigh Thoroughfare Plan as that missing connection and links Morgan Street south of Hillsborough Street to Western Boulevard and Centennial Parkway across the Dorothea Dix property. Such a connection would allow for traffic to flow north-south between Western Boulevard and Hillsborough Street just west of downtown. This connection would also relieve traffic on Pullen Road adjacent to campus or Ashe Avenue through the Pullen Park neighborhood. Developing feasible alternatives for the Blair-Hunt-Morgan Connector is a complex practice balancing the need to serve significant travel demand while considering numerous physical, environmental, historic, and community constraints.



*The Blair-Hunt-Morgan Connector is shown as a future minor thoroughfare on the City of Raleigh Thoroughfare Plan.*



## **PURPOSE AND NEED**

The Blair-Hunt-Morgan Connector is conceived as a north-south link between Morgan Street, Western Boulevard, and Centennial Parkway. The project study area (**Figure 1**) encompasses the land area roughly bounded by Morgan Street and the CSX/NC Railroad to the north, Ashe Avenue, the Pullen Park Terrace neighborhood, and Centennial Parkway to the west, Blair and Umstead Drives to the south, and the Norfolk-Southern Railroad to the east.

### ***Existing Transportation Facilities***

Southwest Raleigh's road system is largely built-out with limited potential for new roadways and connectors, especially within the I-440 Beltline. Interstates 40 and 440, South Saunders Street, and the freeway segment of Wade Avenue serve as the principal arterials for traffic flow into and around the area, with 2005 volumes ranging from 84,000 to 113,000 vehicles per day (vpd) on I-40 and I-440 and 61,000 vpd on Wade Avenue just west of the Beltline. Wade Avenue inside the Beltline and Western Boulevard are secondary arterials that facilitate east/west trips from I-440 and parallel to I-40 to local thoroughfares, collectors, and neighborhood streets. Volumes on these two secondary arterials ranged from 26,000 to 35,000 vpd in 2005. Hillsborough Street carries approximately 20,000 vehicles a day, a volume that is projected to stay level in the future with the projects being planned for its corridor. Lake Wheeler Road, Gorman Street, Centennial Parkway and Avent Ferry Road, offer north-south routes within the District and to neighboring areas. Numerous collectors and local streets manage smaller volumes and shorter trips as they provide access to development within the area.

Traffic volumes on the major roadways in and around the study area are shown in **Figure 2** and **Table 1**.

### ***Planned Transportation Facilities***

Three upcoming City projects will have an impact on travel patterns in the study area. The Hillsborough Street Improvement Project, from Brooks Avenue to Woodburn Avenue, will narrow that corridor from 4- to 2-lanes and install a dual-lane roundabout at the intersection of Hillsborough Street and Pullen Road. This improvement project will limit significant traffic growth on the corridor.

Construction of a single-lane roundabout at the intersection of Hillsborough and Morgan Streets will mean that traffic flow near the northern portion of the study area should be carefully considered to ensure the roundabout can accommodate increased north-south volumes. Special consideration was given to the effect of increased traffic on the roundabout.

Lastly, sections of Morgan Street were converted from a multi-lane, one-way facility to two-way traffic in 2003 in conjunction with the Hillsborough Street Bridge Replacement project. The street has continued two-way operation from St. Mary's Street to Dawson Street since the completion of the bridge. In addition, plans have been developed to continue this two-way conversion from St. Mary's Street west to Hillsborough Street. This plan requires that the capacity of Morgan for this portion be constrained to roughly 16,500 vehicles per day when interpreting the model data.

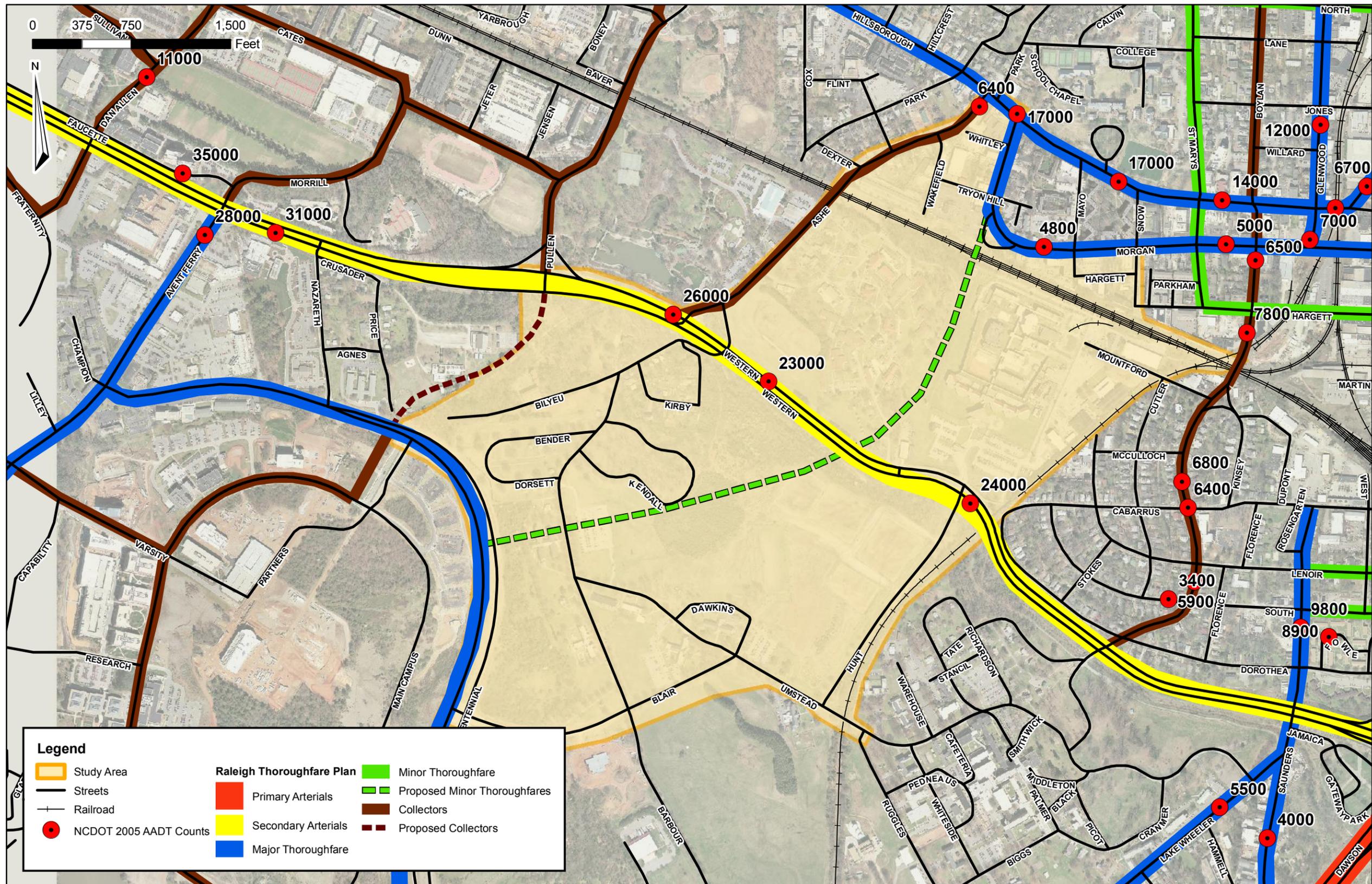
Projected traffic volumes in the study area for Year 2035 are shown in **Table 1** based on results from the Triangle Regional Travel Demand Model, discussed in more detail in the *Traffic Modeling & Forecast* section later in the report.



# BLAIR-HUNT-MORGAN CONNECTOR

CITY OF RALEIGH PLANNING DEPARTMENT

**FIGURE 1**  
**STUDY AREA MAP**



# BLAIR-HUNT-MORGAN CONNECTOR

CITY OF RALEIGH PLANNING DEPARTMENT

**FIGURE 2**  
**EXISTING TRAFFIC CONDITIONS (2005)**



**Table 1. 2005 Existing and 2035 Projected Average Annual Daily Traffic (AADT) Volumes**

Location	AADT	
	2005	2035
<b>Hillsborough Street</b>		
East of Brooks Ave.	22,000	16,900
West of Pullen Rd.	19,000	18,800
East of Oberlin Rd.	19,000	30,000
East of Morgan St.	17,000	34,200
East of St. Mary's St.	14,000	30,300
<b>Western Boulevard.</b>		
East of Gorman St.	35,000	49,200
East of Avent Ferry Rd.	31,000	42,400
East of Pullen Rd.	26,000	53,400
West of Hunt Dr.	23,000	49,600
East of Hunt Dr.	24,000	49,900
South of Downtown	20,000	40,000

Location	AADT	
	2005	2035
<b>Avent Ferry Road.</b>		
South of Western Blvd.	28,000	21,600
<b>Lake Wheeler Road.</b>		
At S. Saunders St.	5,500	26,900
North of I-40	19,000	48,500
<b>Centennial Parkway</b>		
North of Lake Wheeler Rd.	N/A	25,000
<b>Morgan Street</b>		
East of Hillsborough St.	4,800	5,000
West of Boylan Ave.	5,000	12,700
At Glenwood Ave.	7,000	26,700
<b>Ashe Avenue</b>		
South of Hillsborough St.	6,400	4,900

(Source: NCDOT 2005 AADT Counts, NCDOT 2035 Triangle Regional Model)

## PROJECT CONTEXT

### Area Institutions

The study area includes and is bordered by several large institutional and recreational land uses (Figure 3):

- **Pullen Park** is a 68.5-acre city park donated to Raleigh in 1887 and was the first public park in the State. The park facilities include an arts center, recreational fields, aquatics center, carousel, and miniature train ride.
- Established in 1845 and moved to its current location in 1923, **the Governor Morehead School for the Blind** is the only state-supported school in NC that specializes solely in comprehensive educational and residential programs designed specifically for students with visual impairments. The school sits on a 51-acre tract on the east side of Ashe Avenue.
- **Central Prison** is located on Western Boulevard between the Morehead School and the Boylan Heights neighborhood on 39 acres. The prison is operated by the NC Department of Corrections and houses 1,000 inmates.
- **Dorothea Dix Hospital Campus** sits on 311 acres south of Western Boulevard and is the site of the state's main mental hospital as well as offices for the NC Department of Health and Human Services. The hospital is expected to relocate in 2009, with its move the NC General Assembly, Wake County, the City of Raleigh, and local interests have all looked at options to the future use of the campus. To date, five options have been presented:
  - City in the Park: 167 acres of open space and park land, other uses including NC Department of Health and Human Services (NC DHHS) offices, offices, shops, and 1,200 apartments and condos.
  - Central Park: 167 acres of open space, park land, community gardens, and walking trails, other uses including NC DHHS offices.



