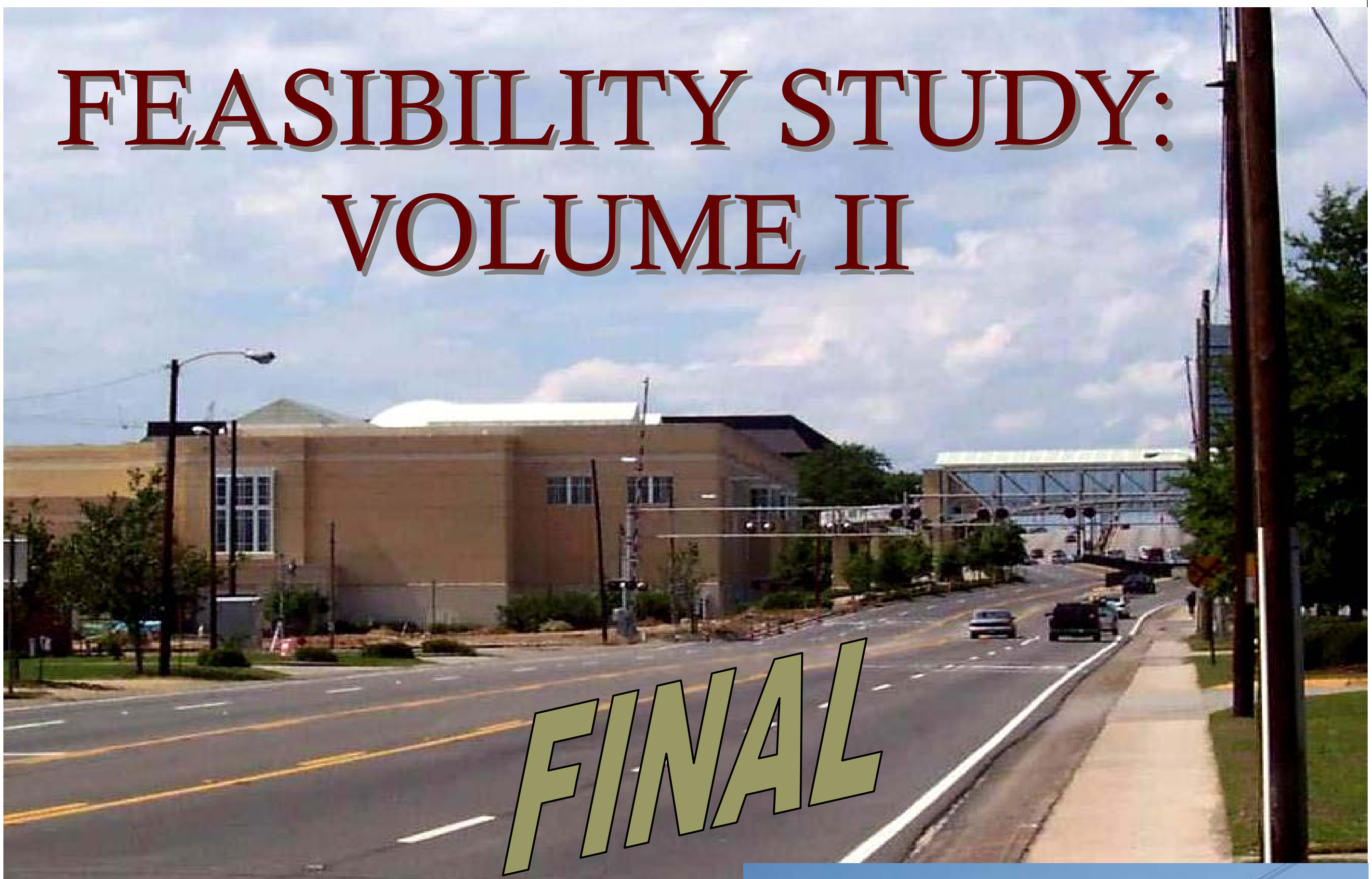
March 2009

FEASIBILITY STUDY: VOLUME II



FINAL

ASSEMBLY STREET Railroad Corridor Consolidation Project

File No. 40.221B PIN 30434
Richland County

STV

SCDOT

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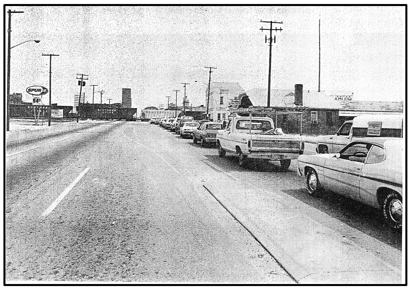
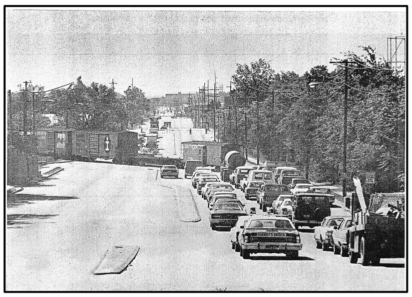
Volume II - Supplemental Documents

I. STUDY PURPOSE

A. Project History





The Assembly Street Railroad Corridor Consolidation and Grade Crossing Elimination Project dates back to the 1970s. At that time, the City of Columbia was dealing with several issues within the downtown area, primarily growth and redevelopment, community connectivity, expansion of the University of South Carolina campus, heavily-used rail corridors that crisscrossed the area and bisected communities, and a notable increase in traffic volume. The need for railroad corridor consolidation had long been recognized as a need for reducing delays in automotive traffic, creating efficient operating speeds for railroad traffic, and eliminating barriers to redevelopment. Representative photographs are included in Appendix A. Many alternative solutions to this growing problem were suggested and studied in an Environmental Impact Statement (EIS), completed in 1981. Among the Alternatives were:

- Evaluation of alternative corridors outside the downtown area.
- Evaluation of alternative modes, such as truck deliveries or relocating businesses.
- Grade separation without consolidating corridors.
- Evaluation of Alternative Designs.
- No Action.

Alternative corridors were not pursued because of the adverse impact of denying rail service to the many businesses in the downtown area that utilize those services. Economic implications of utilizing alternative modes of transportation indicated that the existing rail/motor carrier balance was the best method. Therefore, alternative modes were not considered reasonable. The grade separation alternative did not meet the objective of allowing an orderly redevelopment pattern. Topographic relief in the area also made this an unattractive alternative. Alternative designs were considered for area roadways and railroad corridors. Six potentially feasible alternatives were created that would consolidate railroads and improve at-grade crossings. Existing conditions would continue to deteriorate, including a decline in tax base uneconomical rail facilities.

From this evaluation, it becomes evident that the most feasible alternative would be designing alternatives. Thus, part of the solution developed in the 1970s became known as the "Columbia Railroad Relocation and Roadway Grade Separation Project" and was conceived as a series of four phases. The four phases, Phase 1-A (Assembly Street), Phase 1-B (Elmwood Loop), Phase 1-C (the "Ditch"), and Phase II (the Fairwold Connection), created plans for improving railroad and vehicular traffic in the downtown area. Phase’s 1-B (Elmwood Loop) and 1-C (the ‘Ditch”) have been completed. Phase 1-A (Assembly Street) is the subject of this feasibility study.

B. Current Status

The City of Columbia is still divided by various separate railroad corridors as shown in Figure I-1. These railroad corridors include the: Norfolk Southern (NS) R-line, NS W-line, CSX Transportation (CSXT) AKA-line-, and the CSXT S-line. The area has also seen an increase in development in recent years with a surrounding mix of residential, institutional and commercial uses with some vacant properties.

Figure I-1

Much like in the 1970s, issues associated with the various separate railroad corridors continue to abound today. In particular:

- The railroads are faced with low speed train operation over sprawling facilities;
- The traveling public is forced to wait for lengthy periods of time while trains pass, or are forced to slow down considerably at track crossings; and
- The community's inability to successfully redevelop a valuable growth center in the downtown area.

These issues have only been exasperated with increased growth and revitalization of the city center since the 1990s. Columbia had actually experienced a population loss during the period between 1970 and 1990, similar to many American cities. However, population began to increase in the 1990s as residents returned to the city center and preservation and revitalization efforts were undertaken. The result has netted a population increase of almost 20% in Columbia since 1960, even with the population losses in the 1970-1990 periods.

One of the city's most successful revitalization efforts, the Vista, was the result of Phase 1-C (the "Ditch") which reconnected the area by opening up Gervais Street, as shown in Figure I-2. The Vista is now considered the one of the more popular districts in Columbia boasting a mixture of residential, retail, and cultural entertainment opportunities. Many buildings have been preserved and renovated and new construction is built with the historic character in mind. The Vista serves as a model for the redevelopment potential of the area that is hindered by the Assembly Street railroad crossing.

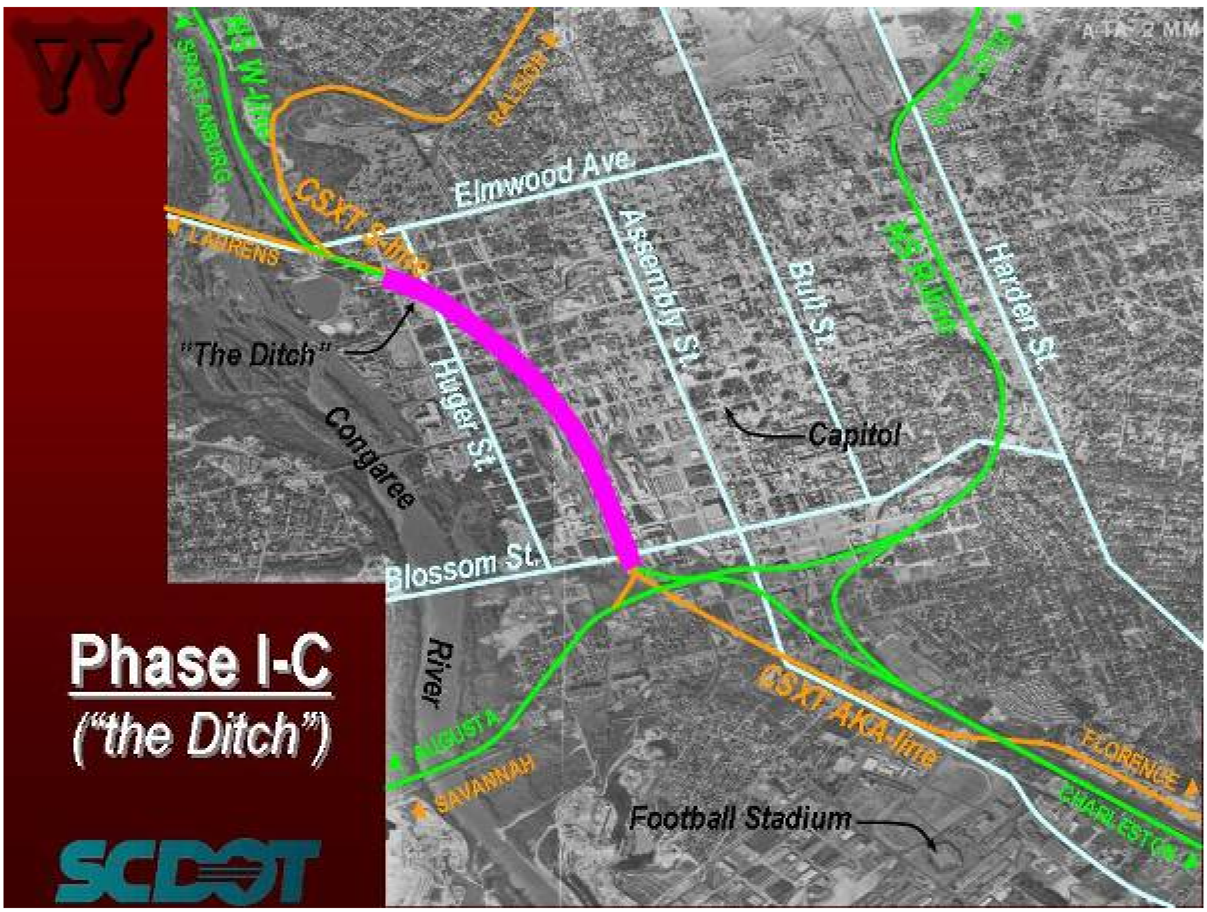


Figure I-2

C. Purpose and Need

Columbia, South Carolina, the capital city and home to the University of South Carolina (USC) and several major healthcare businesses, continues to grow. The university desires to expand and there are initiatives to re-develop the downtown, once a thriving hub for manufacturing and trade. USC has plans to develop a major scientific research park through public-private partnerships called Innovista that could bring growth to Columbia that is comparable to that from the success of similar projects in the Research Triangle in North Carolina. The Innovista campus is planned to be located to the northwest of the Assembly Street crossing. However, the Innovista campus area, much like other vital areas in downtown Columbia, is still accessed by crossing at-grade railroad tracks.

The existing CSX Transportation (CSXT) and Norfolk-Southern Corporation (NS) tracks occupy the same corridor as they enter Columbia through Andrews Yard from the southeast. However, these tracks spread out and cross over Assembly Street, in several locations, and divide the University of South Carolina campus. Assembly Street is a heavily traveled arterial and the combination of increased vehicular traffic congestion and slow train traffic speeds results in unacceptable delays (both to vehicles and trains), increased air and noise pollution, and increased danger to pedestrians. Additionally, it impedes the revitalization of the downtown area along one of Columbia's primary gateways to the city.

The downtown area has already seen a resurgence of residential development returning to the city center. Downtown residential development will most likely continue to increase as many cities similar to Columbia have seen a dramatic increase in the number of people desiring to live in the downtown due to the increase in fuel prices. With an increase in residential development, other uses tend to follow including commercial/retail and other support services for the residential growth. The result of more people living in the city center will be the need to efficiently move the additional pedestrians and vehicles that come with them. Removing the Assembly Street at-grade railroad crossing will help address these needs and could play a vital role in major streetscape improvements for the Assembly Street corridor.

The EIS that was completed in 1981 proposed to consolidate the various tracks into one corridor and to replace the at-grade crossings with grade separation structures by lowering the elevation of the tracks and raising the roadway elevations. This solution would reduce delays along Assembly Street, give USC a more cohesive campus, improve pedestrian safety, prove for increased train speeds through the area, and work toward reducing both air and noise pollution. The purpose of the feasibility study is to determine if this proposed solution is still feasible in light of current conditions, changes in environmental laws and regulations, and the City's vision for the downtown area. The purpose of this report is to summarize the review of existing environmental conditions within the project study area, a .75 square mile study area (see Exhibit #1 Figure I-3) generally bounded by:

- Blossom Street to the north
- Pickens Street and Norfolk Southern (NS) R-Line to the east
- 1,200 feet south of Rosewood Drive to the south
- Huger Street/ Whaley Street/ Wayne Street/ Heyward Street/ Dreyfus Road/ Assembly Street/ CSX Transportation (CSXT) line to the west

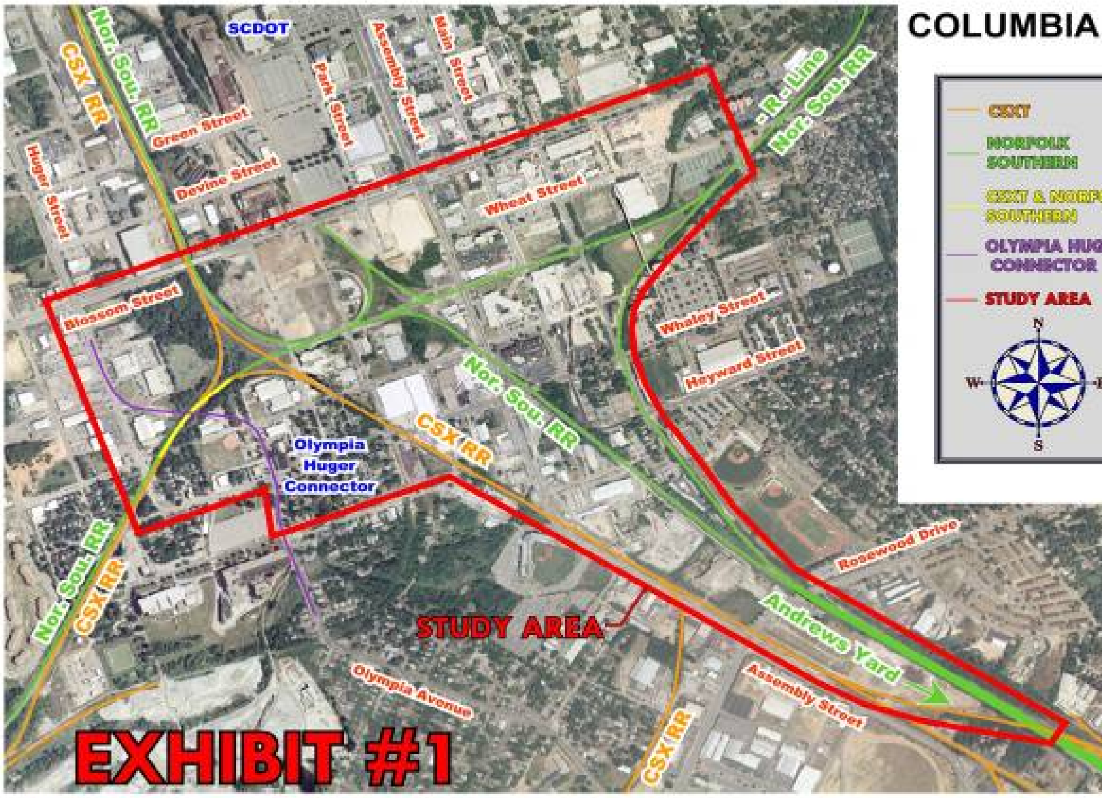


Figure I-3

The City of Columbia is still divided by various separate railroad corridors including the NS R-line, NS W-line, CSXT AKA-line-, and the CSXT S-line. The area has seen an increase in development, and with that development the issues that existed before have only been expatriated. The issues associated with the various separate railroad corridors continue to abound today. In particular:

- The railroads are faced with low speed train operation over sprawling facilities;
- The traveling public is forced to wait for lengthy periods of time while trains pass, or are forced to slow down considerably at track crossings; and
- The community is unable to successfully redevelop a valuable growth center in the downtown area.

II. STAKEHOLDER INVOLVEMENT SUMMARY

A. Individual Stakeholders

To ensure that all issues and concerns of the proposed project were evaluated in the feasibility study, the project team conducted a series of stakeholder meetings to determine interests and expected results. Stakeholders included:

- City of Columbia
- Richland County
- University of South Carolina
- Norfolk Southern Corporation
- CSXT Transportation
- SCANA Corporation
- South Columbia Development Corporation
- Central Midlands Council of Governments

A Stakeholder Involvement program was established as part of this study. The program involved:

- Stakeholder group meeting (kickoff)
- Individual stakeholder meetings
- Stakeholder group meeting (50% review)
- Stakeholder group correspondence (90% review)
- 14 Utilities (public and private)

An initial stakeholder group meeting took place on June 2, 2006 to discuss current operations and constraints, as well as the future plans that any of the stakeholders may have in the project area. In an effort to ascertain specific concerns relative to each agency, individual stakeholder meetings were then held throughout July and August 2006. Additional meetings were held with CSXT in January 2007 and with Norfolk Southern in July 2007. A second group stakeholder meeting took place in September of 2007. Meeting minutes of all the stakeholder meetings are included in Appendix B.

In addition, letters were sent to the individual stakeholders in July of 2008 requesting their feedback on the proposed Alternatives, specifically Alternative 4, which was developed after the last group stakeholder meeting. Figures of all alternatives were included in the letter. Stakeholders were asked to submit any comments or concerns that they may have with the project and the proposed alternatives. Copies of the original letters that were sent out and a summary of returned responses from stakeholders are also included in Appendix B.

B. Utility Stakeholders

Numerous public and private utilities are located throughout the project area and these companies were engaged through group and individual meetings. The purpose was to ascertain information on existing utility operations and gain information on any proposed operations and/or plans. As-builts were obtained from each utility company and their feedback on the proposed project was encouraged.

A utility group meeting was held on August 10, 2006 and was attended by both public and private utility companies and included representation from City of Columbia Sewer and Water, SCE&G, Qwest, BellSouth, Telics and Verizon. The project history was presented as was an overview of the feasibility study. Utility companies were asked to submit any plans or mapping of utilities within the study area. They were also informed at this meeting that individual utility meetings would be held once the alternative was chosen. A detailed summary of the discussions is also included in the attached meeting minutes in Appendix B.

C. Public Information Meetings

Since this project is only a feasibility study, extensive public involvement was not solicited. However, subsequent phases of the project, such as the environmental document and preliminary and final design, will include public involvement in the processes and provide opportunities for public review and comment.

III. EXISTING CONDITIONS / MAPPING /SURVEYING

In order to complete a rail/roadway analysis, field reviews, mapping, interviews, and correspondence with local and state officials were conducted. The available information utilized included:

- Existing census data, property information, zoning, and GIS mapping
- Aerial mapping and surveying
- Daily traffic volume estimates
- Environmental review, natural resources data, and protected species databases
- Roadway/rail crossing data (accidents/incident reports)
- Train operation information from Norfolk Southern and CSXT
- Stakeholder meetings

During the study process, an existing rail/roadway grade crossing analysis was conducted utilizing the following information:

- Existing AADT
- Accident data
- Photos of each crossing
- Traffic Volumes
- Land use classifications surrounding the crossing

Photographs for the crossings are located in Figures III-1 through III-37.

