APPLYING “TOD” DESIGN PRINCIPLES TO THE MULTIMODAL DISTRICT OF DOWNTOWN ATHENS, GEORGIA.

by

QI LI

(Under the Direction of John F. Crowley)

ABSTRACT

In recent years, sustainable development has gained favor in various disciplines, especially in the field of urban planning and design. As part of this push, researchers introduced the concept of transit-oriented development (TOD), hoping to reduce dependence on personal automobiles achieve sustainable development for cities. The population of Athens, Georgia is growing, and its economy is thriving, making this university city a promising regional core center. A transit hub is necessary in such a city, and this hub could allow residents, visitors, and students to live healthier lifestyles by using alternative transportation other than cars.

The goal of this thesis is to apply TOD principles to the existing transit station in the River District of downtown Athens. This study also proposes recommendations for Athens’ future.

INDEX WORDS: Multimodal Transit Hub, Transit-Oriented Development, Mixed Use

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DEDICATION

To John Crowley,

My amazing major professor, who gave me bravery to be a great student and potential urban designer.

To Huiming and Jiajie,

My dear parents, who fully support me with their undoubtable love and patient.

To Gitta,

My best friend, who helped me open my eyes and heart to embrace the unpredictable tomorrow.

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Second, I would like to especially thank Professor Umit Yilmaz. I sincerely appreciated his assistance, interesting conversation, intelligent comments about multimodal transportation planning, and overall support. It is no exaggeration to say that I could not have completed this thesis without his help.

Professor Rosanna Rivero, who is highly knowledgeable regarding Geographic Information Systems (GIS), helped with access to original Athens GIS data and maps. I am grateful for her insight, generosity, and suggestions. By teaching me about urban planning from the perspective of spatial analysis, she introduced me to a brand new planning world.

I would also like to thank the numerous individuals who assisted me on the station project and with computer rendering technologies.

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CHAPTER 1

INTRODUCTION

1.1 Research Background

Transit-oriented development (TOD) was introduced by Peter Calthorpe in the early 1990s in his book *The Next American Metropolis*, quickly becoming a topic of interest with planners. TOD is a strategy for achieving sustainability by concentrating mixed-use and pedestrian-friendly developments around transit stations (Carlton 2007). Since then, different cities throughout the world have accepted and applied TOD principles. In fact, many American cities have implemented TOD strategies as they design railway stations, subway stations, and multimodal transit hubs.

Transportation is an indispensable tool for moving people and cargo, but it also greatly affects the evolution and form of urban development. As American cities and the economy have rapidly developed, and as progress has been made in science and technology, individuals' lifestyles have undergone significant changes. Rail transit is gradually readapting to modern lifestyles, and the construction of urban space form in turn has had a great role in promoting this tendency. "People are moving back to the city after number of years of out-migrating to suburbs." (orginization) The housing market is changing because of demographics, as more and more childless or single adults comprise 41 percent of households, according to research conducted by Reconnecting America which points out it is time to bring TOD concepts to American cities.

The theory of this thesis is based on the transit-oriented development strategy and its extended concepts and guidelines: the basic TOD concept, the concept of multimodal transportation, the concept of multimodal transit hub, and TOD 202 guidelines.

Figure 1. Transit-Oriented Development (TOD) concept, from Institute for Transportation & Development Policy 2016.

1.2 TOD Concept

"Transit Oriented Development is a fast growing trend in creating vibrant, livable, sustainable communities. Also known as TOD, it is the creation of compact, walkable, mixed-use communities centered around a ***transit station****. This makes it possible to live a lower-stress life without complete dependence on a car for mobility and survival. Transit oriented development*

is regional planning, city revitalization, suburban renewal, and walkable neighborhoods combined. TOD is rapidly sweeping the nation with the creation of exciting people places in city after city. The public has embraced the concept across the nation as the most desirable places to live, work, and play. Real estate developers have quickly followed to meet the high demand for quality ***urban places served by rail systems****. Transit oriented development is also a major solution to the serious and growing problems of climate change and global energy security by creating dense, walkable communities that greatly reduce the need for driving and energy consumption. This type of living arrangement can reduce driving by up to 85%."* (Transit Oriented Development Institute)

1.3 Concept of Multimodal Transportation

"Multimodal transportation refers to the network of airports, seaports, roads, rails, transit systems, and walkways that are integrated to form a seamless system for moving people and freight from point A to point B" (Virginia Performs 2016).

Figure 2. Multimodal transportation concept from Eltis 2016

The term “multimodal transportation” evolved from “multimodal transport,” which refers to the carriage of goods by two or more modes of transport, as defined by the United Nations Economic Commission for Europe (ECE). Over time, multimodal transport further evolved into multi-modalism.

Before the advent of the car, cities were transit oriented, not yet knowing the impact of the automobile. “In recent years, transportation planning has expanded to include more of an emphasis on non-automobile modes and more consideration of factors such as environmental impacts and mobility for non-drivers.” (Litman 2014).

Today, both developed Western countries and developing countries and regions are widely implementing multimodal transportation projects in their transit systems. Many cities (including, among others, Singapore, Tokyo, Paris, and New York) have shifted their attention from conventional transportation to multimodal transportation.

1.4 Multimodal Transit Hub

A multimodal transit hub is a transit hub for different modes of transportation transferring between modes which is similar to products distribution center. The term does not have a clear definition, and its name even varies from country to country. In China, the term “comprehensive transit center” is used. The TOD 202 guideline demonstrates the multimodal transit hub as a station area, defining the typical “station area” as the station’s half-mile radius. A multimodal transit hub could include airports, train stations, bus stations, public spaces, parking areas, pedestrian pathways, cyclists’ circulations, taxi cabs, shuttles, and other forms of transportation.

1.5 TOD 202

TOD 202 is a guidebook created by the Reconnecting America organization. It details “seven TOD place types” (TOD 202 Guidebook) and helps to establish transit hub-area planning principles for practitioners.

Seven TOD place types:

Regional Center

Urban Center

Suburban Center

Transit Town Center

Urban Neighborhood

Transit Neighborhood

Special Use/Employment District

Mixed-Use Corridor

As a planner, knowing how to define a TOD place type is a crucial step toward laying out the station area design for a targeted site using TOD strategy. The TOD 202 guidebook provides checklists for practitioners to easily define place types in order to give appropriate recommendations for cities with different scales and features. “Many different types of station areas share similar characteristics. These similarities can help planners, citizens, and elected officials quickly and easily understand key planning considerations and what to expect in terms of the character, role and function of the places that will be created.” (TOD 202 Guidebook)

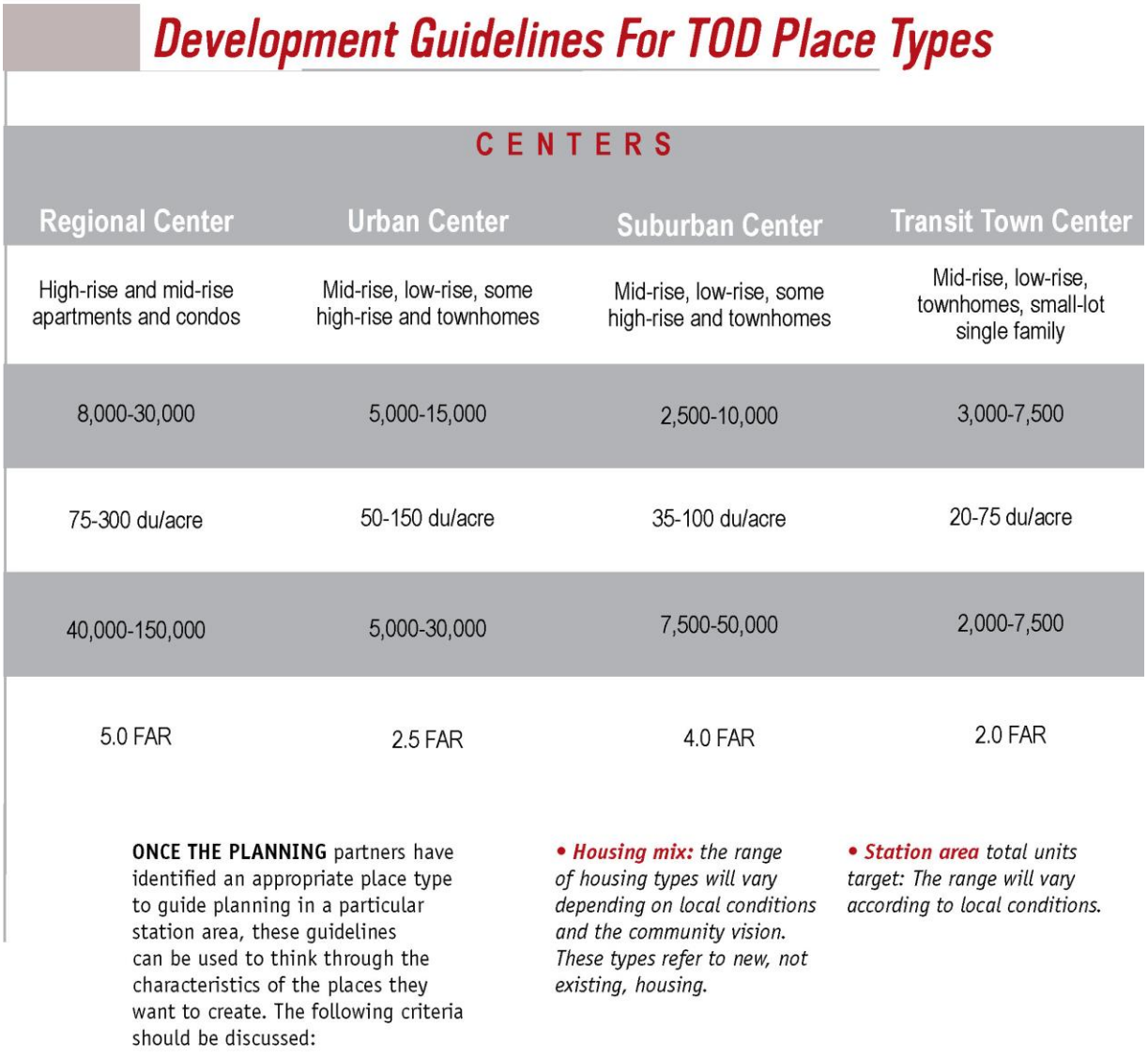
How To Identify A TOD Place Type

CENTERS			
Regional Center	**Urban Center**	**Suburban Center**	**Transit Town Center**
Primary center of economic and cultural activity	Significant center of economic and cultural activity with regional-scale destinations	Significant center of economic and cultural activity with regional-scale destinations	Local center of economic and community activity
All modes	All modes	All modes	Commuter rail, local/regional bus hub, light rail
< 5 minutes	5-15 minutes	5-15 minutes	15-30 minutes
High-density mix of residential, commercial, employment, and civic/ cultural uses	Moderate- to high-density mix of residential, commercial, employment, and civic/cultural uses	Moderate- to high-density mix of residential, commercial, employment and civic/cultural uses	Moderate-density mix of residential, commercial, employment and civic/cultural uses
Regional-serving destination-retail opportunity; need for local-serving retail	Regional-serving destination-retail opportunity; need for local-serving and community-serving retail	Regional-serving destination-retail opportunity; need for local-serving and community-serving retail	Community-serving and destination-retail opportunity; need for local-serving retai
Integrating dense mix of housing and employment into built-out context	Integrating high-density housing into existing mix of housing and employment to support local-serving retail	Introducing housing into predominantly employment uses and improving connections/access to transit	Increasing densities while retaining scale and improving transit access
Downtown San Francisco and Boston, Chicago's Loop, Midtown Manhattan, downtown Denver	Rosslyn-Ballston Corridor outside Washington D.C.; downtown Baltimore; Hoboken, New Jersey; Houston's Medical Center	Lindbergh City Center in Atlanta; Evanston, Illinois; Addison Circle outside Dallas; Stamford, Connecticut;	Prairie Crossing in Grayslake outside Chicago; Suisun City in the San Francisco Bay Area; Roslindale Village and Winchester outside Boston

Figure 3. Identifying a TOD place type from TOD 202 guideline-station area planning

DISTRICTS			CORRIDOR
Urban Neighborhood	Transit Neighborhood	Special Use/ Employment District	Mixed-Use Corridor
Predominantly residential district with good access to regional and subregional centers	Predominantly residential district organized around transit station	Local focus of economic and community activity without distinct center	Local focus of economic and community activity without distinct center
Heavy rail, LRT/streetcar, BRT, commuter rail, local bus	LRT/streetcar, BRT, commuter rail, local bus	LRT/streetcar, BRT, potentially heavy rail	LRT/streetcar, BRT, local bus
5-15 minutes	15-30 minutes	15-30 minutes	5-15 minutes
Moderate- to high-density residential uses with supporting commercial and employment uses	Low- to moderate-density residential uses with supporting commercial and employment uses	Concentrations of commercial, employment and civic/cultural uses, potentially with some residential	Moderate-density mix of residential, commercial, employment and civic/cultural uses
Primarily local-serving retail opportunity; need for some community-serving retail	Primarily local-serving retail opportunity	Potential for community- and regional-serving retail but need to balance demands for access	Primarily local-serving retail opportunity; need for some community-serving retail
Expanding local-serving retail opportunities and increasing high-density housing	Integrating moderate-density housing and supporting local-serving retail	Creating sustainable off-peak uses and accommodating peak travel demand	Expanding local-serving retail opportunities and high-density housing opportunities
Fruitvale in Oakland, Greenwich Village in New York City, the Pearl District in Portland, University City in Philadelphia	Ohlone-Chynoweth outside San Jose; Plano, Texas; Barrio Logan in San Diego; Capitol Hill in Washington D.C.	South of Market in San Francisco, Camden Station in Baltimore, South Waterfront in Portland	International Boulevard in Oakland, Washington Street in Boston, University Avenue in St. Paul, Minnesota

Figure 4. Identifying a TOD place type from TOD 202 guideline-station area planning



Development Guidelines For TOD Place Types

CENTERS

Regional Center	Urban Center	Suburban Center	Transit Town Center
High-rise and mid-rise apartments and condos	Mid-rise, low-rise, some high-rise and townhomes	Mid-rise, low-rise, some high-rise and townhomes	Mid-rise, low-rise, townhomes, small-lot single family
8,000-30,000	5,000-15,000	2,500-10,000	3,000-7,500
75-300 du/acre	50-150 du/acre	35-100 du/acre	20-75 du/acre
40,000-150,000	5,000-30,000	7,500-50,000	2,000-7,500
5.0 FAR	2.5 FAR	4.0 FAR	2.0 FAR

ONCE THE PLANNING partners have identified an appropriate place type to guide planning in a particular station area, these guidelines can be used to think through the characteristics of the places they want to create. The following criteria should be discussed:

- ***Housing mix:*** *the range of housing types will vary depending on local conditions and the community vision. These types refer to new, not existing, housing.*
- ***Station area*** *total units target: The range will vary according to local conditions.*

Figure 5. Development guidelines for TOD place types from TOD 202 guideline-station area planning

DISTRICTS			CORRIDOR
Urban Neighborhood	Transit Neighborhood	Special Use/ Employment District	Mixed-Use Corridor
Mid-rise, low-rise, townhomes	Low-rise, townhomes, small-lot single family, and some mid-rise	Limited residential potential; mid-rise and high-rise if appropriate	Mid-rise, low-rise, townhomes, with small-lot single family off the corridor
2,500-10,000	1,500-4,000	2,000-5,000	2,000-5,000
40-100 du/acre	20-50 du/acre	50-150 du/acre	25-60 du/acre
NA	NA	7,500-50,000	750-1,500
1.0 FAR	1.0 FAR	2.5 FAR	2.0 FAR

• ***Net project density:*** *The range should include several housing types. Local market conditions will determine densities and design.*

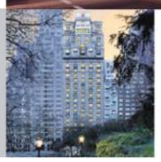
• ***Station area total*** *jobs target: The market for employment uses will determine the potential for jobs. The targets can help determine the amount of land devoted to each use.*

• ***Minimum FAR:*** *The floor area ratios provide a baseline for the development of employment and help determine the appropriate mix of building types.*

Figure 6. Development guidelines for TOD place types from TOD 202 guideline-station area planning