- Wake/Raleigh “Garden of Lights” Plan: 180 acres of open space and park land, other uses include 1,500 apartments and condos, a hotel, a school and restaurants.
- Friends of Dorothea Dix Park (FDDP) Plan: Maximum acreage of open and space and parkland, removal of non-historical structures, incorporation of State Farmers Market into park.
- Urban Land Institute (ULI) Plan: 215 acres of open space and park land combined with 248 acres of mixed use development combined on portions of the Dix Campus, Spring Hill Precinct and the State Farmers Market.
- Dix Garden: Entire site as a world-class botanical garden.
- Dix Memorial: 200 acres of open space and park land, other uses include NC DHHS offices, adaptive reuse of historic buildings, and new mental health treatment center.
- The **State Farmers Market** is located just off Lake Wheeler Road and along the southern boundary of the study area. The site contains a public market, shops and restaurants, and warehousing facilities.
- **NC State University’s Centennial Campus** Research Park lies mostly west of the study area and is the focus area for the University’s growth for its Colleges of Textiles, Engineering, and Physical & Mathematical Sciences. The campus sits on 1,221 acres of land and includes the Spring Hill Precinct, a portion of the Dix campus acquired by NC State for future growth.
- **St. Mary’s School** is private college-preparatory, boarding and day school located on Hillsborough Street just north of the study area. The school was founded in 1842 and has a student population of approximately 300 young women in grades 9-12.

### *Neighborhoods*

Three Raleigh neighborhoods are located adjacent to the study area (**Figure 3**):

- **Boylan Heights** lies east of the project area and was developed beginning in 1907. The area currently includes approximately 267 homes, ranging in size and demographics. The neighborhood was designated a historical district in 1984 by the City of Raleigh.
- **Cameron Park** was developed beginning in 1910 as a streetcar suburb to Downtown Raleigh. The neighborhood is located just north of the study area on Hillsborough Street and also is a registered historic district.
- **Pullen Park Terrace** (Kirby-Bilyeu) is a small neighborhood of approximately 25 homes located to the west of the Dix campus off Western Boulevard.

### *Historic Resources*

Information regarding National Register historic properties and archaeological sites was obtained from the North Carolina State Historic Preservation Office (SHPO) and the State Office of Archaeology (OSA), as well as from an inventory of historic properties prepared by Edwards-Pitman Environmental and included in the Dorothea Dix Campus Master Plan (August 2005).

The following historic sites and districts are located near the study area (**Figure 3**):

- Harwell Hamilton Harris Farm
- Cameron Park Historic District
  - Cameron Park Apartments
- St. Mary’s Historic District
  - St. Mary’s Chapel
  - Smedes Hall
  - Eliza Battle Pittman Auditorium
  - East Rock Building
  - West Rock Building
  - John W. Thompson House



- Grosvenor Gardens Apartments
- Elmwood House
- Tucker Carriage House
- St. Mary's Apartments
- Hillyer Memorial Christian Church
- Cameron Court Apartments
- Commercial Block (530 Hillsborough Street)
- Boylan Apartments
- Gibbon Esso Service Station
- Pullen Park Carousel
- Joel Lane House
- Raleigh Hosiery Company Building
- Boylan Heights Historic District
  - Montford Hall
- Spring Hill House
- Dix Hill Historic District

Many of the homes and buildings within the historic districts are contributing structures to the districts' designations, and several structures within the Dorothea Dix have recently been judged to be eligible for historic designations. Several buildings at the Governor Morehead School and remnants of the original Central Prison may also be eligible.

While they may not be officially recognized as historic resources, the large oaks that line Umstead and Blair Drives are a valued and iconic part of the Dix campus and representative of the City of Oaks. The trees serve as natural delineations between the institutional, natural, and recreational uses. Minimizing the impact to these trees and their root systems and ensuring they will survive as a part of the campus will be crucial to garnering community support for a Blair-Hunt-Morgan Connector project.

#### ***Natural and Physical Resources***

A preliminary analysis of the natural resources within the project corridor study area was conducted to identify and approximate the location of various environmental features

within the project study area to assist in the location and development of the proposed roadway project. This analysis was conducted utilizing GIS mapping and database reviews (**Figure 4**).

**Water Resources:** National Wetland Inventory (NWI) maps and aerial photographs were reviewed to identify the locations of potential wetland areas. U.S. Geological Survey topographic maps, Natural Resources Conservation Service (NRCS) soil survey maps, and N.C. Division of Water Quality (DWQ) GIS mapping were used to identify potential streams in the project study area.

Water resources within the project study area include Rocky Branch Creek as well as unnamed tributaries to Rocky Branch Creek and Walnut Creek. Any action proposed by this project to place fill into stream locations would fall under the jurisdiction of the USACE under Section 404 of the Clean Water Act and require permitting. Stream locations are inferred from NCDWQ mapping. NWI mapping does not indicate wetland areas within the project area.

The Nutrient Sensitive Waters Management Strategy for the Protection and Maintenance of Riparian Buffers provides a designation for uses that cause impacts to riparian buffers within the Neuse River Basin. The rule applies to a 50-foot wide riparian buffer (measured perpendicular to the stream from the top of bank on either side of the stream). Within the project study area, this rule applies to vegetated buffers adjacent to the aforementioned streams.

#### **Threatened and Endangered Species:**

According to the United States Fish and Wildlife Service, there are three endangered species listed for federal protection in Wake County: red-cockaded woodpecker (*Picoides borealis*), dwarf wedgemussel (*Alasmidonta*

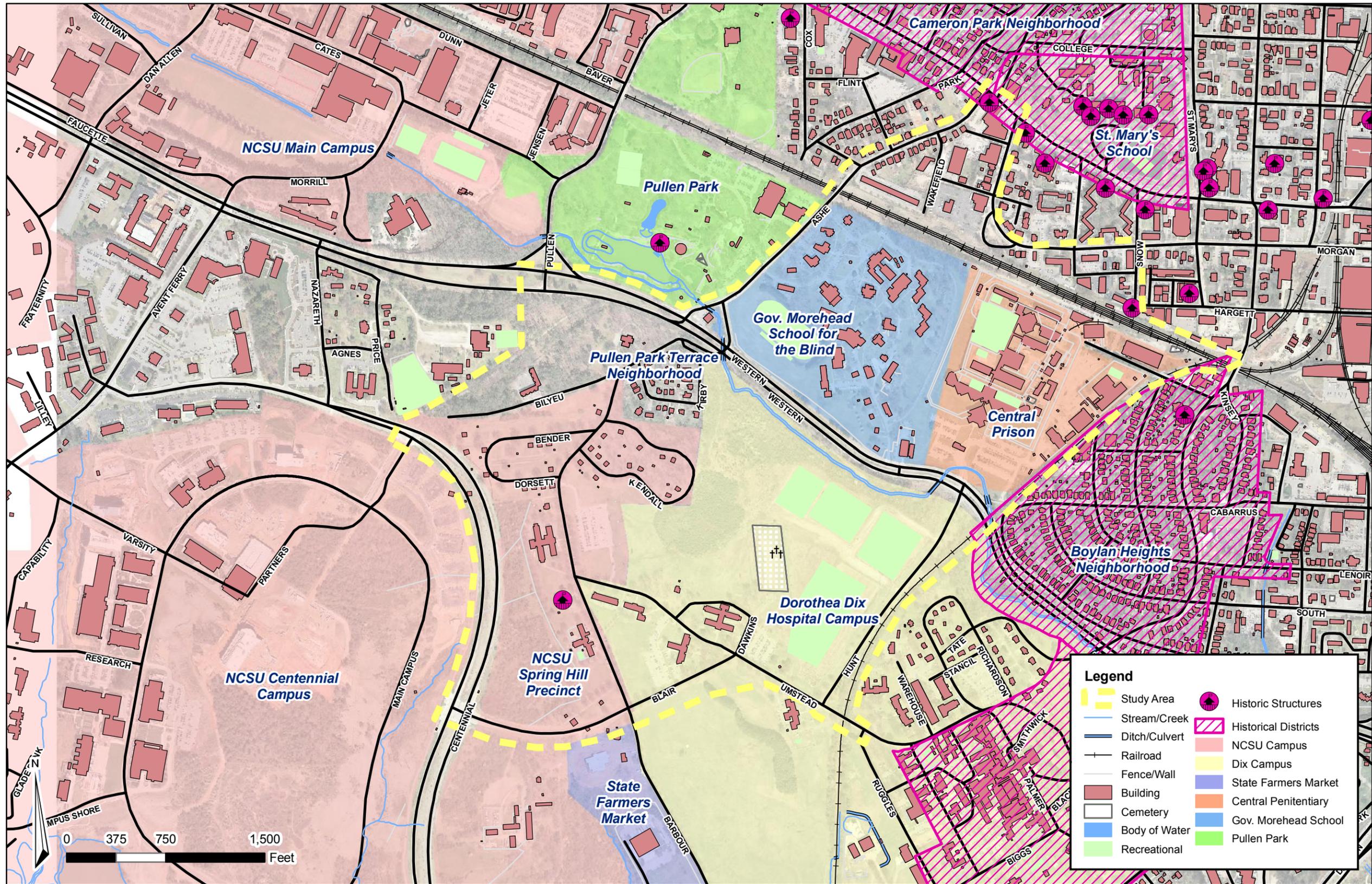


heterodon), and Michaux's sumac (*Rhus michauxii*). There are sixteen species listed as Federal Species of Concern for Wake County. None are specifically identified as occurring in the study area.