MAP REFERENCE

CSX Transportation (CSXT)

Figure No.	Crossing No.	RR Milepost	Existing Crossing Location	Warning Device(s)
III-1	634629C	373.11	Andrews Road	None
III-2	634630W	373.20	Rosewood Drive	Cantilevered flashing lights
III-3	634632K	373.39	Assembly Street	Cantilevered flashing lights
III-4	634633S	373.39	Hamrick Street	None
III-35	634634Y	-	Olympia Avenue	None
III-5	634635F	373.39	Bluff Road	Cantilevered flashing lights
III-6	634636M	373.39	Rosewood Drive	None
III-7	634637U	373.39	Vine Street	None
III-8	634638B	373.39	Vine Street	None
III-9	634640C	373.39	Duval Street	None
III-10	634641J	373.39	Duval Street	None
III-11	634642R	373.39	Garland Street	None
III-13	634643X	373.39	Garland Street	None
III-12	634644E	373.39	Oakdale Road	None
III-37	634647A	373.43	Assembly Street	Gates, mast mounted flashing lights, cantilevered flashing lights
III-14	634648G	373.65	Park Street	Gates, mast mounted flashing lights, cantilevered flashing lights
III-15	634651P	373.60	Heyward Street	None
III-16	634654K	373.77	Whaley Street	Cantilevered flashing lights
III-17	634655S	373.80	Lincoln Street	Mast mounted flashing lights, Cantilevered flashing lights
III-18	634656Y	373.91	Catawba Street	Mast mounted flashing lights, Cantilevered flashing lights
III-19	634657F	374.00	Gadsden Street	None
III-20	715847J	S359.61	Huger Street	Gates, mast mounted flashing lights, cantilevered flashing lights
III-36	915073P	372.70	Blaylock Road	None

Norfolk Southern Corporation (NS)

Figure No.	Crossing No.	RR Milepost	Existing Crossing Location	Warning Device(s)
III-21	715396H	C126.90	Key Road	None
III-22	715400V	C127.10	Shop Road	Gates, mast mounted flashing lights
III-23	715402J	C128.50	Heyward Street	Gates, mast mounted flashing lights
III-24	715403R	C128.60	Whaley Street	Mast mounted flashing lights
III-25	715620R	108.35	Assembly Street	Gates, mast mounted flashing lights, cantilevered flashing lights
III-26	715621X	R108.30	Main Street	Gates, mast mounted flashing lights, cantilevered flashing lights
III-27	715846C	R109.05	Tryon Street	Gates, mast mounted flashing lights
III-28	715866N	R107.85	Pickens Street	Gates, mast mounted flashing lights
III-29	716361K	W161.74	Flora Street	None
III-30	716363Y	W161.46	Assembly Street	Gates, mast mounted flashing lights
III-31	716364F	W161.42	Catawba Street	None
III-32	716365M	W161.20	Lincoln Street	Mast mounted flashing lights
III-33	716366U	W161.10	Gasden Street	None
III-34	904635C	127.00	Andrews Roads	None

Crossing Number	Milepost	Railroad	Street Name	Street Classification	Warning Device	Land Use
634629C	373.11	CSX	Andrews Road	Urban Collector	CB	Commercial

24 Hour ADT	24 Hour Train Volume	Accident History	Transit Route	School Bus Route	Truck Route
260	6	None	No		

Preemption	Humped Crossing	Crossing Condition_Geometry	Crossing Surface Condition	Crossing Condition_Sight	Redundant Crossing
☐	☐	Poor	Poor	Fair	No

Economic Impact if Closed	Feasibility of Roadway Improvements	Grade Separation Investigation	Recommendations

Aerial

Figure III-1

Crossing Number	Milepost	Railroad	Street Name	Street Classification	Warning Device	Land Use
634630W	373.20	CSX	Rosewood Drive	Urban Minor Arterial	CB, MMFL, CFL	Commercial

24 Hour ADT	24 Hour Train Volume	Accident History	Transit Route	School Bus Route	Truck Route
16280	7	2-Injury, 8-PDO	No		

Preemption	Humped Crossing	Crossing Condition_Geometry	Crossing Surface Condition	Crossing Condition_Sight	Redundant Crossing
☐	☐	Good	Good	Good	No

Economic Impact if Closed	Feasibility of Roadway Improvements	Grade Separation Investigation	Recommendations

Aerial

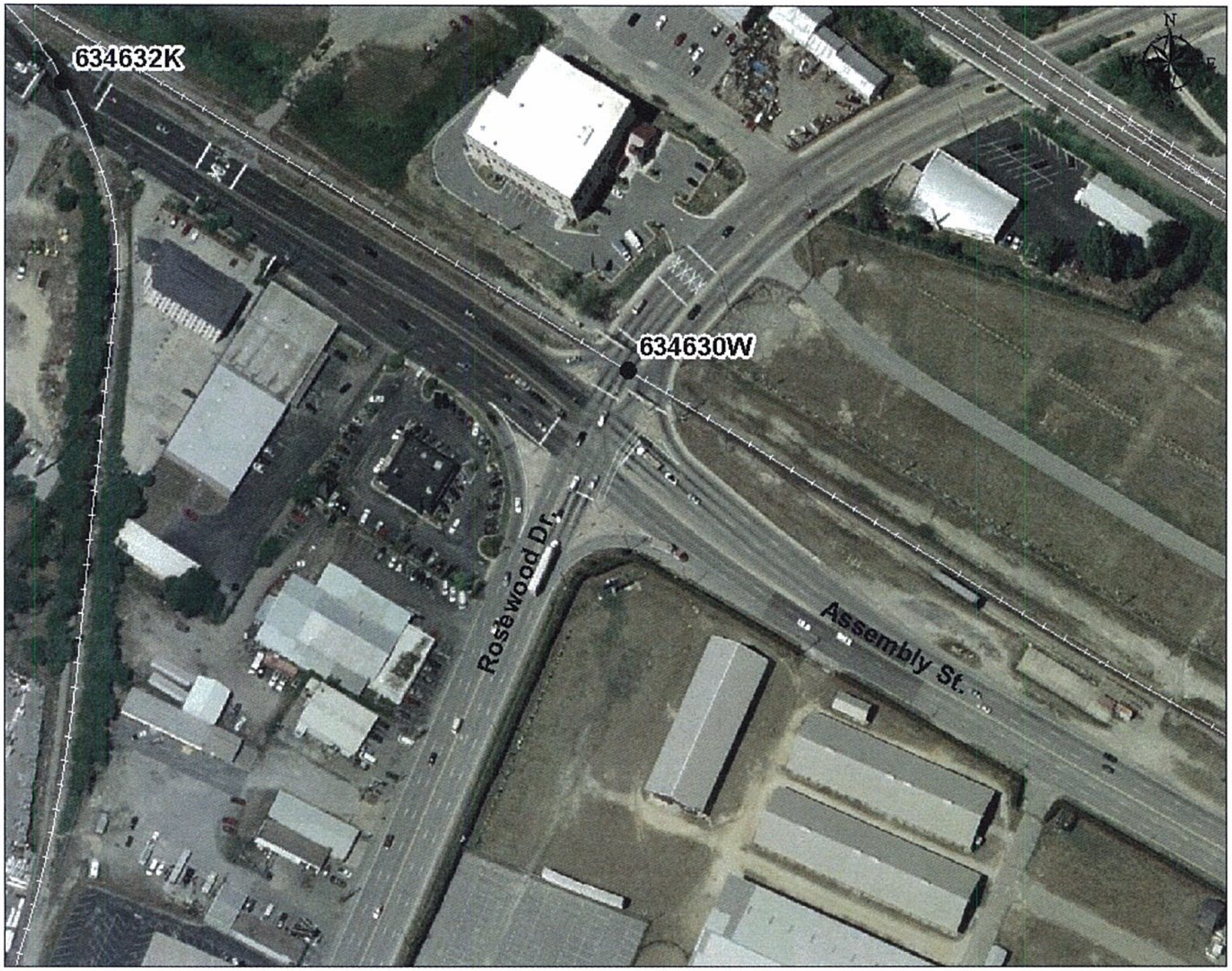


Figure III-2

Crossing Number	Milepost	Railroad	Street Name	Street Classification	Warning Device	Land Use
634632K	373.39	CSX	Assembly Street	Urban Minor Arterial	CB, MMFL, CFL	Commercial

24 Hour ADT	24 Hour Train Volume	Accident History	Transit Route	School Bus Route	Truck Route
23845	2	1-PDO	No		

Preemption	Humped Crossing	Crossing Condition_Geometry	Crossing Surface Condition	Crossing Condition_Sight	Redundant Crossing
☐	☐	Poor	Good	Poor	No

Economic Impact if Closed	Feasibility of Roadway Improvements	Grade Separation Investigation	Recommendations

Aerial

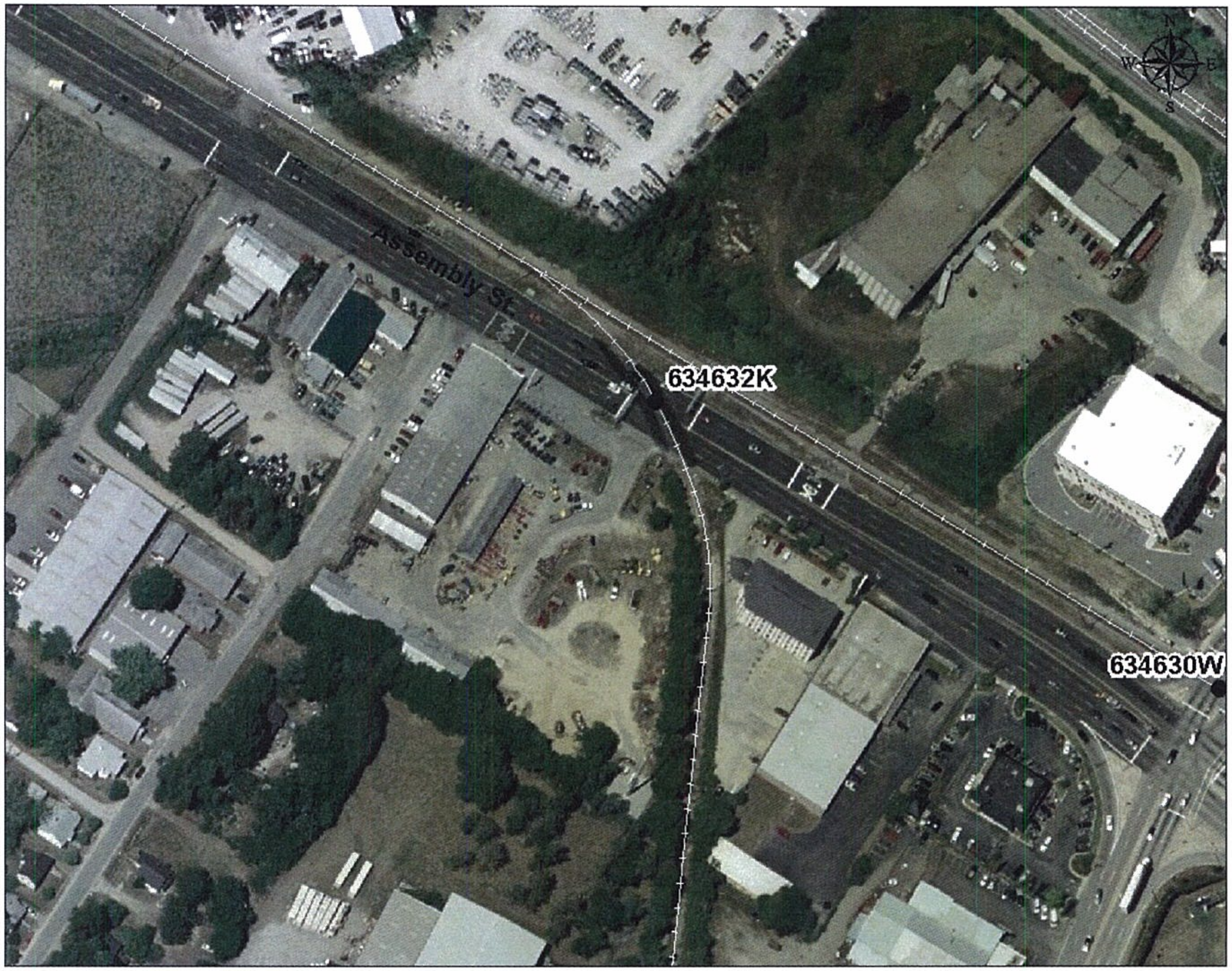


Figure III-3

Crossing Number	Milepost	Railroad	Street Name	Street Classification	Warning Device	Land Use
634633S	373.39	CSX	Hamrick Street	Urban Local	CB	Commercial/Residential

24 Hour ADT	24 Hour Train Volume	Accident History	Transit Route	School Bus Route	Truck Route
755	2	None	No		

Preemption	Humped Crossing	Crossing Condition_Geometry	Crossing Surface Condition	Crossing Condition_Sight	Redundant Crossing
☐	☐	Good	Poor	Fair	No

Economic Impact if Closed	Feasibility of Roadway Improvements	Grade Separation Investigation	Recommendations

Aerial

Figure III-4

Crossing Number	Milepost	Railroad	Street Name	Street Classification	Warning Device	Land Use
634635F	373.39	CSX	Bluff Road	Urban Minor Arterial	CB, MMFL, CFL	Commercial

24 Hour ADT	24 Hour Train Volume	Accident History	Transit Route	School Bus Route	Truck Route
12925	2	3-PDO	No		

Preemption	Humped Crossing	Crossing Condition_Geometry	Crossing Surface Condition	Crossing Condition_Sight	Redundant Crossing
☐	☐	Fair	Fair	Fair	No

Economic Impact if Closed	Feasibility of Roadway Improvements	Grade Separation Investigation	Recommendations

Aerial

Figure III-5

Crossing Number	Milepost	Railroad	Street Name	Street Classification	Warning Device	Land Use
634636M	373.39	CSX	Rosewood Drive	Rural Local	CB	Industrial

24 Hour ADT	24 Hour Train Volume	Accident History	Transit Route	School Bus Route	Truck Route
2420	2	1-PDO	No		

Preemption	Humped Crossing	Crossing Condition_Geometry	Crossing Surface Condition	Crossing Condition_Sight	Redundant Crossing
☐	☐	Good	Fair	Good	No

Economic Impact if Closed	Feasibility of Roadway Improvements	Grade Separation Investigation	Recommendations

Aerial

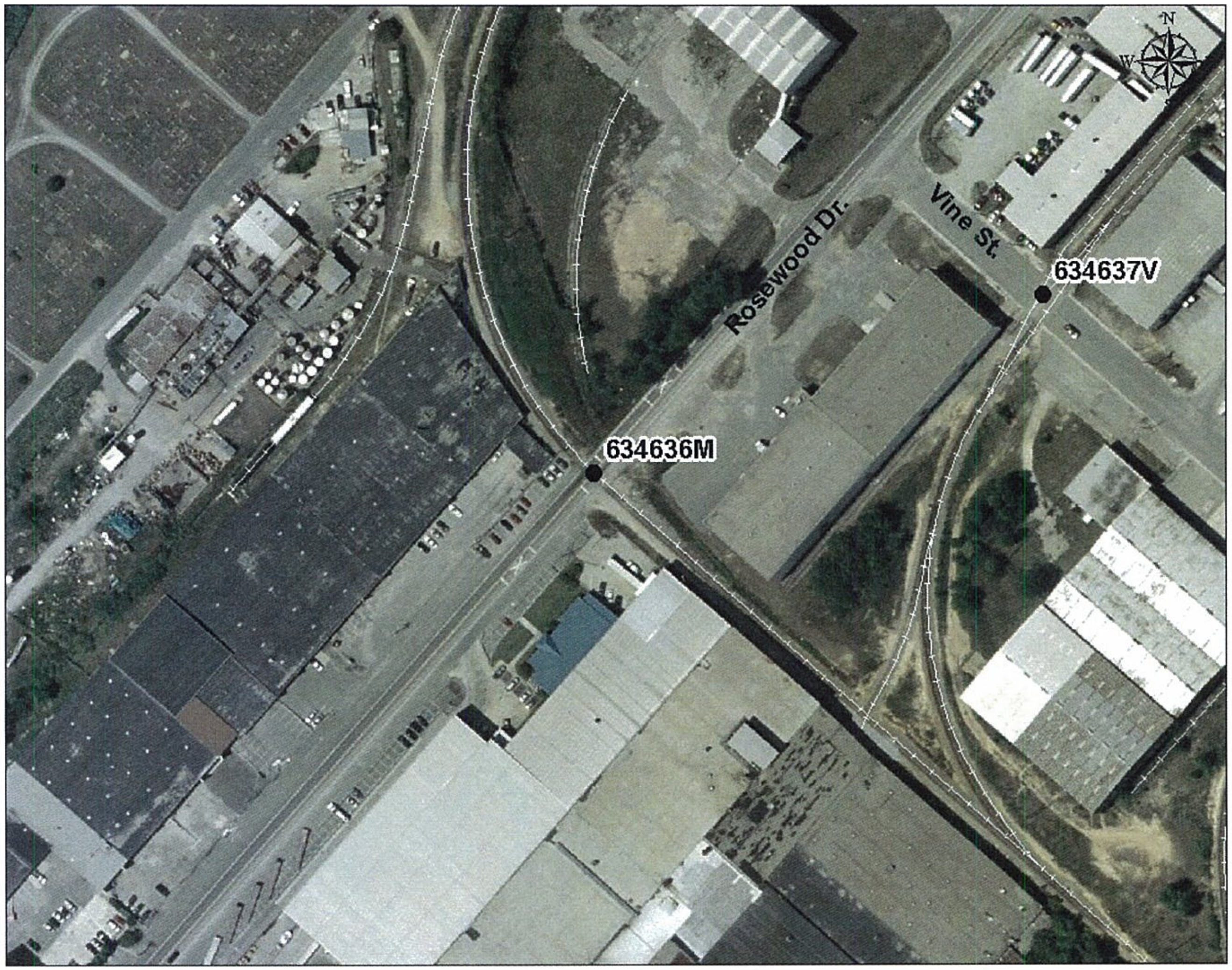


Figure III-6

Crossing Number	Milepost	Railroad	Street Name	Street Classification	Warning Device	Land Use
634637U	373.39	CSX	Vine Street	Urban Local	CB	Industrial

24 Hour ADT	24 Hour Train Volume	Accident History	Transit Route	School Bus Route	Truck Route
320	2	None	No		

Preemption	Humped Crossing	Crossing Condition_Geometry	Crossing Surface Condition	Crossing Condition_Sight	Redundant Crossing
☐	☐	Good	Poor	Good	No

Economic Impact if Closed	Feasibility of Roadway Improvements	Grade Separation Investigation	Recommendations

Aerial

Figure III-7

Crossing Number	Milepost	Railroad	Street Name	Street Classification	Warning Device	Land Use
634638B	373.39	CSX	Vine Street	Rural Local	CB	Industrial

24 Hour ADT	24 Hour Train Volume	Accident History	Transit Route	School Bus Route	Truck Route
120	2	None	No		

Preemption	Humped Crossing	Crossing Condition_Geometry	Crossing Surface Condition	Crossing Condition_Sight	Redundant Crossing
☐	☐	Good	Poor	Good	No

Economic Impact if Closed	Feasibility of Roadway Improvements	Grade Separation Investigation	Recommendations

Aerial

Figure III-8

Crossing Number	Milepost	Railroad	Street Name	Street Classification	Warning Device	Land Use
634640C	373.39	CSX	Duval Street	Urban Local	CB	Industrial

24 Hour ADT	24 Hour Train Volume	Accident History	Transit Route	School Bus Route	Truck Route
115	2	None	No		

Preemption	Humped Crossing	Crossing Condition_Geometry	Crossing Surface Condition	Crossing Condition_Sight	Redundant Crossing
☐	☐	Good	Poor	Good	No

Economic Impact if Closed	Feasibility of Roadway Improvements	Grade Separation Investigation	Recommendations

Aerial

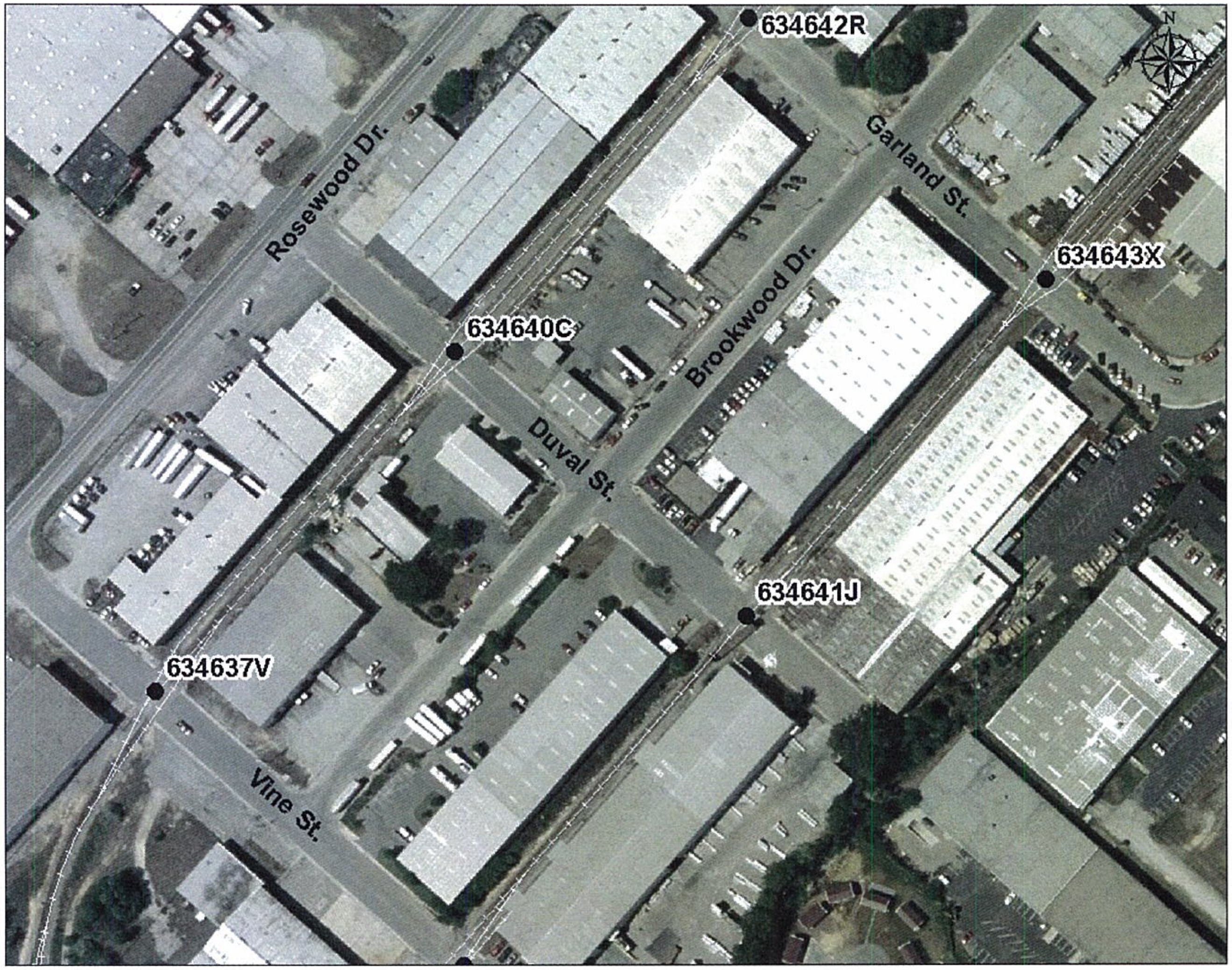


Figure III-9

Crossing Number	Milepost	Railroad	Street Name	Street Classification	Warning Device	Land Use
634641J	373.39	CSX	Duval Street	Urban Local	CB	Industrial