A TOD Residential Building Typology

RESIDENTIAL TYPES

Net Density (Target)	Characteristics	Construction Type	Parking Configuration	
8-20 du/acre (15 du/acre)	Small lots (max 6,000 sf), 2-3 stories with detached units, direct entry from street with potential for secondary units	Type V (max 3 stories/35 feet)	Individual garage/ driveway and on-street	
12-40 du/acre (30 du/acre)	2-4 stories with attached units, direct entry from street, units can be paired with flats for increased density	Type III/V (max 4 stories/50 feet)	Tuck-under garage/ driveway and on-street	
20-75 du/acre (55 du/acre)	2-4 stories with apartments/condos, single- or double-loaded corridors with lobby entrance, off-street parking in surface/structure	Type III (max 4 stories/50 feet)	Tuck-under garage or surface parking lot, potential for structured parking	
50-150 du/acre (110 du/acre)	4-6 stories with apartments/condos, single- or double-loaded corridors with lobby entrance, off-street parking structure/below grade	Type I/III (max 5 stories/65 feet)	Ground floor podium/sub-grade or elevated structure	
75+ du/acre	7+ stories, usually with base and point tower, single- and double-loaded corridors with lobby entrance, off-street parking in structure or below grade	Type I/II (max 12 stories/120 feet/no limits on Type I)	Off-street parking in structure or below grade	

Note: *In both charts "Construction Type" refers to categories of fire protection that govern construction in the Uniform Building Code. "Type I" refers to structures of concrete and/or steel; "Type II" refers to structures of load-bearing masonry and/or steel; "Type III" refers to structures of load-bearing masonry, steel and/or wood; and "Type V" refers to wood structures.*

Figure 7. A TOD building typology from TOD 202 guideline-station area planning

A TOD Mixed Use/Employment Building Typology

	Net Density	Characteristics	Construction Type	Parking Configuration	
MIXED USE TYPES	40-90 du/acre	3-6 stories with apartments, single- or double-loaded corridors with lobby entrance, off-street parking in structure or below grade	Type I/III (max 6 stories with building code modification/65 feet)	Groundfloor podium/ subgrade or elevated structure	
	60+ du/acre	7+ stories, usually with base and point tower, single- or double-loaded corridors with lobby entrance, off-street parking in structure or below grade	Type I/II (max 12 stories/120 feet/no limits on Type 1)	Off-street parking in structure or below grade	
EMPLOYMENT TYPES	0.5-2.5 FAR	1-3 stories with lobby entrance to upper floors; retail, office or mixed-use with mix of tenant types, including limited large-footprint retail uses; parking in surface lots or structures	Type III/IV/V (max 4 stories/65 feet)	Off-street parking in groundfloor podium or surface	
	2.0-5.0 FAR	3-7 stories, with lobby entrance to upper floors, office with potential groundfloor retail, parking in structure or below grade	Type I/II (max 12 stories/160 feet)	Off-street parking in structure or below grade	
	4.0+ FAR	6+ stories with lobby entrance to upper floors sometimes with point tower over base, office with potential groundfloor retail, parking in structure or below grade	Type 1 (no limits)	Off-street parking in structure or below grade	
	varies	schools, civic uses, stadiums, hospitals, other entertainment uses; range of densities and sizes; parking often in structures or below grade	Varies	Parking often in structures or below grade	

Figure 8. A TOD mixed-use/employment building typology from TOD 202 guideline-station area planning

A TOD Open Space Typology

OPEN SPACE TYPES

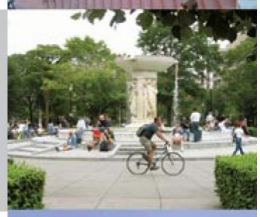
Size	Characteristics	
0.1-0.5 acres	Small open space adjacent to the station; can be linear or with a defined center; primarily hardscape amenities for riders; used to support station access and passive recreation	
0.1-1.0 acres	Small open space, usually close to buildings; primarily hardscape with some landscaping; primarily passive recreation	
0.1-2.0 acres	Small open space, often separated from buildings by a roadway; primarily landscaped with some hardscape; primarily passive recreation	
1.0-5.0 acres	Medium-sized open space, usually separated from buildings by a roadway; mix of landscape and hardscape; mix of active and passive recreation	
varies	Large open space as part of a trail system or network of parks; primarily landscaped; primarily active recreation	

Figure 9. A TOD open space typology from TOD 202 guideline-station area planning

To design a successful multimodal station, planners must take into account potential access and circulation problems, as well as place-making considerations and the public infrastructure. An examination of TOD 202 makes clear that a station's TOD plan should contain certain key components:

Streets:

- Safety is the priority.
- Use narrow travel lanes and slow speed limits.
- Provide more alternative modes of transportation.
- Incorporate bike and pedestrian access.

Public spaces:

- Create more plazas or parks.
- Develop community programs to involve people.
- Consider designing standard-streets signage and furniture designs.
- Encourage public art that adds Aesthetic value.

Parking:

- Identify parking demand and supply.
- Consider whether to provide parking.
- Provide bicycle parking facilities.

Connectivity:

- Identify key pedestrian corridors.
- Create bicycle networks.
- Design intermodal facilities.

Study of the TOD 202 guidebook helps determine preferred station area design layouts:

Station layout comparison:

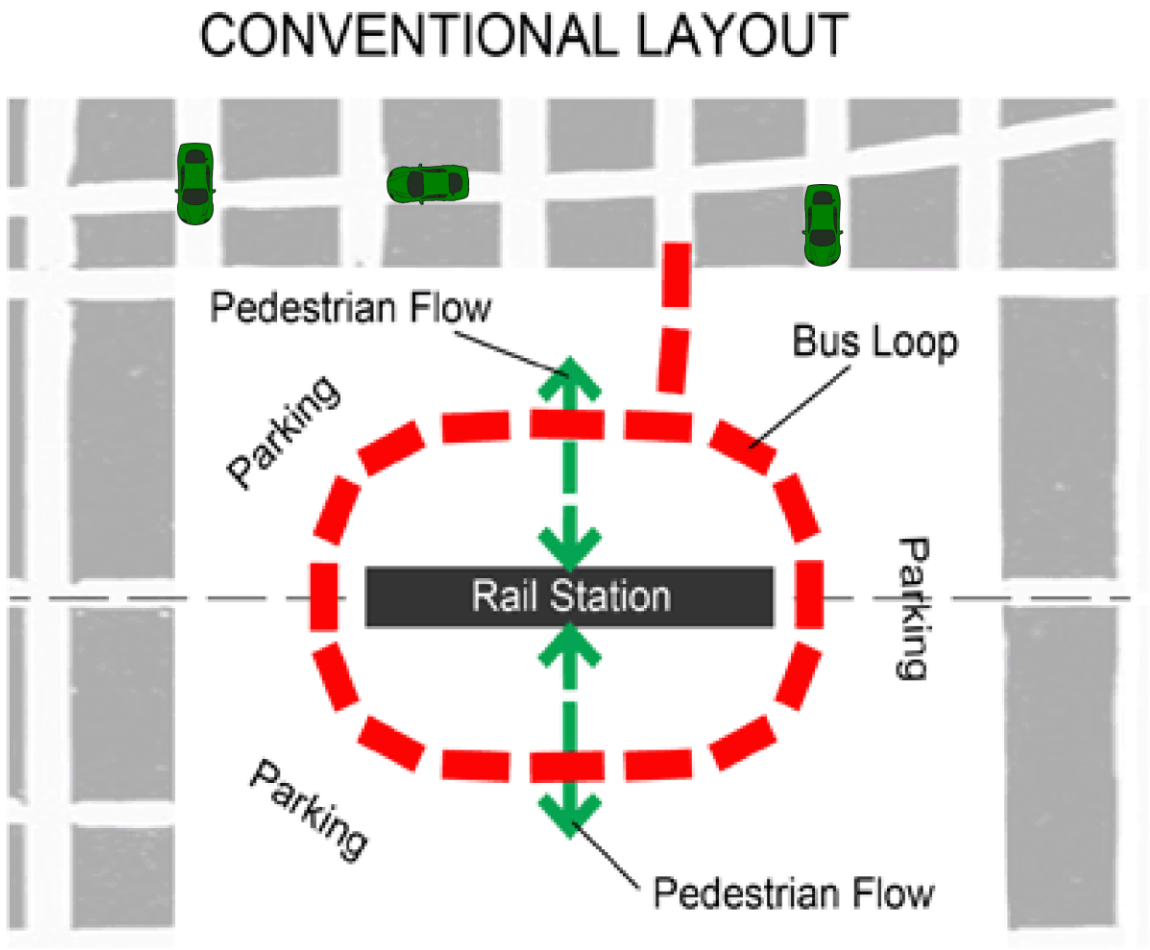


Figure 10. A TOD station area, conventional layout from transit oriented development organization

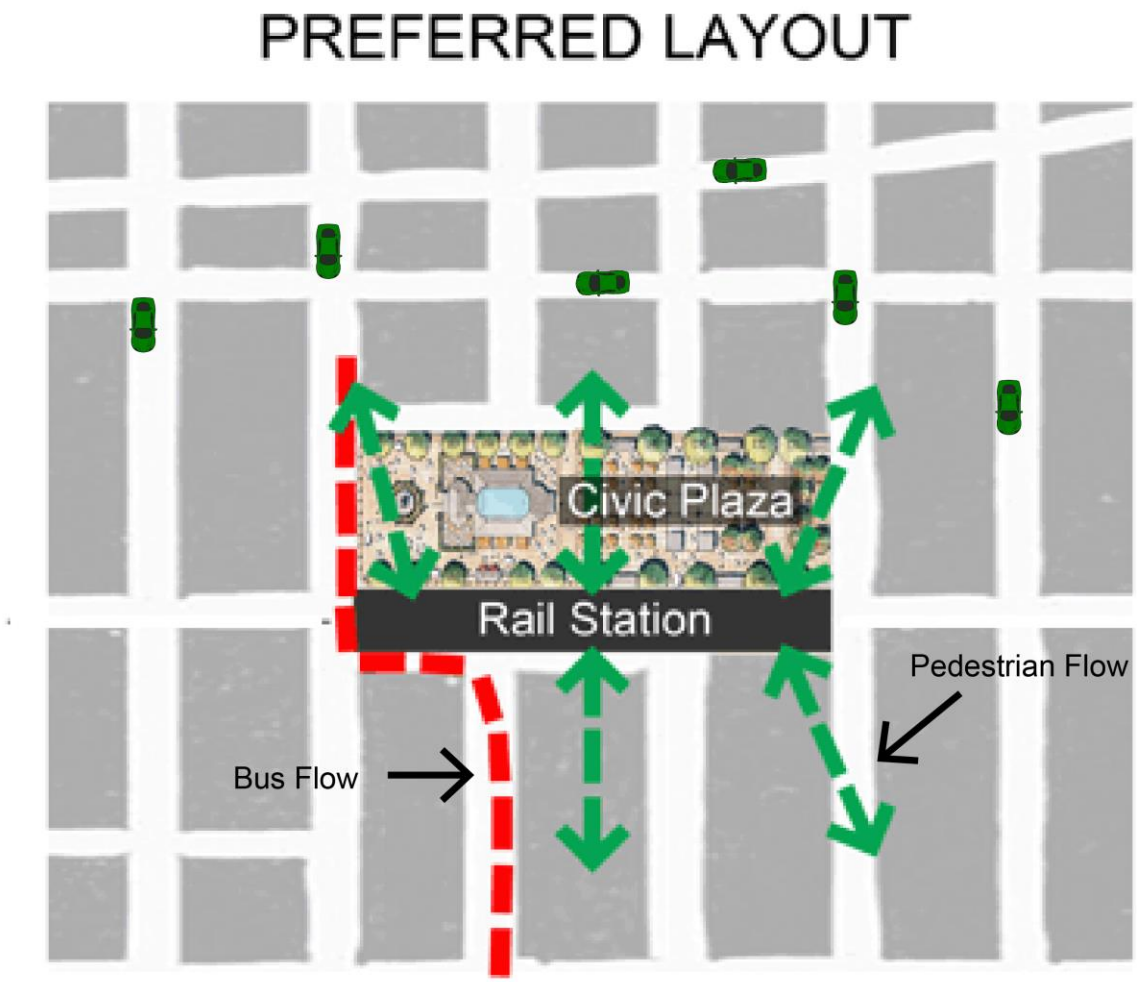


Figure 11. A TOD station area, preferred layout from transit oriented development organization

Conventional station:

A conventional layout isolates the station from the city center. Such stations are only accessible via buses or cars. Features of such stations include:

- No pedestrian friendly access.
- No connection with city or urban center.
- No public space.

- No cafes and retail space.

Preferred station:

- seamlessly integrated into the city center
- station modeled after downtown rail stations
- provides a pleasant, lively walking experience
- easily accessible for pedestrians
- rrioritizies safety
- reduces vehicle traffic
- develops commercial spaces and retail stores

CHAPTER 2

INTRODUCTION TO THE PROBLEM

The United States is implementing TOD strategies in its cities nationwide. However, it is quite hard to integrate land use with transportation systems as Developers see the opportunity to make more profit through building more condos and apartments around popular areas developers see an opportunity to maximize profit by building condos and apartments in high-demand areas. At the same time, transportation departments have a vision of enhancing road networks, but have a limited perception of how to fill that vision while connecting different kinds of transportation modes. In other words, neither of these authorities addresses the problem of connectivity; they lack a core center, a hub, or a station to bind transit modes together and create the surrounding for the station.

2.1 Case background: City of Athens

As a student in the environmental planning program at the University of Georgia, I saw this problem of lack of center firsthand in Athens. My studies in the program involved numerous studio studies and charrettes. Athens, the county seat of Athens-Clarke County and an important regional core center. is located 50 miles east of Atlanta. As of the 2015 population estimates, the county had a total population of about 123,000. In 2010, it had 129,000 total population, show obvious rapid growth for the city in a five year span. Athens has been trying to attract people to use alternative transportation by introducing more pedestrian and cyclist-friendly trails and roads,

but it has not been an easy transition. As a student, I took buses and walked to class and from my time on public transit I was able to see problems in terms of connectivity.

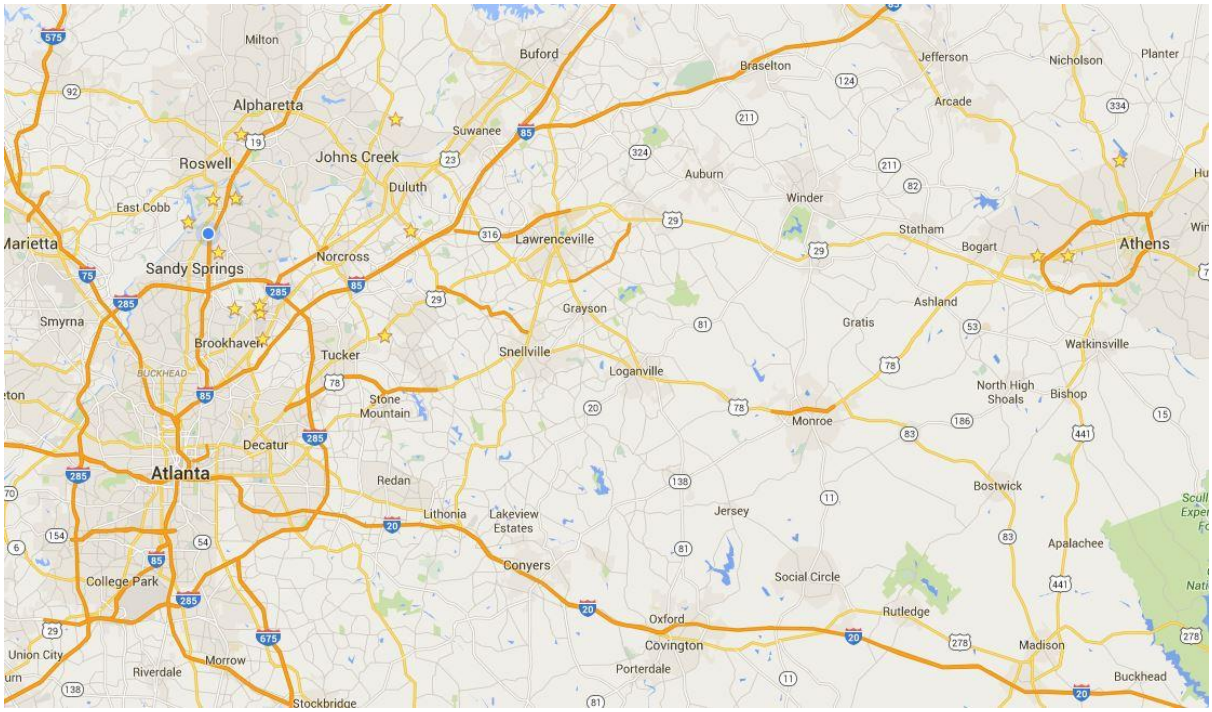


Figure 12. Athens location map from Google Maps

2.2 Study area and Delimitating-what exists

The design of this thesis is limited to an area of downtown Athens. This study area is located in downtown Athens' "East End." in an area bounded by Willow, East Broad, and Foundry Streets, with a transmission line at its north end. It is used as a multimodal center for people to take the local Athens and university buses, taxis, and regional buses. Thus, the area plays a significant role in downtown Athens. Within the perspective of the Downtown Athens Master Plan, it will use light rail to connect the major transportation corridor both regionally and locally.