**Existing Landfill:** A solid waste landfill operated by the City of Raleigh from 1957 to 1972, Old Raleigh Landfill #11, is located on the Dorothea Dix Hospital campus (**Figure 4**). The landfill was closed and capped off in the 1970s. Fill dirt was added above the capped-off landfill to construct the existing soccer fields. Additional fill from the Raleigh Convention Center site has been placed above the landfill. Two maps and one aerial photograph showing the approximate extent of the landfilled waste at the Old Raleigh Landfill #11 (**Appendix I**) were provided by the North Carolina Department of Environment and Natural Resources - Division of Waste Management (NCDENR-DWM).

During conversations with DWM, concerns were raised about constructing a road on unstable capped landfill. If any alternative is selected that crosses the existing landfill, waste should be excavated prior to road construction to avoid the potential for extensive maintenance and repairs if the existing fill is unstable and settles. In addition, the conditions of the City's lease on the land should be reviewed before any construction actions.

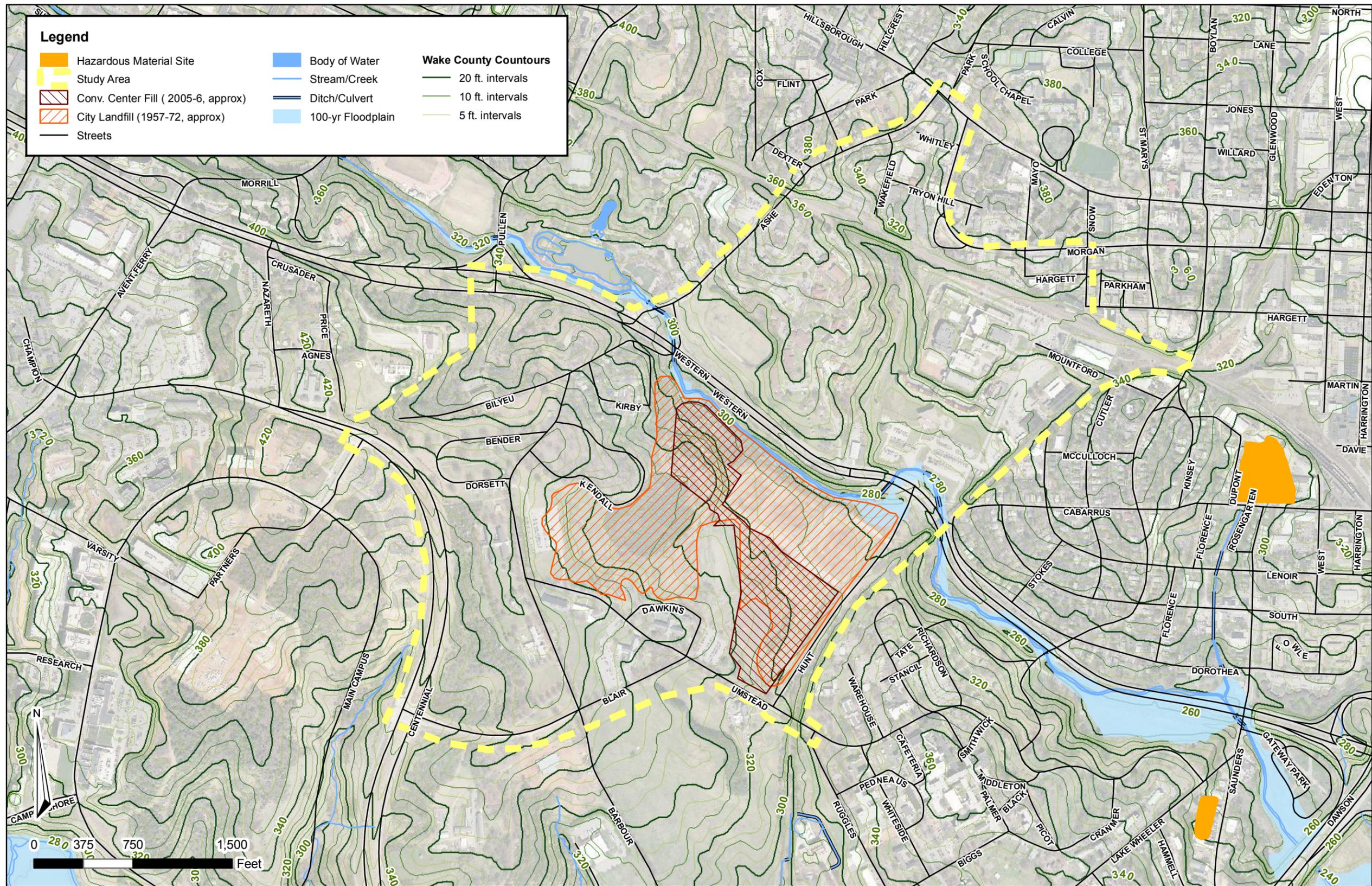
**Rail Corridors:** Two rail corridors run through the project area: the NC Railroad and CSX rail lines in the east/west corridor north of Western Boulevard and the Norfolk-Southern rail line along the eastern study area limits.



# BLAIR-HUNT-MORGAN CONNECTOR

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**FIGURE 3  
PROJECT CONTEXT**



# BLAIR-HUNT-MORGAN CONNECTOR

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**FIGURE 4**  
**ENVIRONMENTAL FEATURES**



## ALIGNMENT ALTERNATIVES

Based on discussions with City staff and past planning efforts for the area completed by the City, consultants, and NC State students, numerous alignments were developed for the Blair-Hunt-Morgan Connector. Options included connections to Ashe Avenue, Western Boulevard, Centennial Parkway, and Lake

Wheeler Road via Goode Street. These alignments are shown in **Figure 5** and outlined in **Table 2**, along with advantages and disadvantages for each alternative. For the southern segment, the table notes the compatibility of each alignment with various plans that have been envisioned for the Dix campus.

**Table 2. Alignment Options and Descriptions**

Alignment	Connections/Connection Options	Notes
<b>Northern Segment:</b> Morgan St. to Western Blvd./Hunt Dr.		
<b>A</b> 	<b>At Morgan St.:</b> <ul style="list-style-type: none"> <li>- Signalized (realign Morgan St.)</li> <li>- T-intersection on Morgan St.</li> <li>- Roundabout</li> </ul> <b>At Western Blvd.:</b> <ul style="list-style-type: none"> <li>- At-grade signalized, T-intersection near Motor Fuels Lab</li> </ul>	Grade-separated over RR Option to extend Morgan St. to Ashe Ave.
<b>Pros:</b> Less costly without Western Blvd. grade separation, easier to provide access to adjacent institutions if needed <b>Cons:</b> Less direct connection to Dix and Centennial Campus, additional signal on Western Blvd.		
<b>B</b> 	<b>At Morgan St.:</b> <ul style="list-style-type: none"> <li>- Signal (realign Morgan St.)</li> <li>- T-intersection on Morgan St.</li> <li>- Roundabout</li> </ul> <b>At Western Blvd.:</b> <ul style="list-style-type: none"> <li>- Grade-separated with connection to existing Hunt Dr. intersection at Western Blvd.</li> </ul>	Grade-separated over RR Option to extend Morgan St. to Ashe Ave.
<b>Pros:</b> More direct connection to Dix and Centennial Campus, access to Western Blvd. facilitated at current signal with square loop type ramp, single signal at Western Blvd., less ROW impact if on bridge structure <b>Cons:</b> More costly due to bridge Western Blvd. grade separation, difficult to provide access to adjacent institutions if needed, probable impact on landfill/soccer sites		
<b>C</b> 	<b>At Morgan St.:</b> <ul style="list-style-type: none"> <li>- T-intersection on Morgan St.</li> </ul> <b>At Ashe Ave.:</b> <ul style="list-style-type: none"> <li>- Stop-controlled</li> </ul> <b>At Western Blvd.:</b> <ul style="list-style-type: none"> <li>- Grade-separated with connection to existing Ashe Ave. intersection at Western Blvd.</li> <li>- At-grade, signalized (<i>slope/grade issues</i>)</li> </ul>	Create new connection between Morgan St. and Ashe Ave.
<b>Pros:</b> Provides direct connection between Western Blvd. and Centennial Pkwy., utilizes existing Ashe Ave. railroad bridge <b>Cons:</b> Cost of grade-separation over Western Blvd., connection to Western Blvd. necessary and would need signal, counter to recent traffic calming efforts on Ashe Ave., improvements needed for connections to Ashe Ave. or Morgan St. north of tracks, impact to entrances of Gov. Morehead School and Pullen Park		