24 Hour ADT	24 Hour Train Volume	Accident History	Transit Route	School Bus Route	Truck Route
145	2	None	No		

Preemption	Humped Crossing	Crossing Condition_Geometry	Crossing Surface Condition	Crossing Condition_Sight	Redundant Crossing
☐	☐	Good	Poor	Good	No

Economic Impact if Closed	Feasibility of Roadway Improvements	Grade Separation Investigation	Recommendations

Aerial

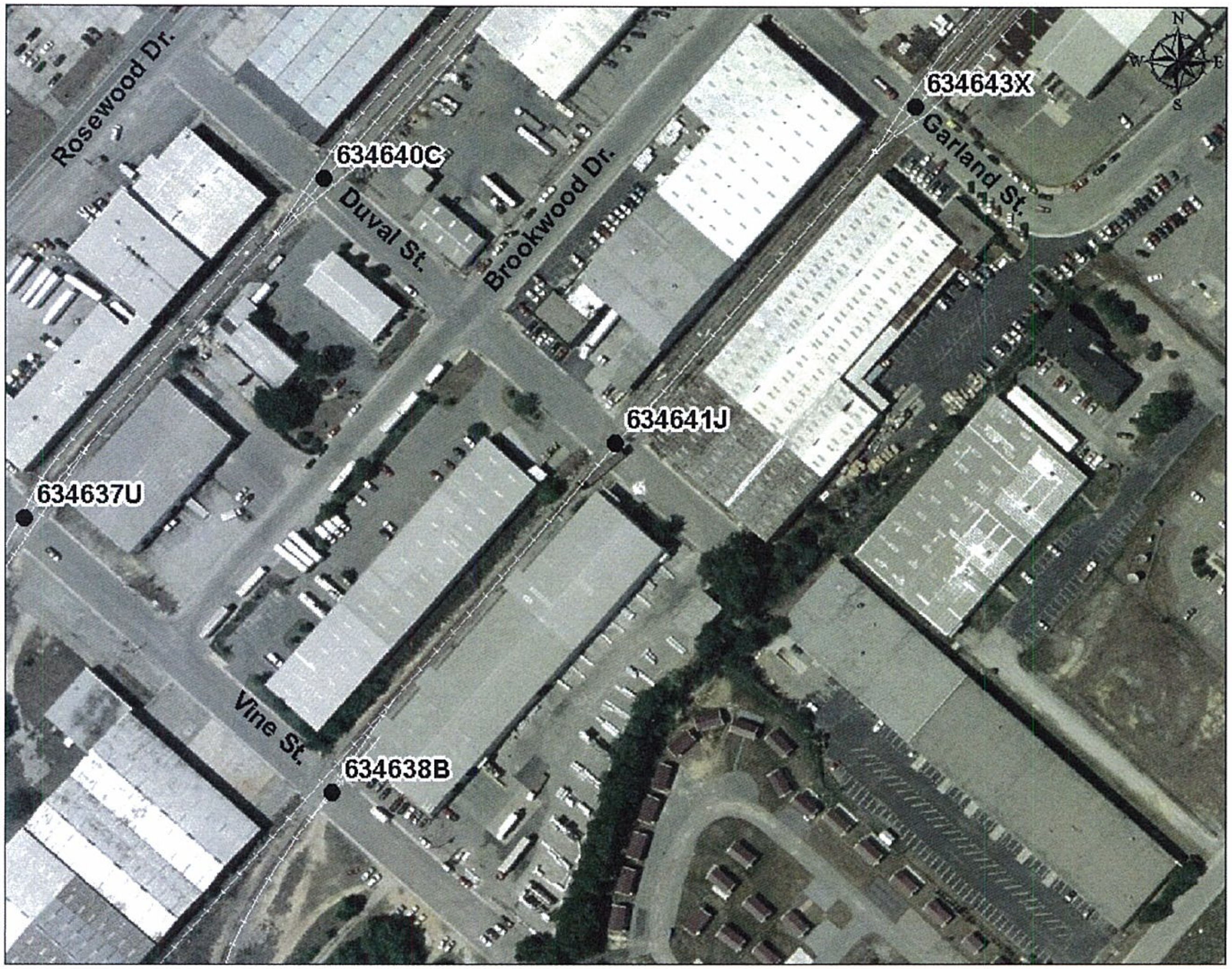


Figure III-10

Crossing Number	Milepost	Railroad	Street Name	Street Classification	Warning Device	Land Use
634642R	373.39	CSX	Garland Street	Urban Local	CB	Industrial

24 Hour ADT	24 Hour Train Volume	Accident History	Transit Route	School Bus Route	Truck Route
175	2	None	No		

Preemption	Humped Crossing	Crossing Condition_Geometry	Crossing Surface Condition	Crossing Condition_Sight	Redundant Crossing
☐	☐	Good	Fair	Good	No

Economic Impact if Closed	Feasibility of Roadway Improvements	Grade Separation Investigation	Recommendations

Aerial

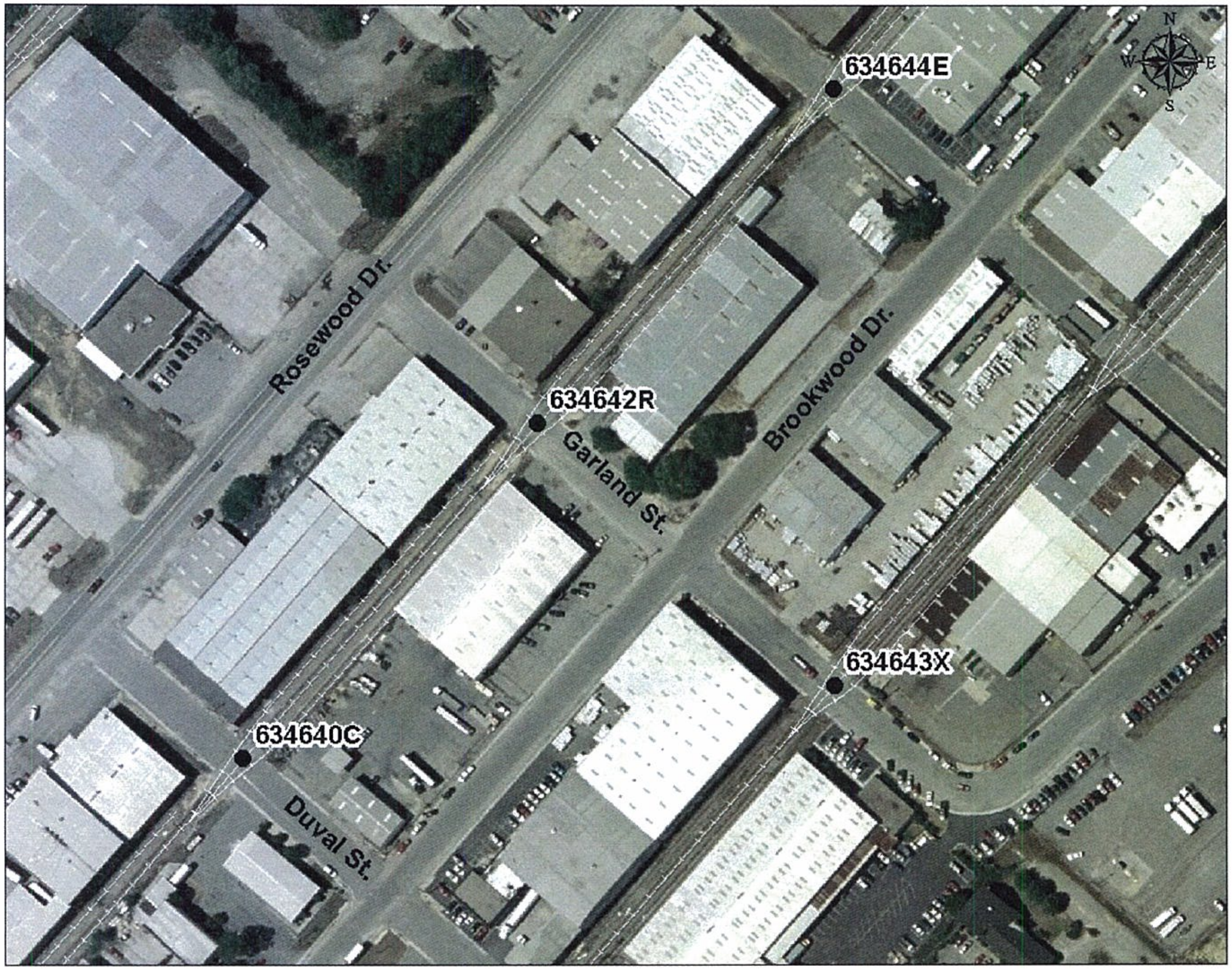


Figure III-11

Crossing Number	Milepost	Railroad	Street Name	Street Classification	Warning Device	Land Use
634644E	373.39	CSX	Oakdale Road	Urban Local	CB	Industrial

24 Hour ADT	24 Hour Train Volume	Accident History	Transit Route	School Bus Route	Truck Route
110	2	None	No		

Preemption	Humped Crossing	Crossing Condition_Geometry	Crossing Surface Condition	Crossing Condition_Sight	Redundant Crossing
☐	☐	Fair	Poor	Fair	No

Economic Impact if Closed	Feasibility of Roadway Improvements	Grade Separation Investigation	Recommendations

Aerial

Figure III-12

Crossing Number	Milepost	Railroad	Street Name	Street Classification	Warning Device	Land Use
634643X	373.39	CSX	Garland Street	Urban Local	CB	Industrial

24 Hour ADT	24 Hour Train Volume	Accident History	Transit Route	School Bus Route	Truck Route
305	2	None	No		

Preemption	Humped Crossing	Crossing Condition_Geometry	Crossing Surface Condition	Crossing Condition_Sight	Redundant Crossing
☐	☐	Good	Fair	Fair	No

Economic Impact if Closed	Feasibility of Roadway Improvements	Grade Separation Investigation	Recommendations

Aerial

Figure III-13

Crossing Number	Milepost	Railroad	Street Name	Street Classification	Warning Device	Land Use
634648G	373.65	CSX	Park Street	Urban Local	Gates, MMFL, CFL	Commercial/Residential

24 Hour ADT	24 Hour Train Volume	Accident History	Transit Route	School Bus Route	Truck Route
500	7	3-PDO	No		

Preemption	Humped Crossing	Crossing Condition_Geometry	Crossing Surface Condition	Crossing Condition_Sight	Redundant Crossing
☐	☐	Good	Good	Good	No

Economic Impact if Closed	Feasibility of Roadway Improvements	Grade Separation Investigation	Recommendations

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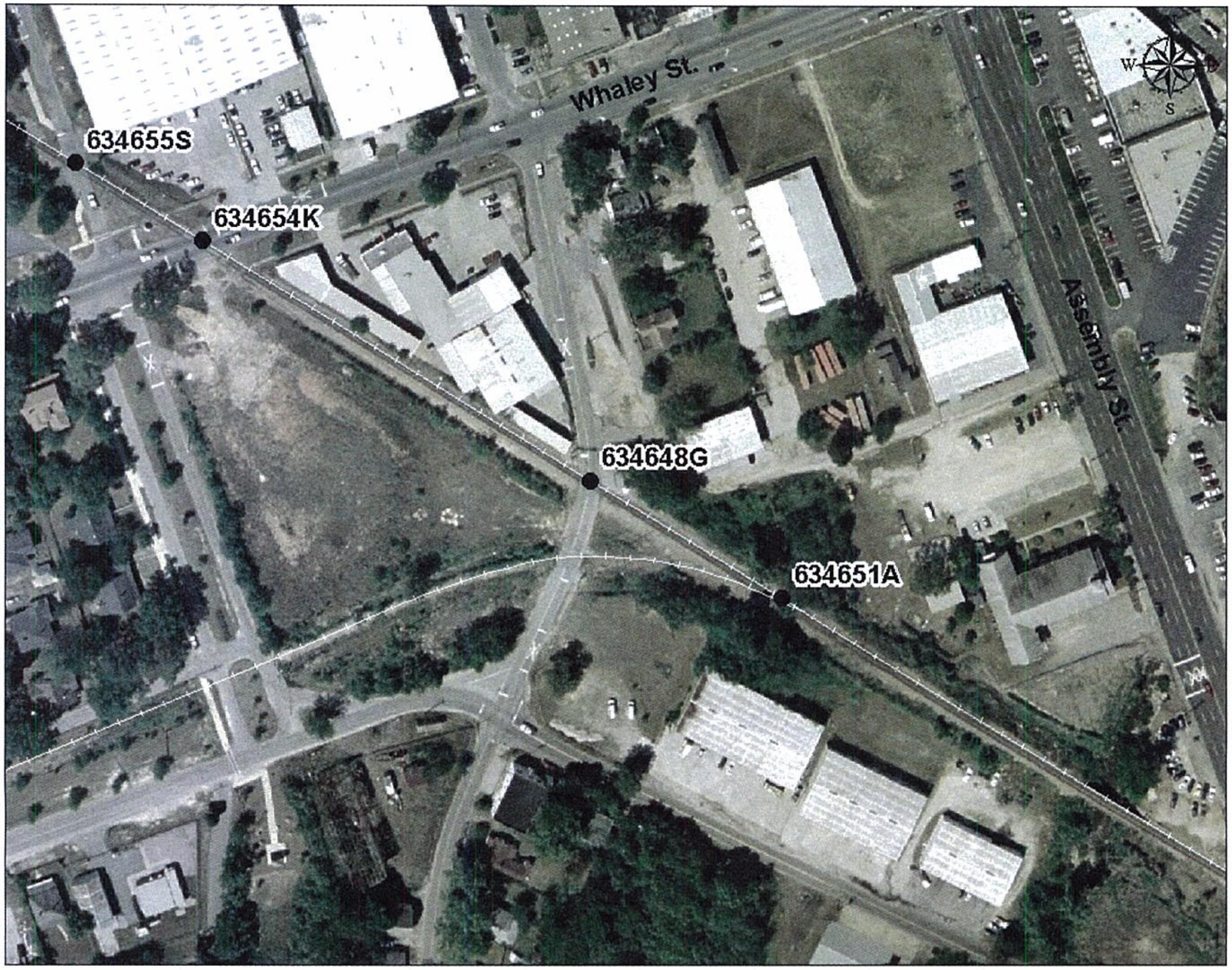

Figure III-14

Crossing Number	Milepost	Railroad	Street Name	Street Classification	Warning Device	Land Use
634651P	373.60	CSX	Heyward Street	Urban Local	CB	Commercial

24 Hour ADT	24 Hour Train Volume	Accident History	Transit Route	School Bus Route	Truck Route
4800	1	1-PDO	No		

Preemption	Humped Crossing	Crossing Condition_Geometry	Crossing Surface Condition	Crossing Condition_Sight	Redundant Crossing
☐	☐				No

Economic Impact if Closed	Feasibility of Roadway Improvements	Grade Separation Investigation	Recommendations

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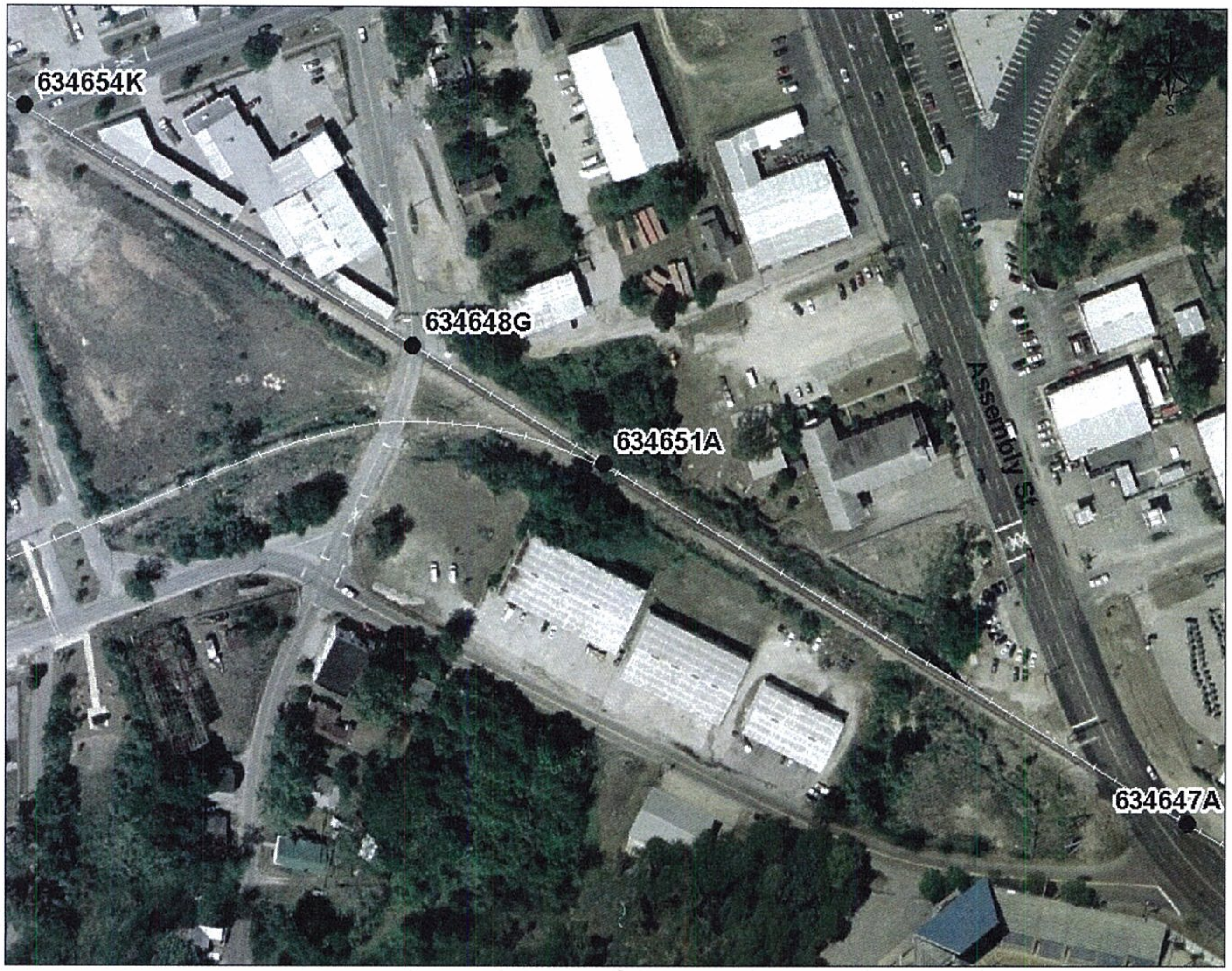


Figure III-15

Crossing Number	Milepost	Railroad	Street Name	Street Classification	Warning Device	Land Use
634654K	373.77	CSX	Whaley Street	Urban Minor Arterial	CB, MMFL, CFL	Commercial/Residential

24 Hour ADT	24 Hour Train Volume	Accident History	Transit Route	School Bus Route	Truck Route
8065	7	1-Injury, 12-PDO	No		

Preemption	Humped Crossing	Crossing Condition_Geometry	Crossing Surface Condition	Crossing Condition_Sight	Redundant Crossing
☐	☐	Poor	Fair	Poor	No

Economic Impact if Closed	Feasibility of Roadway Improvements	Grade Separation Investigation	Recommendations

Aerial

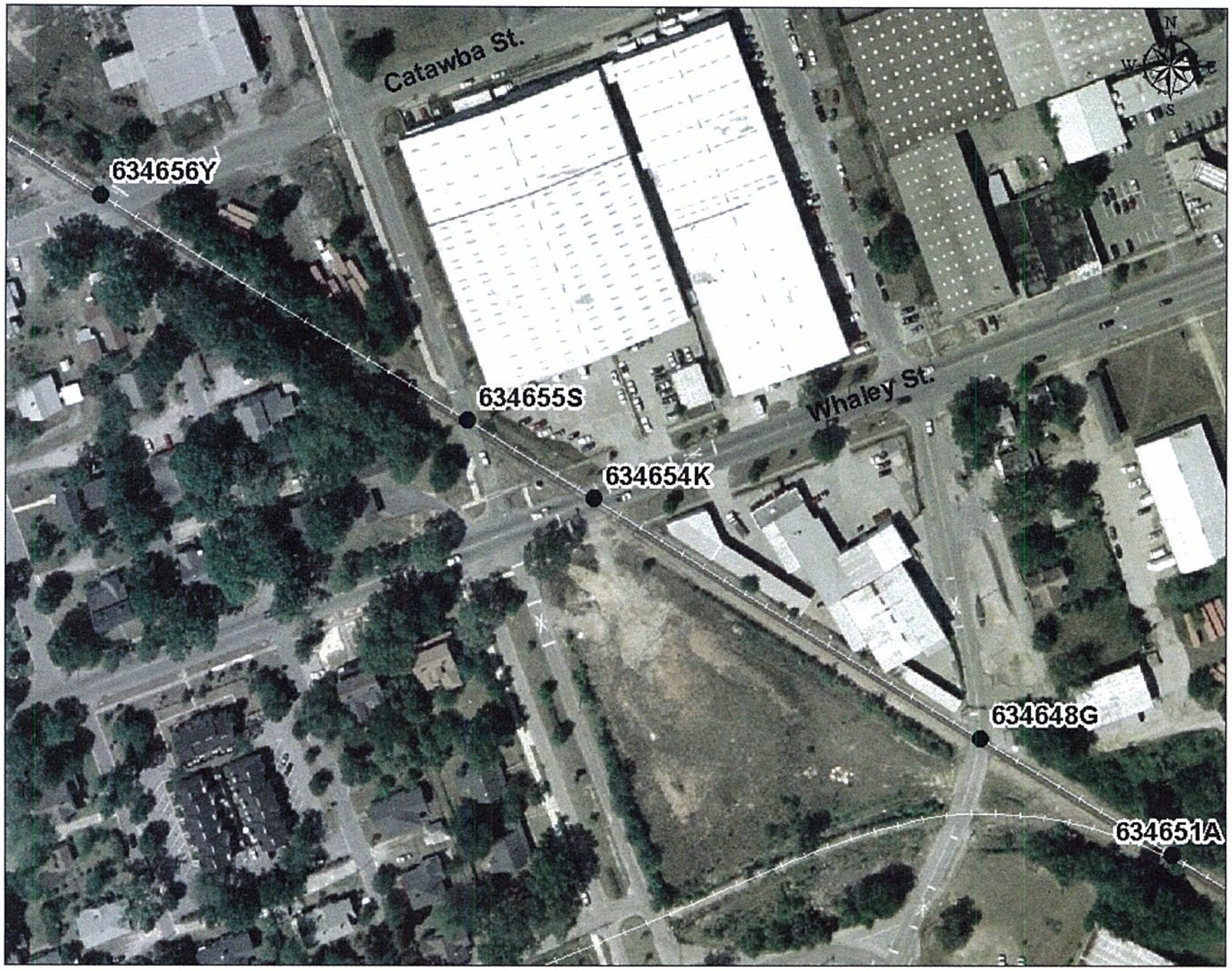


Figure III-16

Crossing Number	Milepost	Railroad	Street Name	Street Classification	Warning Device	Land Use
634655S	373.80	CSX	Lincoln Street	Urban Local	CB	Commercial