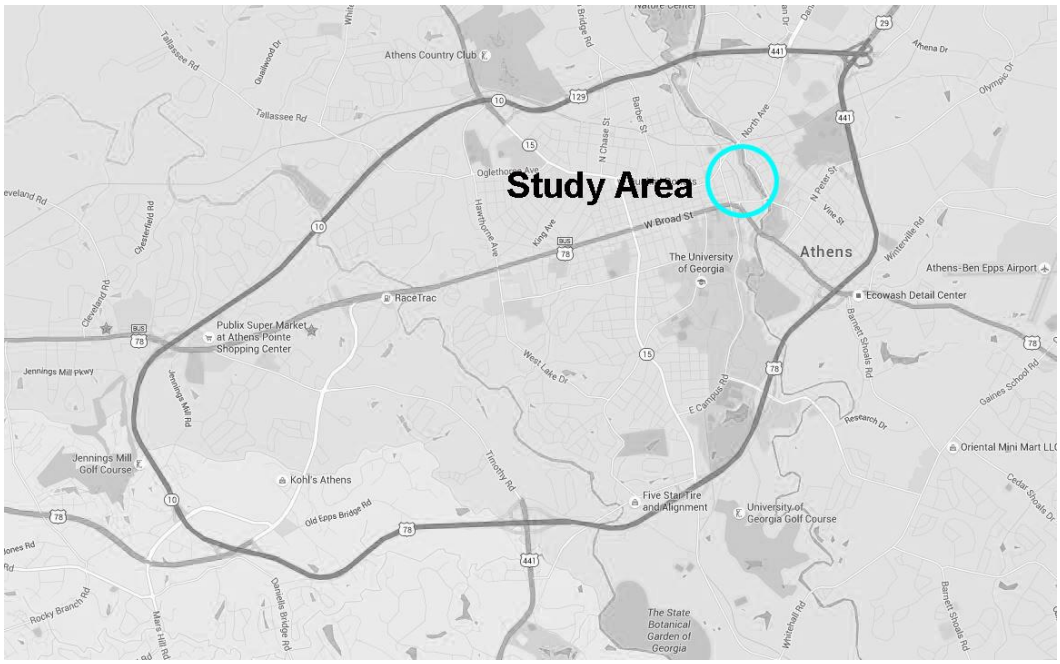


Figure 13. Athens location map from google map

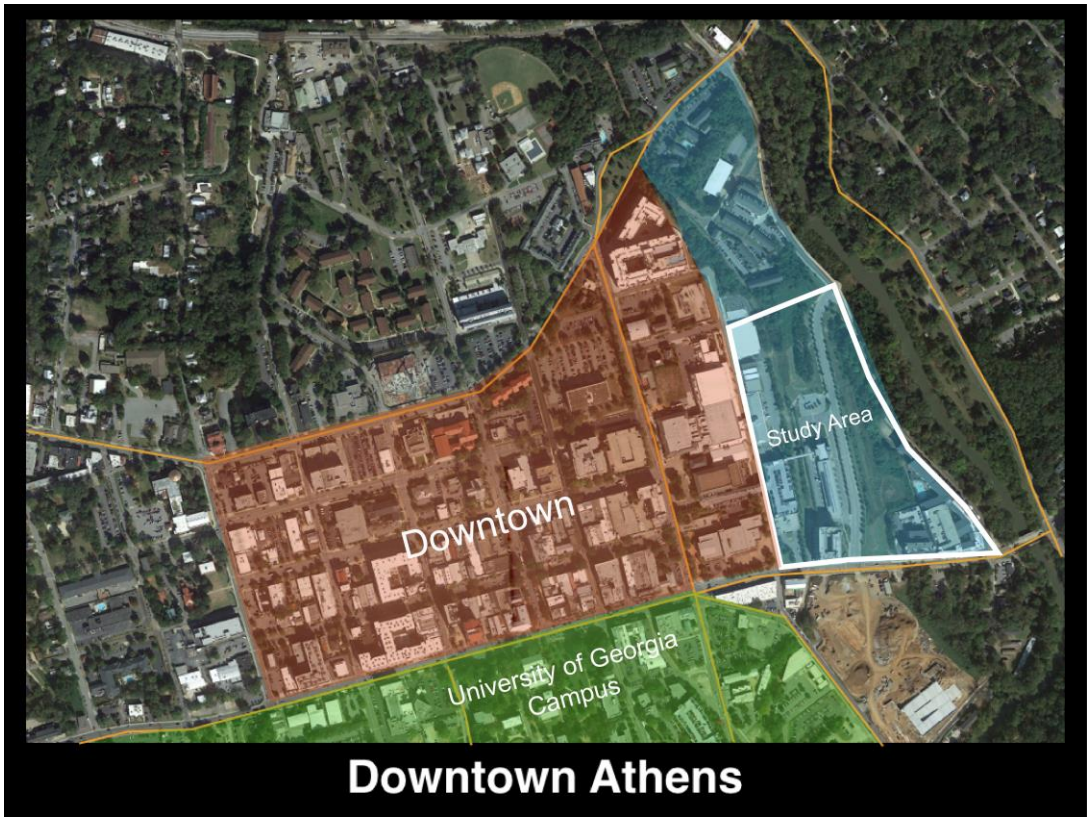


Figure 14. Athens Land use. Copy right: QI LI

This site is surrounded by residential and commercial developments. The University of Georgia main campus sits south of the study area within a half mile. Athens city zoning by-laws currently designate the site as “Government (G)”.

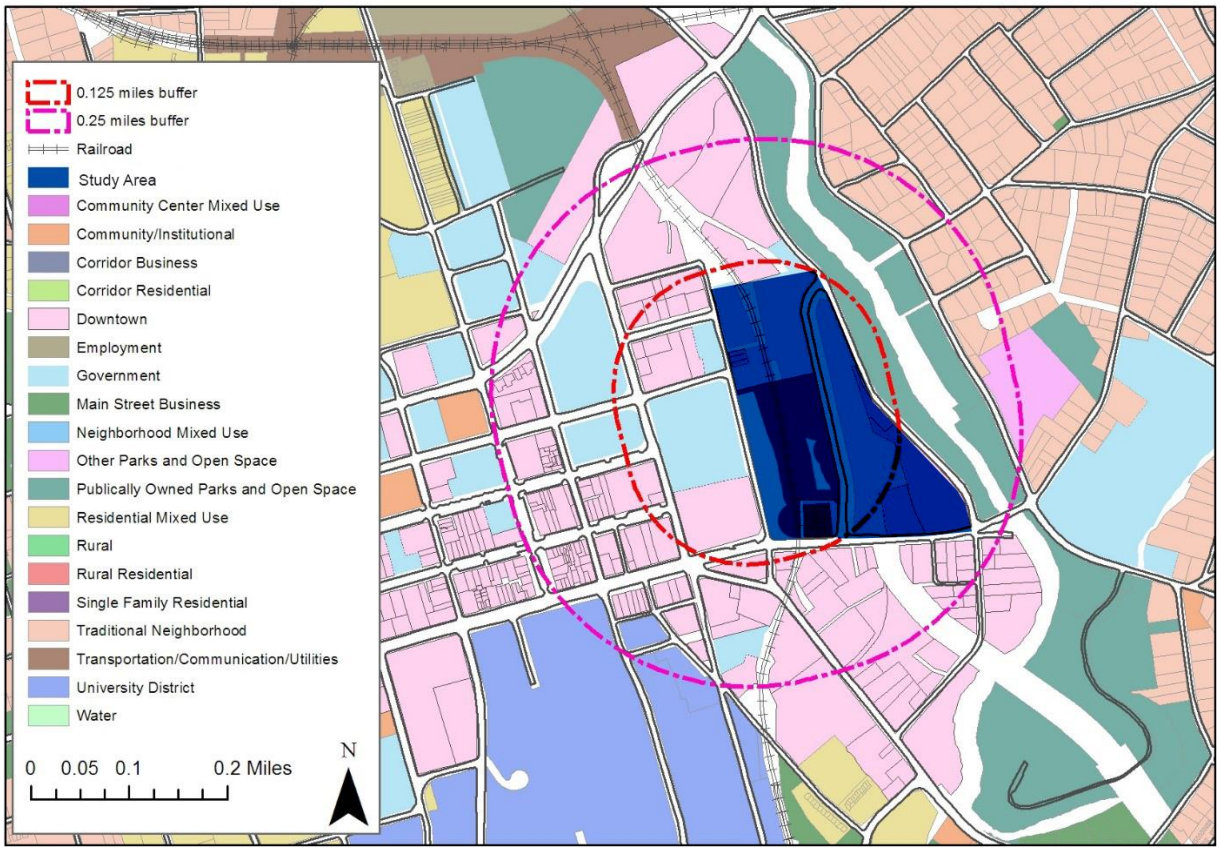


Figure15. Athens Land use map with 0.25 mile and 0.125 mile buffers, Copy right: QI LI

Figure 16. Existing Multimodal center site context picture, Copyright: QI LI

I will explain the current site conditions from five different aspects: pedestrian, cycling, vehicular, destinations, and landmarks

Pedestrian context:

The pedestrian road system around the site is not perfect, although most of the major roads have sidewalks and are generally quiet. The main issue drawing people away from the area is a steep hillside inhibiting mobility and a lack of lively and active components.

East Broad Street is the major vehicular corridor that connects the local loop and major avenues, and has the highest traffic volume in Athens (the average daily traffic volume is approximately 21,800 vehicles) (Georgia department of transportation). Both sides of the street have sidewalks. A diverse offering of restaurants provides pedestrians with a positive experience.

Foundry Street is the secondary corridor paralleling the east side of downtown Athens. Again, both sides of the street have sidewalks. However, the street lacks interesting elements to create an enjoyable walking experience.

Hickory Street is directly adjacent to the Athens Multimodal Center. This is a two-lane street used mainly for bus transit. Both sides of the street have well-built sidewalks.

Pedestrian access:

Four primary roads provide at least one sidewalk featuring a quite pleasing environment. Hickory Street is the only option for bus access; all buses will theoretically stop at the multimodal station to pick up and drop off passengers. This road's traffic flow is fairly low (the average daily traffic volume is approximately 6,000 vehicles).

- East Broad Street
- Foundry Street

These three streets will be the predominant corridors connecting the transit hub from the pedestrians' perspective.

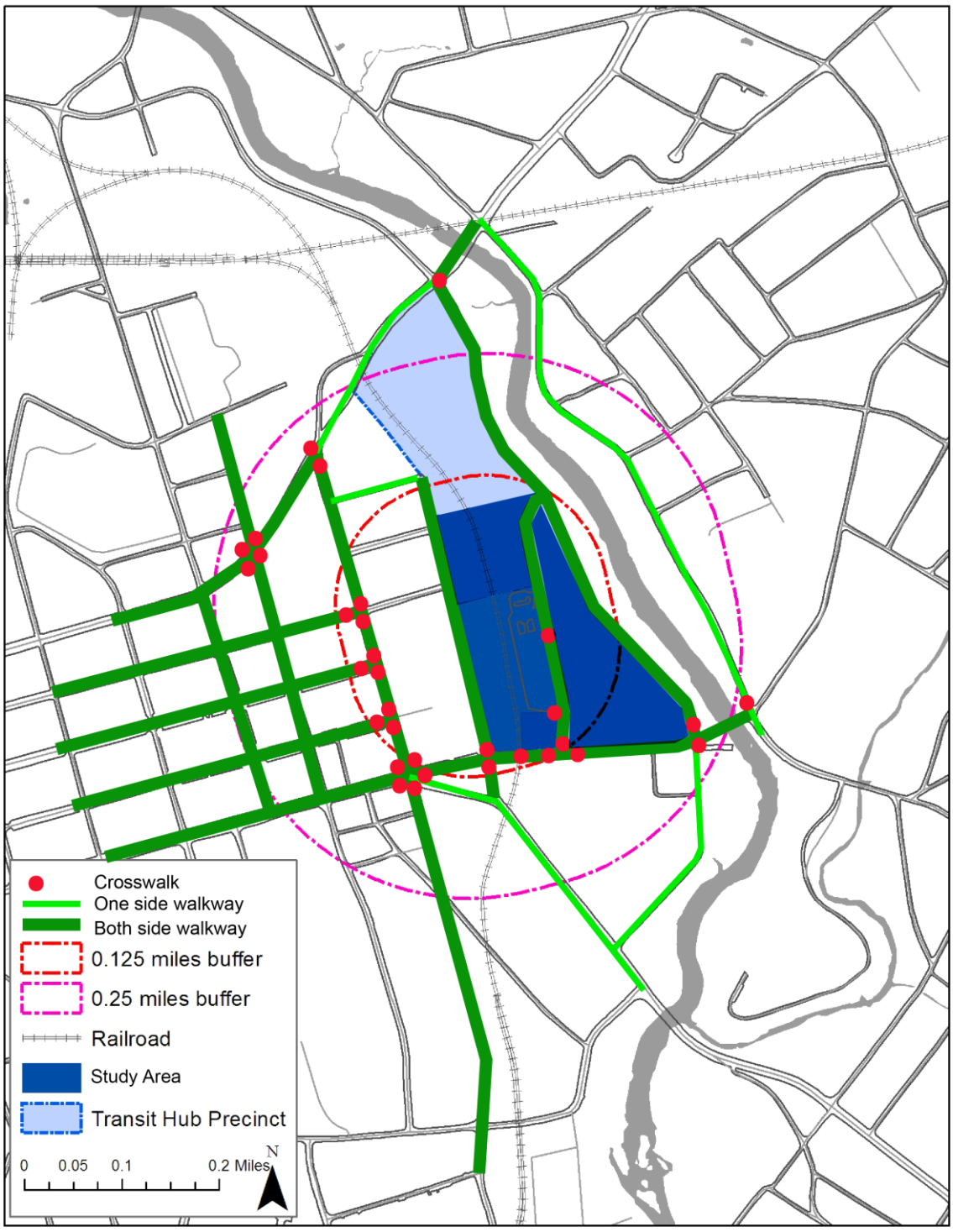


Figure 17. Multi-modal Center site pedestrian map, Copyright: QI LI

Cycling context:

Cycling is still on the rise in Athens, and it has been named a cyclist-friendly city. In 2001, Athens approved the Bike Master Plan (BMP) for the city, with a planning horizon extending to the year 2020. Over sixteen bicycle routes were proposed to improve Athens' cycling facilities and connectivity. These routes will establish a major cycling corridor connecting the University of Georgia and downtown Athens. In the future, the multimodal transportation hub will further extend the connectivity of this network to the surrounding region.

The future multimodal transit hub will be located on the right side of East Broad Street. The GDOT Statewide Bicycle Route Network also has proposed to use this site as part of its new network.

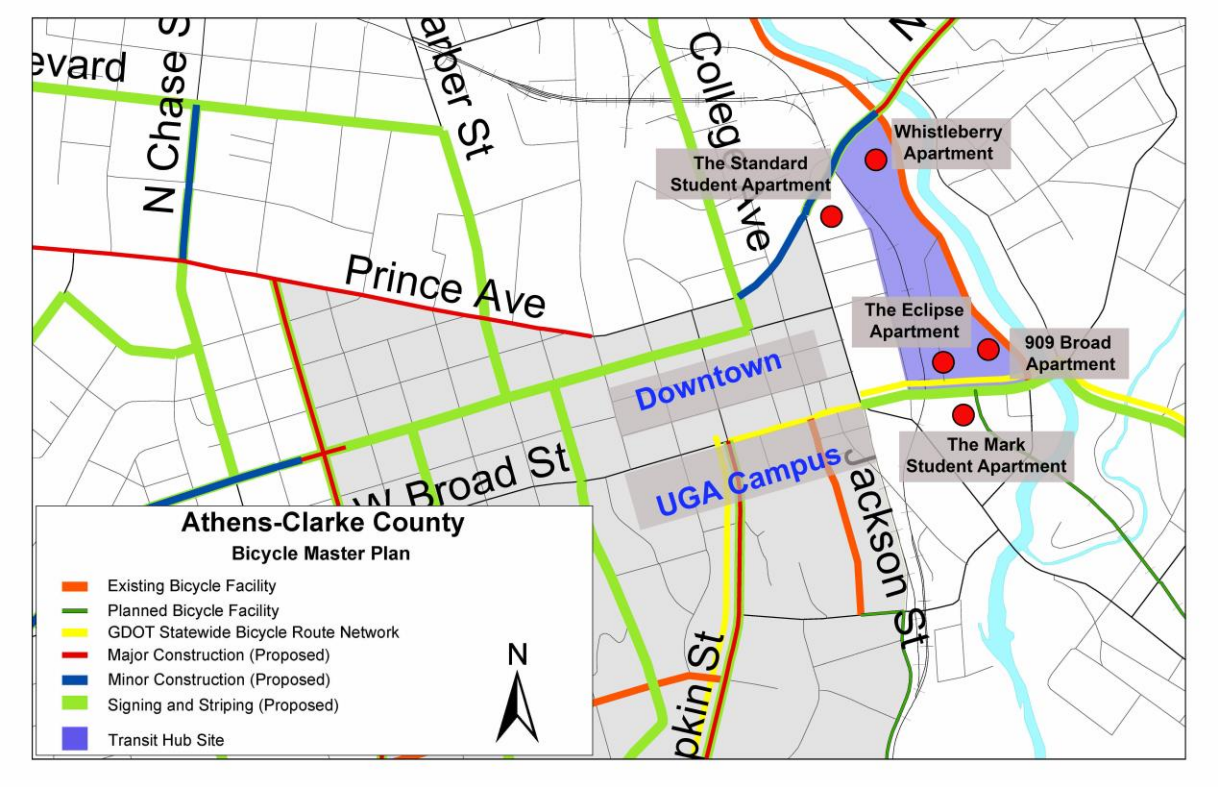


Figure 18. Multimodal center site context map, Copyright: QI LI

Vehicular Context:

The transit hub precinct includes Foundry Street, East Broad Street, and Hickory Street.