**Table 2. Alignment Alternatives and Descriptions (cont'd)**

Alignment	Connections/Connection Options	Notes
<b>Northern Segment:</b> Morgan St. to Western Blvd./Hunt Dr. (cont'd)		
<b>D</b> 	<p><b>At Morgan St.:</b></p> <ul style="list-style-type: none"> <li>- Signal (realign Morgan St.)</li> <li>- T-intersection on Morgan St.</li> <li>- Roundabout</li> </ul> <p><b>At Western Blvd.:</b></p> <ul style="list-style-type: none"> <li>- Grade-separated with connection to existing Hunt Dr. intersection at Western Blvd.</li> <li>- At-grade signalized, T-intersection near Motor Fuels Lab</li> </ul>	Tunnel under RR Option to extend Morgan St. to Ashe Ave.
<p><b>Pros:</b> Same as Alignments A or B depending on Western Boulevard connection, alignment along existing topography on south side eliminates need for bridge structure, may have better connections to adjacent institutions</p> <p><b>Cons:</b> Tunnel may be more costly than bridge, grades to tie tunnel with existing topography on north side would mean extensive use of retaining walls, may eliminate access points to businesses on north side, coordination with rail during construction to provide rail detour would be problematic with volume of rail traffic, may have impacts to Gov. Morehead School</p>		
<b>Southern Segment:</b> Western Blvd./Hunt Dr. to Barbour Dr./Centennial Pkwy.		
<b>E</b> 	<p><b>At Umstead/Barbour Drs.:</b></p> <ul style="list-style-type: none"> <li>- Stop-controlled on minor street</li> </ul> <p><b>At Centennial Pkwy.:</b></p> <ul style="list-style-type: none"> <li>- Existing signalized at Blair Dr.</li> </ul>	New location east of Blair Dr.
<p><b>Pros:</b> Uses most of existing Hunt Dr., provides direct connection between Western Blvd. and Centennial Pkwy., maintains existing Blair Dr. corridor as ped/bike or service corridor, initially supported by NC State</p> <p><b>Cons:</b> Mostly new location, affects corner of landfill section, affects west side of the Big Field, limited tree impacts</p> <p><b>Dix Plan Compatibility:</b> Compatible with: City in a Park, Wake/Raleigh (moderate) Not compatible with: Central Park, ULI, FDDP, Dix Garden Unknown: Dix Memorial</p>		
<b>F</b> - West  - East 	<p><b>At E. Umstead Dr.:</b></p> <ul style="list-style-type: none"> <li>- Roundabout</li> </ul> <p><b>At W. Umstead/Barbour Drs.:</b></p> <ul style="list-style-type: none"> <li>- Stop-controlled on minor street</li> </ul> <p><b>At Centennial Pkwy.:</b></p> <ul style="list-style-type: none"> <li>- Existing signalized at Blair Dr.</li> </ul>	<p>Median-divided facility along Blair and Umstead Drs.</p> <p>Maintain existing segments of Umstead and Blair Drs. for one direction of traffic, construct laneage for other direction east/west of Blair Dr.</p>
<p><b>Pros:</b> Provides connection between Western Blvd. and Centennial Pkwy., maintains existing Blair Dr. corridor as one half of cross-section, options to choose location of other half, little/no effect on landfill and the Big Field</p> <p><b>Cons:</b> Half on new location, limited impacts with potential impacts to root system for trees along Umstead and Blair Drs.</p> <p><b>Dix Plan Compatibility:</b> Compatible with: City in a Park, Wake/Raleigh, FDDP (moderate) Not compatible with: Central Park, ULI, Dix Garden Unknown: Dix Memorial</p>		



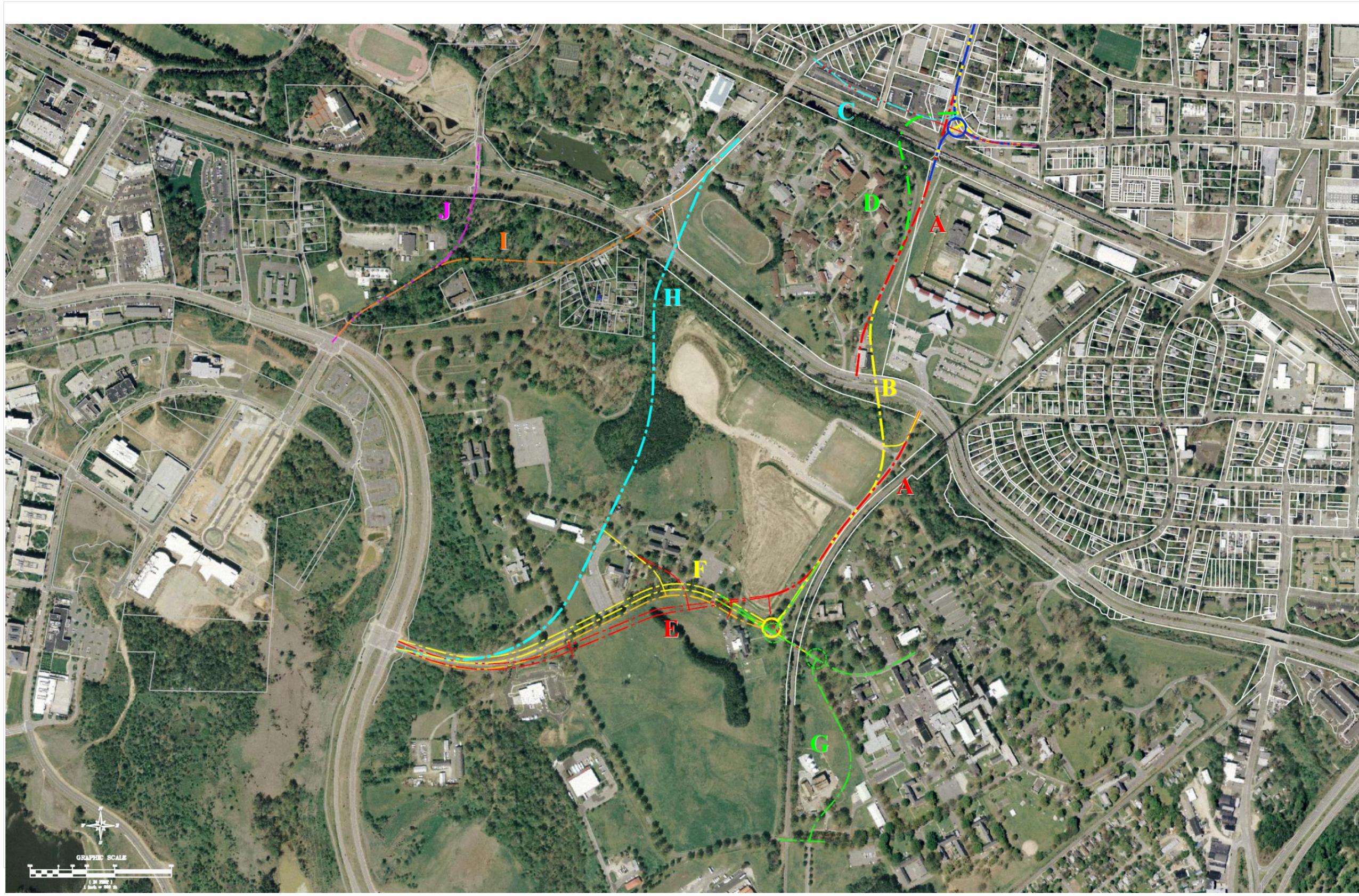
**Table 2. Alignment Alternatives and Descriptions (cont'd)**

Alternative	Connections/Connection Options	Notes
<b>Southern Segment:</b> Western Blvd./Hunt Dr. to Barbour Dr./Centennial Pkwy. (cont'd)		
<b>G</b> 	<b>At Umstead Dr.:</b> - Small roundabouts - Stop-controlled on minor street  <b>At Goode St.:</b> - Two-way, stop-controlled	Contingent on the western portion of Dix staying all park and DHHS locating on Dix Hill  Connection with Goode St. allows for intersection improvements at Lake Wheeler Rd. at the transition between 2-L (residential) and 4-L (commercial/ industrial) sections
<p><b>Pros:</b> Provides connection between Western Blvd. and Lake Wheeler Rd., maintains existing Blair/Umstead Dr. corridor, no effect on landfill, the Big Field, and the oaks along Blair and Umstead Drives</p> <p><b>Cons:</b> Portion on new location, no improved connection to Centennial Pkwy.</p> <p><b>Dix Plan Compatibility:</b> Compatible with: Central Park, City in a Park, Wake/Raleigh (moderate)                      Not compatible with: ULI, FDDP, Dix Garden                      Unknown: Dix Memorial</p>		
<b>H</b> 	<b>At Western Blvd.:</b> - Grade-separated with connection to existing Ashe Ave. intersection at Western Blvd. - At-grade, signalized ( <i>slope/grade issues</i> )  <b>At Umstead/Barbour Drs.:</b> - Stop-controlled on minor street  <b>At Centennial Pkwy:</b> - Existing signalized at Blair Dr.	Create new connection between Morgan St. and Ashe Ave.
<p><b>Pros:</b> Provides direct connection between Western Blvd. and Centennial Pkwy., maintains existing Blair Dr. corridor as ped/bike or service corridor</p> <p><b>Cons:</b> New location between existing structures, cost of grade-separation over Western Blvd., proximity to Kirby-Bileyu neighborhood, affects wooded areas, connection to Western Blvd. necessary and would need signal</p> <p><b>Dix Plan Compatibility:</b> Compatible with: Wake/Raleigh, Central Park (moderate), City in a Park (moderate)                      Not compatible with: ULI, FDDP, Dix Garden                      Unknown: Dix Memorial</p>		



**Table 2. Alignment Alternatives and Descriptions (cont'd)**

Alternative	Connections/Connection Options	Notes
<b>Other Alternatives / Complementary Routes Identified but Not Under Consideration</b>		
<b>Ashe Avenue:</b> Morgan St. to Centennial Pkwy.		
<b>I</b> 	<b>At Morgan St.:</b> - T-intersection on Morgan St. <b>At Ashe Ave.:</b> - Stop-controlled <b>At Western Blvd.:</b> - Grade-separated with connection to existing Ashe Ave. intersection at Western Blvd. - At-grade, signalized ( <i>slope/grade issues</i> ) <b>At Centennial Pkwy.:</b> - Existing signalized at Main Campus Dr.	Create new connection between Morgan St. and Ashe Ave. Contingent on redevelopment of Catholic Diocese property Connections between Western Blvd. and Centennial Pkwy. to be determined by redevelopment
<b>Pullen Road:</b> Western Blvd. to Centennial Pkwy.		
<b>J</b> 	<b>At eastbound Western Blvd.:</b> - Tie into existing intersection - New interchange <b>At Centennial Pkwy.:</b> - Existing signalized at Main Campus Dr.	Contingent on redevelopment of Catholic Diocese property Connections between Western Blvd. and Centennial Pkwy. to be determined by redevelopment



# BLAIR-HUNT-MORGAN CONNECTOR

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**FIGURE 5  
ALIGNMENT OPTIONS**



Project staff reviewed the alignments and based on the benefits and impacts of each decided to carry forward four alternatives for more detailed study (**Figure 6**):

**Alternative #1 – Morgan Street Extension with grade separation over Western Boulevard:**

This alternative follows Alignment B from Morgan Street over the rail lines and Western Boulevard to the intersection with Umstead Drive at Hunt Drive. The Umstead/Hunt intersection was moved slightly north to accommodate room for a potential roundabout and to establish the connector as the main roadway through the intersection. The southern segment preserves the existing Umstead and Blair segment to a great extent as the southbound lane of a two-lane, median-divided segment, with the existing trees maintained inside the median. A short segment would be constructed to connect Umstead and Blair Drives south of their current intersection.