24 Hour ADT	24 Hour Train Volume	Accident History	Transit Route	School Bus Route	Truck Route
990	7	1-Injury, 3-PDO	No		

Preemption	Humped Crossing	Crossing Condition_Geometry	Crossing Surface Condition	Crossing Condition_Sight	Redundant Crossing
☐	☐	Poor	Fair	Fair	No

Economic Impact if Closed	Feasibility of Roadway Improvements	Grade Separation Investigation	Recommendations

Aerial

Figure III-17

Crossing Number	Milepost	Railroad	Street Name	Street Classification	Warning Device	Land Use
634656Y	373.91	CSX	Catawba Street	Urban Local	MMFL, CFL	Commercial/Residential

24 Hour ADT	24 Hour Train Volume	Accident History	Transit Route	School Bus Route	Truck Route
565	7	1-PDO	No		

Preemption	Humped Crossing	Crossing Condition_Geometry	Crossing Surface Condition	Crossing Condition_Sight	Redundant Crossing
☐	☐	Poor	Fair	Fair	No

Economic Impact if Closed	Feasibility of Roadway Improvements	Grade Separation Investigation	Recommendations

Aerial

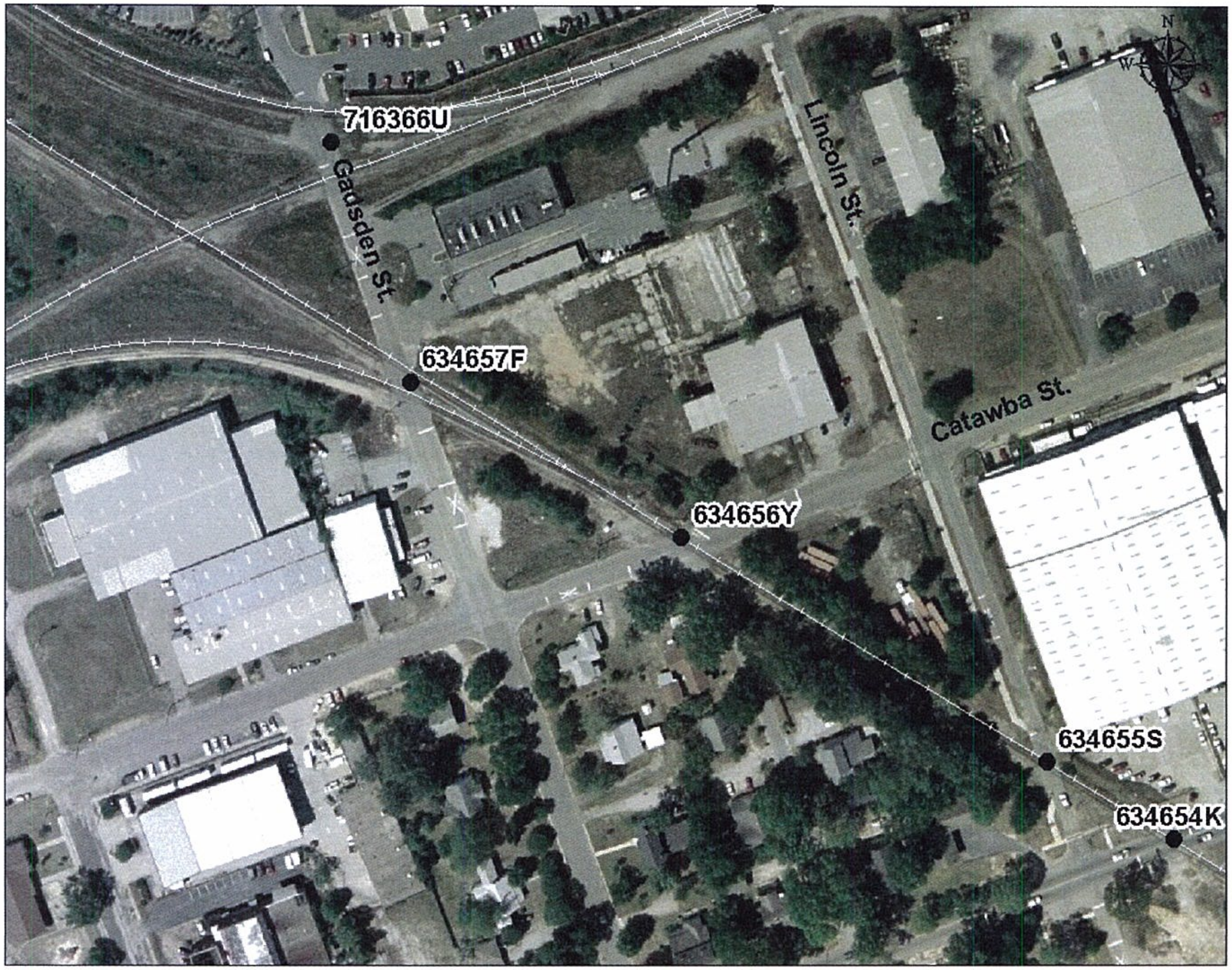


Figure III-18

Crossing Number	Milepost	Railroad	Street Name	Street Classification	Warning Device	Land Use
634657F	374.00	CSX	Gadsden Street	Urban Local	CB	Commercial

24 Hour ADT	24 Hour Train Volume	Accident History	Transit Route	School Bus Route	Truck Route
185	7	None	No		

Preemption	Humped Crossing	Crossing Condition_Geometry	Crossing Surface Condition	Crossing Condition_Sight	Redundant Crossing
☐	☐	Good	Good	Good	No

Economic Impact if Closed	Feasibility of Roadway Improvements	Grade Separation Investigation	Recommendations

Aerial

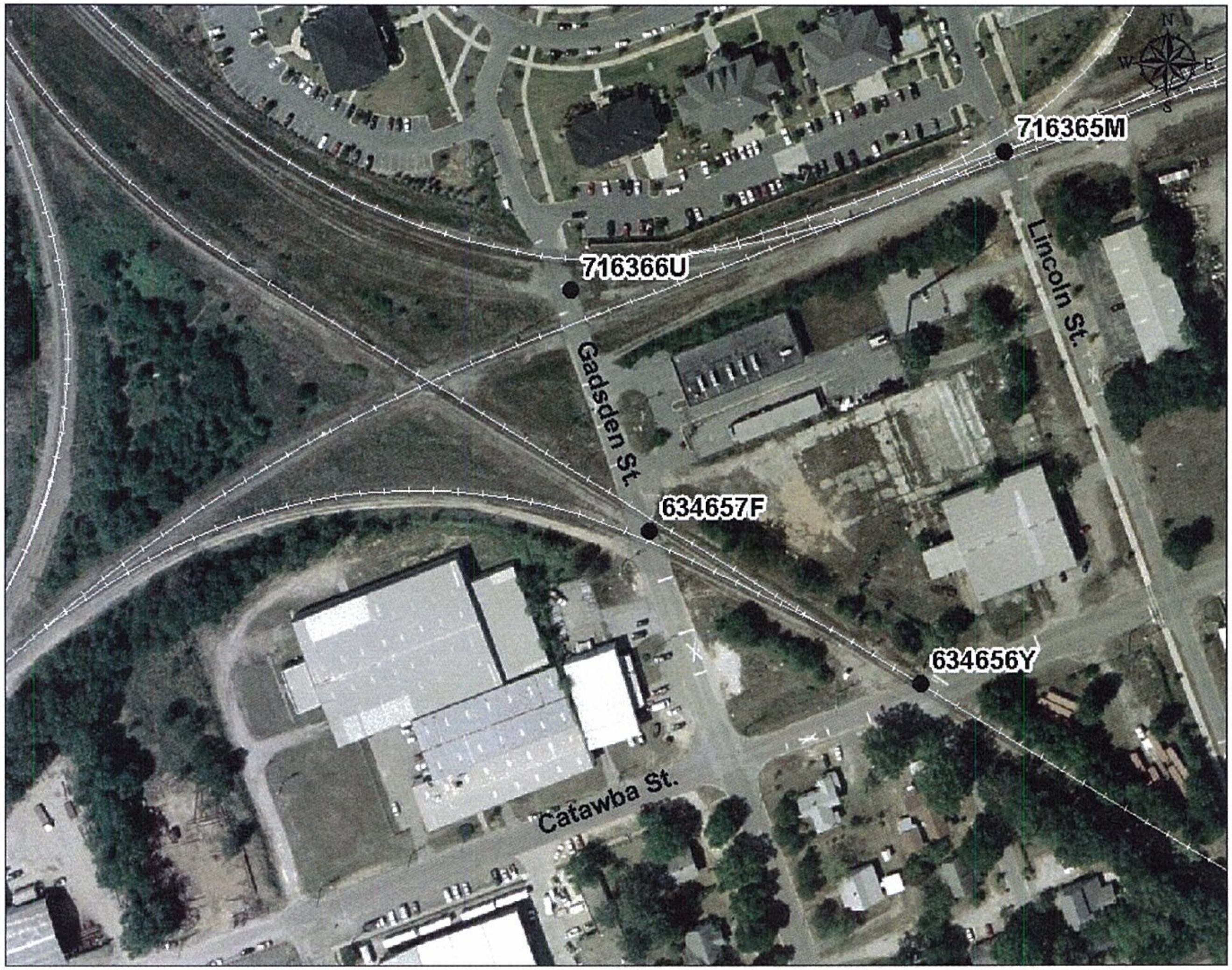


Figure III-19

Crossing Number	Milepost	Railroad	Street Name	Street Classification	Warning Device	Land Use
715847J	S359.61	CSX	Huger Street	Urban Minor Arterial	CB, Gates, MMFL, CFL	Commercial/Residential

24 Hour ADT	24 Hour Train Volume	Accident History	Transit Route	School Bus Route	Truck Route
18105	8	2-Injury, 5-PDO	No		

Preemption	Humped Crossing	Crossing Condition_Geometry	Crossing Surface Condition	Crossing Condition_Sight	Redundant Crossing
☐	☐	Good	Good	Good	No

Economic Impact if Closed	Feasibility of Roadway Improvements	Grade Separation Investigation	Recommendations

Aerial

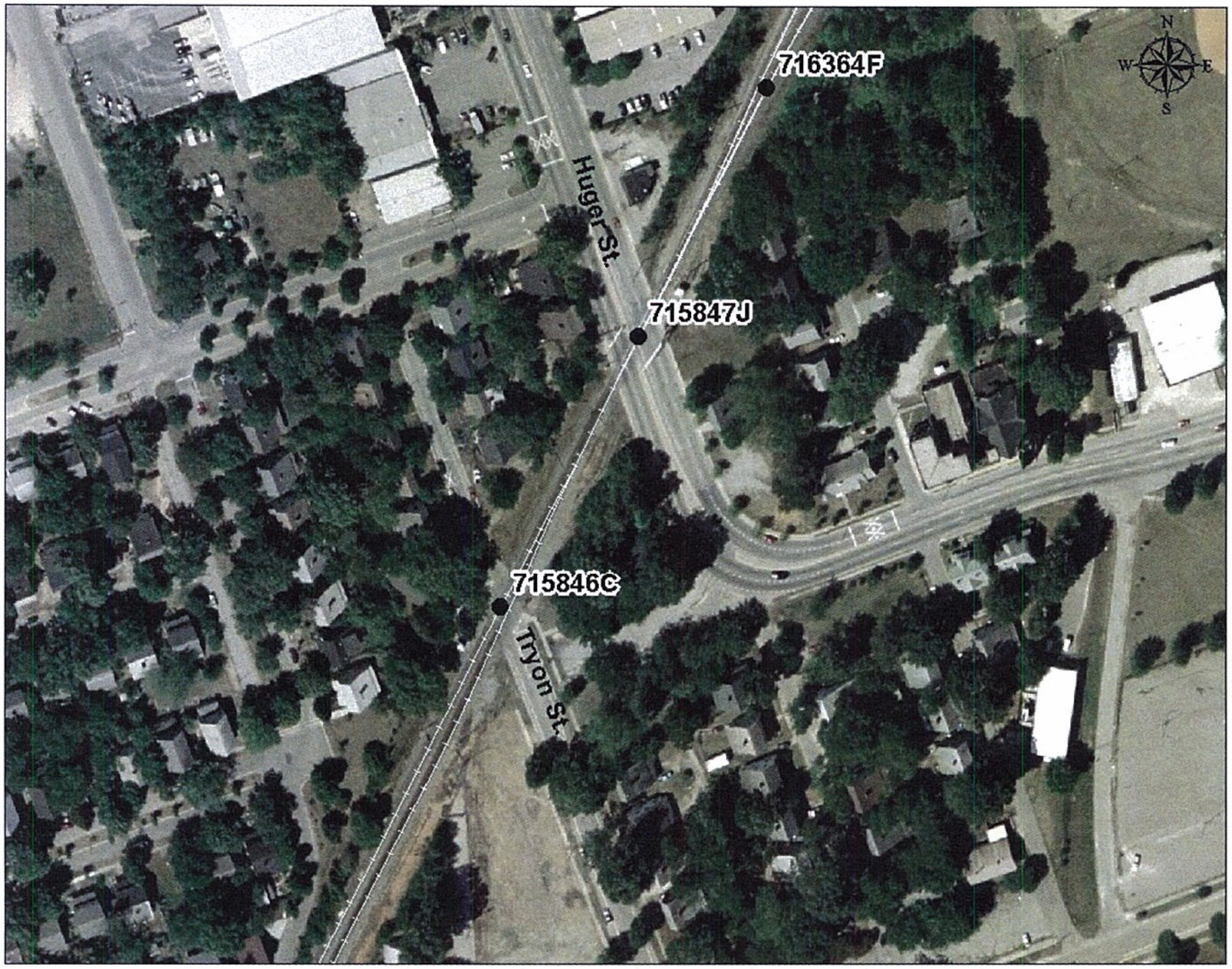


Figure III-20

Crossing Number	Milepost	Railroad	Street Name	Street Classification	Warning Device	Land Use
715396H	C126.90	NS	Key Road	Urban Collector	CB	Commercial

24 Hour ADT	24 Hour Train Volume	Accident History	Transit Route	School Bus Route	Truck Route
1610	0	1-PDO	No		

Preemption	Humped Crossing	Crossing Condition_Geometry	Crossing Surface Condition	Crossing Condition_Sight	Redundant Crossing
☐	☐	Poor	Fair	Poor	No

Economic Impact if Closed	Feasibility of Roadway Improvements	Grade Separation Investigation	Recommendations

Aerial

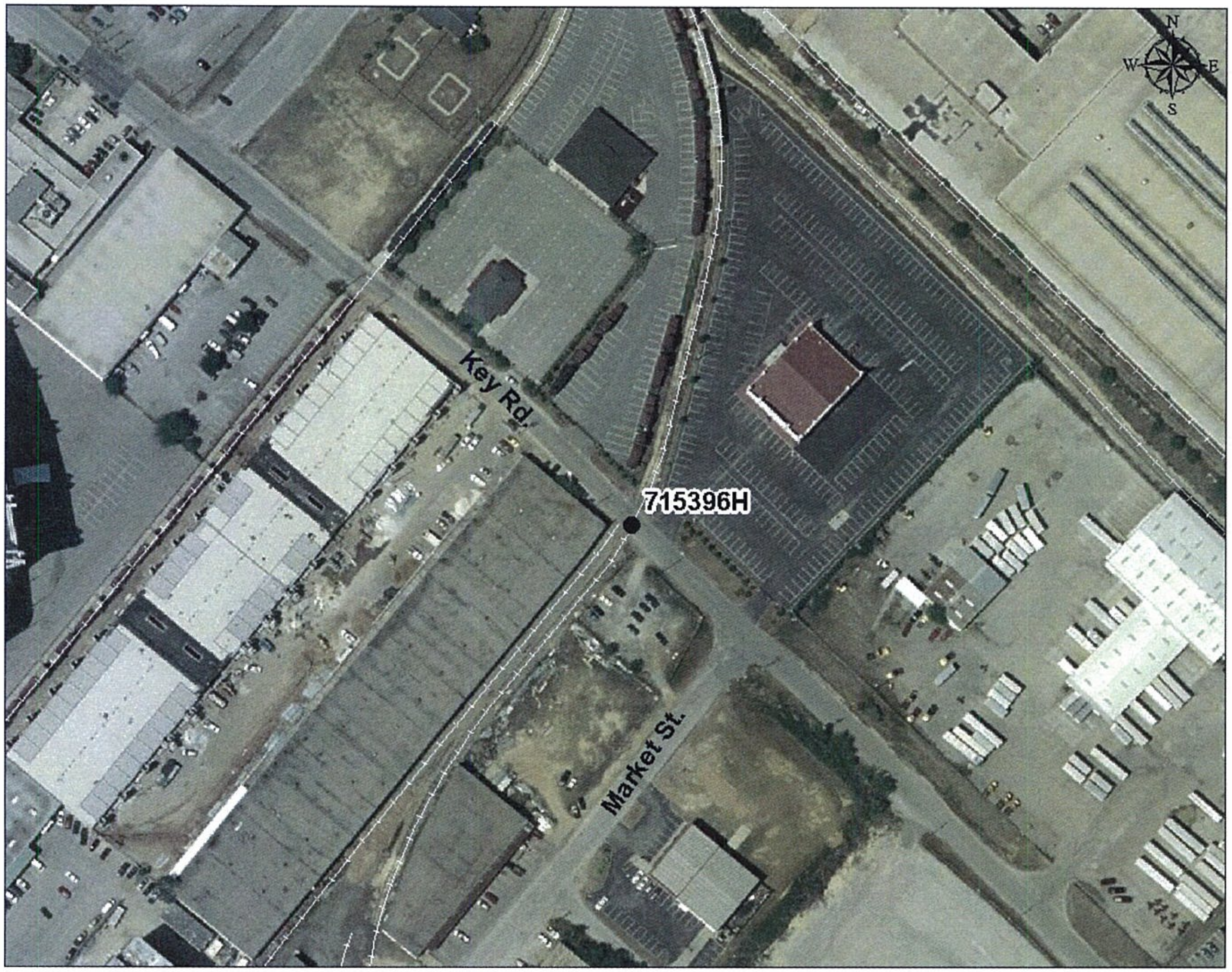


Figure III-21

Crossing Number	Milepost	Railroad	Street Name	Street Classification	Warning Device	Land Use
715400V	C127.10	NS	Shop Road	Urban Minor Arterial	CB, Gates, MMFL	Commercial

24 Hour ADT	24 Hour Train Volume	Accident History	Transit Route	School Bus Route	Truck Route
20700	2	1-Injury, 2-PDO	No		

Preemption	Humped Crossing	Crossing Condition_Geometry	Crossing Surface Condition	Crossing Condition_Sight	Redundant Crossing
☐	☐	Poor	Good	Poor	No

Economic Impact if Closed	Feasibility of Roadway Improvements	Grade Separation Investigation	Recommendations

Aerial

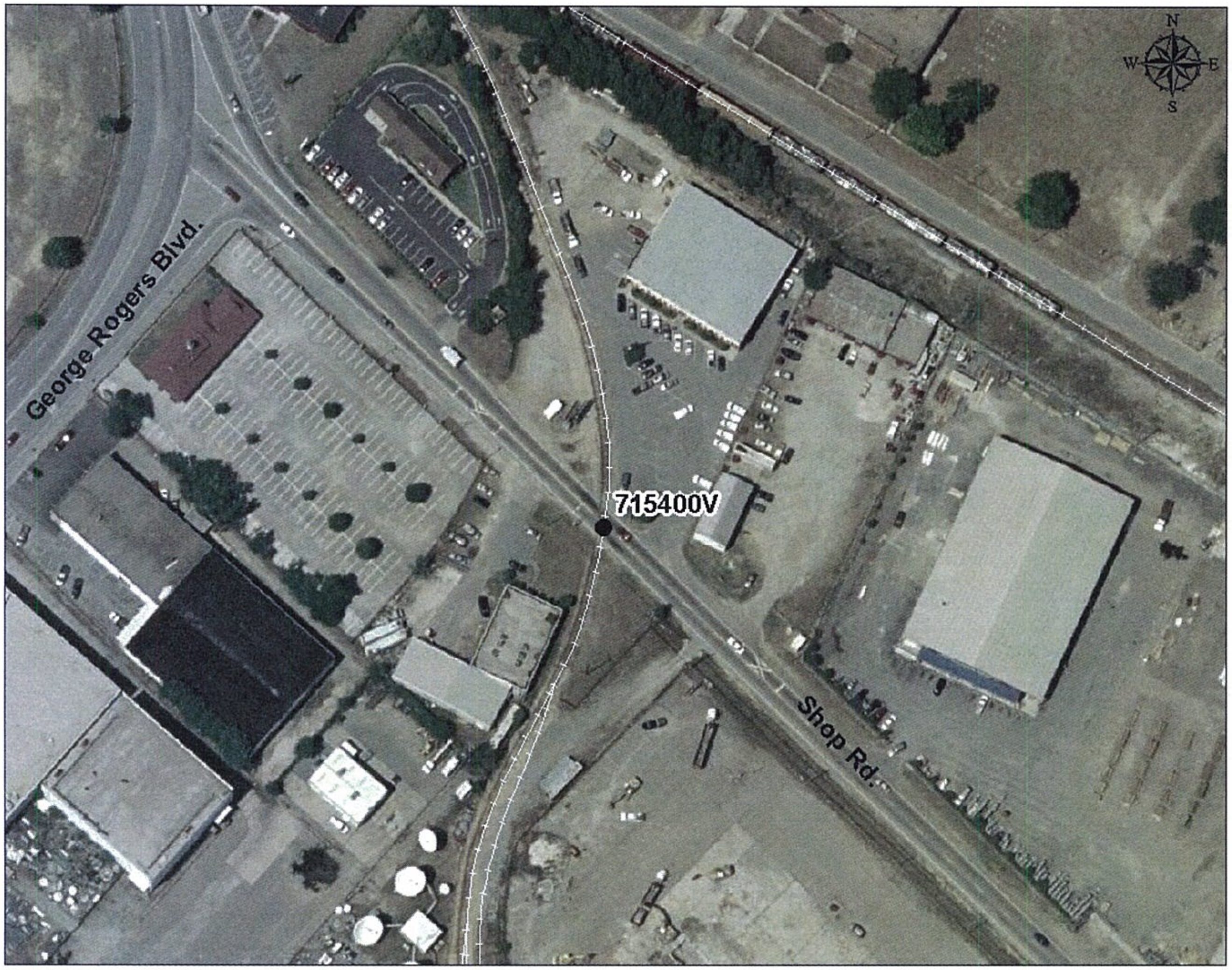


Figure III-22

Crossing Number	Milepost	Railroad	Street Name	Street Classification	Warning Device	Land Use
715402J	C128.50	NS	Heyward Street	Urban Collector	CB, Gates, MMFL	Residential/Institutional