Average daily traffic volumes：Data from GDOT traffic counts in Georgia

- East Broad Street/Foundry Street 2014 Average daily traffic volumes (ADTV): 5,580
- East Broad Street 2014 ADTV: 21,800

Currently, East Broad Street carries a high volume of traffic, approximately 22,000 vehicles per day. While the intersection of East Broad Street and Hickory Street carries a relatively low traffic volume, it will increase with the development of the multimodal transit hub.

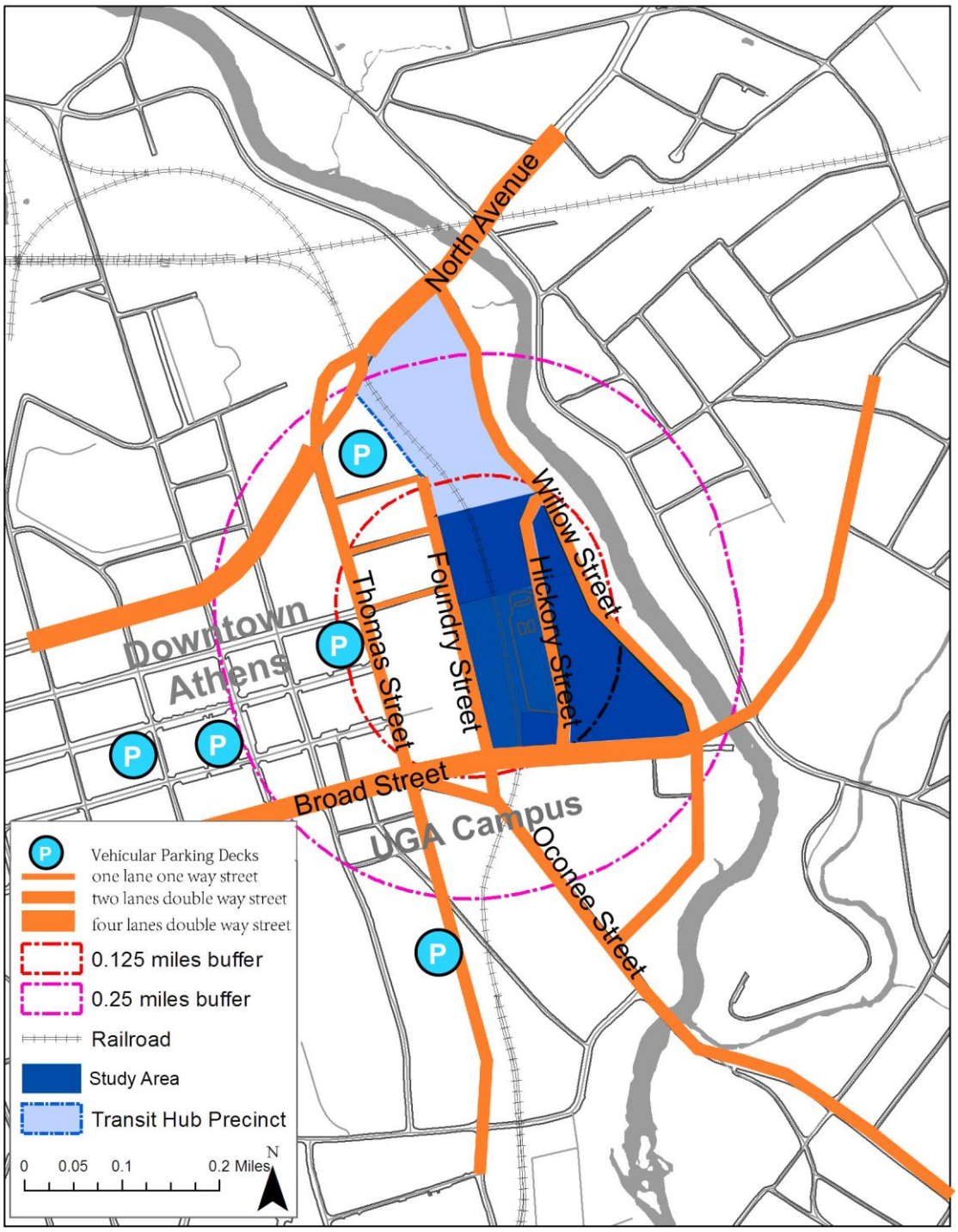


Figure 19. Site vehicular map, Copyright: QI LI

Destinations and landmarks

Destinations and landmarks are taken into consideration, since the station is located in downtown Athens. There are several destinations and landmarks within a half mile walking distance of the station. These include:

- Classic Center: “The Classic Center is northeast Georgia's premier award-winning convention center and performing arts theatre. Located in the heart of downtown Athens, The Classic Center provides unique meeting space, outstanding special events services and a wide range of entertainment options, making this unconventional convention center the choice for conferences, meetings and special events” (Classic center of Athens).
- Amphitheater and Arena: North of the Multimodal Center on the publicly-owned hillside above Hickory Street is the suggested amphitheater site abutting an Arena site that can be developed in stages. The model for this project is the Gerald Ford Amphitheater in Vail Colorado (Crowley 2015).
- North Oconee River Park: North Oconee River Park covers approximately 20 acres between Martin Luther King Parkway and Willow Street (Athens-Clarke county).
- Goddess Athena Statue
- Dudley Park
- The Arch of UGA
- Main Campus of University of Georgia
- Athens City Hall
- The Georgia Morton Theater
- The Performing Arts Center

- More than 100 restaurants and pubs in the downtown
- 6 built or planned hotels in the downtown (3 in the multimodal area)
- The Mark student apartment
- The standard student apartment
- New hotel under construction

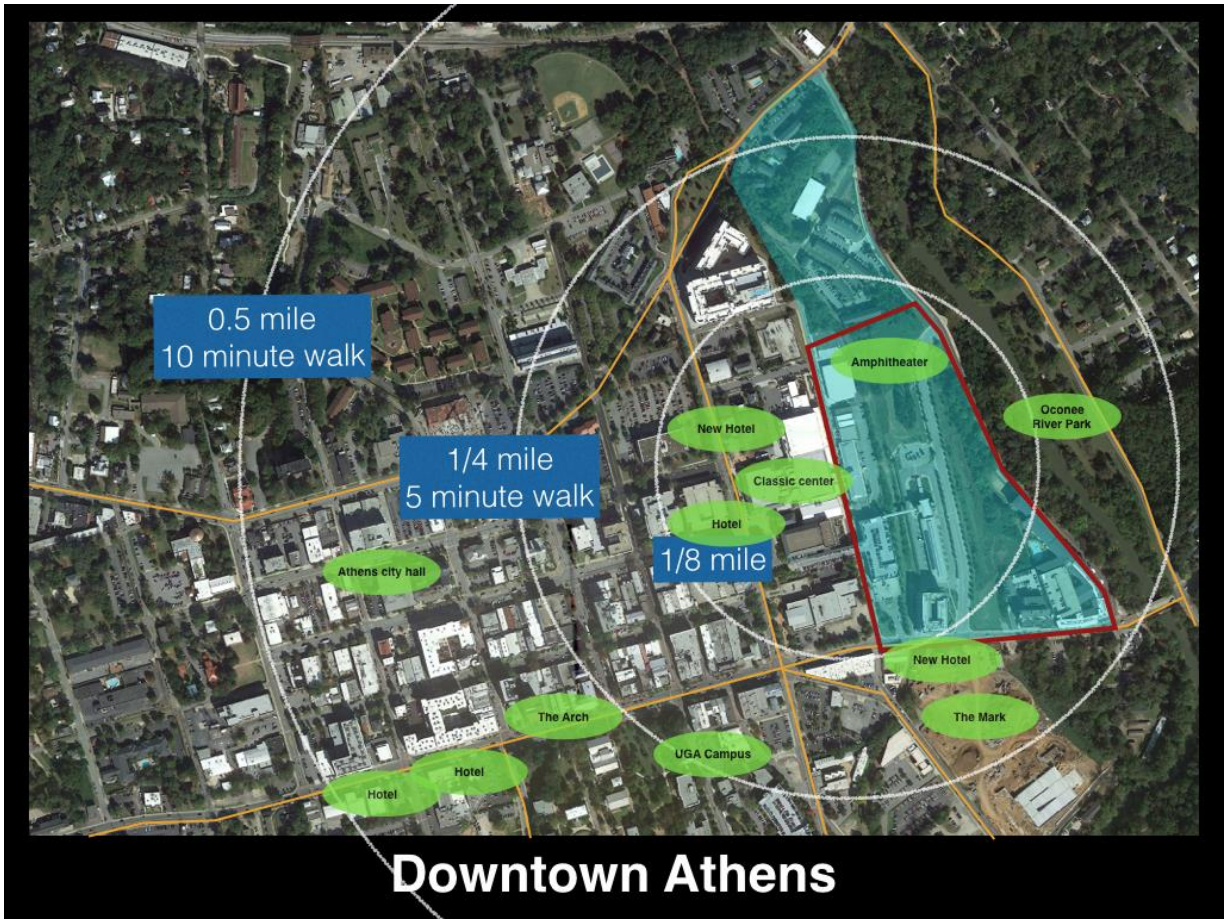


Figure 20. Multimodal center site context map, Copyright: QI LI

2.3 Future plans for Athens-what is proposed

Transportation

Two passenger rail opportunities for downtown Athens and a rail-to-trail Firefly Trail project:

- local light rail system connecting the UGA campus to downtown Athens
- commuter rail connecting Athens to Atlanta, as well as its airports and other major institutions
- Firefly Trail is a planned 39-mile rail-trail from Athens to Union Point in northeast Georgia, connecting Athens-Clarke, Oglethorpe, and Greene Counties
- Campus trail

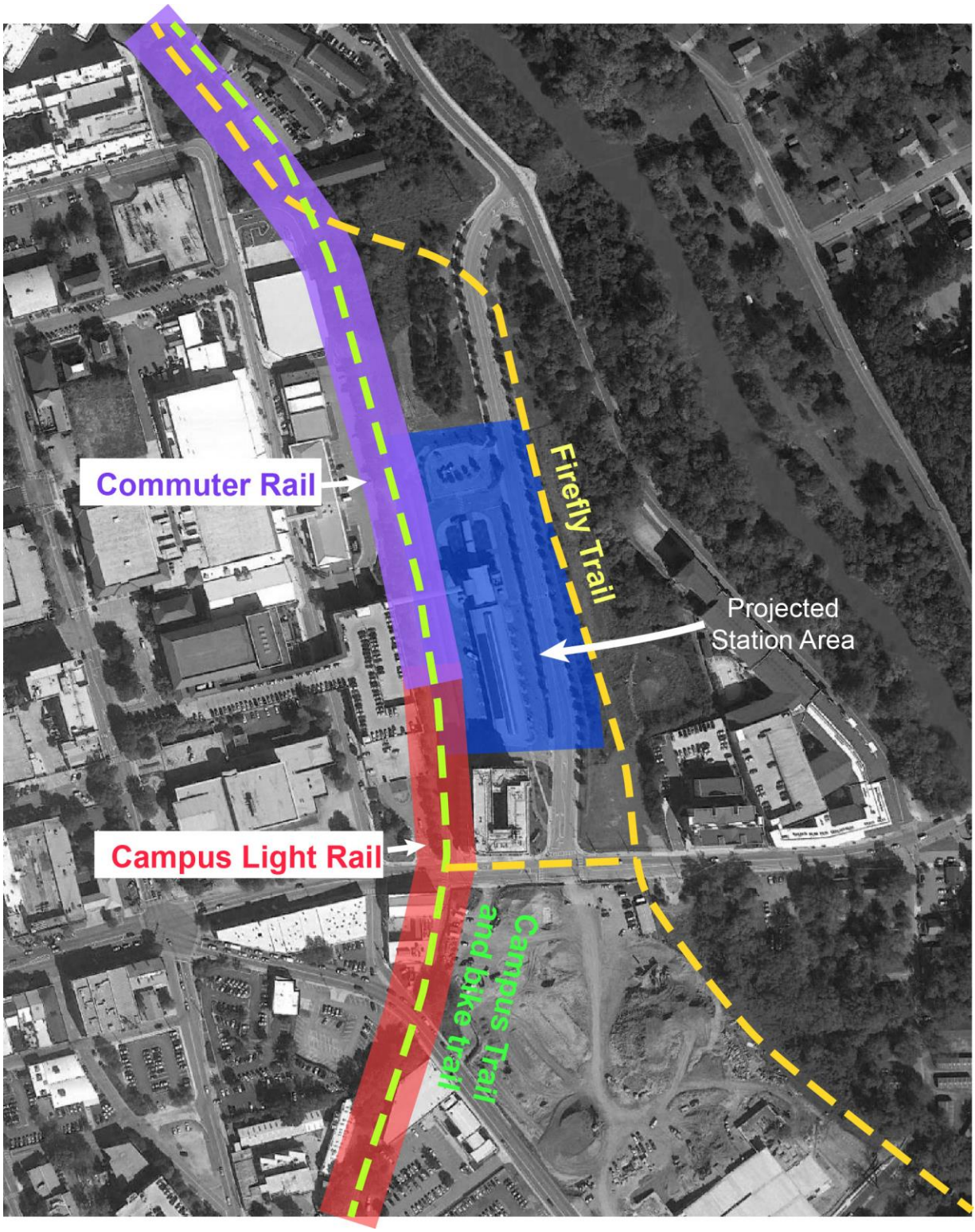


Figure 21. Existing transportation features on study area, Copyright: QI LI

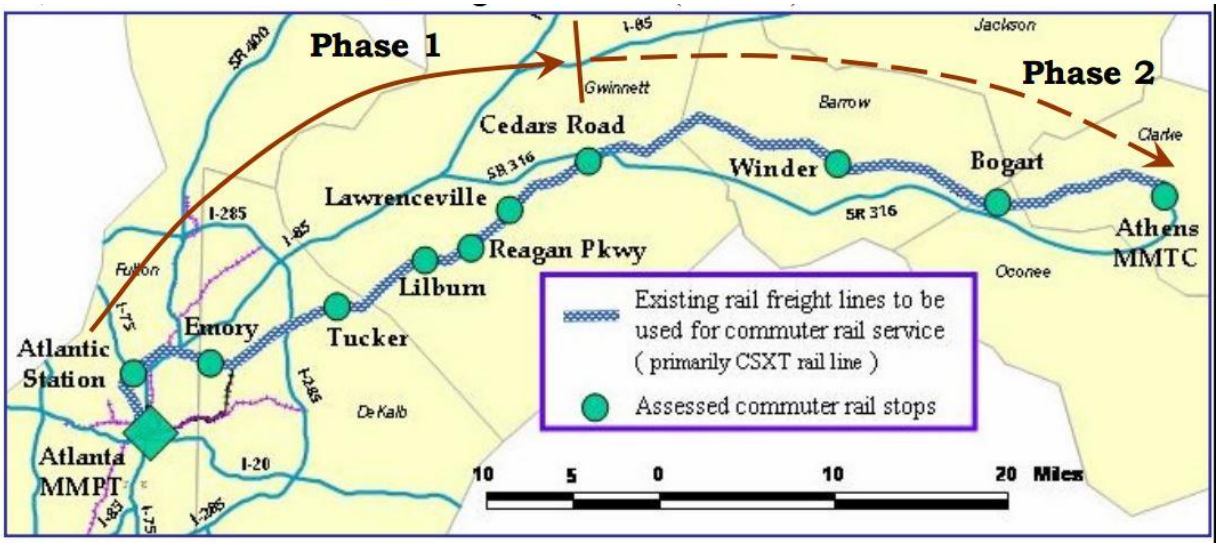


Figure 22. Proposed commuter rail plan, by Georgia Department of Transportation from

Commuter rail overview:

This commuter rail study was conducted by the Georgia Department of Transportation. The rail system is 72 miles long, connecting Athens to Atlanta. It contains eleven stops, including: Winder, Lilburn, Tucker, and Emory University. The line parallels the existing MARTA subway system. According to the report, this railway will have the highest ridership of all Georgia Rail Passenger Program commuter rail lines. "A total of 8,000 trips a day, all of them during peak periods, are projected for 2015, increasing to over 10,600 by 2030"(Georgia Department of Transportation)

Services provided:

- Six round-trip trains a day, five days a week.
- Two trains originating at the Athens Multimodal Transportation Center.
- Four additional trains run to the downtown Atlanta MMPT.
- The service will run within existing railroad right-of-way using existing and new tracks.