**Alternative #2 – Morgan Street Extension to Western Boulevard at grade:**

This alternative follows Alignment A from Morgan Street over the rail lines and to an at-grade intersection with Western Boulevard just west of the Motor Fuels Laboratory. The southern segment matches Alternative 1 but maintains Hunt Drive to its intersection with Western Boulevard.

**Alternative #3 – Morgan Street Extension to Ashe Avenue at grade:**

This alternative follows Alignment C north of the rail lines and ties into Ashe Avenue across from Dexter Place. The southern segment matches that of Alternative 2.

**Alternative #4 – Extensions to both Western Boulevard and Ashe Avenue:**

This alternative looks at the transportation impacts with a combination of both connectors added to the network.

## TRAFFIC MODELING & FORECAST

Based on the currently planned improvements and population forecasts for Raleigh, the 2035 Triangle Regional Travel Demand Model was used to project the traffic volumes in the study area based on no build conditions and with the addition of the study alternatives. The 2035 model includes long-range transportation improvements around the study area including the widening of Western Boulevard and Lake Wheeler Road, improvements on Hillsborough Street, and a new I-40 interchange between Gorman Street and Lake Wheeler Road. The model runs tested the effects of adding a connection between Morgan Street and Centennial Parkway, a connection between Ashe Avenue and Morgan Street paired with a connection between Western and Centennial Parkway, or the combination of both. The existing model had no connection between Centennial Parkway and Western Boulevard in the study area as the model does not include local streets.

The Blair-Hunt-Morgan Connector was modeled as a four-lane facility, the Ashe Avenue Connector as a two-lane facility. The model analysis that included all new connections also incorporated the planned connection into Centennial Campus from Blair Drive and a two-way Morgan Street.

The results of those model runs are displayed in **Appendix II**. With the new connection first tested as a four-lane facility, the projections immediately showed that there is a high demand for the additional north-south link between Western Boulevard and Morgan Street, filling the new road to near capacity. Upon examination of the parallel north-south facilities from Gorman Street to Downtown Raleigh, the



**Legend**

- Study Area

**Alternatives**

- Alternative 1
- Alternative 2
- Alternative 3
- + — Alternative 4
- — — Shared Segments

# BLAIR-HUNT-MORGAN CONNECTOR

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**FIGURE 6**  
**STUDY ALTERNATIVES**



connector diverts approximately 16,000 to 20,000 daily trips from those streets. The source of the other trips cannot be directly determined from the model results, but they may be trips by motorists choosing new routes between areas north and west of Downtown Raleigh or choosing new destinations because increased connectivity and travel time savings. These projections prompted the analysis to include the new facility from Morgan Street to Western as a four-lane facility for the forecasts.

The Ashe Avenue and the Blair-Hunt connections alone do not divert nearly the same volume of trips on their own accord, but there is an inherent demand along the Blair-Hunt segments when the direct connection to Centennial Campus is included. Even with this increased demand, both of these connections are expected to handle the projected traffic with two-lane facilities.

Model analyses and observations were used to help develop traffic forecasts for the four alternatives, as well as a scenario with both the Ashe and Blair-Hunt-Morgan Connectors, as shown in **Figure 7**. In developing the forecasts, several key considerations were used:

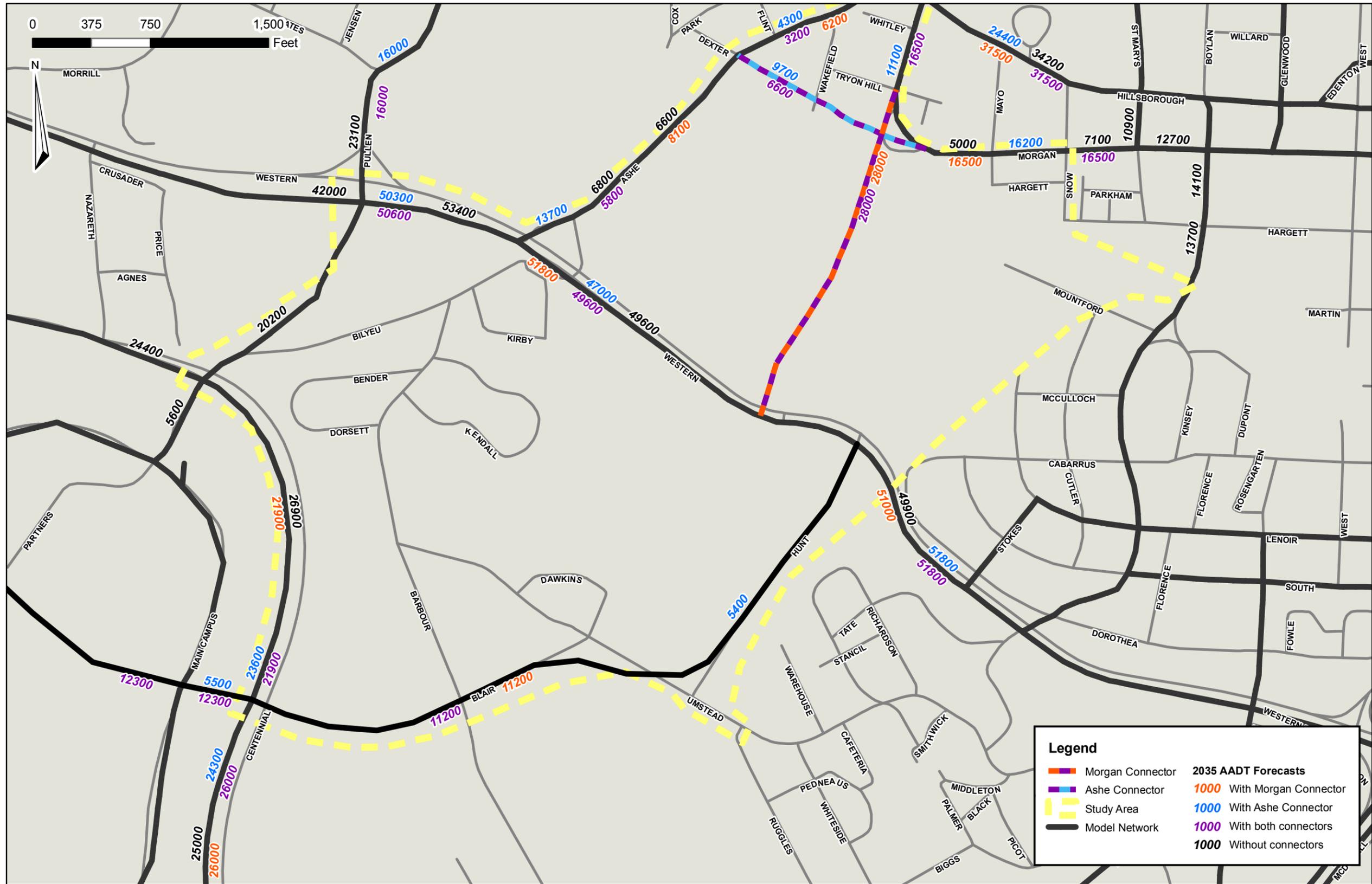
- Volumes on Morgan Street and Pullen Road were capped at approximately 16,500 vpd to reflect near capacity conditions for two-lane roadways.
- Volumes on Hillsborough Street were capped at approximately 31,500 vpd to reflect near capacity conditions for four-lane undivided roadways.
- Volumes on Western Boulevard were capped at approximately 51,800 vpd to reflect near capacity conditions for six-lane divided roadways, the planned cross-section in 2035.
- Volumes on the Morgan Connector were restrained based on the observed volume diversions from parallel facilities, capacity

restraints connecting facilities, and the ability to adequately accommodate the resulting turning movement volumes from Western Boulevard and Morgan Street.

- Volumes observed in the final model run including the connection to Centennial Campus and two-way operations on Morgan Street were incorporated into the forecasts for the other alternatives.

The forecasts show that a new major connection between Morgan Street and Western Boulevard attracts a significant number of trips, forecast at 28,000 vehicles per day. A connector to Ashe Avenue does not attract similar traffic volumes, particularly as Ashe Avenue is not planned to be widened beyond its current cross-section. The new Ashe connection also does not provide an improved link between Centennial Campus and destinations east and north of Downtown Raleigh.

AADT forecasts including turning movements can be found in Appendix II.



# BLAIR-HUNT-MORGAN CONNECTOR

CITY OF RALEIGH PLANNING DEPARTMENT

**FIGURE 7**  
**2035 TRAFFIC FORECAST**



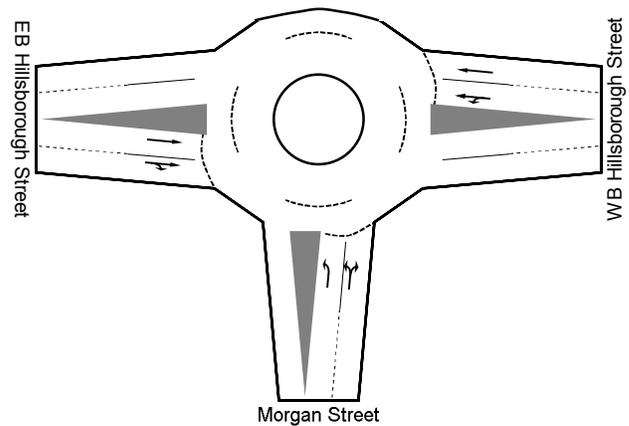
## TRAFFIC ANALYSIS & EVALUATION

Using the traffic projections, 2035 design year peak hour turning movement volumes were developed for the key intersections affected by the addition of the proposed connectors. Without full forecast data, truck percentages, peak hour factors, and directional distributions were assigned based on engineering judgment and familiarity with traffic conditions in the study area. After initial volumes were calculated using the details of the projections, an evaluation of the link volumes was performed to determine any need for balancing between intersections. The peak turning movement calculations are provided in **Appendix III**.

At-grade intersection analyses were performed using Synchro<sup>®</sup> (version 7) and SIDRA Intersection<sup>®</sup> (version 3.1) traffic capacity software using methodologies prescribed in the 2000 Highway Capacity Manual to compute level-of-service (LOS) and delay for each intersection, signalized and unsignalized, under all current and future scenarios. NCDOT Congestion Management Capacity Analysis Guidelines were followed (unless otherwise noted) to create a coordinated network along the study area corridors in 2035. Right turns on red were allowed in the analysis.