24 Hour ADT	24 Hour Train Volume	Accident History	Transit Route	School Bus Route	Truck Route
2000	12	1-PDO	No		

Preemption	Humped Crossing	Crossing Condition_Geometry	Crossing Surface Condition	Crossing Condition_Sight	Redundant Crossing
☐	☐	Good	Good	Good	No

Economic Impact if Closed	Feasibility of Roadway Improvements	Grade Separation Investigation	Recommendations

Aerial

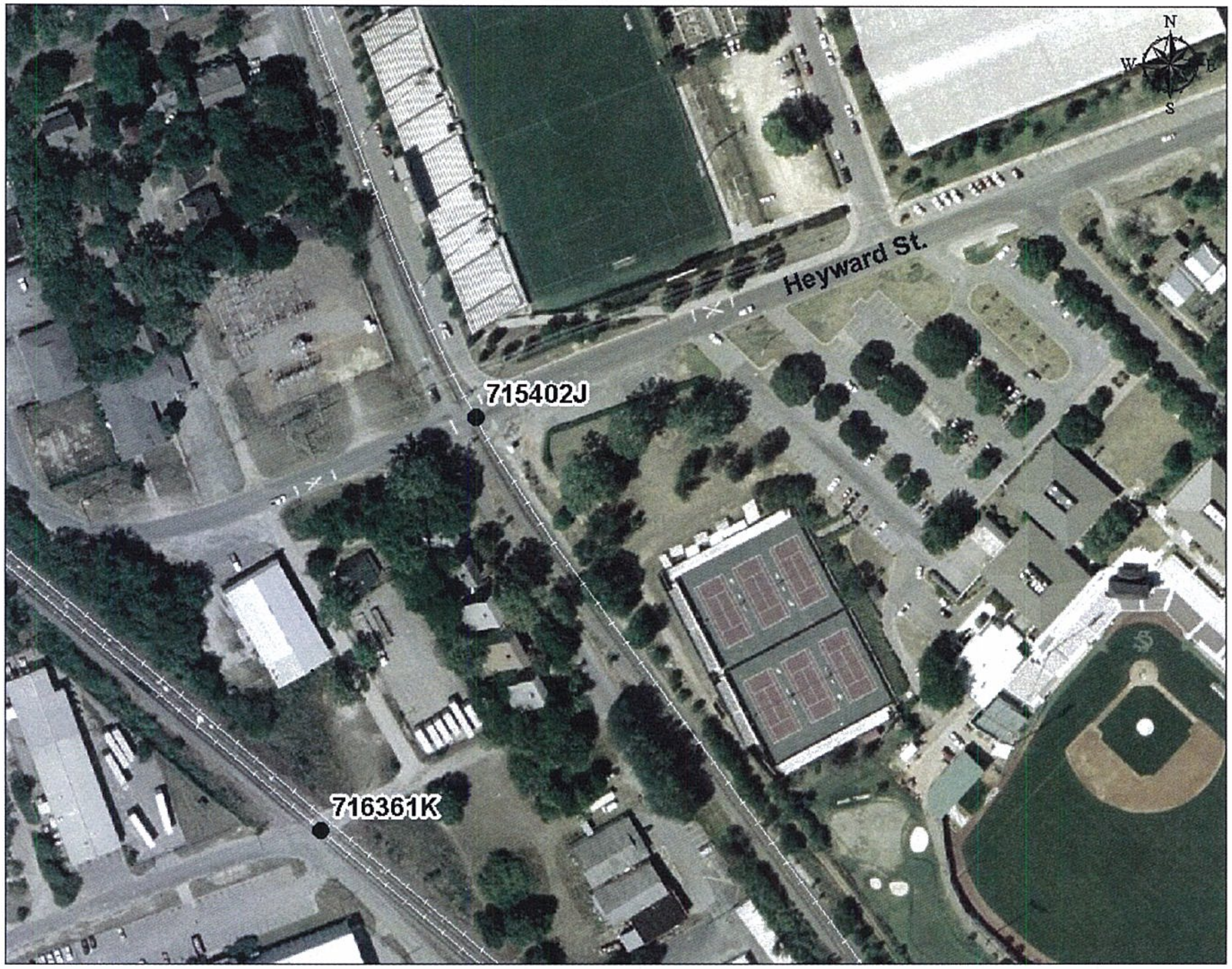


Figure III-23

Crossing Number	Milepost	Railroad	Street Name	Street Classification	Warning Device	Land Use
715403R	C128.60	NS	Whaley Street	Urban Collector	CB, MMFL	Institutional

24 Hour ADT	24 Hour Train Volume	Accident History	Transit Route	School Bus Route	Truck Route
6110	2	1-PDO	No		

Preemption	Humped Crossing	Crossing Condition_Geometry	Crossing Surface Condition	Crossing Condition_Sight	Redundant Crossing
☐	☐	Good	Fair	Good	No

Economic Impact if Closed	Feasibility of Roadway Improvements	Grade Separation Investigation	Recommendations

Aerial

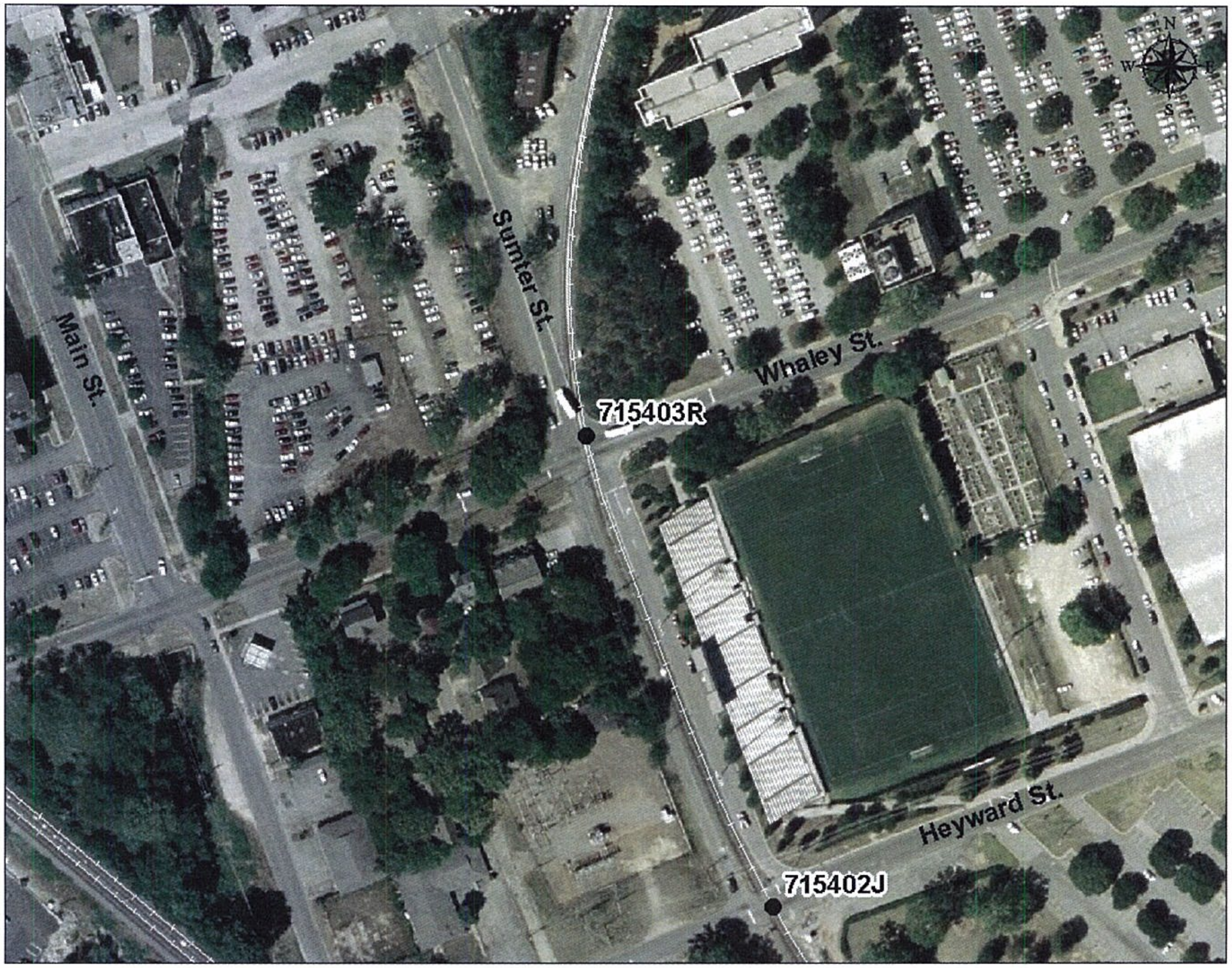


Figure III-24

Crossing Number	Milepost	Railroad	Street Name	Street Classification	Warning Device	Land Use
715620R	108.35	NS	Assembly Street	Urban Minor Arterial	CB, Gates, MMFL, CFL	Commercial

24 Hour ADT	24 Hour Train Volume	Accident History	Transit Route	School Bus Route	Truck Route
26100	6	1-Injury, 5-PDO	No		

Preemption	Humped Crossing	Crossing Condition_Geometry	Crossing Surface Condition	Crossing Condition_Sight	Redundant Crossing
☐	☐	Good	Fair/Good	Good	No

Economic Impact if Closed	Feasibility of Roadway Improvements	Grade Separation Investigation	Recommendations

Aerial

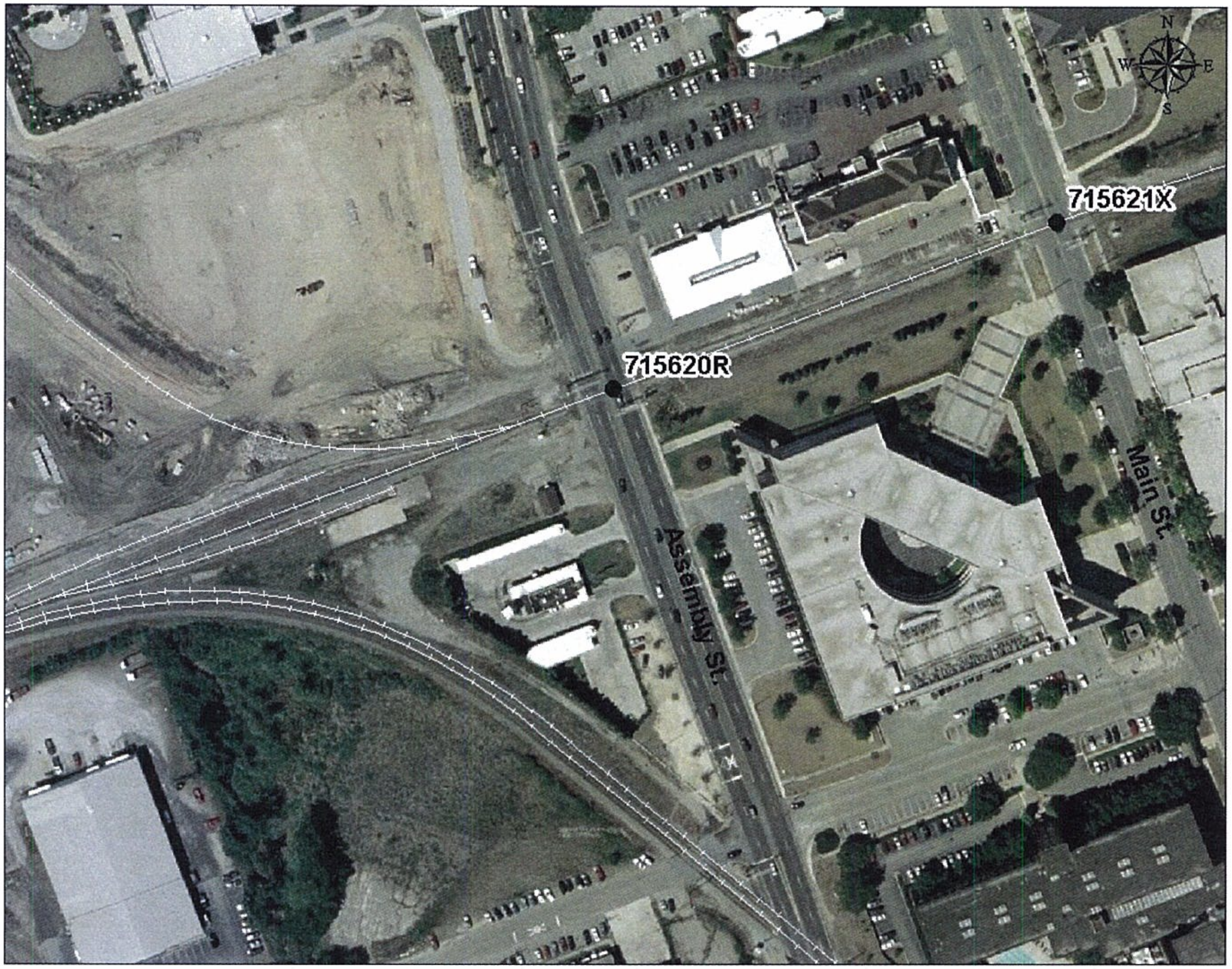


Figure III-25

Crossing Number	Milepost	Railroad	Street Name	Street Classification	Warning Device	Land Use
715621X	R108.30	NS	S. Main Street	Urban Local	CB, Gates, MMFL, CFL	Commercial/Institutional

24 Hour ADT	24 Hour Train Volume	Accident History	Transit Route	School Bus Route	Truck Route
4655	10	2-Injury, 3-PDO	No		

Preemption	Humped Crossing	Crossing Condition_Geometry	Crossing Surface Condition	Crossing Condition_Sight	Redundant Crossing
☐	☐	Good	Fair	Good	No

Economic Impact if Closed	Feasibility of Roadway Improvements	Grade Separation Investigation	Recommendations

Aerial

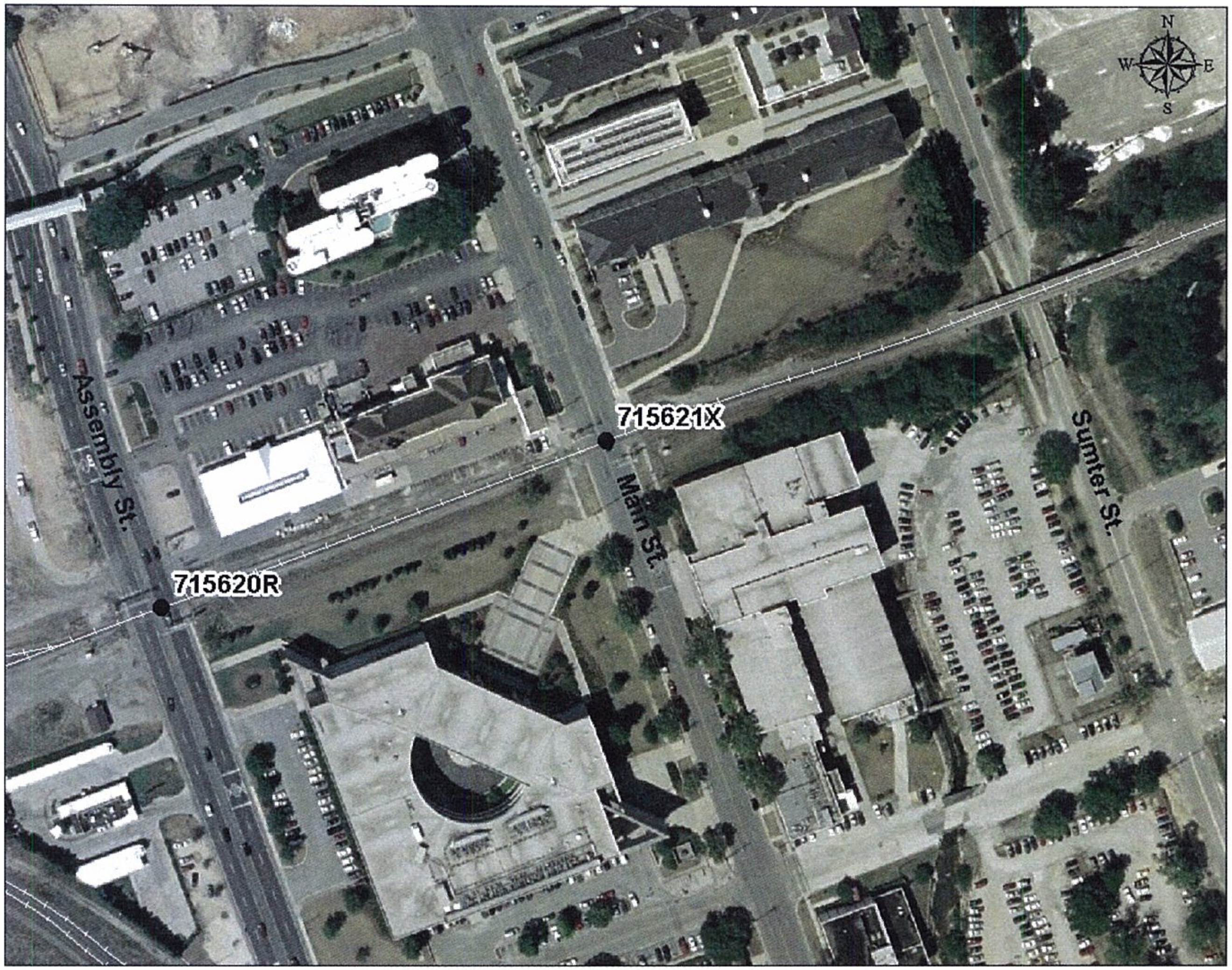


Figure III-26

Crossing Number	Milepost	Railroad	Street Name	Street Classification	Warning Device	Land Use
715846C	R109.05	NS/CSX	Tryon Street	Urban Local	CB, Gates, MMFL	Residential

24 Hour ADT	24 Hour Train Volume	Accident History	Transit Route	School Bus Route	Truck Route
360	14	1-PDO	No		

Preemption	Humped Crossing	Crossing Condition_Geometry	Crossing Surface Condition	Crossing Condition_Sight	Redundant Crossing
☐	☐	Good	Good	Good	No

Economic Impact if Closed	Feasibility of Roadway Improvements	Grade Separation Investigation	Recommendations

Aerial

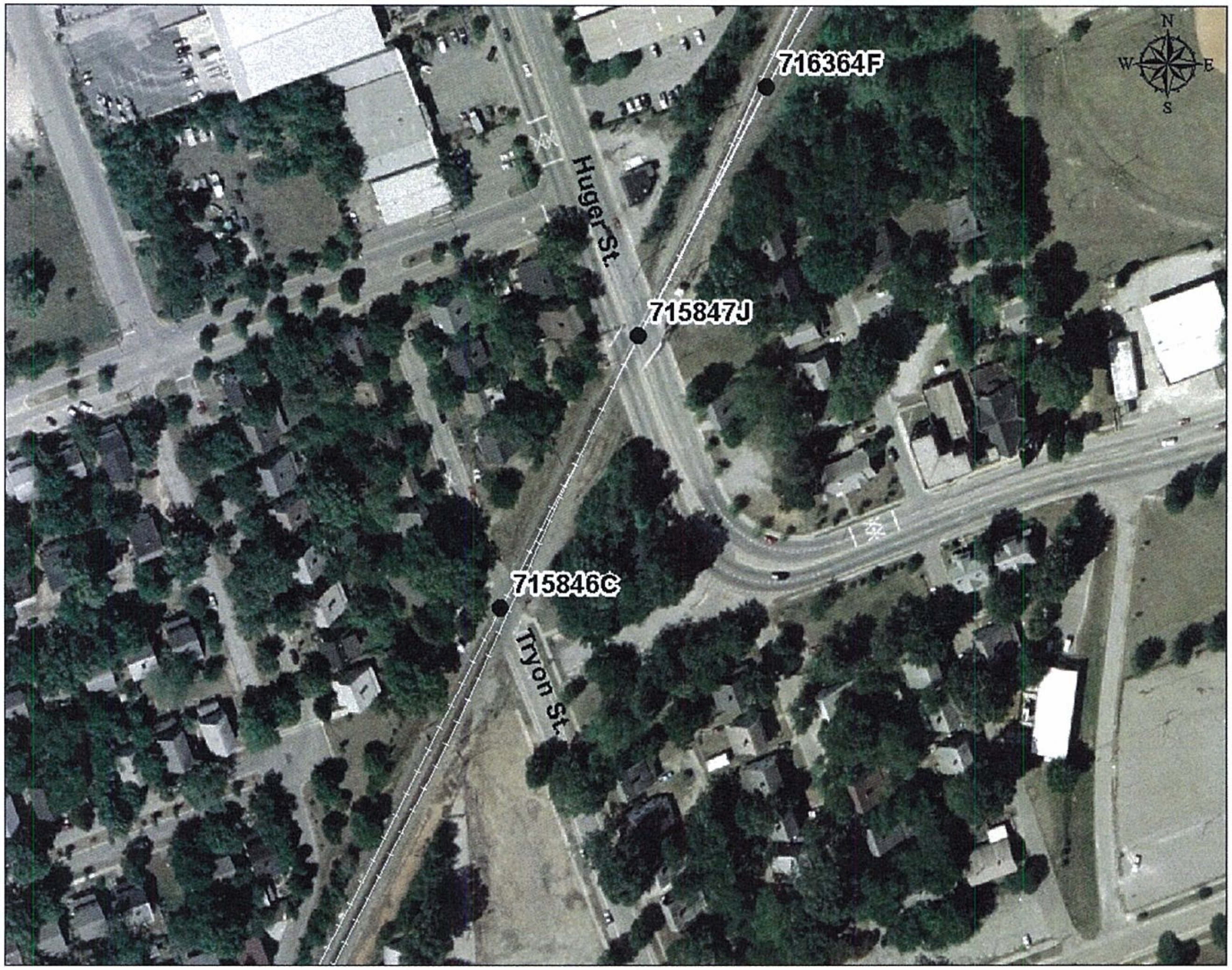


Figure III-27

Crossing Number	Milepost	Railroad	Street Name	Street Classification	Warning Device	Land Use
715866N	R107.85	NS	Pickens Street	Rural Major Collector	CB, Gates, MMFL	Residential/Institutional