Railroad property

"CSXT owns most parts of the railroad right-of-way except for a short part of the rail line in downtown Athens and Atlanta that are owned by Norfolk Southern Corporation" (Georgia Department of Transportation)

Light Rail Overview:

The light rail system is proposed by John Crowley as part of his Athens Downtown Master Plan. This light rail would run from the current downtown Athens Multimodal Center to the University of Georgia campus. This route will provide thousands of students, staff, visitors, and residents a great alternative mode of public transportation.

These two potential future rail systems would make the current Athens multimodal station a core hub for travelers. "The transit site will redevelop the existing Athens multi-modal transportation center. It will constitute the center of the planned Light Rail Transit (LRT) system that will operate between Atlanta and Athens regionally, and between north and south campus locally. Many bus routes will be? reconfigured upon introduction of LRT service in Athens" (Waterloo 2013).

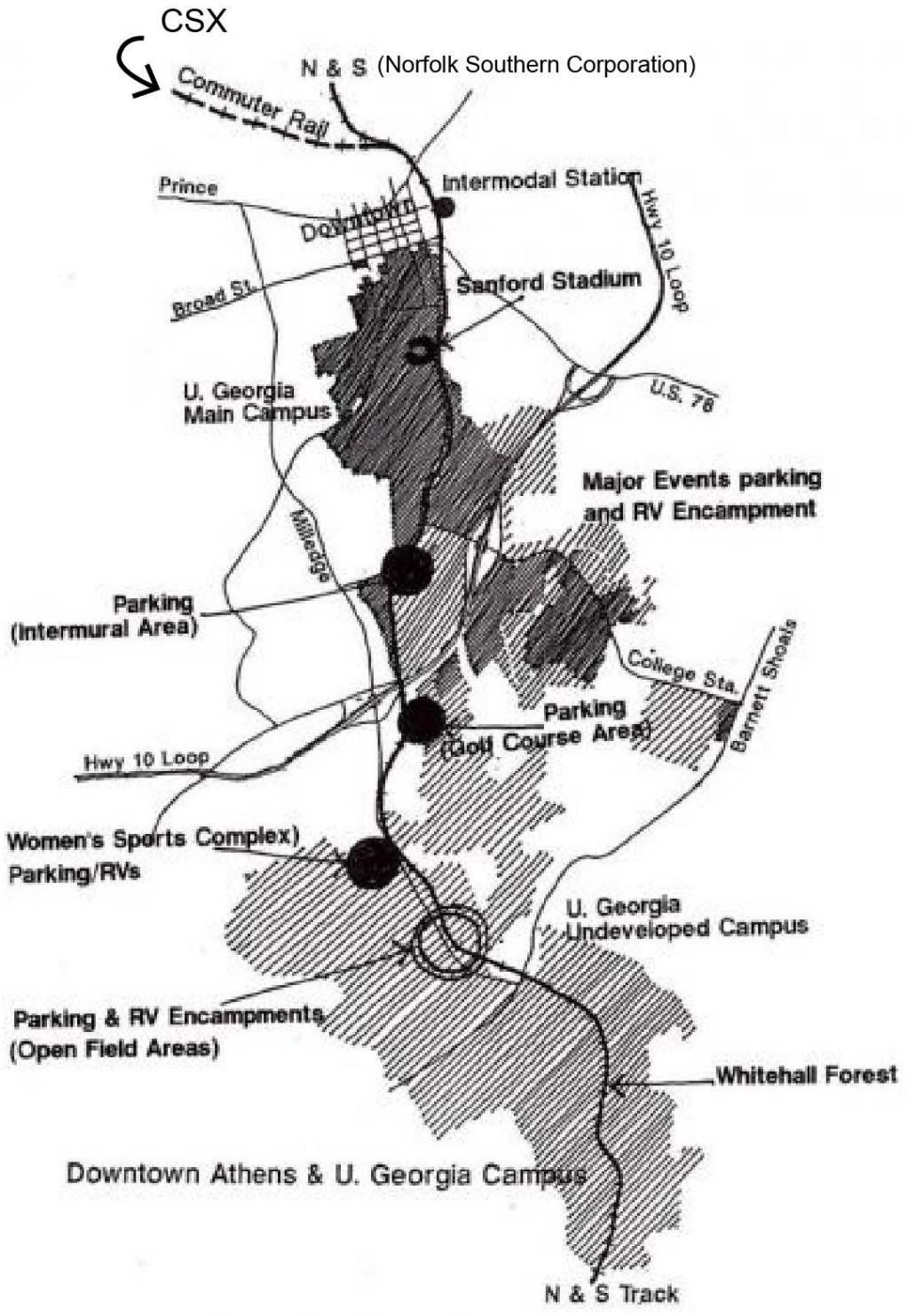


Figure 23. Proposed Athens light rail system from John Crowley

Station surroundings

Revitalization and redevelopment of the Athens downtown has thrived recently. Proposed residential student housing will be adding 1156 beds in total around the station. Three hotels are under construction and an amphitheater has been proposed for improving future entertainment options.

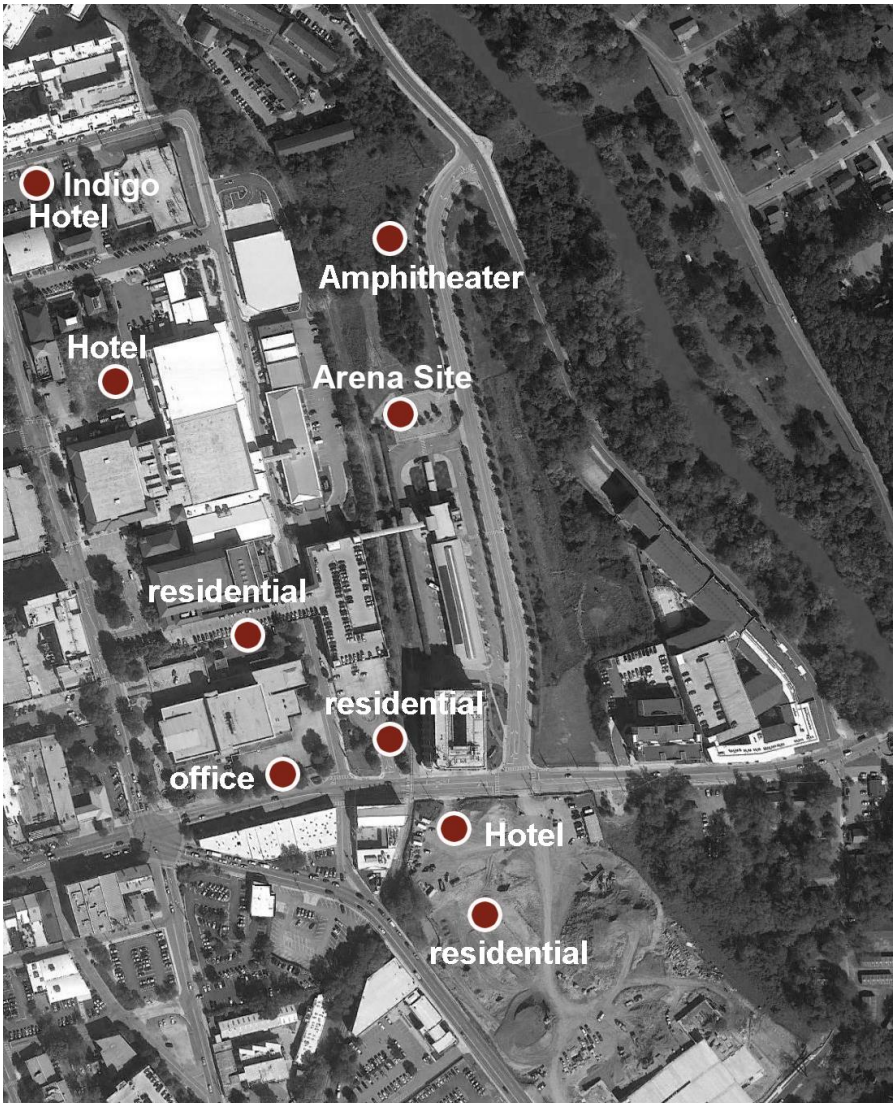


Figure 35. Proposed development for future Athens, Copyright: QI LI

2.4. Problems and challenges:

As I walked around the site, from my personal view I found three major problems, even though Athens has thrived in recent years, and the local transportation department has focused enhancing roads. One problem is the barriers around the station, while another is topographical differences starting from the west side of Athens to the station all the way to the Oconee River. The last problem is the property problem. As this study mentioned in a previous chapter, the station area sits on existing rail track, and the rail track right-of-way belongs to Norfolk Southern Corporation.

It is about 1.7 acres. Therefore getting the property within budget is an uncertain prospect. If we see the station as a center potentially interacting with all directions, the rail track itself becomes a barrier. The Oconee River is considered another barrier because there is no bridge connecting to its farther bank. The transmission lines form a visual sky barrier because they block pedestrians' views. The Classic Center buildings cause this same problem(? Or are they a physical barrier?).

Figure 25. Athens existing Multimodal center railroad property map, Copyright: QI LI

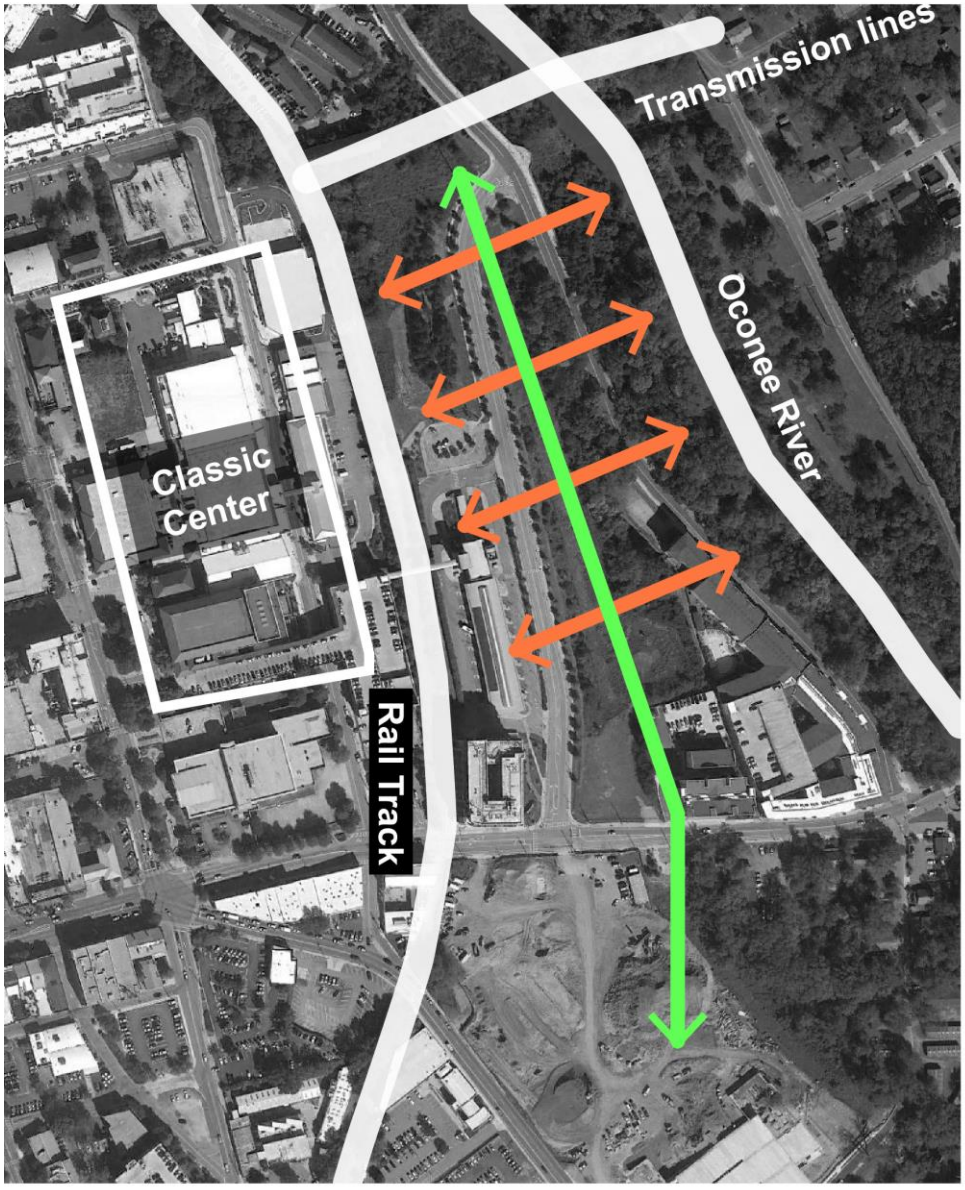


Figure 26. Athens study area barrier map, Copyright: QI LI

The topographical difference presents a major challenge, as the downtown of Athens has higher contours than Oconee River; the contour drops from 736 feet to 654 feet, and there is an 82 foot

height difference within a quarter mile. It is hard to bring people from the lower level to the higher level of the street without any enhancement.

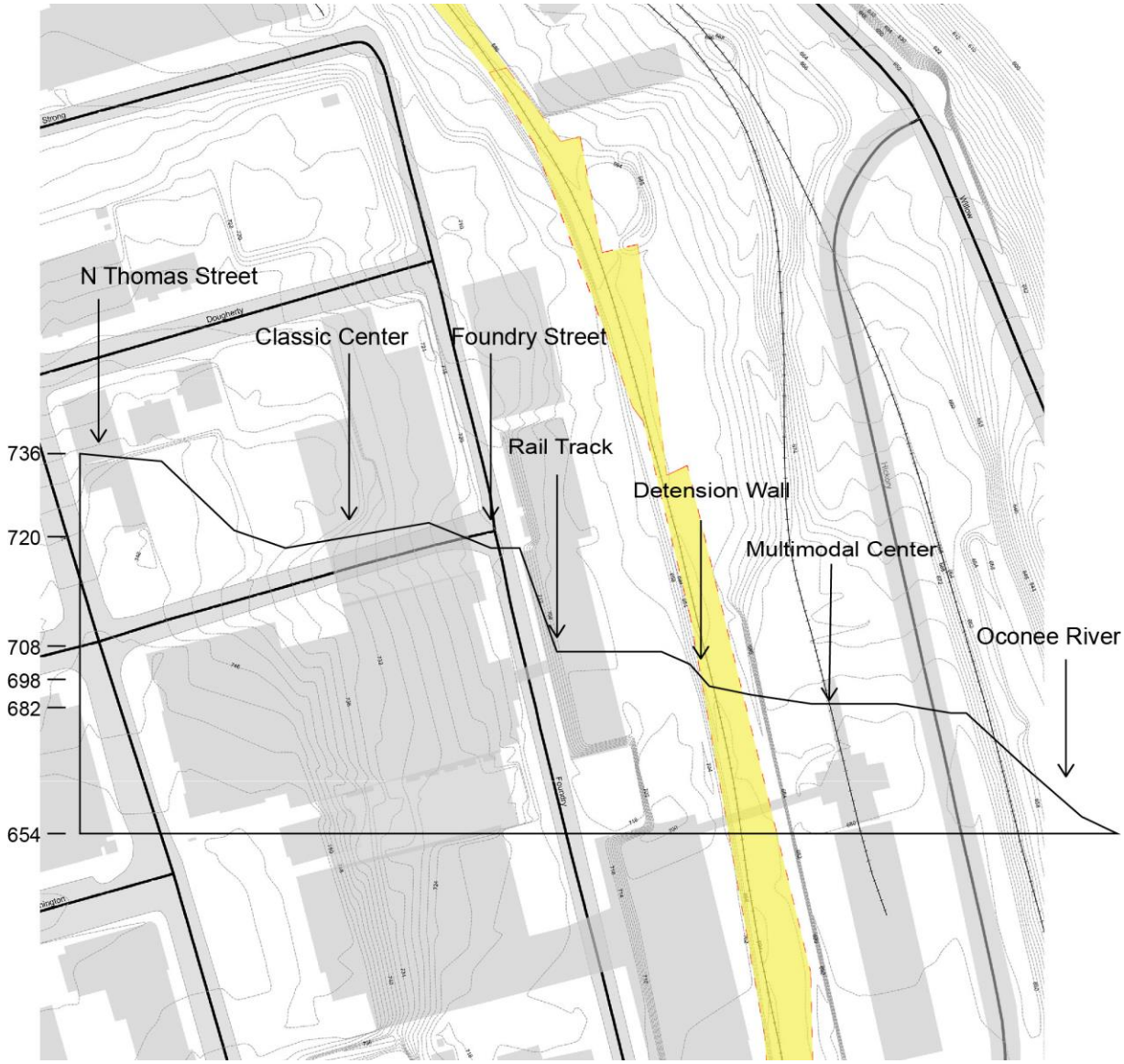


Figure 27. Topography difference map and Property Area map, Copyright: QI LI

CHAPTER 3

METHODOLOGY AND LIMITATIONS

3.1 Methodology

The purpose of this thesis is to provide a recommendation for a multimodal transit hub in Athens, Georgia, based on the concept of transit-oriented development (TOD). This study uses an exploratory method of referencing case studies, observations, and integrating other studies. It explores a number of different case studies that specifically focus on integrating TOD principles into multimodal transit hub design. To incorporate these concepts into design, referencing national and international case studies with different scales as the best transit-oriented development examples would be ideal for providing a completed horizon to this study.