**Table 3** details the results of the intersection analyses, organized by alternative. **Figure 8** references the appropriate laneage and storage lengths for each alternative.

**General Comments:** The proposed roundabout project at the intersection of Hillsborough Street and Morgan Street was evaluated in all four alternatives. In each scenario, the modeled and forecast volumes exceeded the capacity of a single-lane roundabout, therefore the analysis



*Dual-lane roundabout schematic used for Hillsborough/Morgan intersection analysis*

was conducted with a dual-lane roundabout configuration at this location, as shown in the illustration above. The results of the analyses are provided in **Table 3** with the highest movement degree of saturation reported below the LOS and delay.

For all alternatives, the intersection of Blair Drive at Centennial Parkway operates at LOS D or E in the peak periods. This intersection includes the planned connection into Centennial Campus that would continue to Main Campus Drive. With significant increases in traffic volume on Centennial Parkway due to build-out at the campus, the intersection handles a considerable number of turning movements to and from Blair Drive. The signals at the intersection are currently set to operate with protected left-turn phases on all approaches. A comparison of operations with protected-only versus permitted-only left-turn phases on Blair Drive show similar movement LOS and queues for the left turn movements from the side streets under the two scenarios. The latter provides more effective green time to the mainline, reducing delay to the 35-40 and 45 second ranges in the respective AM and PM peaks.



**Table 3. Intersection Level-of-Service Summary (2035)**

Intersection	LOS and Delay (s) by Alternatives							
	1: Morgan Street Connector: Grade-separated		2: Morgan Street Connector: Split at-grade		3: Ashe Avenue Connector		4: Both Connectors	
	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak
Blair Dr. @ Centennial Pkwy. – Signalized	D (54.9)*	E (64.3)*	D (54.9)*	E (67.1)*	D (43.7)*	D (46.7)*	D (53.7)*	E (63.7)*
Hunt Dr. @ Morgan Connector. – Signalized	D (35.1)*	D (49.3)*	--	--	--	--	--	--
Hunt Dr. @ Western Blvd. . – Signalized – U-turn option	F (97.5)* N/A	F (83.5)* N/A	E (64.0)* C (29.4)	D (46.5)* C (23.7)	D (45.1)* N/A	C (28.9)* N/A	E (62.1)* C (22.9)	E (63.2)* C (34.0)
Morgan Connector. @ Western Blvd. . – Signalized – U-turn option	--	--	C (33.1) D (50.2)	D (37.9) D (51.7)	--	--	C (32.0) D (40.8)	D (35.5) D (41.8)
Western Blvd. @ Ashe Ave. . – Signalized – U-turn option	--	--	--	--	C (23.4) N/A	C (34.9)* N/A	B (15.6) B (14.2)	B (16.7) B (16.8)
Morgan Connector or Ashe Connector @ Morgan St. . – Signalized	D (38.7)*	D (37.9)*	D (37.8)*	D (48.9)*	B (18.3)	B (16.8)	D (47.8)*	D (49.4)*
Morgan St. @ Hillsborough St. – Roundabout**	C (28.8) 0.883	C (23.9) 0.943	C (28.8) 0.883	C (23.9) 0.943	B (11.7) 0.593	B (10.8) 0.660	C (30.8) 0.904	D (50.2)* 1.052
Ashe Connector @ Ashe Ave. – Unsignalized***	--	--	--	--	E (38.1) WBL	F (77.1) WBL	A (9.7) WBL	B (10.8) WBL

\* Indicates at least one major movement operates at LOS E or F and/or reports long queues lengths

\*\* LOS and delay for unsignalized intersection are reported for the movement that experiences the greatest delay.

\*\*\* LOS and delay for roundabout are reported for the movement that experiences the greatest delay based on unsignalized intersection LOS as covered in HCM. The degree of saturation for the movement that experiences the highest delay is report below LOS and delay.



**Alternative #1:** Operations for Alternative #1 fail based on inadequate storage for heavy turning movements between the proposed connector and Western Boulevard. Because of the grade separation, a short ramp is needed to provide a roadway link between the two roadways. Because of the location of Hunt Drive and the adjacent landfill, the connector alignment cannot be shifted west and prevents a more lengthy connection. The intersection of the ramp at Western Boulevard fails during both peak periods and the southbound left turn from the new connector towards Western Boulevard experiences long delays and queues. Several options including free right turns were tested but all failed.

Based on the failure of this crucial link in the alternative design, Alternative #1 was rejected as a feasible option and therefore is not shown in **Figure 8**.

**Alternative #2:** The feasibility of this alternative relies on traffic operations at the Western/Hunt intersection and the connection to Morgan Street. The alternative has the advantage that the two intersections on Western Boulevard are offset such that left turn queues do not interfere with the adjacent intersection. The intersection at Western Boulevard and Hunt Drive operates just beyond the LOS E threshold in the morning peak and at a moderate LOS D in the evening peak. The phases for Hunt Drive and the prison driveway are set as split phases to maintain a three-lane approach on Hunt Drive, with an exclusive left turn bay, a shared left-through lane, and an exclusive right-turn bay. Long queues occur for the westbound left turn as the constraint of the railroad bridge prohibits more than one turn lane and a storage lane more than approximately 200 feet.

One option to alleviate the turning movement problems at the Western/Hunt intersection

would be to prohibit westbound left-turn, southbound left-turn, and southbound through movements from Western Boulevard and provide a U-turn lane at the downstream intersection. The U-turn phase would run with the eastbound left-turn phase from Western Boulevard to the northern portion of the connector. The change allows for shorter cycle lengths at both signals on Western Boulevard. Western Boulevard through movements are granted proportionately more green time and they experience the same cross traffic (westbound left-turns at Hunt Drive are simply diverted to the Morgan Connector intersection) while the side streets experience shorter queues. The westbound U-turn also has the potential for longer storage lengths.

The intersections at Western Boulevard and Morgan Street for the northern segment of the connector operate at LOS D or better in both peak periods. Adequate operations at the intersections are dependent of providing adequate storage for critical movements. **Figure 8** references those storage lengths and the appropriate laneage.

The intersection at northern end of the connector and Morgan Street was evaluated and it is recommended that best configuration would be to carry the connector straight to join with the existing north-south alignment of Morgan Street. The east-west segment would intersect with the route south of the Charlie Goodnight's complex.

The Hillsborough/Morgan roundabout is expected to operate near capacity under this scenario, with long queues on the northbound leg and in the peak directions on Hillsborough Street during peak periods.

**Alternative #3:** The volumes coming to and from Centennial Campus as well as from north



of the study area via Hillsborough Street are significantly lower based on forecasts for this alternative, and subsequently all intersections evaluated operate at better LOS than their counterparts in Alternative #2. The westbound left turns from Western Boulevard onto Hunt Drive do not present as significant a queuing problem, with 95<sup>th</sup>-percentile queues stacking just beyond the available storage in the PM peak periods.

Along Ashe Avenue, turning movements at Western Boulevard could be handled by a signalized intersection but would require dual-left turn lanes on eastbound Western Boulevard and southbound Ashe Avenue. With the southbound dual-left, an exclusive southbound right, and two outbound receiving lanes, the widening of the southbound approach may require a taking with the gas station on the northeast corner of the intersection. The short street connection just to the east would need to remain in the future but be converted to one-way operations northbound.

The intersection at Ashe Avenue and the new connector would experience moderate delay overall if controlled as a four-way stop. The four-way stop was installed in recent years with the completion of a traffic calming project for Ashe Avenue. Improvements at the intersection to ensure short queues and storage space will help alleviate traffic diversions on Ashe Avenue north of the railroad, but traffic calming measures constructed to the south of the rail line would have to be modified to facilitate increased traffic between the new connector and Western Boulevard. It is recommended that the new connector include a westbound through-right turn bay to allow motorist to bypass any queue turning left onto southbound Ashe Avenue. A short northbound right-turn bay should be included in the design as well to allow for one or two vehicles to queue if preceding

north on Ashe Avenue and not affect motorists turning right.

The other intersections in the scenario operate well in both peak periods, including the Hillsborough/Morgan roundabout. Based on volumes, it is recommended that the east/west portion of Morgan Street be extended to created the Ashe Connector, with north/south segment of Morgan teeing into the extended street.