24 Hour ADT	24 Hour Train Volume	Accident History	Transit Route	School Bus Route	Truck Route
8110	6	2-Injury, 7-PDO	No		

Preemption	Humped Crossing	Crossing Condition_Geometry	Crossing Surface Condition	Crossing Condition_Sight	Redundant Crossing
☐	☐	Good	Fair	Good	No

Economic Impact if Closed	Feasibility of Roadway Improvements	Grade Separation Investigation	Recommendations

Aerial

Figure III-28

Crossing Number	Milepost	Railroad	Street Name	Street Classification	Warning Device	Land Use
716361K	W161.74	NS	Flora Street	Urban Local	CB	Commercial

24 Hour ADT	24 Hour Train Volume	Accident History	Transit Route	School Bus Route	Truck Route
290	4	3-PDO, 1-Unknown	No		

Preemption	Humped Crossing	Crossing Condition_Geometry	Crossing Surface Condition	Crossing Condition_Sight	Redundant Crossing
☐	☐	Good	Good	Good	No

Economic Impact if Closed	Feasibility of Roadway Improvements	Grade Separation Investigation	Recommendations

Aerial

Figure III-29

Crossing Number	Milepost	Railroad	Street Name	Street Classification	Warning Device	Land Use
716363Y	W161.46	NS	Assembly Street	Urban Minor Arterial	CB, Gates, MMFL	Commercial

24 Hour ADT	24 Hour Train Volume	Accident History	Transit Route	School Bus Route	Truck Route
26100	4	2-Injury, 1-PDO	No		

Preemption	Humped Crossing	Crossing Condition_Geometry	Crossing Surface Condition	Crossing Condition_Sight	Redundant Crossing
☐	☐	Good	Poor (Heaving)	Good	No

Economic Impact if Closed	Feasibility of Roadway Improvements	Grade Separation Investigation	Recommendations

Aerial

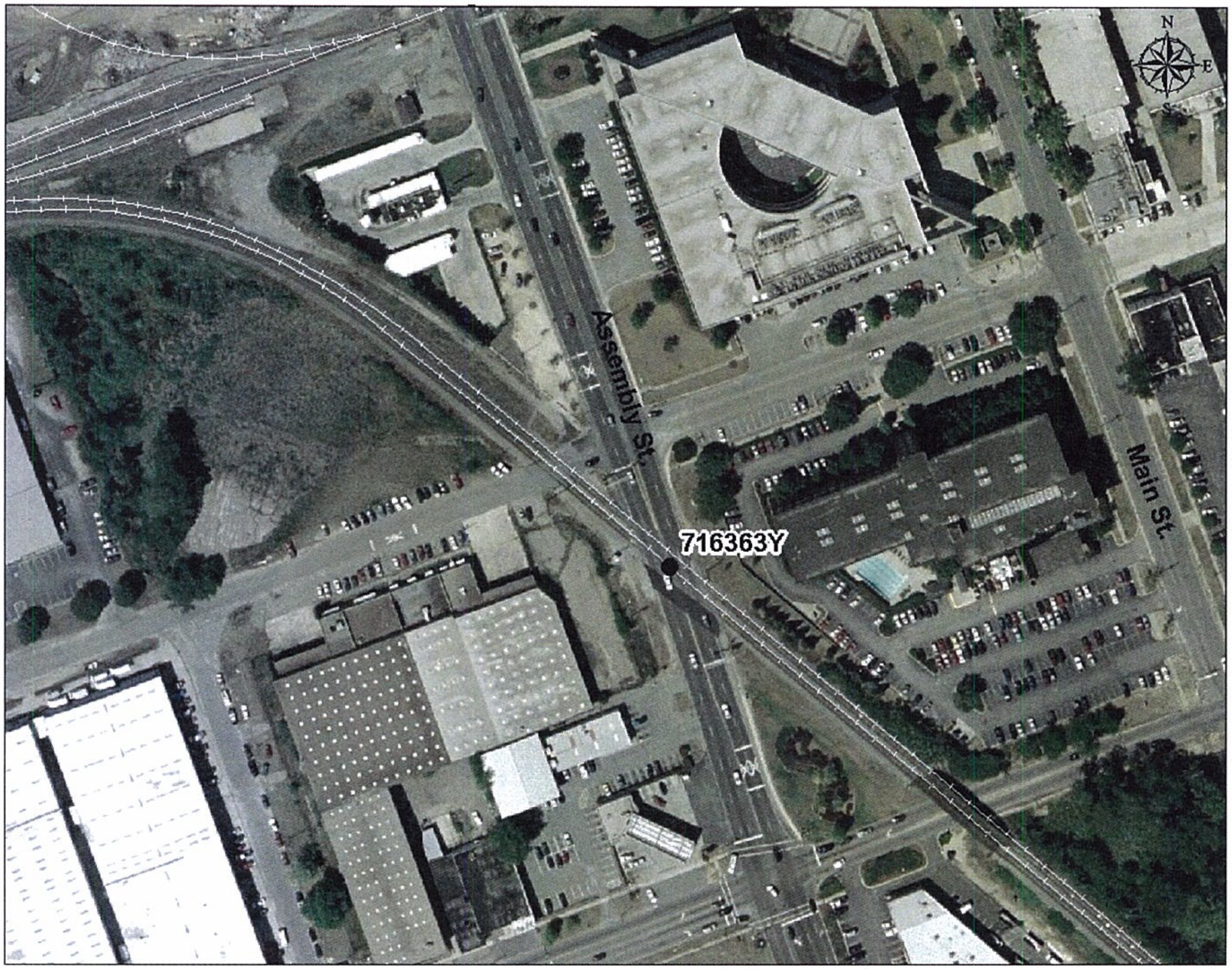


Figure III-30

Crossing Number	Milepost	Railroad	Street Name	Street Classification	Warning Device	Land Use
716364F	W161.42	NS	Catawba Street	Urban Local	CB	Commercial

24 Hour ADT	24 Hour Train Volume	Accident History	Transit Route	School Bus Route	Truck Route
540	16	1-Injury, 4-PDO	No		

Preemption	Humped Crossing	Crossing Condition_Geometry	Crossing Surface Condition	Crossing Condition_Sight	Redundant Crossing
☐	☐				No

Economic Impact if Closed	Feasibility of Roadway Improvements	Grade Separation Investigation	Recommendations

Aerial

Figure III-31

Crossing Number	Milepost	Railroad	Street Name	Street Classification	Warning Device	Land Use
716365M	W161.20	NS	Lincoln Street	Rural Local	CB, MMFL	Commercial

24 Hour ADT	24 Hour Train Volume	Accident History	Transit Route	School Bus Route	Truck Route
1155	16	None	No		

Preemption	Humped Crossing	Crossing Condition_Geometry	Crossing Surface Condition	Crossing Condition_Sight	Redundant Crossing
☐	☐	Good	Good	Good	No

Economic Impact if Closed	Feasibility of Roadway Improvements	Grade Separation Investigation	Recommendations

Aerial

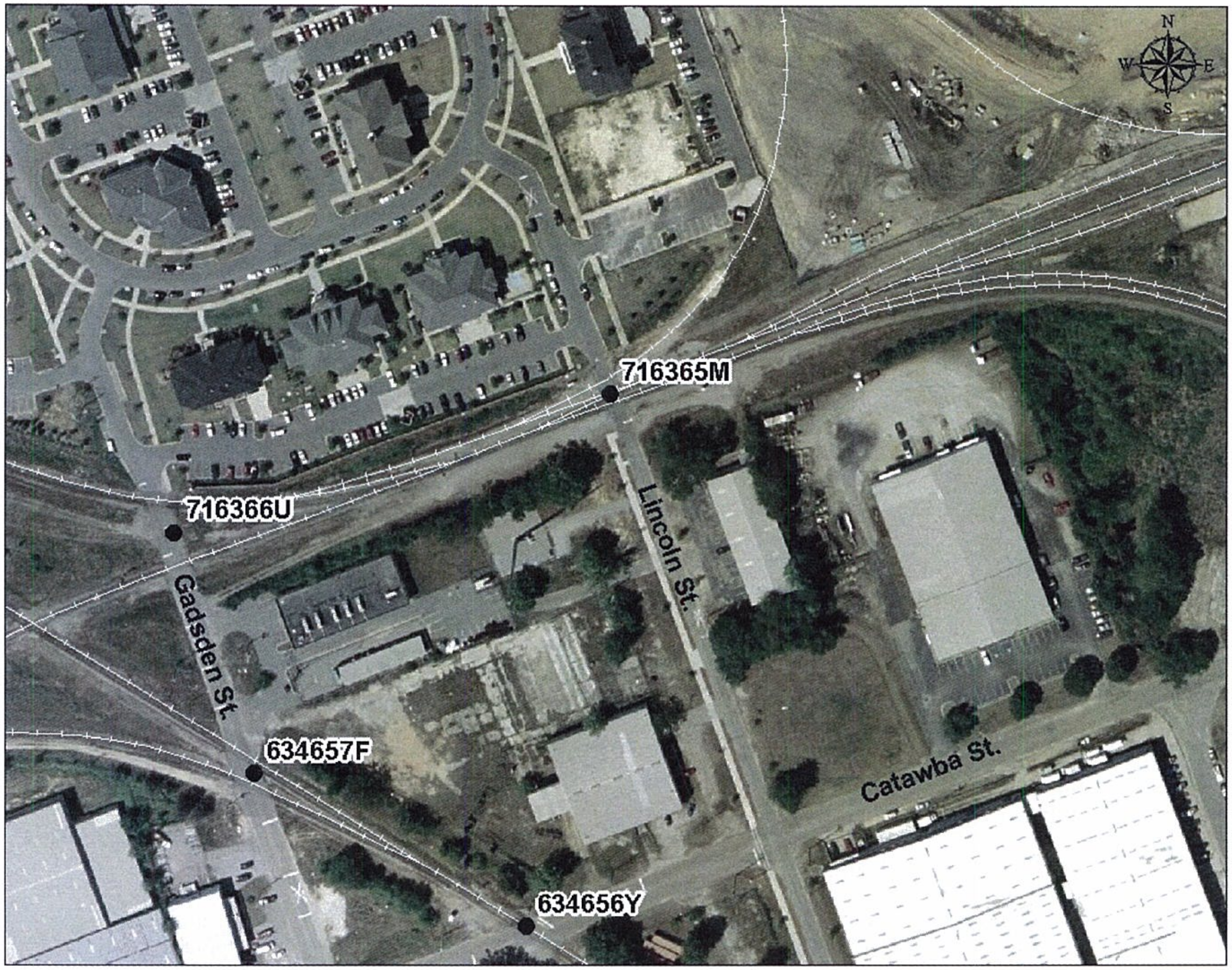


Figure III-32

Crossing Number	Milepost	Railroad	Street Name	Street Classification	Warning Device	Land Use
716366U	W161.10	NS	Gasden Street	Rural Minor Collector	CB	Commercial

24 Hour ADT	24 Hour Train Volume	Accident History	Transit Route	School Bus Route	Truck Route
545	16	None	No		

Preemption	Humped Crossing	Crossing Condition_Geometry	Crossing Surface Condition	Crossing Condition_Sight	Redundant Crossing
☐	☐	Good	Fair	Good	No

Economic Impact if Closed	Feasibility of Roadway Improvements	Grade Separation Investigation	Recommendations

Aerial

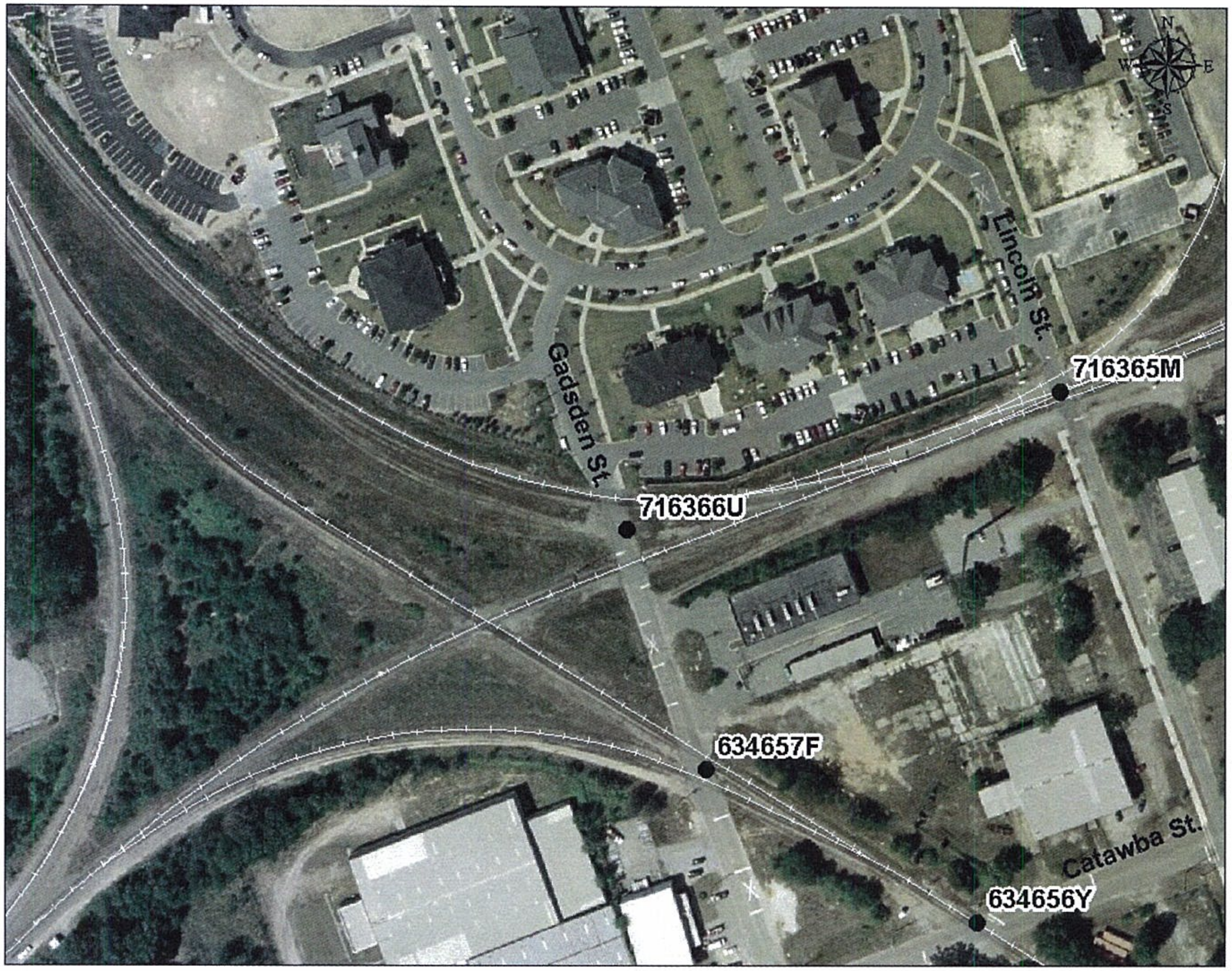


Figure III-33

Crossing Number	Milepost	Railroad	Street Name	Street Classification	Warning Device	Land Use
904635C	127.00	NS	Andrews Road	Urban Local	CB	Industrial

24 Hour ADT	24 Hour Train Volume	Accident History	Transit Route	School Bus Route	Truck Route
35	0	None	No		

Preemption	Humped Crossing	Crossing Condition_Geometry	Crossing Surface Condition	Crossing Condition_Sight	Redundant Crossing
☐	☐				No

Economic Impact if Closed	Feasibility of Roadway Improvements	Grade Separation Investigation	Recommendations

Aerial

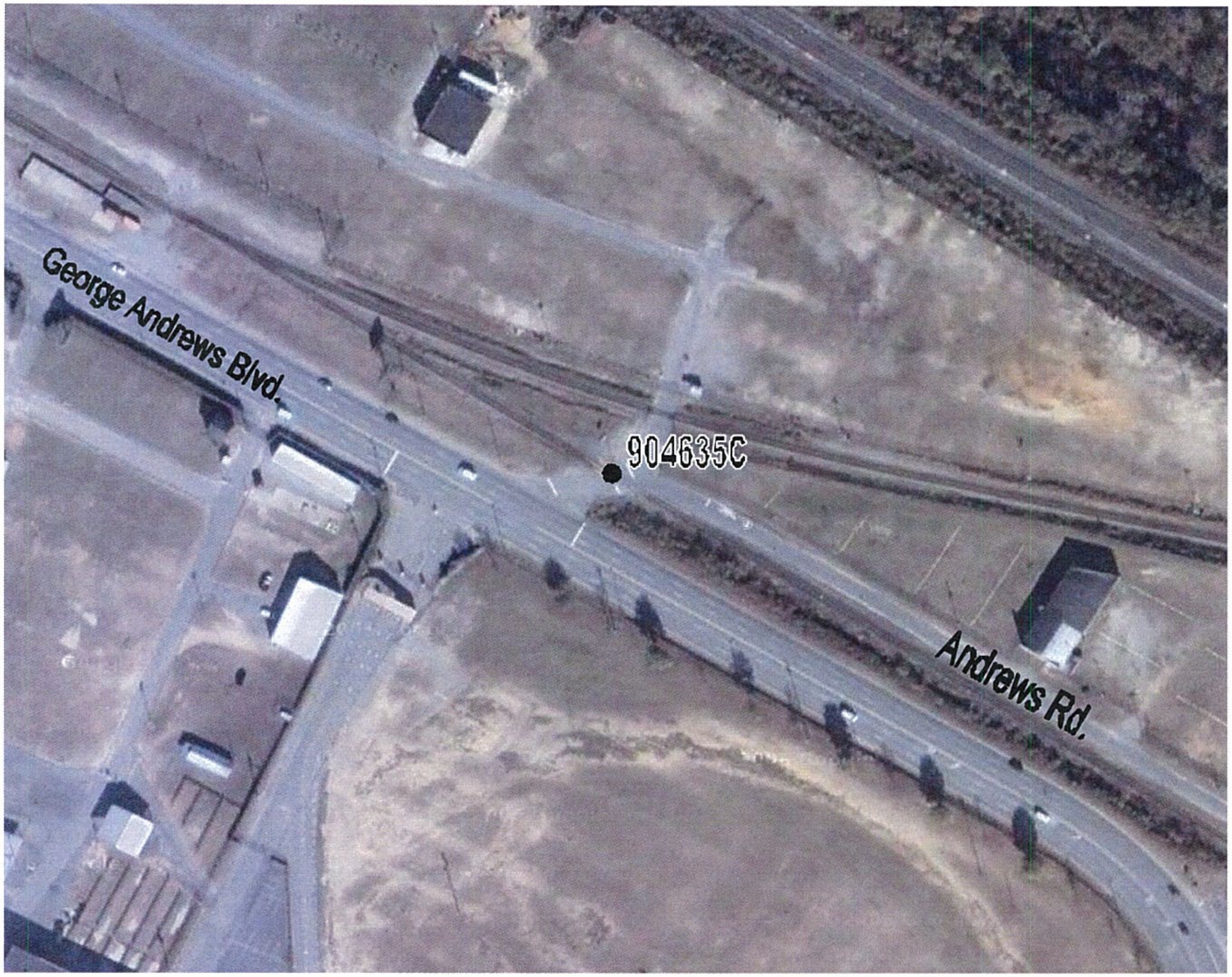


Figure III-34

Crossing Number	Milepost	Railroad	Street Name	Street Classification	Warning Device	Land Use
634634Y		CSX	Olympia Avenue	Urban Local	CB	Commercial/Residential

24 Hour ADT	24 Hour Train Volume	Accident History	Transit Route	School Bus Route	Truck Route
			No	No	

Preemption	Humped Crossing	Crossing Condition_Geometry	Crossing Surface Condition	Crossing Condition_Sight	Redundant Crossing
☐	☐	Good	Poor	Poor	No

Economic Impact if Closed	Feasibility of Roadway Improvements	Grade Separation Investigation	Recommendations

Aerial

Figure III-35

Crossing Number	Milepost	Railroad	Street Name	Street Classification	Warning Device	Land Use
915073P	372.70	CSX	Blaylock Road	Rural Local		Industrial

24 Hour ADT	24 Hour Train Volume	Accident History	Transit Route	School Bus Route	Truck Route
170	1	None	No		

Preemption	Humped Crossing	Crossing Condition_Geometry	Crossing Surface Condition	Crossing Condition_Sight	Redundant Crossing
☐	☐				No

Economic Impact if Closed	Feasibility of Roadway Improvements	Grade Separation Investigation	Recommendations

Aerial

Figure III-36

Crossing Number	Milepost	Railroad	Street Name	Street Classification	Warning Device	Land Use
634647A	373.43	CSX	Assembly Street	Urban Minor Arterial	Gates, MMFL, CFL	Commercial

24 Hour ADT	24 Hour Train Volume	Accident History	Transit Route	School Bus Route	Truck Route
28000	7	1-Injury, 3-PDO	No		

Preemption	Humped Crossing	Crossing Condition_Geometry	Crossing Surface Condition	Crossing Condition_Sight	Redundant Crossing
☐	☐	Poor	Poor	Poor	No

Economic Impact if Closed	Feasibility of Roadway Improvements	Grade Separation Investigation	Recommendations