3.2 Limitations

The chosen site has a number of associated weaknesses and limitations. This study is based on other case studies, all of which are located in different cities, and some of which are larger in scale than the targeted site. The social behavior study is not taken into account, as well? as stakeholder and public consultation. The study is only based on the urban aspect of TOD strategy and its extended multimodal transportation concept. When utilizing TOD principles, it is challenging to find a balance between creating more parking lots and creating more people places. This is because the construction of livable and walkable streets means reducing the number of parking spaces on or around the targeted site. The research is only a projection of what could be developed under the proposed Downtown Athens Master Plan.

CHAPTER 4

CASE STUDIES OF MULTIMODAL TRANSIT STATIONS

Analysis of best-practice case studies (King-Victoria, Raleigh's Multimodal Transit Center, and Greensboro Station,) can help identify and clarify the principles behind the stations' layouts. The cases range from urban core areas to township centers, thus providing a variety of perspectives to consider in our future site design.

3.1 King-Victoria Transit Hub: Toronto, Canada

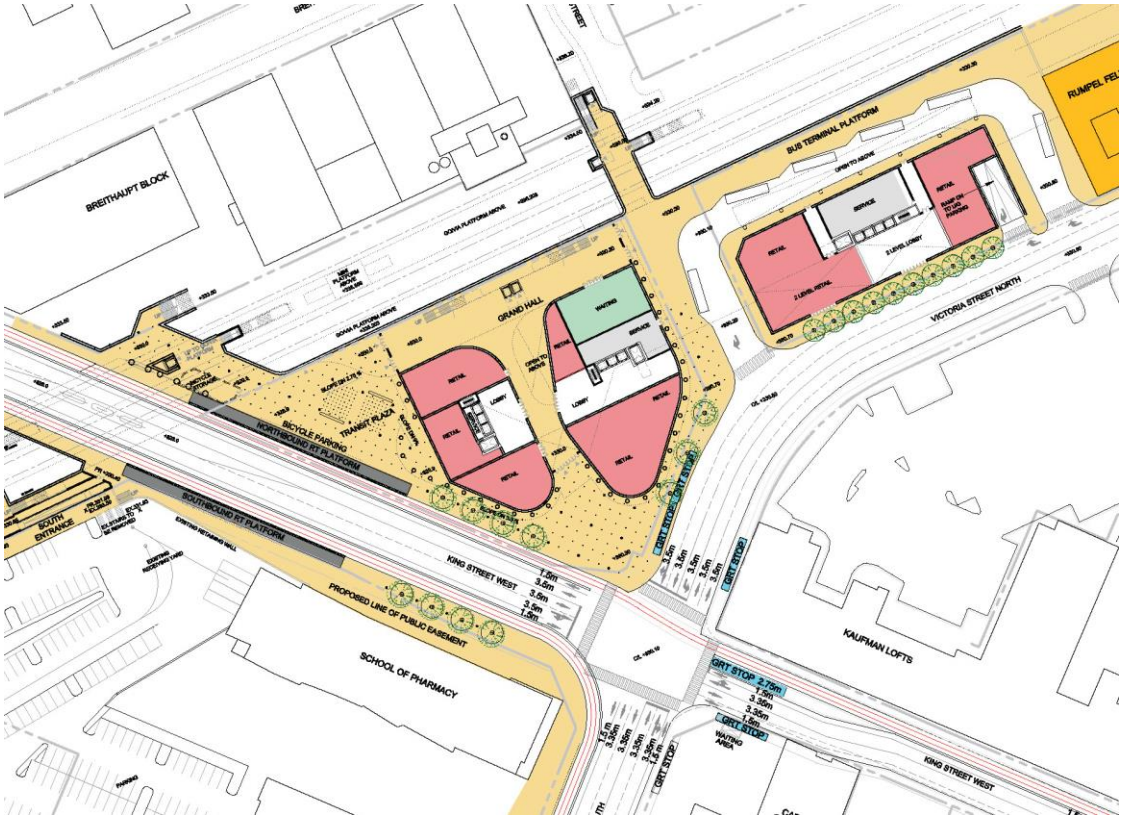


Figure 28. King Victoria Transit Hub plan, view 1st level Source: KING-VICTORIA TRANSIT HUB Preliminary Site Design Station Area Access Study

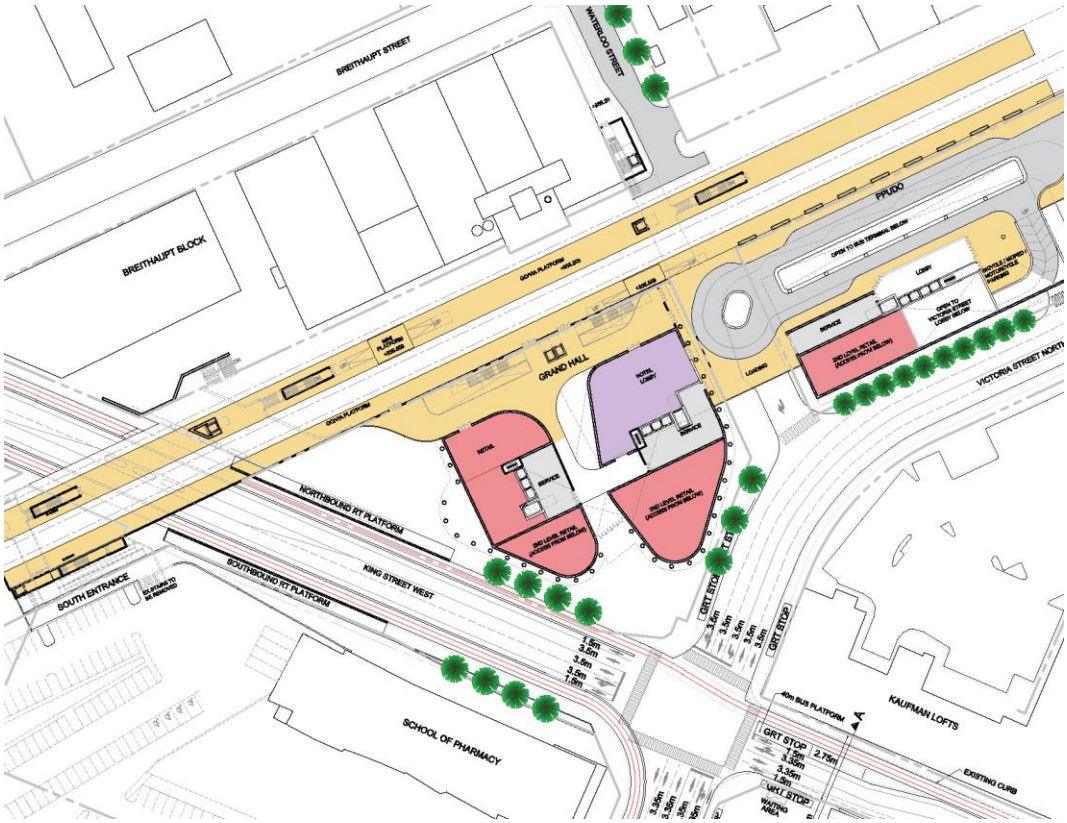


Figure 29. King-Victoria Transit Hub Plan, view 2nd level. Source KING-VICTORIA TRANSIT HUB Preliminary Site Design Station Area Access Study

Figure 30. King-Victoria Transit Hub plan, land use map. Source: KING-VICTORIA TRANSIT HUB Preliminary Site Design Station Area Access Study

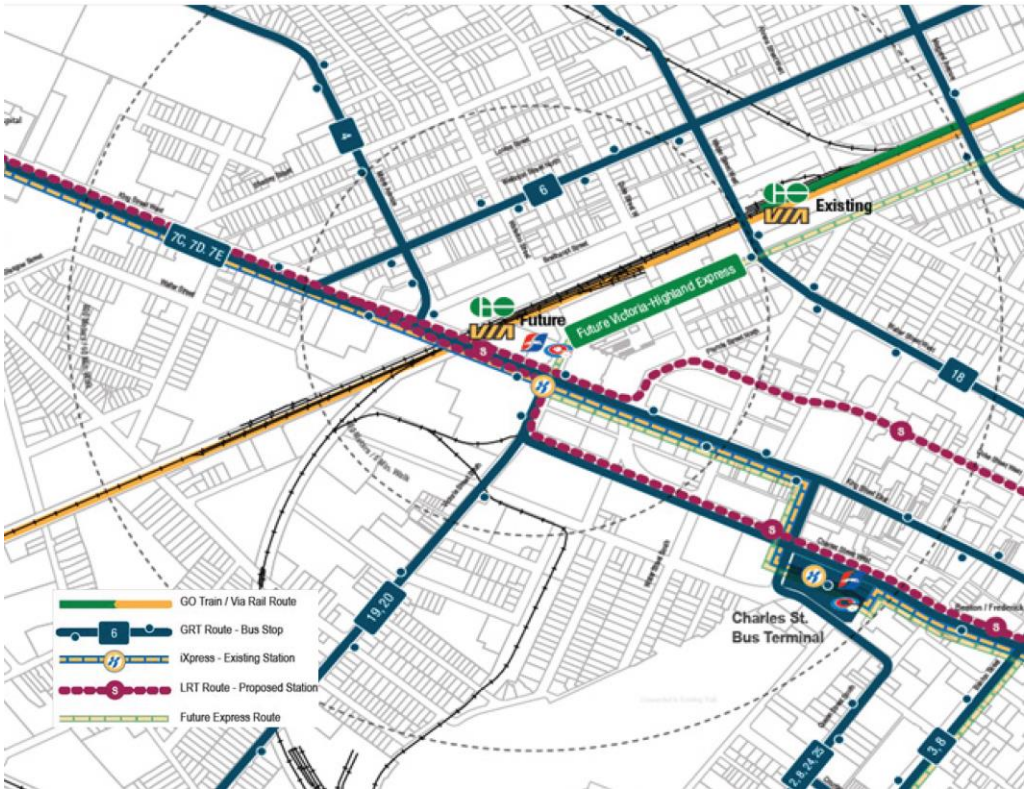


Figure 31. Transportation diagram, Toronto, Canada. Source: KING-VICTORIA

Figure 32. King-Victoria Transit Hub, Toronto, Canada. Source: KING-VICTORIA

This case study showcases the design detail and principles when it comes to designing a successful station. Even though its scale is different from Athens, it is valuable to look at its station structure, and how people navigate around the station. This case solved the problem of topographical difference, a solution that can be applied in future Athens station design. This transit hub is located in a known warehouse district of Toronto. This district will be anchored by the redevelopment of the city of Kichener's public works yard. Moreover, redevelopment of other sites around the transit hub is planned. "The transit hub site consists of two urban blocks that are constrained between Victoria street north and the railway corridor." (Waterloo) This property area is approximately 4.3 acres. The project is a multimodal transit hub intended to serve as the focal point of the Waterloo Region's higher order transit services. "The Transit Hub also plays an integral role to the continuing evolution and revitalization of the Innovation District of downtown Kitchener, which retains and enhances the highly walkable and urban character of the city core." The section below describes the King-Victoria Transit Hub design from the pedestrian perspective.

Highlights:

- The Transit Hub will be served by two rail platforms for both GO Transit and VIA rail.
- The LRT operates in the curb lane on King Street, with platforms integrated with sidewalks.
- The King Street Grade Separation forms part of the Hub with linkages through the precinct for pedestrians and cyclists.

- The site features an off-street bus terminal that serves intercity buses, GO Transit buses, and GRT buses that terminate at the Transit Hub. The terminal could also allow for Mobility PLUS pick ups and drop offs.
- Mixed-use development integrates with the Transit Hub, with office, retail, residential, and other uses at a higher intensity forming a landmark in downtown Kitchener (Waterloo 2013).

Key elements:

- Two public plazas
- A pedestrian underpass
- An enclosed bike station
- Shot and long-term bicycle parking
- Two light rail platforms
- Express train platform
- Pick-up and drop-off service (taxi and buses)

Station layout:

This station has two main levels above ground and two levels of parking garages underground. All four levels. (Levels above the station are residential apartments.)

Victoria Street: first level above ground:

This level houses the light rail platforms, two platforms with four railroad tracks. Passenger pick up and drop off is also possible on this level, which has entrances and exits for taxis and buses.

Rain corridor: second level above ground:

This level is home to the GO train platform, which at the ground level connects to Duke Street. People can easily change modes of transportation by taking the elevators and stairs. This level provides ticket sales, waiting areas, lockers, and restrooms.

Two private parking levels below ground:

These two levels contain a parking garage that only serves the upper-level residents.