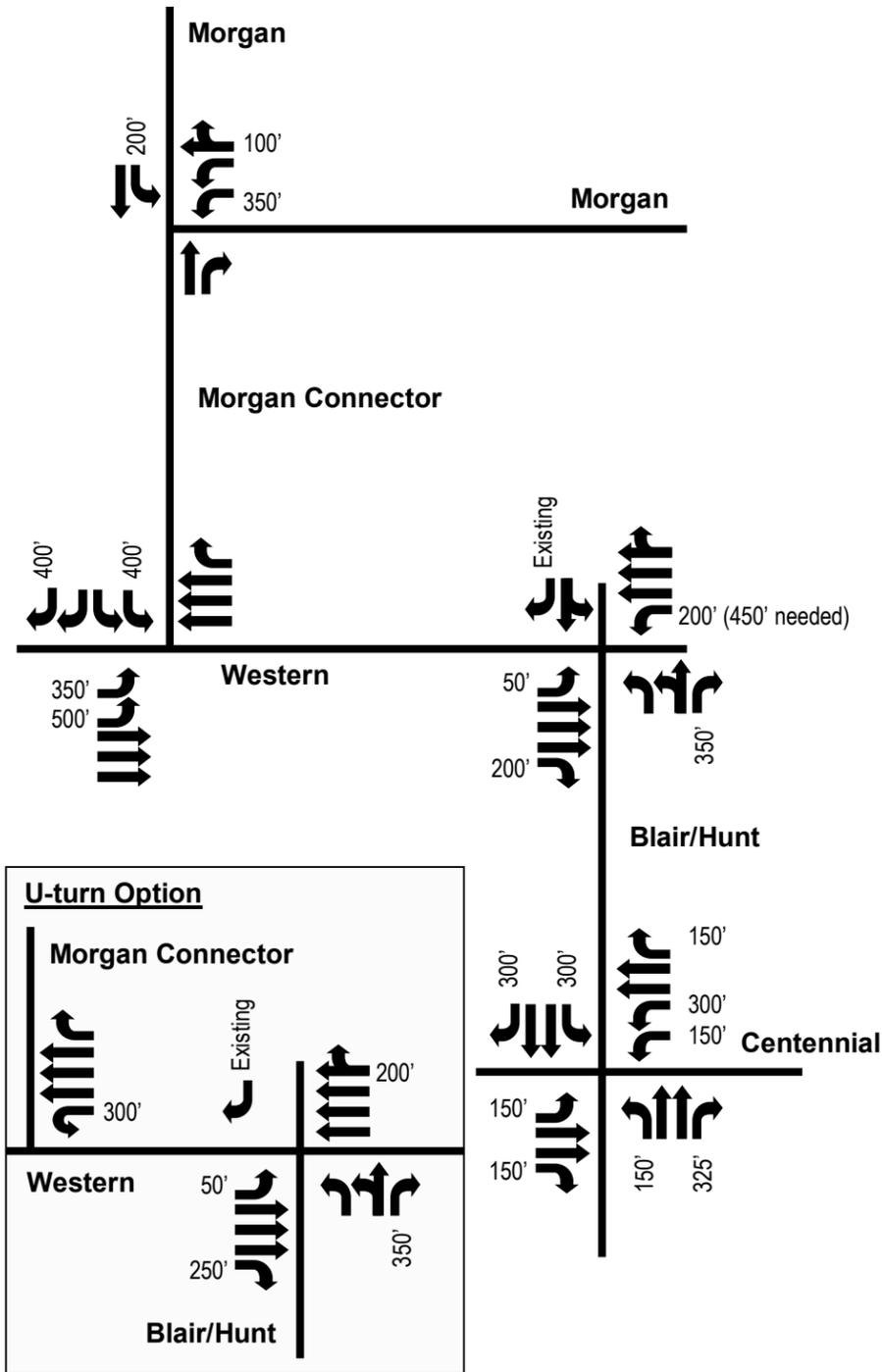
**Alternative #4:** With the combination of both new links added to the transportation network, the intersections for the southern portion of the connector operate similar to those in Alternative #2. Operations on Ashe Avenue are improved as the majority of motorists choose to use the Morgan Street Connector.

The intersection where the two new streets meet Morgan Street is expected to operate at LOS E in the AM and PM peak periods. While the T-intersections evaluated in the previous alternatives can handle the heavy turning movements relatively well, operations for certain movements fail at the creation of a four-way intersection with heavy volumes on the northbound through, southbound left, and westbound left movements. The analysis incorporated logical trip diversions through the study area and the prohibition of northbound and eastbound left-turn movements in attempt to improve operations at the intersection. Even with the diversion, improvements require more turn lanes and a wider cross section for existing Morgan Street to north to operate at LOS D as shown in **Table 3**, in order to receive traffic from two northbound lanes off the Morgan connector. Construction of these lanes may be hindered due to impacts to existing land uses and structures in the area. Queuing on the northbound approach would also require that the northbound right-turn lane extend south and would require a wider bridge or tunnel.

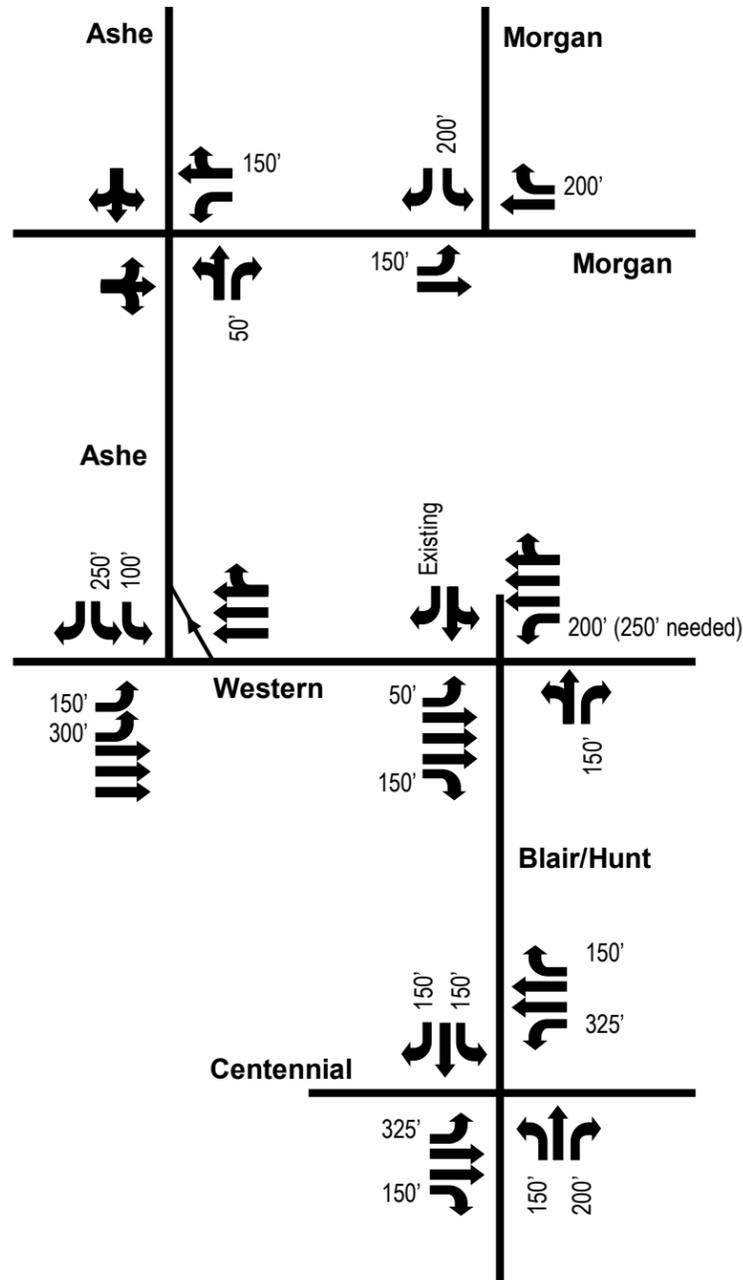


As an option, a discontinuous alternative based on the western tunnel option was evaluated, with the Morgan Connector tying into the Ashe Connector at a T-intersection. Heavy turning movements at the intersections of the two connectors and at Morgan Street with the new east-west connector caused both junctions to fail in the design year despite the inclusion of dual turn lanes in several locations and resultant widenings on Morgan Street to provide adequate outbound receiving lanes.

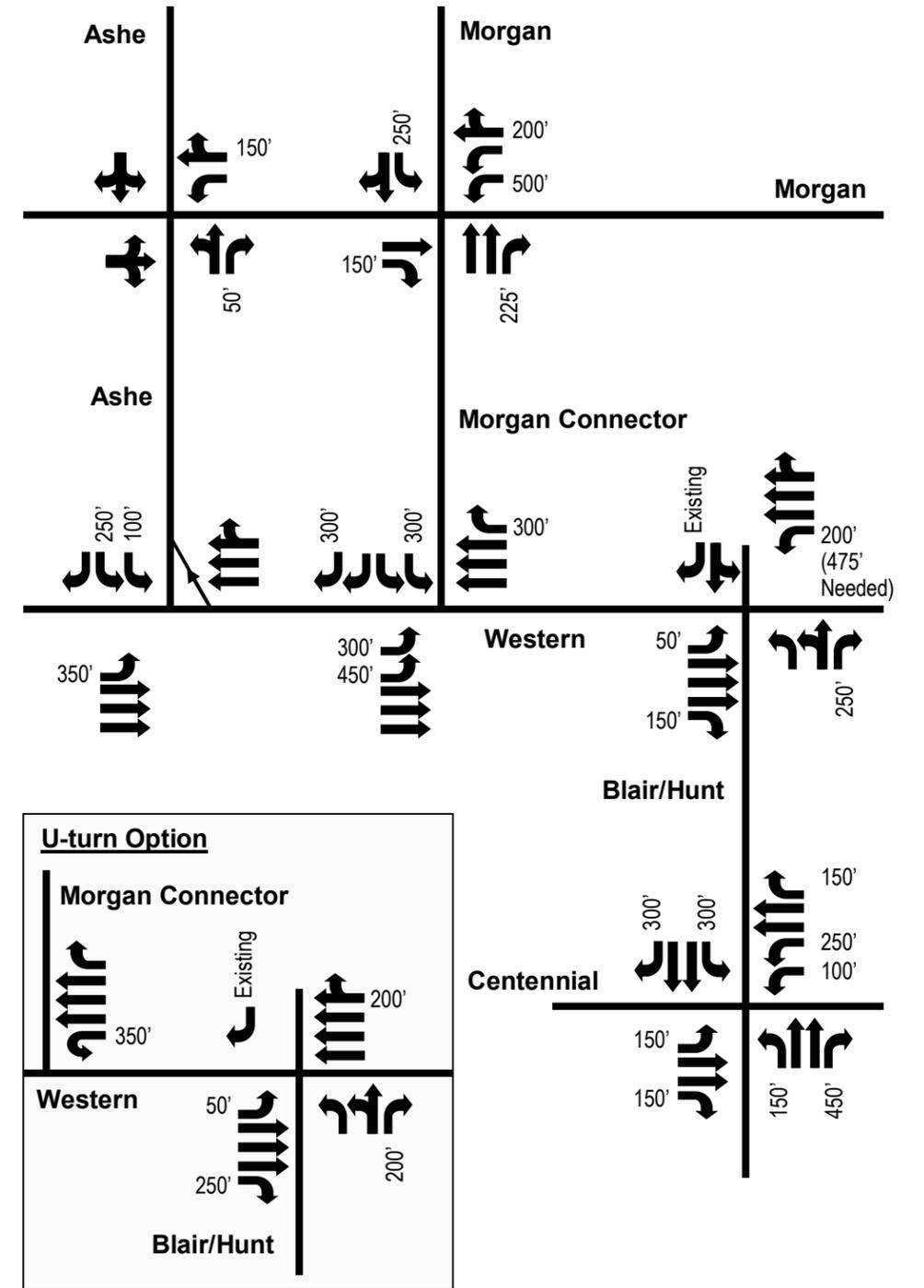
**Alternative #2**



**Alternative #3**



**Alternative #4**





## DESIGN CONSIDERATIONS

In developing the designs for the alternative, options for crossing of the rail line were investigated. A review of the topographical information show that an overpass of the railroad is more feasible considering the elevations on either side of the rail line. Morgan Street in front of the Charlie Goodnight's Complex is approximately 20 feet higher than the rail line. Assuming the pavement surface on the bridge is 30 feet higher than the railway in order to provide the necessary clearance for the bridge structure, the connector would be able to meet grade with on the north side with an approach grade of approximately 5% (7% maximum grade for urban arterials in rolling terrain). With maximum grade of the south side, the bridge structure would be approximately 600 feet long, but could be shortened if fill and retaining wall were used for the approach on the south side. Of note, the earth moved from the Convention Center site at the landfill area at the Dix campus could be a potential source for that fill if found suitable.