Aerial

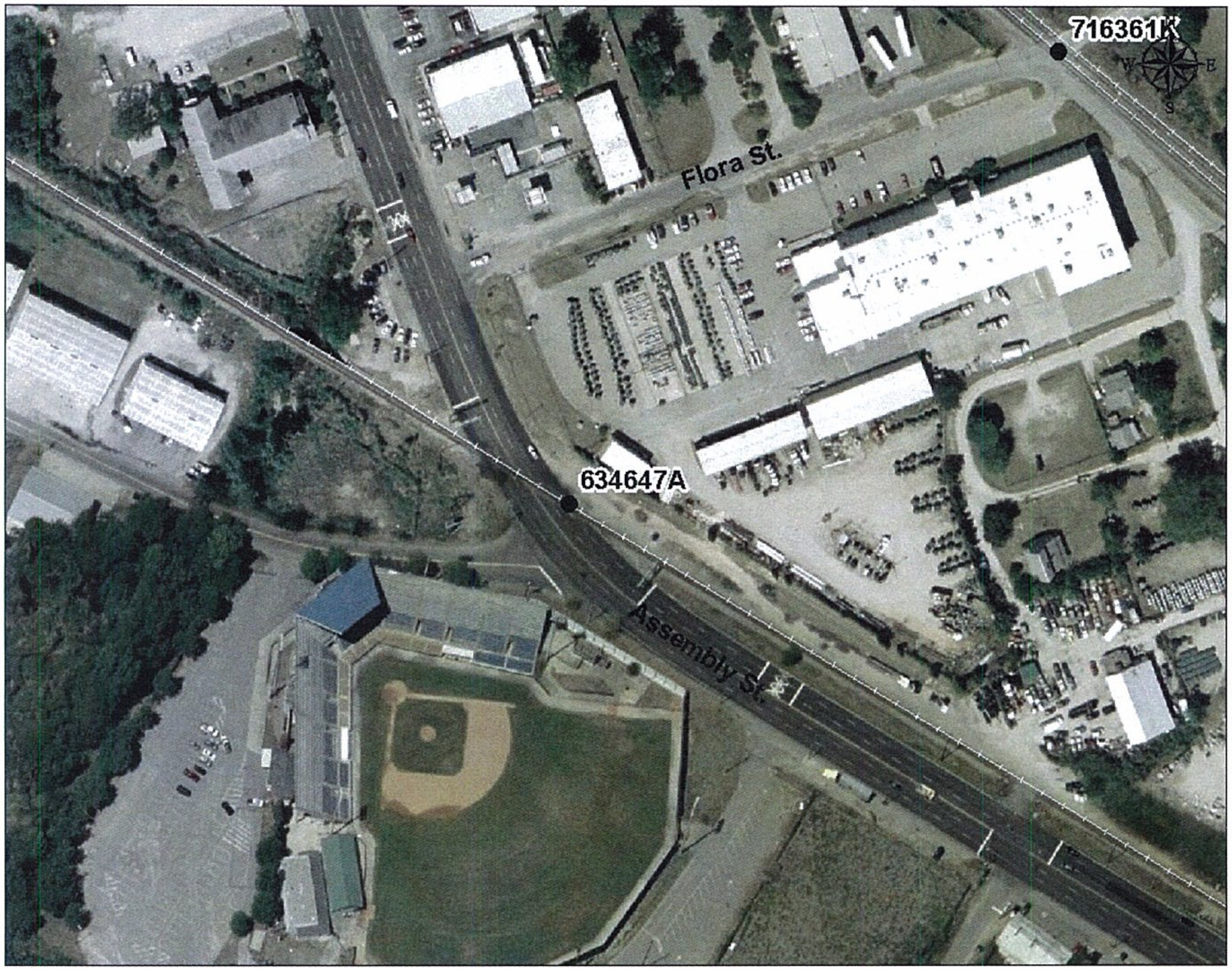


Figure III-37

IV. RAIL / ROADWAY TRAFFIC ANALYSIS

A. Traffic Analysis

At the beginning of this study, the project team was given direction to develop various alternatives that would consolidate the various tracks into one corridor and replace the at-grade crossings with grade separation structures. By utilizing mapping, survey, field studies and other data gathered, the project team conducted various analyses.

One of the analyses included conducting a rail and roadway traffic analysis. The rail analysis was done by utilizing the Federal Railroad Administration's (FRA) database search engine, GradeDec. This application determines the effects that rail corridor investments will have on safety and highway delay and queuing. The FRA web site also provides data on the rail lines, such as average train speeds, accident reports, average train volumes, etc. The analysis also utilized information about the rail operations through discussions with the individual rail companies.

A traffic analysis was also conducted for the roadways within the study area. Accident rates, both rail and roadway, were investigated as well.

A crossing analysis was also conducted to determine if there were any major issues relating to a crossing. An increase in the number of trains and/or automobiles at an at-grade crossing leads to a greater potential for accidents. A cost/benefit analysis was also conducted to determine if the at-grade railroad crossing should be either grade separated or closed in order to improve the railroad's level of service and reduce the potential for accidents. In addition, an exposure index was calculated; a delay analysis was performed; and an accident analysis was performed; and a cursory review of potential system enhancement options was investigated.

1. Exposure Index

An exposure index can be used to determine if a grade separation structure is warranted at highway/rail grade crossings. The exposure index is calculated by multiplying the number of trains per day by the number of vehicles per day that use the crossing. As a general rule, grade separations should be considered in rural areas when the exposure index is 15,000 or more. In urban areas grade separations should be considered when the exposure index is 30,000 or more. Other factors that need to be considered in the feasibility of grade separations are:

- Accident history
- Topography
- Adjacent land use
- Construction impacts
- Costs

The exposure index was calculated for each of the 39 crossings (25 CSXT crossings and 14 NS crossings) for the year 2005 traffic volumes. Table IV-1 contains the exposure index calculations for each of the 39 crossings for 2005. Ten (10) crossings exceeded the exposure index of 30,000 for the year 2005.

TABLE IV-1

CSXT Crossings

CROSSING NO.	STREET NAME	TRAINS PER DAY YEAR 2005	2005 ADT	EXPOSURE INDEX YEAR 2005
634 629C	Andrews Road	6	260	1,560
634 630W	Rosewood Drive	7	16,280	113,960
634 632K	Assembly Street	2	23,845	47,690
634 633S	Hamrick Street	2	775	1,550
634 635F	Bluff Road	2	12,925	25,850
634 636M	Rosewood Drive	2	2,420	4,840
634 637U	Vine Street	2	320	640
634 638B	Vine Street	2	120	240
634 639H	Vine Street	2	300	600
634 640C	Duval Street	2	1,115	2,230
634 641J	Duval Street	2	145	290
634 642R	Garland Street	2	175	350
634 643X	Garland Street	2	305	610
634 644E	Oakdale Road	2	110	220
634 647A	Assembly Street	7	28,000	196,000
634 648G	Park Street	7	500	3,500
634 651P	Heyward Street	1	4,800	4,800
634 654K	Whaley Street	7	8,065	56,455
634 655S	Lincoln Street	7	990	6,930
634 656Y	Catawba Street	7	565	3,955
634 657F	Gadsden Street	7	185	1,295
715 847J	Huger Street	8	18,105	144,840
915 073P	Blaylock Road	1	170	170

NS Crossings

CROSSING NO.	STREET NAME	TRAINS PER DAY YEAR 2005	2005 ADT	EXPOSURE INDEX YEAR 2005
715 396H	Key Road	0	1,610	-
715 400V	Shop Road	2	20,700	41,400
715 402J	Heyward Street	12	2,000	24,000
715 403R	Whaley Street	2	6,110	12,220
715 620R	Assembly Street	6	26,100	156,600
715 621X	Main Street	10	4,655	46,550
715 846C	Tryon Street	14	360	5,040
715 866N	Pickens Street	6	8,110	48,660
716 361K	Flora Street	4	290	1,160
716 363Y	Assembly Street	4	26,100	104,400
716 364F	Catawba Street	16	540	8,640
716 365M	Lincoln Street	16	1,155	18,480
716 366U	Gadsden Street	16	545	8,720
904 635C	Andrews Road	0	35	-

2. Delay Analysis

Level of Service is a measure of the operational efficiency of the highway/rail grade crossing. It is determined using procedures from the *Highway Capacity Manual* procedures. Level of service is expressed as a letter ranging from A (free flowing) to F (severely congested) and is determined using the average delay for all vehicles. Table IV-2 summarizes the average delay and corresponding level of service crossings.

TABLE IV-2

Level of Service (LOS)	Avg. Delay/Vehicle (seconds)
A	10.0
B	>10.0 to 15.0
C	>15.0 to 25.0
D	>25.0 to 35.0
E	>35.0 to 50.0
F	>50.0

The delay calculations are based on the methodology developed for the Proposed Conrail Acquisition Draft Environmental Impact Statement (DEIS) by the Surface Transportation Board's Sections of Environmental Analysis (SEA) and modified as needed for this project.

The following values were calculated for existing and future conditions.

- Blocked crossing time per train
- Event time
- Average delay per day
- Maximum vehicle queue
- Total stopped vehicle delay per day
- Average delay for all vehicles
- Traffic level of service (LOS)

The level of service (LOS) for each of the 39 crossings was determined based on these computed values and the Highway Capacity Manual procedures. Table IV-3 summarizes the existing conditions delay and LOS for the NS and CSXT railroad crossings.

Table IV-3

CSXT Crossings

Crossing #	Street Name	No. Lanes (one-way direction)	ADT	Arrival Rate (Veh/Min) 2x uniform	Departure Rate	Trains per day	Train Speed (miles/hr)	Train Length (feet)	Crossing Blockage Time (min) T_c	Event (Queue) Time (min) T_e	Total Stopped Vehicle Delay Per Day (min/day) D_T	Number Vehicles Delayed/Day V_D	Max. Peak Hr. Queue (veh/lane) Q	Average Delay /Stopped Veh. (mins) D_{avg}	Avg. Delay/Veh. In Secs. (All Vehicles) D_r	LOS
634629C	Andrews Rd.	1	260	0.36	30.00	6	10	9,000	10.23	10.35	58.05	11	3	5.18	26.79	D
634630W	Rosewood Dr.	3	16,280	22.61	90.00	7	40	9,000	2.56	10.38	4264.26	822	14	5.19	31.43	D
634632K	Assembly St.	3	23,845	33.12	90.00	2	10	9,000	10.23	-98.40	160335.36	-3259	81	-49.20	806.89	F
634633S	Hamrick St.	1	775	1.08	30.00	2	10	9,000	10.23	10.61	60.56	11	8	5.30	9.38	A
634635F	Bluff Rd.	1	12,925	17.95	30.00	2	10	9,000	10.23	25.47	5820.45	457	132	12.73	54.04	F
634636M	Rosewood Dr.	1	2,420	3.36	30.00	2	10	9,000	10.23	11.52	222.94	39	25	5.76	11.05	B
634637U	Vine St.	1	320	0.44	30.00	2	10	9,000	10.23	10.38	23.95	5	3	5.19	8.98	A
634638B	Vine St.	1	120	0.17	30.00	2	40	9,000	2.56	2.57	0.55	0	0	1.29	0.55	A
634640C	Duval St.	1	1,115	1.55	30.00	2	10	9,000	10.23	10.78	90.05	17	11	5.39	9.69	A
634641J	Duval St.	1	145	0.20	30.00	2	10	9,000	10.23	10.30	10.68	2	1	5.15	8.83	A
634642R	Garland St.	1	175	0.24	30.00	2	10	9,000	10.23	10.31	12.92	3	2	5.16	8.86	A
634643X	Garland St.	1	305	0.42	30.00	2	10	9,000	10.23	10.37	22.79	4	3	5.19	8.97	A
634644E	Oakdale Rd.	1	110	0.15	30.00	2	10	9,000	10.23	10.28	8.07	2	1	5.14	8.81	A
634647A	Assembly St.	3	28,000	38.89	90.00	7	40	9,000	2.56	-8.63	5067.70	-1175	24	-4.31	21.72	C
634648G	Park St.	1	500	0.69	30.00	7	20	9,000	5.11	5.23	33.30	13	3	2.62	7.99	A
634651P	Heyward St.	0	4,800	6.67	0.00	1	10	9,000	10.23	13.15	288.18	44	#DIV/0!	6.57	7.20	A
634654K	Whaley St.	1	8,065	11.20	30.00	7	20	9,000	5.11	8.16	1305.45	320	41	4.08	19.42	C
634655S	Lincoln St.	1	990	1.38	30.00	7	20	9,000	5.11	5.36	69.11	26	5	2.68	8.38	A
634656Y	Catawba St.	1	565	0.78	30.00	7	20	9,000	5.11	5.25	37.86	14	3	2.63	8.04	A
634657F	Gadsden St.	1	185	0.26	30.00	7	20	9,000	5.11	5.16	11.96	5	1	2.58	7.76	A
715847J	Huger St.	2	18,105	25.15	60.00	8	10	9,000	10.23	63.21	200922.63	6358	93	31.60	1331.72	F
915073P	Blaylock Rd.	1	170	0.24	30.00	1	10	9,000	10.23	10.31	6.27	1	2	5.15	4.43	A

NS Crossings

Crossing #	Street Name	No. Lanes (one-way direction)	ADT	Arrival Rate (Veh/Min) 2x uniform	Departure Rate	Trains per day	Train Speed (miles/hr)	Train Length (feet)	Crossing Blockage Time (min) T_c	Event (Queue) Time (min) T_e	Total Stopped Vehicle Delay Per Day (min/day) D_T	Number Vehicles Delayed/Day V_D	Max. Peak Hr. Queue (veh/lane) Q	Average Delay /Stopped Veh. (mins) D_{avg}	Avg. Delay/Veh. In Secs. (All Vehicles) D_r	LOS
715396H	Key Rd.	1	1,610	2.24	30.00	0	10	9,000	10.23	11.05	0.00	0	16	5.53	0.00	A
715400V	Shop Rd.	1	20,700	28.75	30.00	2	25	9,000	4.09	98.18	138570.25	2823	85	49.09	803.31	F
715402J	Heyward St.	1	2,000	2.78	30.00	12	10	9,000	10.23	11.27	1058.60	188	20	5.64	63.52	F
715403R	Whaley St.	1	6,110	8.49	30.00	2	10	9,000	10.23	14.26	862.98	121	62	7.13	16.95	C
715620R	Assembly St.	2	26,100	36.25	60.00	6	10	9,000	10.23	-49.09	131039.26	-5339	133	-24.55	602.48	F
715621X	Main St.	2	4,655	6.47	60.00	10	10	9,000	10.23	13.04	2747.08	421	24	6.52	70.82	F
715846C	Tryon St.	1	360	0.50	30.00	14	10	9,000	10.23	10.40	189.30	36	4	5.20	63.10	F
715866N	Pickens St.	1	8,110	11.26	30.00	6	20	9,000	5.11	8.19	1132.72	277	41	4.09	16.76	C
716361K	Flora St.	1	290	0.40	30.00	4	20	9,000	5.11	5.18	10.82	4	1	2.59	4.48	A
716363Y	Assembly St.	2	26,100	36.25	60.00	4	20	9,000	5.11	-24.55	21839.88	-1780	67	-12.27	100.41	F
716364F	Catawba St.	1	540	0.75	30.00	16	45	9,000	2.27	2.33	16.30	14	1	1.17	3.62	A
716365M	Lincoln St.	1	1,155	1.60	30.00	16	10	9,000	10.23	10.81	749.14	139	12	5.40	77.83	F
716366U	Gasden St.	1	545	0.76	30.00	16	45	9,000	2.27	2.33	16.46	14	1	1.17	3.62	A
904635C	Andrews Rd.	1	35	0.05	30.00	0	10	9,000	10.23	10.24	0.00	0	0	5.12	0.00	A

The following ten highway/rail grade crossings had a LOS F (> 50 seconds of avg. delay/vehicle) based on 2005 rail and highway traffic volumes:

1. Assembly Street (Crossing # 634 632K)
2. Bluff Road (Crossing # 634 635F)
3. Huger Street (Crossing # 715 847J)
4. Shop Road (Crossing # 715 400V)
5. Heyward Street (Crossing# 715 402J)
6. Assembly Street (Crossing # 715 620R)
7. Main Street (Crossing # 715 621X)
8. Tryon Street (Crossing # 715 846C)
9. Assembly Street (Crossing # 716 363Y)
10. Lincoln Street (Crossing # 716 365M)

3. Accident Analysis

Seventy-Five (75) accidents involving train/vehicle collisions have been reported at 22 of the 39 crossings within the past 30 years. Out of the 75 accidents, there was only 1 fatality.

Accidents are summarized using the following classifications:

- Fatality
- Injury
- PDO – property damage only

Table IV-4 summarizes the accident data for the past 30 years.

Table IV-4

CSXT Crossings								
Crossing Number	Railroad	Street Name	Total # of Accidents	# with Fatalities	# with Injuries	# with PDO	Unknown	Remarks
634 629C	0373.11	Andrews Road	0	0	0	0	0	
634 630W	0373.20	Rosewood Drive	11	0	2	9	0	stopped and then proceeded, did not stop (8), stopped on crossing
634 632K	0373.39	Assembly Street	1	0	0	1	0	did not stop
634 633S	0373.39	Hamrick Street	0	0	0	0	0	
634 635F	0373.39	Bluff Road	3	0	0	3	0	did not stop (3)
634 636M	0373.39	Rosewood Drive	1	0	0	1	0	did not stop
634 637U	0373.39	Vine Street	0	0	0	0	0	
634 638B	0373.39	Vine Street	0	0	0	0	0	
634 639H	0373.39	Vine Street	0	0	0	0	0	
634 640C	0373.39	Duval Street	0	0	0	0	0	
634 641J	0373.39	Duval Street	0	0	0	0	0	
634 642R	0373.39	Garland Street	0	0	0	0	0	
634 643X	0373.39	Garland Street	0	0	0	0	0	
634 644E	0373.39	Oakdale Road	0	0	0	0	0	
634 647A	0373.43	Assembly Street	3	0	1	2	0	drove around or thru the gate (2), stopped on crossing
634 648G	0373.65	Park Street	3	0	0	1	0	did not stop (3)
634 651P	0373.60	Heyward Street	1	0	0	1	0	stopped and then proceeded
634 654K	0373.77	Whaley Street	12	0	1	11	0	did not stop (11), stopped on crossing
634 655S	0373.80	Lincoln Street	3	0	1	2	0	did not stop (3)
634 656Y	0373.91	Catawba Street	1	0	0	1	0	did not stop
634 657F	0374.00	Gadsden Street	0	0	0	0	0	
715 847J	S359.61	Huger Street	5	1	2	3	0	drove around or thru the gate, stopped and then proceeded, did not stop (3)
915 073P	0372.70	Blaylock Road	0	0	0	0	0	

Table IV-4 (continued)

NS Crossings								
Crossing Number	Railroad	Street Name	Total # of Accidents	# with Fatalities	# with Injuries	# with PDO	Unknown	Remarks
715 396H	C126.90	Key Road	1	0	0	1	0	did not stop
715 400V	C127.10	Shop Road	2	0	1	1	0	did not stop (2)
715 402J	C128.50	Heyward Street	1	0	0	1	0	did not stop
715 403R	C128.60	Whaley Street	1	0	0	1	0	stopped on crossing
715 620R	0108.35	Assembly Street	6	0	1	5	0	drove around or through the gate, did not stop (4), stopped on crossing
715 621X	R108.30	Main Street	3	0	2	1	0	did not stop (2), stopped on crossing
715 846C	R109.05	Tryon Street	1	0	0	1	0	did not stop
715 866N	R107.85	Pickens Street	7	0	2	5	0	did not stop (5), stopped on crossing (2)
716 361K	W161.74	Flora Street	4	0	0	4	0	did not stop (3), stopped on crossing
716 363Y	W161.46	Assembly Street	1	0	1	0	0	did not stop
716 364F	W161.42	Catawba Street	4	0	1	3	0	did not stop (3), unknown
716 365M	W161.20	Lincoln Street	0	0	0	0	0	
716 366U	W161.10	Gadsden Street	0	0	0	0	0	
904 635C	0127.00	Andrews Road	0	0	0	0	0	

B. Safety and Mobility Issues

During the feasibility study, various factors were analyzed to determine the existing conditions of the road network, rail crossings and service routes within the study area. These factors are discussed below.

1. Vehicles Queuing Across Railroad Tracks

The presence of nearby traffic signals, intersections, or parallel roadways can result in queues of stopped vehicles extending onto or across a highway/rail crossing. During the site inspections there were no crossings that had queuing of vehicles across the tracks when trains were present.

2. Traffic Signal Preemption

Standard practice (based on *The Manual on Uniform Traffic Control Devices*) requires that traffic signals located within 200 feet of a highway/rail at-grade crossing be coordinated with the crossing's train detection and warning system to preempt normal operations of the traffic signal. There were no locations within the study area that currently have traffic signal preemption.

There are no crossings currently scheduled for signal improvements according to the SCDOT STIP.

The following crossing is recommended, as part of this study, for traffic signal improvements:

- Rosewood Drive (Crossing # 634 630W)

3. Humped Crossings

A "humped" crossing exists where the elevation of the railroad is significantly higher than the crossing roadway, causing vehicles to ascend on one side of the tracks and descend on the other. The severity of this condition can range from discomfort at normal speeds, to "bottoming out" of vehicles with long wheelbases or low clearances. This dragging can damage vehicles, or cause them to become stuck on the crossing, creating a serious hazard. Routine track maintenance tends to exacerbate the problem over time, as track ballast work typically adds about three inches per occurrence. Over a ten-year period, the railroad may rise as much as one foot as a result of this routine maintenance.

Crest vertical curves across the tracks that do not create a need for the driver to reduce speed are not considered to be a humped profile. The combination of short crest and sag vertical curves caused by a buildup of the ballast and raising of the track create a need to reduce speed across the crossing. There were no crossings identified with a humped profile.

4. Grade Crossing Conditions

A poor grade crossing surface can result in a rough, uneven ride. This can increase wear and tear on vehicles, potentially create a traffic safety hazard, and may add to congestion by reducing travel speeds. The crossing materials used on these grade crossings include asphalt, concrete slab, and rubber. Even though some materials provide a slightly improved ride and longer term maintenance, the main safety issue is the condition of the crossing. The following crossings have surfaces that are deemed to be in substandard condition:

- Andrews Road (Crossing # 634 629C)
- Hamrick Street (Crossing # 634 633S)
- Vine Street (Crossing # 634 637U)
- Vine Street (Crossing # 634 638B)
- Duval Street (Crossing # 643 640C)
- Duval Street (Crossing # 634 641J)
- Oakdale Road (Crossing # 634 644E)
- Assembly Street (Crossing # 634 647A)
- Assembly Street (Crossing # 716 363Y)
- Olympia Avenue (Crossing # 634 634Y)

5. Vehicles Driving Around Automated Gates

Several situations can lead to the circumvention of automated gates by motorists:

- Gates are lowered, but no train is visible
- Gates fail, and remain in the lowered position
- Gates are lowered and train is visible, but motorist is too impatient to wait

It was noted in the SCDOT and FRA accident reports that four accidents have occurred within the last 30 years at the following locations due to vehicles driving around automated gates:

- Assembly Street (Crossing # 634 647A)
- Huger Street (Crossing # 715 847J)
- Assembly Street (Crossing # 715 620R)

The remainder of the accidents in Columbia were attributed to either vehicles not stopping at highway/rail grade crossings or vehicles being stopped on the tracks.