3.2 Union Station: Raleigh's Multimodal Transit Center

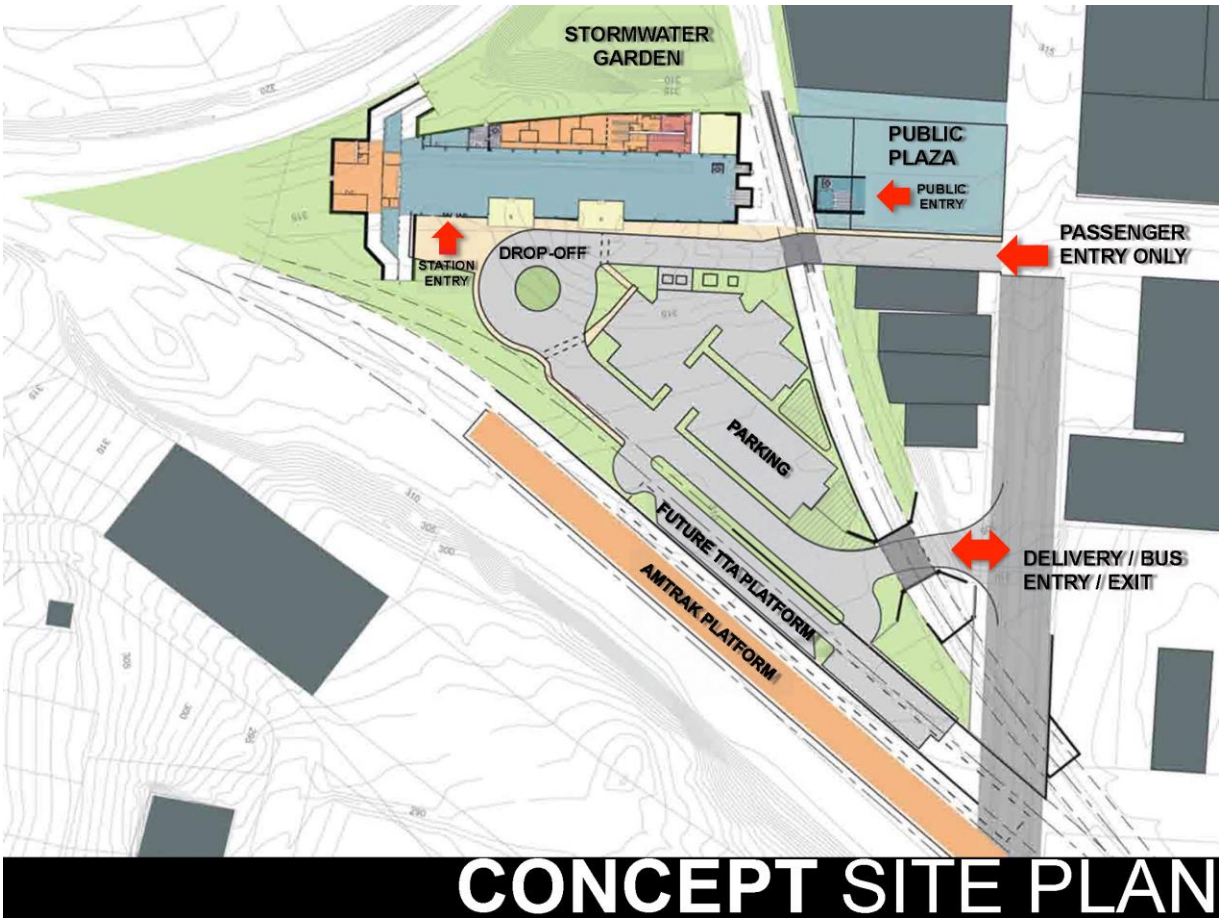


Figure 35. Union Station, Raleigh's multimodal center site plan from North Carolina department of transportation

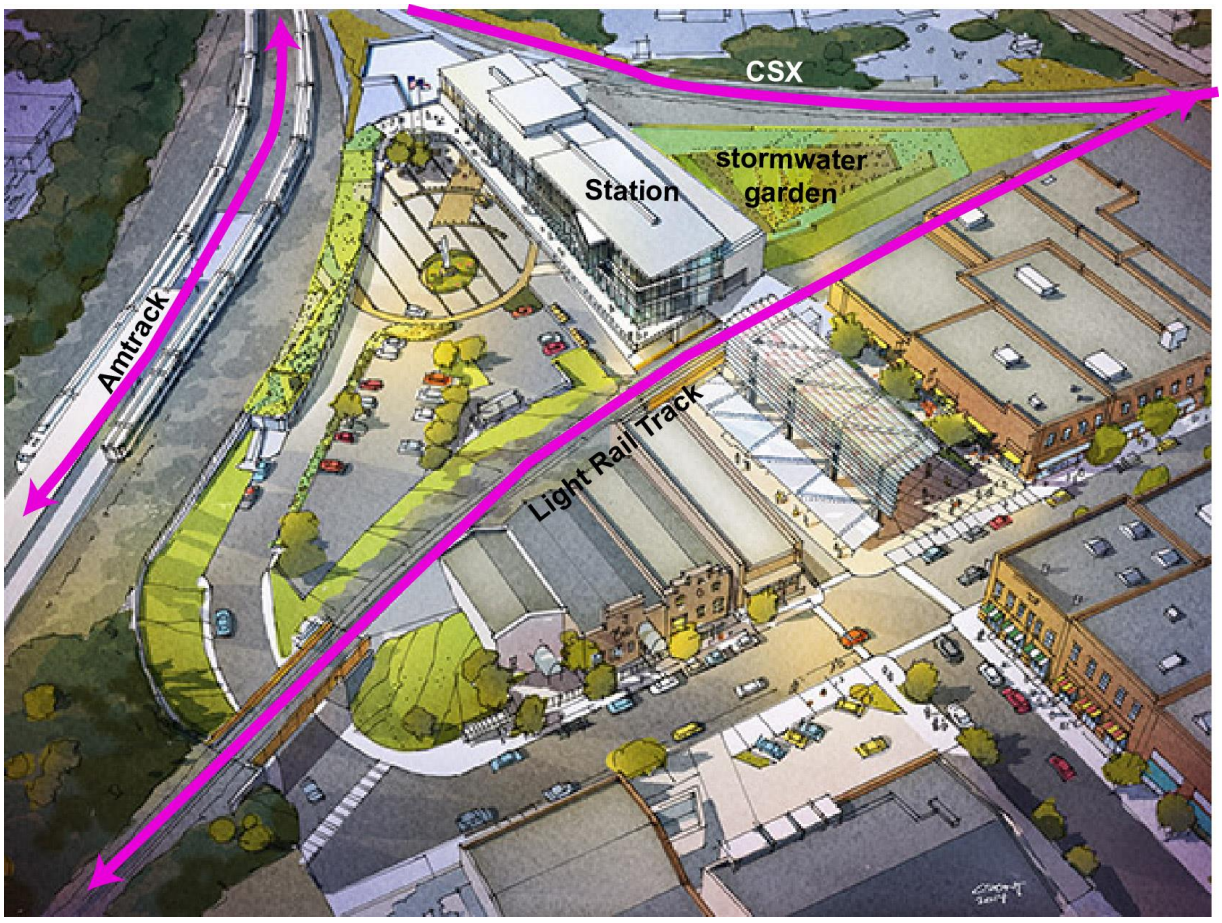


Figure 34. Union Station, Raleigh's Multimodal center eye bird's view from North Carolina department of transportation

Serving more than 160,000 passengers in 2014, Raleigh's current Amtrak station has four daily round-trip passenger trains. Two more round-trips from Raleigh to Charlotte are in the planning stages to meet increasing demand. Still, the station's size and location cannot accommodate demand or expected ridership growth, nor can it serve as a multimodal transportation center. The reason for choosing this case is because it shares similar characteristics with Athens in terms of its city size, population, and its location next to the downtown area. It also solved the barrier problems similar to those present in Athens.

Highlights:

- The station reused an industrial building that was vacant since 2005, and has a 26,000-square-foot building that will provide 9,200 square feet of passenger areas.
- A triangle-shaped storm water park, located behind the station block, utilizes the natural topology to create a sustainable development and enhance the environment surrounding the station.
- The concourse, built with a transparent ceiling, benefits from natural light during the day and connects the station and boarding platforms.
- A 600-foot-long canopy built on top of a 920-foot-long passenger platform will provide passengers with comfortable and accessible space. The center island platform will allow them to board trains on either side. The platform will also be level with the train doors, so passengers will not need steps or wheelchair lifts.
- The new station layout solved the blocking problems when boarding trains, as described in the official project highlights: "The new facility will have two dedicated tracks specifically for trains that are stopping at Raleigh Union Station. This removes passenger trains from the mainline tracks, which allows freight and other passenger trains to bypass the station" (url format citation). http://www.ncdot.gov/projects/raleighunionstation/

Station layout:

This station has two main levels above ground.

First level above ground:

This level houses the light rail canopy platforms. There are two platforms with five railroad tracks. Passenger pick up and drop off are also possible at the taxi and bus entrances and exit.

Furthermore, this level contains the passenger concourse, public plazas and stormwater garden, street retail stores, and a surface parking lot. It also has a grand hall for ticketing services, as well as a waiting area and restrooms.

Second level above ground:

This level houses staff offices, a security room, and maintenance facilities.

3.3 Greensboro Station, Virginia

Figure 37. Greensboro Station, plan view from Virginia department of transportation:

Station layout:

This station has one main level above ground.

First level above ground:

This level contains the light rail platform. There is one platform with two railroad tracks. It also includes: passenger pick up and drop off, taxi and bus entrances and exit, bus stops, a "kiss and ride" area, and a car-share program. There is also a passenger concourse and public entertaining streets.

This urban design development in Greensboro is a prime example of excellent public space. It contains numerous mobility hub elements, such as a car-share program, bike-share program, bicycle racks, and lockers. Large, wide-set pathways for pedestrians slow the traffic, making streets safer. This design helped to inspire our proposed onsite public space for Athens, as well as provide evidence that a 5-6 story high-density residential development was not out of the question. The retail centers on the first floor areas of both sides of this development draw in pedestrians and make the area a vibrant living space that interacts with its open/public space.

Lessons learned:

Through studying best-practice TOD cases, I learned the following lessons:

- Introducing a three-dimensional transport system, as in the three cases above, achieves people-vehicle separation.

  To manage the large flows of human traffic at the station, as well as the complex transportation transfer system itself, a three-dimensional transport system operates more efficiently than a mono-transport system.
- Effectively utilizing and organizing underground and ground-level space, as well as reinforcing connections between spaces, can improve people's movement efficiency.

- Completing the transfer system will improve the public transportation travel ratio.

  The Athens Multimodal Transit Hub will have the highest public traffic flow. To improve its efficiency, it is crucial to seamlessly integrate different modes of transportation, so that people will become willing to use public transportation.

- Mixed-use development is highly recommended.

  The area surrounding the station site should provide a variety of urban functions (such as office space, commercial stores, cultural entertainment, and residential units) to meet people's daily needs and attract them to live near the station.

- Station accessibility is crucial.

  Creating seamless transitions between station entrances and exits and the surrounding buildings unifies the station's design and the city's appearance. Focus on design details such as creating various signs and maps to help people easily navigate through different levels of the station. Retail stores on the first floor of the existing classic parking deck also help with navigation.

- Minimize the site's parking accessibility.

  TOD's key point is to encourage people to leave their cars behind and use the public transportation system instead.

- Create public space.

CHAPTER 5

DESIGN: TRANSIT HUB CONCEPT

This chapter demonstrates the transit hub design concept, on the basis of the theories described in previous chapters. It also incorporates observations from the site and its surrounding area, as well as input from professionals.

The urban design transit hub is a design concept for mixed-use development (including residential, commercial, and public spaces) with a transit system that prioritizes pedestrians' needs. Project highlights include:

- Residential space wrap parking deck
- Parking garage ground floor retail
- Public plazas
- An underpass for pedestrians and cyclists
- Bicycle facilities
- Light rail platform
- Commuter rail platform
- Pick-up and drop-off service
- Stormwater garden
- Arena infill project covering a 30-year range

Area Calculation:

Total Residential Development = 37,431 Sq. ft.

Total Retail Development = 4,802 Sq. ft.

Total Parking Development = 10,845 Sq. ft.

Total Developed Area = 53,078 Sq. ft.

Figure 38. Plan's view of the design. Copyright: QI LI

6.1 Building

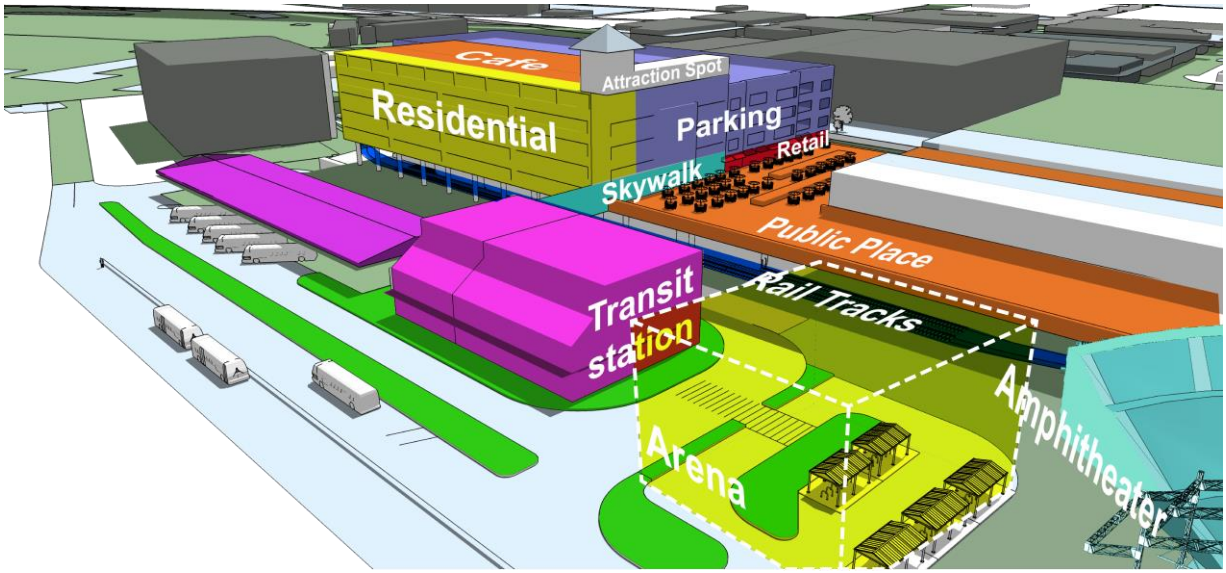


Figure 39. Bird's-eye view of the design. Copyright: QI LI

"When there is a balanced mix of complementary activities within a local area, a mix of residences, workplaces and local retail commerce, many daily trips can remain short and walkable." (Transit oriented development organization)

The infill projects are listed below:

1. Indigo Hotel
2. New Hotel
3. Amphitheater
4. Future Residential on top of parking garage
5. Residential
6. Office
7. New Hotel

8. The Mark Apartment

TOD encourages a mixed-use built form (vertically mixed-use development), thus suggesting that a mixed-use building could be constructed on this site. A parking bay could be added to the second level as an extended footprint of the existing traditional parking deck, which previously had four levels. This is part of the infill strategy, which collaborates with other existing onsite buildings and proposed infill buildings. The residential apartments wrap around the existing parking deck to give residents and travelers easy access to the multimodal station. The top of the parking deck will provide a scenic view, a bird's-eye glimpse of downtown Athens. The first floor retail stores were proposed to make the walking experience more involved and interesting.

6.2 Station Design

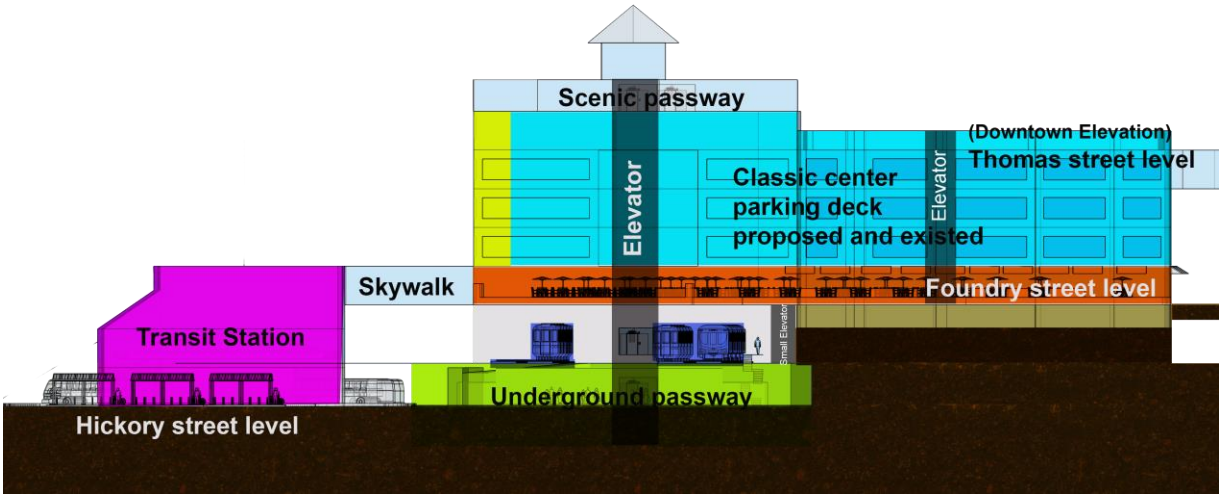


Figure 40. Section view of the design. Copyright: QI LI

Station layout:

This station has three main levels above ground; the first of these contains a pedestrian tunnel that connects the light rail platform to the multimodal station. All four levels of new buildings. (Classic parking deck redevelopment is not included.)

First level above ground:

This level contains the light rail platform and the commuter rail. There are two platforms with four railroad tracks, one for the commuter rail, two for the light rail, and one for freight. As designed, short-term bicycle parking will be attached to the existing multimodal station. This level also provides ticket sales, waiting areas, lockers, and restrooms.

Second level above ground (connects to the second level of the classic parking deck):

The third level of the multimodal station connects to the second level of the classic parking deck via a skywalk tunnel. The ground level also connects to Foundry Street, so people can easily change modes of transportation by taking the elevators and stairs.

Pedestrians and cyclists crossing the below-ground tunnel:

An underground crossing connects the train platform to the multimodal station, public plaza, apartments, parking deck, bicycle parking rack, and retail stores.