The feasibility of tunnel options to cross the rail line was also evaluated. Upon review, the tunnel option would be favorable on the south side of the tracks because of topography, but the elevations and development on the north side would make such an option difficult. Assuming a road bed 25 feet lower than the rail (accounting for rail bridge and overhead clearance requirements), a maximum 7% grade, and the alignments shown in **Figure 6**, the connector would not be able to tie back into existing grade of the north-south portion of Morgan Street until midway between Tryon Hills Road and Whitley Street. If the tunnel were routed to the west where the elevation is lower than the rail, the grade necessary to meet back with existing Morgan Street would be

approximately 12%. With a maximum grade of 7%, the connection would tie back to the existing Morgan Street just north of Tryon Hills Road (near Irregardless Restaurant) and at the start of the east-west segment. The impact of carrying these retaining walls into the community area north of the tunnel would affect several businesses and offices, as well as cut off access to certain parcels. Another considerable logistical hurdle to constructing a tunnel under an operating rail line would be the requirement to provide a detour alignment for rail traffic. These impediments make the option impractical, expensive, and considerably difficult.

For the Ashe Avenue Connector options, the topography of the area north of the rail line also presents an issue that will need to be solved. The area between Ashe Avenue and Morgan Street has a low point just south of the office building located at 905 Tryon Hill Drive. With either the bridge or tunnel option, the low area would likely need to be filled (with or without retaining walls) for the new street to connect with the intersections on either side. The Ashe Avenue connection would also mean the taking of the Pullen Park Lofts apartment complex and likely the office building at 905 Tryon Hill Drive.

Conceptual layout of the crossing options are shown in **Figure 9**.

Lastly, the segment of the new connector that spans the Dix campus would include several minor intersections, including ones at the entrance and exit to the soccer fields, the eastern and western segments of Umstead Drive, and Barbour Drive. Traffic data for these intersections was not available. The traffic control and design of these intersections will depend primarily on future land use decisions made on the campus site. This study envisioned several options including roundabouts or two-



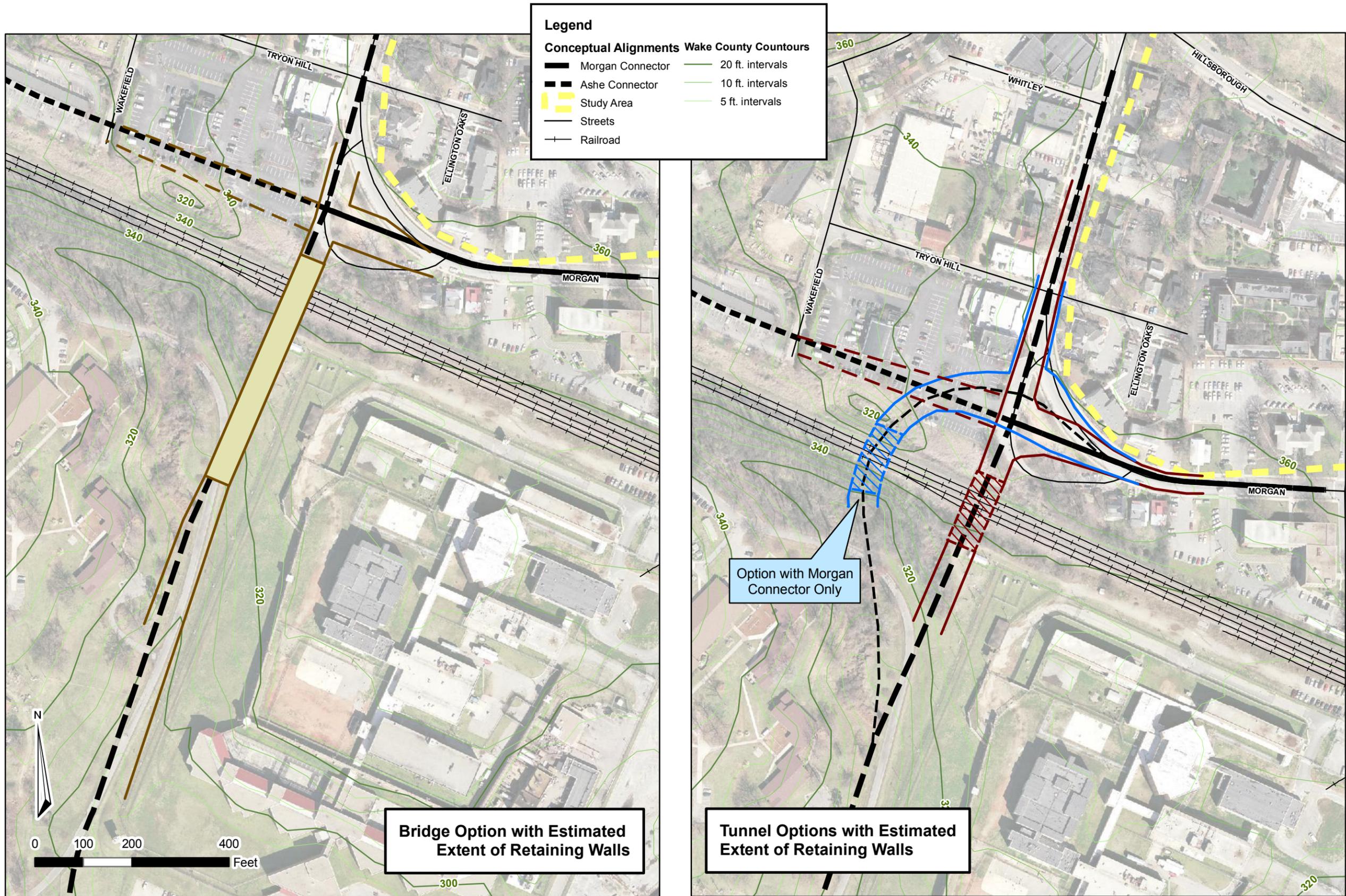
way stop-controlled intersections with short left-turn lanes on the connector as viable options, but did not evaluate the particular intersection operations because of the uncertainty of the future land uses on the Dix campus.

## **FINDINGS & CONCLUSIONS**

Based on the development of the AADT forecasts and the traffic analysis, it is clear that there is an unmet demand for a new north/south connection within the study area. The Blair-Hunt-Morgan Connector provides a crucial link between NC State's ever-expanding Centennial Campus and downtown and it diverts traffic flow from local streets that run adjacent to parks, educational campuses, and historic neighborhoods. While the need for the project is evident, the construction of a new connector will be challenging with the number of community features and natural resources in the study area, as well as the necessary rail crossing.

In looking at the project alternatives, the traffic analysis clearly showed that Alternative #1 would not be feasible. Alternative #4 also seems an unlikely candidate because of intersection operations at Morgan Street and the new connectors to Western Boulevard and Ashe Avenue. As stated earlier in the report, the alternative would require widening existing Morgan Street north of the new connector and a wider bridge/tunnel to provide LOS D operations. The indirect connection that would offset the Morgan Street Connector to the west was also not feasible. The remaining two alternatives must be considered based on the merits and drawbacks of each.

Alternative #2 provides the greatest traffic benefits as a direct connection from Morgan Street to Centennial Parkway. Construction of a four-lane segment from Western Boulevard to Morgan Street and an improved two-lane median-divided segment across the Dix campus would help meet the future traffic demand and suit the context of the project. The U-turn option for the Western Boulevard intersection provides the means to serve westbound traffic



# BLAIR-HUNT-MORGAN CONNECTOR

CITY OF RALEIGH PLANNING DEPARTMENT

**FIGURE 9  
RAIL CROSSING OPTIONS**



on Western Boulevard turning south towards Centennial, even though it may not be as direct of a route. While a tunnel option is feasible, construction of a rail overpass for the new connector is expected to create fewer impacts to the commercial land uses north of the rail line. Selection of this option though would require a sizable budget with the construction of a rail overpass and retaining walls for the section south of the rail corridor.

**Alternative #3** does not serve the intended purpose to better link Centennial Parkway and Campus to downtown. This alternative would serve as a capacity improvement to the existing transportation network, but the model results show it does not fully serve a greater demand between Western Boulevard and Morgan Street. The existing bridge on Ashe Avenue, without improvements and widening, creates a choke point in the route that limits the effect of the new Ashe Connector to serve the full demand of a new north-south link. While the Ashe Avenue Connector provides a long-needed link between Ashe Avenue and Morgan Street, the improvements would likely create a substantial impact to local institutions, residents and business. The option would funnel traffic along the borders of Pullen Park, the Governor Morehead School, and the Pullen Park neighborhood where recent traffic calming efforts have been focused to reduce and slow cut-through traffic.

Based on the consideration of the purpose and need, traffic analysis, and design, Alternative #2 with a rail overpass is recommended for future consideration in the City of Raleigh's development of a Blair-Hunt-Morgan Connector corridor. The Morgan Street Connector provides a direct link between NC State Centennial Campus, Western Boulevard, and downtown Raleigh under acceptable traffic operations. While traffic analysis showed that a

grade separation is not feasible for Western Boulevard, an overpass is a more reasonable alternative for crossing the CSX/NC Railroad tracks, considering the amount of rail traffic on the line as well as impacts to the businesses and community north on Morgan Street. Both tunnel and bridge options will be costly, but the difference in price cannot be determined until more detailed surveys can be undertaken to provide crucial data for vertical and structural design.