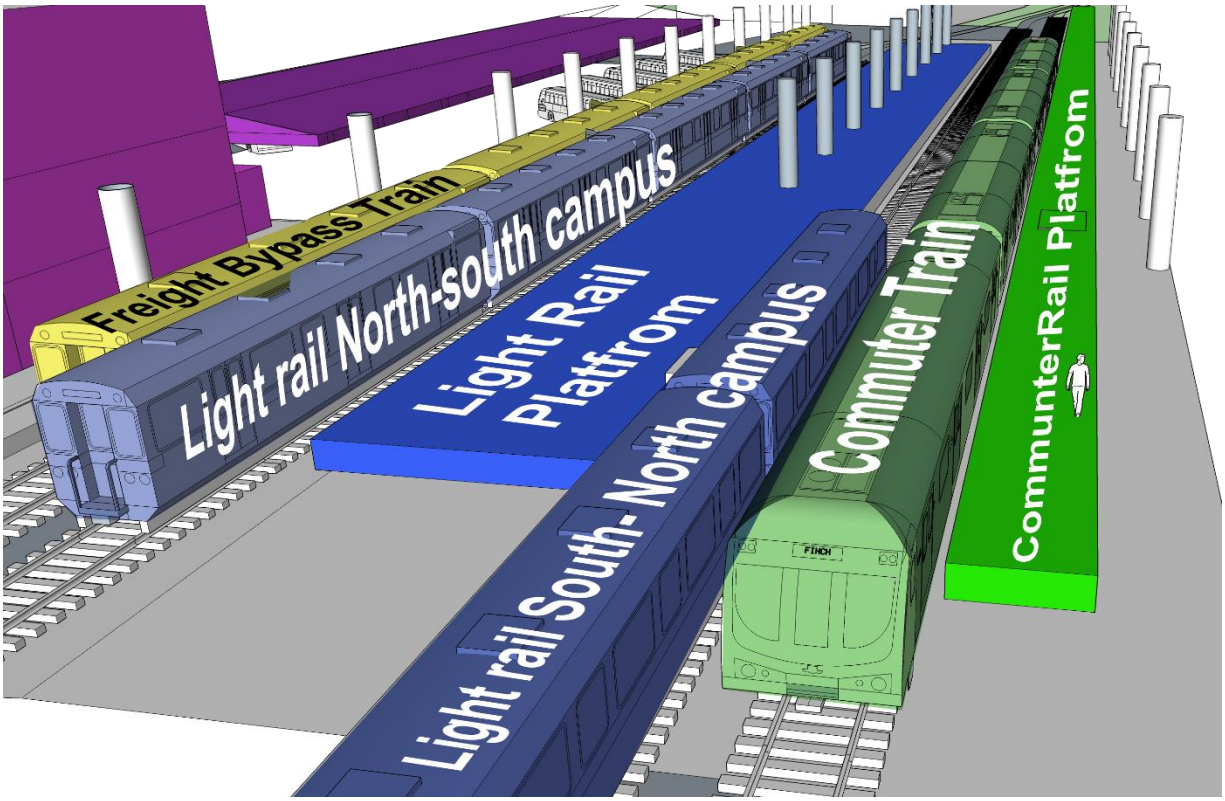


Figure 41. Rail track orientation diagram. Copyright: QI LI

Two rail platforms:

To provide passengers with a safe and comfortable waiting and boarding area, stations will have one light rail platform and one commuter rail platform. The light rail platform is a center platform, with tracks on both sides serving north- and south-bound lines. The south-bound line can carry passengers (mainly students and faculty on weekdays, visitors, and residents weeklong) and starts from the downtown Athens multimodal station, running to the very south end of campus. This light rail platform will be 350 feet long and 30 feet wide.

The commuter rail is a side-type platform with a single track on one side. It will serve passengers commuting from downtown Atlanta to Athens. This platform will be 550 feet long and 10 feet

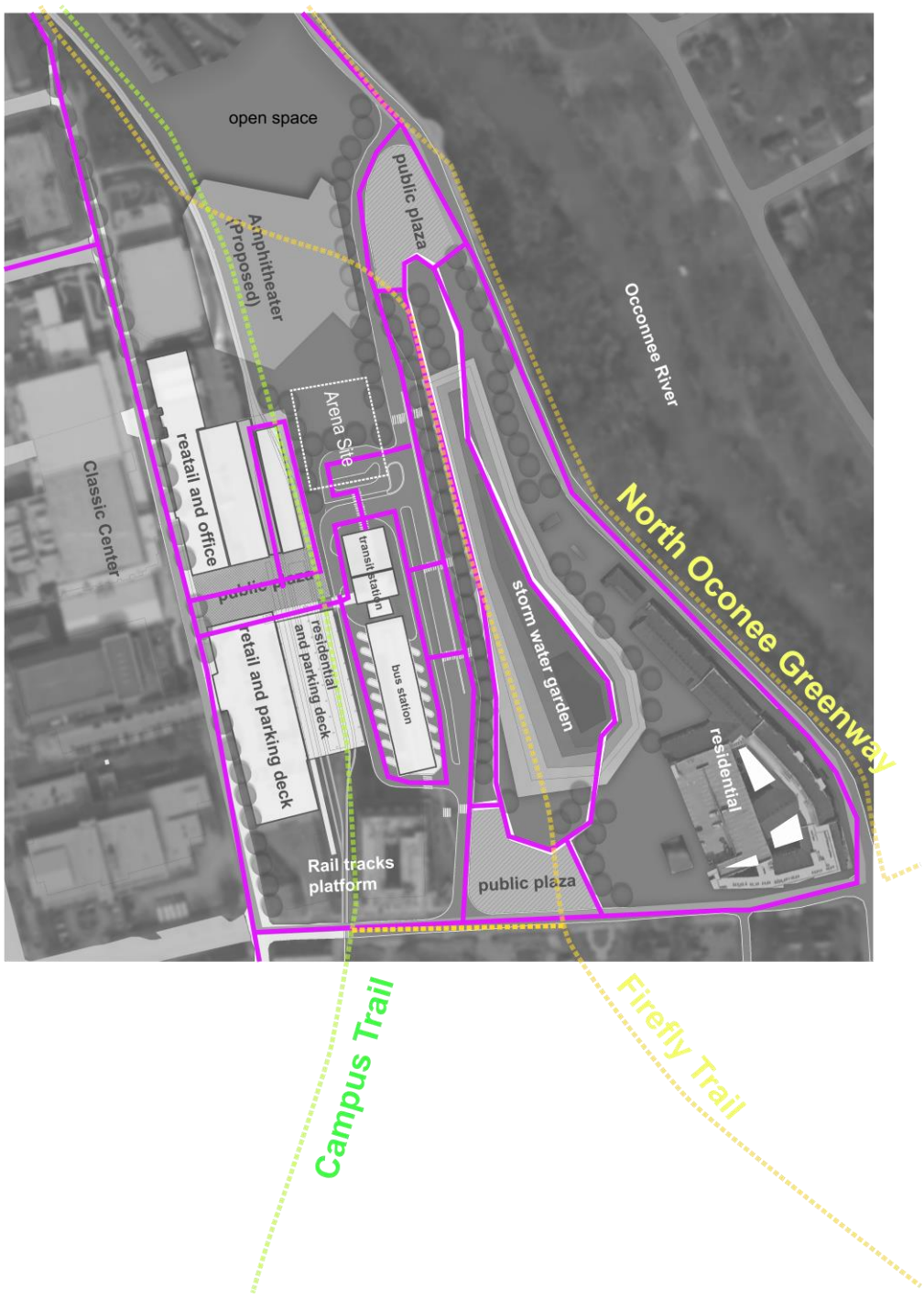


Figure 42. Pedestrian circulation. Copyright: QI LI

wide. All platforms will be high-level (at the same level as the train floor) to provide level boarding for all passengers and to accommodate wheelchairs, wheeled luggage, and strollers. There will be platform safety gates at every station, separating customers from the tracks when trains are not stopped at the station.

6.1 Pedestrian-Oriented Design

This station design is designed through the pedestrian's perspective and, therefore, accessibility was the minimum requirement throughout the design process. Enhancing the walking experience by improving the design details of every aspect of the station ties together various elements of the site. These elements include signage, pavement, wayfinding, appropriate sidewalks, and resting areas.

- Four new plazas and an atrium

  One plaza at the top of the proposed mixed-use structure could be used as public space, a green roof, and a rooftop café for residents. The other plaza is adjacent to the second floor of the Classic Center parking deck. Right across the street of classic center. Additionally, there are two extra plazas attached to the stormwater garden park that connect the existing greenway and the proposed stormwater garden. These public spaces will provide visitors, residents, students, and faculty with a relaxing getaway after work or on the weekends. Retail stores at the first floor fronting onto the second plaza could help fill the gap between the transit hub with indoor spaces.

- A new underpass

  A new underpass will serve as a main connection between the platforms and the station, as well as between the parking deck and the public plaza.

- A new attraction

The top of the Classic Center parking deck, easily accessible to all visitors to the transit hub, will offer a bird's-eye view of Athens.

Figure 43. HI Seoul Youth Hostel, Seoul, South Korea from youth Hostel cafe

Figure 44. ROOFTOP CAFÉ, Sam Antonio, Texas from Rooftop cafe

6.2 On-site Bike Facilities

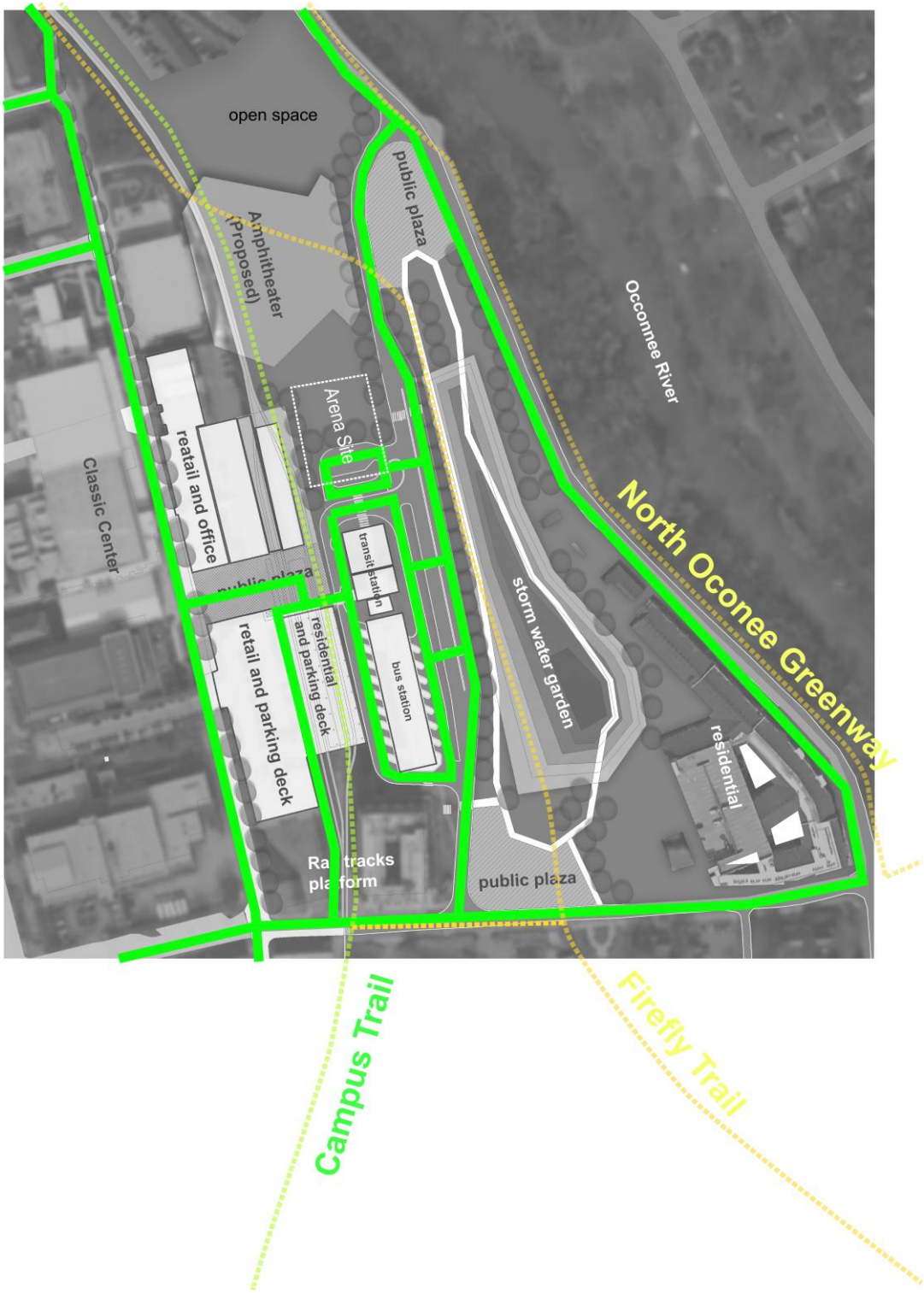


Figure 45. Bicycle circulation and bike facilities. Copyright: QI LI

To encourage bicycle access to the transit station, some bike amenities were proposed in this project.

This design offers ten bicycle parking spots, serving not only the transit station but also the stormwater garden park. People can easily cycle to this station, park their bicycles, and jump onto the public transportation or directly enter the stormwater park. Moreover, the two rail transit systems offer a bicycle carry-on program, meaning that people can carry their bicycles onto trains. This program will help achieve a seamless connection between rails and bicycles

6.3 **Street Design**

Bring complete streets concept:

"Complete streets should be implemented throughout the mobility hub, in the primary, secondary and tertiary zones."

- *Build or retrofit a network of complete streets to create a balance between the movement of pedestrians, cyclists, transit, and vehicles. Adopt road design standards that ensure safe movement of all road users.*
- *Provide an attractive pedestrian environment with a high level of priority, safety and amenities.*
- *Create cycling-supportive streets and communities.*
- *Adopt goods movement strategies within mobility hubs that support complete streets, while ensuring the efficient delivery of goods and services. (Fairfax County 2013)*

If street-level trees cannot be accommodated by the right-of-way, built canopies or structures could be considered. Moreover, consistency with downtown Athens' larger streetscapes should be taken into consideration.

Stormwater Garden (Bioretention Gardens)

Figure 46. Glenwood park site plan. Source: Plan courtesy Green Street Properties

Glenwood Park is a suitable example of how onsite vegetation and landscape facilities can successfully manage stormwater.

Figure 47. Stormwater management, Copyright: QI LI

Bioretention gardens are large gardens designed to capture and infiltrate or filter stormwater runoff. “They are typically much larger than rain gardens, because they collect stormwater

runoff from larger areas such as office building rooftops and parking lots. Designed by professional engineers, they feature sub-drains and engineered soils that facilitate infiltration and can handle excess water from large storms."

A stormwater garden park was included in this design to achieve sustainability. The stormwater park located across from the transit station is easily accessible on foot for people coming from the street or from the station.

(Source: http://www.dceservices.org/kiosk/index.php/bioretention-gardens)

6.4 New Technology

People rely much more on new technology today than they did in the past. For example, people use Google Maps to navigate in unknown cities, and they can look up the most popular restaurant in a minute without any former experience of a city. In Athens, most of the population is students. Since students frequently use public transit, the University of Georgia developed a smartphone application called UGA that allows people to track different kinds of public transit in order to efficiently travel from one destination to another. It is a feasible idea to add the future light rail and commuter rail to this application, helping ensure seamless connection between different modes.

CHAPTER 6

CONTIGENCY QUESTION AND CONCLUSION

This study began by analyzing the relevant theories and practices regarding urban station surroundings and discussing domestic multimodal transit hub comprehensive development problems, while proposing to make use of the advantages of transit hub design guidelines to solve problems, and finally apply these theories to the Athens Multimodal transit hub design. In doing so, it created faster transfers between different modes of transportation, cross-functional mixed-use development, spatial concentration stations, and proposed urban design for the future Athens multimodal station surrounding area. This thesis attempts to provide recommendations for the future multimodal transit hub design.

Conclusion:

- Encourage urban mixed-use development for the multimodal transit station's above-ground design, based on the TOD concept.
- Encourage horizontal web structured development for the multimodal transit station ground-level design.
- Pedestrians are the top priority; always design from the pedestrian's perspective.
- Build connections between different modes of transportation to achieve a seamless city transportation system.

The development will promote and update surrounding areas, gathering city functions together through revitalization of the transit hub.

This paper has made some achievements, but because I was not involved in the actual project of multimodal transit hub design, this research's conclusions are inevitably one-sided. Furthermore, because the topic is so wide-ranging and complex, many factors still require additional study. Research is lacking on Athens' local multimodal transportation planning and transportation hub. And, most importantly, the opinions of the public and of relevant professionals should also be sought.

Studying station designs of various scales, TOD projects, and urban design in general allowed me to find relatively objective solutions for Athens' future multimodal transit hub. Hopefully this study of multimodal transit hubs can offer recommendations to the planning department and the public regarding what a multimodal transportation hub could bring to this promising city.

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