6. Improved Signs and Markings

The effectiveness of required warning signs, markings, signals, and other devices depends heavily on proper installation and maintenance by state and municipal transportation departments and the railroads.

7. Roadway Grade Separation

To fully eliminate the potential for train/vehicle collisions while still maintaining access across the tracks, construction of grade separations should be evaluated. However, modifications to mainline railway grades or profiles are severely constrained by strict design standards. Highway overpasses of railroads require a vertical clearance of 23 feet, while railroad overpasses of highways typically require 16 to 17 feet. Due to sight distance requirements for safe stopping, a “crest” curve on a roadway overpass is longer than a “sag” curve at a comparable underpass, thereby involving a longer approach distance. This can have important implications with respect to property access and street network connectivity. Other considerations include visual and noise impacts of roadway overpasses, especially in neighborhoods, downtowns, or historic areas.

One valuable tool to measure if an existing rail/highway crossing should be grade separated is to utilize the *Exposure Index (EI) Formula*. Using the *EI* formula, the following 10 crossings exceed the relevant threshold for urban conditions (30,000) that result from multiplying the number of vehicles per day by the number of trains per day (See Table V-1):

TABLE V-1 – EXPOSURE INDEX

Street	Crossing #	2005 EI
Assembly Street	634 647A	196,000
Assembly Street	715 620R	156,600
Huger Street	715 847J	144,840
Rosewood Drive	634 630W	113,960
Assembly Street	716 363Y	104,400
Whaley Street	634 654K	56,455
Pickens Street	715 866N	48,660
Assembly Street	634 632K	47,690
Main Street	715 621X	46,550
Shop Road	715 400V	41,400

There are many factors that need to be considered along with the exposure index when looking at grade separations. These include accident history, topography, adjacent land uses, construction impacts, and costs. Currently, there are no crossings scheduled for roadway grade separations in the SCDOT's 2007-2012 Transportation Improvement Program (TIP).

8. Community Services

Hospitals, schools, fire and rescue stations, and parks have been located as part of this study to determine the potential impacts on Columbia residents who would be affected by changes in the crossing status of the 39 existing highway/rail grade crossings. The studies included a field survey in the vicinity of the identified rail crossings and an investigation of all adjacent neighborhoods on foot and photography to establish general demographic patterns in the neighborhoods. Community facilities and/or other features that may have a focal role in the neighborhood or add to the sense of community are identified.

This study is intended only to provide basic data, to assist in deciding the need for additional studies; it will not include any statistical analysis of demographic data, or attempt to analyze the ramifications of proposed highway/rail grade crossing modifications on the communities identified.

C. System Enhancement Options

There are several methods available to enhance railroad-crossing safety. This chapter discusses some of these methods in more detail.

1. Grade Separation Structures

Grade separations provide the most benefit to safety measures when it comes to enhancement options. Unfortunately, these are typically the most costly types of improvements.

Many factors must be considered before suggesting grade separation, including:

- Exposure Index
- Accident history
- Topography
- Adjacent land use
- Construction impacts
- Costs

a. Exposure Index

An exposure index is employed by SCDOT as one factor in determining whether or not grade separation should be considered in place of highway/rail crossings. See previous section IV.B.7 for discussion of the exposure index.

b. Accident History

In some cases, the accident history of a low-volume crossing may contribute to justification of a grade separation, even with a low exposure index. If the crossing cannot be closed, or other safety provisions made, a physical separation between the road and tracks may be the only feasible solution.

c. Topography

The relationship between elevations and slopes in the vicinity of the crossing greatly influence the viability of constructing a grade separation. Where existing topography facilitates a highway overpass, minimizing earthwork and ROW requirements, the cost of grade separation can be significantly reduced. When topography is relatively flat, costs (and other impacts) can escalate significantly.

d. Adjacent Land Use

In heavily developed areas, such as a central business district (CBD) impacts to the existing land use may be severe enough that it results in grade separations being considered not feasible. Costs for right-of-way acquisition and socio-economic impacts associated with loss of business and jobs can result in less than a favorable project benefit-cost ratio.

e. Construction Impacts

While the impacts of constructing a new grade separation can be significant, retrofitting an existing grade separation to comply with current design criteria is typically more disruptive during and after construction. Visual, noise, and access degradation can be severe, and the separation may require the relocation of businesses or dwellings. Other potential impacts can involve wetlands/woodlands, historic/archaeological sites, and hazardous materials.

f. Costs

Grade separation structures represent substantial, long-term infrastructure investments, often exceeding several million dollars. Careful analysis and planning is required to insure that this alternative is the most cost-effective and beneficial solution.

2. Crossing Protection Device Upgrades

The most common and cost-effective way to increase the safety at a railway crossing is to upgrade existing warning devices at the crossing. Typical warning devices include signs, gate arms, flashing lights and bells. *Passive* devices, such as advanced warning signs and crossbucks, merely warn the motorist of the existence of a railroad crossing. These devices are most suitable where train and traffic volumes and speeds are low and where sight distance is adequate. *Active* devices that warn motorists of approaching trains include flashing lights, bells, and automated gates. Such devices are usually employed at locations exhibiting higher volumes or speeds, or greater potential for accidents.

a. Median Barriers

Median barriers consist of markers mounted on raised islands along the roadway centerline to discourage motorists from driving in opposing travel lanes to "go around" lowered gate arms. Median treatments typically extend 70 feet to 100 feet back from the gates, but may be precluded by driveways or intersecting roads within this distance.

Example of Median Barriers

b. Four-Quadrant Gates

This crossing treatment requires an additional gate on each approach, completely "sealing" the crossing. Several measures are employed to prevent vehicles from becoming “trapped” inside the gates, including careful timing of the gates to allow traffic to clear; providing 16 feet of clearance between track center and gates; leaving adequate space between gate tips for a vehicle to “squeeze” out; and use of breakaway arms. In tests at the Sugar Creek Road crossing in Charlotte, four-

Example of 4 Quadrant Gate

quadrant gates alone reduced violations by 86%; in combination with median barriers, the reduction in violations rose to 98%.

c. Long Gate Arms

Extra-long arms cover at least ¾ of the crossing width. When tested at the Orr Road crossing in Charlotte, the installation of long gate arms reduced crossing violations by 67%.

d. Articulated Gates

Articulated gates are hinged arms that unfold to cover at least ¾ of crossing width. They are typically warranted where overhead obstructions prevent the use of long gate arms.

e. Remote Video Detection

Remote video detection allows train operators to visually see if there are any vehicles stopped on the tracks on the upcoming railroad at-grade crossing. The video cameras are installed at the crossings which are linked to monitors in the trains' engine room. However, not all trains and at-grade crossings are equipped with video detection devices.

f. Crossing Consolidation & Elimination

Many low-volume crossings are unnecessary due to the availability of alternative access across the tracks. These alternative crossings can often be made safer, since many low-volume crossings lack adequate warning devices. Resources are not available to upgrade warning devices on all existing crossings, and grade separation would be even less feasible. Therefore, consolidation and closure of these minor crossings is an effective strategy in terms of both costs and safety benefits. Typically, a crossing is considered redundant (and therefore a candidate for elimination) if it is within ¼-mile of another crossing connected to the same street network.

Crossing consolidations eliminate the potential for train/vehicle collisions. Crossing-related installation and maintenance costs are reduced, and by concentrating traffic at fewer, higher-volume crossings, more expensive active warning treatments and roadway improvements can be justified.

Crossings with high potential for elimination include:

- Redundant crossings near parallel crossings or grade separations, or where traffic can be safely and efficiently diverted to another crossing;
- Skewed crossings, or those where sight distance is limited by horizontal/vertical curvature, vegetation, or permanent obstructions;
- Crossings with a history of frequent accidents;
- Crossings adjacent to a newly constructed crossing or grade separation;
- Private crossings with no identifiable owner, or where the owner is unwilling or unable to fund crossing upgrades;

- Complex crossings that cannot be effectively served by warning devices due to multiple tracks, extensive switching operations, etc.

g. Roadway Improvements

Roadway improvements can reduce both accident potential and traffic delay at railroad crossings. Realignment and re-grading can improve visibility and reduce the time required to traverse a crossing. Additional lanes significantly increase capacity, reducing the residual delay following a crossing event. New roadways can provide alternative routes, allowing crossings to occur at more desirable locations, and potentially eliminate the number of crossing trips.

h. Traffic Signals

Improving the signal timing of traffic signals along a corridor where there are numerous railroad at-grade crossings can improve the traffic flow and potentially reduce the amount of vehicular stacking at those crossings. By installing signal pre-emption at signalized intersections within 200 feet of a railroad at-grade crossing, the signal will be activated as the train approaches the crossing. This creates a safety mechanism prohibiting vehicles from making a turning movement into the at-grade crossing.

V. ENVIRONMENTAL REVIEW

This section examines environmental issues within the proposed project area. Further environmental investigation will be warranted as the project proceeds and any Federal Funding will require the project to meet all requirements of the National Environmental Policy Act (NEPA) and most likely an Environmental Assessment (EA) review. At the EA level of the project, community members will be invited to provide input on the project as part of the process.

A. Socio-Economic Analysis

1. Regional Overview

Columbia is the capital of and largest city in the state of South Carolina. Columbia is the county seat of Richland County, but a small portion of the city extends into Lexington County. Founded in 1786 as the site of South Carolina's new capital city, it was one of the first planned cities in the United States. The area is often cited for its high quality of life offerings, with its many cultural amenities, parks, and recreational features.

Columbia benefits from an excellent interstate highway system, with three interstates, I-26, I-77, and I-20, forming an outer loop around the city. I-26 runs east and west from Kingsport, Tennessee to Charleston, South Carolina. I-77 is a major interstate in eastern U.S. running from Columbia, SC all the way to Cleveland, Ohio. I-20 is another major east-west interstate, connecting Kent, Texas to Florence, South Carolina for a total of 1,535 miles.

2. Population Trends

Since 1960 Columbia has grown almost 20%. Between 1990 and 2000 Richland County, the second largest county in South Carolina grew 12%. The following table (V-1) summarizes population trends for Richland County, Columbia and the state of South Carolina.

Table V-1. POPULATION TRENDS 1960 - 2000

Year	Richland County	Columbia, SC	South Carolina
1960	200,102	97,433	2,382,594
% Change 1960-1970	16.8%	16.5%	8.7%
1970	233,868	113,542	2,590,516
% Change 1970-1980	15.3%	-10.8%	20.5%
1980	269,602	101,208	3,121,820
% Change 1980-1990	6.2%	-3.1%	11.7%
1990	286,321	98,052	3,486,703
% Change 1990-2000	11.9%	18.6%	15.1%
2000	320,677	116,278	4,012,012

*Source: US Census 1960 – 2000

All of the tables in this section were compiled using US Census 2000 data at the county, city and state level.

a. Minority Population Distribution

The following table (Table V-2) presents demographic data for race and ethnicity among Richland County and Columbia, both of which comprise the focus area, and the state of South Carolina. Overall, 52% of Columbia's population qualifies as a minority compared to Richland County and South Carolina that contain 51% and 45% respectively.

Table V-2. Minority Population Distribution

Race	Richland County	Columbia, SC	South Carolina
White	161,276	57,208	2,195,716
Black	144,809	53,487	1,663,843
American Indian	782	348	12,036
Asian	5,501	1,976	36,108
Pacific Islander	263	116	0
Other Race	3,724	1,627	4,012
Two or more	4,322	1,627	4,012
Hispanic or Latino	8,713	3,488	96,285
Totals	**329,390**	**119,766**	**4,012,012**
% Minority	**51%**	**52%**	**45%**

*Source: US Census Bureau, Census 2000

b. Income and Poverty Distribution

The following table (Table V-3) indicates the persons below poverty level in the focus area, along with median household income and per capita income. In general, low-income populations have lower rates of car ownership and are thus more dependent on alternate modes of transportation. In Richland County, 40,386 people and in Columbia, 20,778 people were identified as being below the poverty level. As noted below, the almost 34% below poverty level could be directly affected by the proposed project.

Table V-3 Income and Poverty Distribution

Area	Median Household Income	Per Capita Income	Total Considered Population	Total below Poverty Level	Percent below Poverty Level
Richland County	$39,961	$20,794	170,704	40,386	23.6%
Columbia, SC	$31,141	$18,853	61,718	20,778	33.6%
South Carolina	$37,082	$18,795	1,974,222	547,869	27.7%

Source: US Census Bureau, Census 2000
Note: Considered population does not take into account persons living in-group quarters (school dormitories, nursing homes, or prisons) or unrelated persons 15 years or younger.

c. Language Distribution

The following table (Table V-4) illustrates language characteristics within the focus area. Numerous languages are spoken in the project area, including Spanish, Indo-European, Asian and Pacific Islander languages; however, the vast majority of individuals only speak English. In total there are 22,079 individuals (about 8%) that speak other languages, and 3,282 individuals (about 1%) that do not speak English "well" or "at all." Spanish-speakers comprise the vast majority of the non-English speaking population.

Table V-4 Language Distribution

Category	Richland County		Category	Richland County
Persons 5 years & older	**300,624**		Speak English only	**278,545**
Speak Spanish:	**10,494**		Speak other languages:	**748**
Speak English very well	**6,152**		Speak English very well	**538**
Speak English well	**2,377**		Speak English well	**169**
Speak English not well	**1,569**		Speak English not well	**31**
Speak English not at all	**396**		Speak English not at all	**10**
Speak other Indo-European languages:	**6,805**		Speak non-English languages (totals):	**22,079**
Speak English very well	**5,150**		Speak English very well	**13,804**
Speak English well	**1,053**		Speak English well	**4,993**
Speak English not well	**572**		Speak English not well	**2,758**
Speak English not at all	**30**		Speak English not at all	**524**
Speak Asian and Pacific Island languages:	**4,032**			
Speak English very well	**1,964**			
Speak English well	**1,394**			
Speak English not well	**586**			
Speak English not at all	**88**			

Source: US Census Bureau, Census 2000

d. Age Distribution

The following table (Table V-5) shows the age demographics within the project area. It is important to note the presence of both the elderly population (65 years and over) and the population that is at or below the legal driving age (16 years and under). These age groups (65 years and over and 16 years and under) may have special transportation and other social needs that are not characteristic of the rest of the population, i.e. an inability to drive and thus the necessity for alternate modes of transportation. Overall, 10.3% of Columbia is above age 65, while at least 16.5% is below age 16. Therefore, approximately 27% of the focus area population would fall into this category.

Table V-5. Age Distribution

Area	Total	By year								
		5 & under	5-14	15-24	25-34	35-44	45-54	55-64	65 & over	% above 65
Richland County	320,677	20,285	43,849	60,359	50,155	51,304	42,446	23,553	31,472	9.8%
Columbia, SC	116,278	6,478	12,690	30,804	19,541	15,466	12,381	6,936	11,982	10.3%
South Carolina	4,012,012	264,679	575,719	577,091	560,831	625,114	550,321	372,911	485,333	12.1%

Source: US Census Bureau, Census 2000

B. Cultural Resources

Brockington and Associates, Inc., performed a cultural resources reconnaissance of the proposed Assembly Street Railroad Relocation Project in May-August 2006. The reconnaissance involved reviewing the listings of known archaeological sites at the South Carolina Institute of Archaeology and Anthropology at the University of South Carolina, the listings of historic properties (sites, buildings, structures, objects, or districts listed on or eligible for the National Register of Historic Places [NRHP]), and the reports of previous cultural resources investigations in and near the project area. An architectural reconnaissance survey was also conducted to determine if there are unrecorded historic architectural resources in the project area. Previous historical architectural surveys cover a majority of the survey area. These surveys include:

City-Wide Architectural Survey and Historic Preservation Plan (John M. Bryan and Associates, 1991-1993). No resources within the present survey area were determined eligible for listing on the National Register of Historic Places.

Upper Richland County, South Carolina, Historical and Architectural Survey, (Jennifer Martin et. al., 2002). No resources within the project area were determined eligible for listing on the National Register of Historic Places.

A summary of the surveys is presented below. For more detailed information, please reference the report entitled Cultural Resources Reconnaissance of the Proposed Assembly Street Railroad Relocation Project, located in Appendix C.

The project area contains numerous late nineteenth to late twentieth century industrial, commercial, and residential buildings and a few community-related buildings (e.g., small churches). Older buildings are associated with the development of the Granby, Olympia, and Richland cotton mills, all of which began operation in the second half of the nineteenth century. None are currently in operation, but the mill buildings and some associated housing remain in enclaves adjacent to the project area.

Briefly, there are no known archaeological sites in the project area. Given the industrial and commercial development that has occurred throughout most of the project area since the second half of the nineteenth century, there is little potential that extensive archaeological deposits related to any occupations prior to the mid-twentieth century remain. There are two NRHP-listed districts (Granby Mill and Olympia Mill) and one historic district (Whaley Street/Olympia Mill) in and adjacent to the northwest corner of the project area. The Richland Cotton Mill, listed on the NRHP, stands adjacent to the northeast side of the project area. Activities associated with changes to the current streetscape and railroad alignments that do not infringe on these districts and buildings will not effect these historic properties. Adverse effects to the setting of the districts could occur if such changes extend into the districts, altering the alignments of streets or separating housing enclaves from the mill buildings or each other. We identified and recorded 12 historic architectural resources in the project area built between the 1890s and 1940s. These include mill housing, commercial buildings, and light industrial buildings. The recommendation to the State Historic Preservation Office would be that all of these resources not be eligible for the NRHP.

C. Noise Levels

Current noise levels in the project area are typical for residential and business uses located in close proximity to railroad tracks. High noise exposure is generated by the train traffic that currently flows through the downtown area. Noise levels can expect to be temporarily elevated above normal during construction to separate and consolidate the CSXT and NS tracks and to have minor permanent increases once the project is completed in the area adjacent to the consolidated tracks because of additional trains. However, the embankment from the grade-separated tracks would act as a natural noise barrier. Eliminating at-grade crossings will reduce the need for trains to blow their whistles for warning at crossings.

D. Natural Resources

The project area consists of mostly of commercial and industrial development, maintained/disturbed roadsides, and maintained railroad right-of-way (ROW). Other habitats identified within the project area included upland mixed hardwood-pine forest, riparian hardwood forest, stream channels, emergent herbaceous wetlands, forested wetlands, and a pond. The wetland communities, stream channels, and pond located within the project area are discussed in more detail below. See the Environmental Summary Report in Appendix D for additional details on natural resources.

Potential jurisdictional waters of the U.S. identified within the project area include six stream channels (Streams 1 through 6), three wetland areas (Wetlands A through C), and one pond

(Pond A). These features are located within the Broad River Basin. A brief summary of each area follows:

1. Stream Channels

Concrete Flume – Rocky Branch Creek

Stream channels located within the project area include Rocky Branch Creek (Stream 1), three unnamed tributaries (Streams 2 through 4) to Rocky Branch Creek, and two unnamed tributaries (Streams 5 and 6) to the Congaree River. Stream 1 is a perennial tributary to the Congaree River and flows in a general northeast to southwest direction through the center of the project area. Stream 1 has been significantly altered (culverts concrete flumes, channelization, etc.) due to commercial development and associated road crossings throughout the streets of downtown Columbia. The stream varies in width from 15 to 30 feet wide and contains a substrate of sand, silt, cobble, and rock. Stream bank heights vary from 5 to 15 feet. Aquatic life, including fish, crayfish, and salamanders, were observed within the stream channel. There are three existing railroad crossings over Stream 1 within the project area, including bridged crossings on Sumter Street and just south of Assembly Street and a piped crossing in between Heyward Street and Whaley Street.

Stream 2 is a short intermittent tributary to Stream 1 and is located along the west side of Sumter Street. The stream contains weak flow with no sinuosity. Stream channel widths vary from 3 to 5 feet. Substrate consists of sand, silt, and rock.

Stream 3 is a perennial tributary to Stream 1 and is located in the eastern portion of the project area. The upper reaches of this stream have been highly altered in the form of ditches and culverts associated with commercial development and street and railroad crossings along Assembly Street and Rosewood Drive. The stream varies in width from 3 to 6 feet and contains a substrate of sand, silt, and cobble. Aquatic life, including fish and crayfish, were observed within the stream channel. There are two existing railroad crossings over Stream 3 within the project area, including piped crossings just east of Rosewood Drive and just north of Assembly Street.

Stream 4 appears to be a perennial tributary to Stream 1 and is located in the central portion of the project area just north of Catawba Street. Stream 4 flows in a general north to south direction. From Catawba Street south, the project area has been highly commercialized and the stream appears to be connected via underground pipes to Stream 1. The stream contains a weak flow, a weak sinuosity, and a substrate consisting of sand and silt to gravel and cobble. Stream widths vary from 4 to 7 feet.

Streams 5 and 6 are located within an area of undeveloped woodland southeast of the intersection of Huger Street and Blossom Street. Stream 6 is an intermittent tributary to Stream 5. Stream 5 appears to be a perennial tributary to the Congaree River. Between the areas of undeveloped woodland to the Congaree River, the project area has been highly commercially developed and Stream 5 appears to be connected via underground pipes to the Congaree River. Stream widths on both Streams 5 and 6 vary from 3 to 7 feet. Stream 5 contains a sand and silt to gravel and cobble substrate, strong sinuosity, and weak to moderate flow. Stream 6 contains a highly organic mucky substrate, weak sinuosity, weak flow, and a discontinuous bed and bank.

2. Wetlands

Potential jurisdictional wetland areas within the project area include two emergent herbaceous wetlands (Wetlands A and B) and one forested wetland (Wetland C). Wetland A is functioning as a wet detention basin and is located just west of Sumter Street adjacent to Stream 2. Dominant vegetation within Wetland A included cattail, black willow, and common reed. Wetland hydrology indicators included saturated soils to standing water up to 3 inches.

Wet Detention Basin – Wetland A

Wetland B is located north of Catawba Street in the central portion of the project area. The wetland is contiguous with Stream 4 and adjacent to a railroad line. Dominant vegetation within Wetland B included soft rush, black willow, wool grass, and blackberry. Wetland hydrology indicators included soils saturated to the surface.

Wetland C is located adjacent to Stream 5 in the area of undeveloped woodland southeast of Huger Street and Blossom Street. Dominant vegetation within Wetland C consisted of Chinese privet, ironwood, and poison ivy. Wetland hydrology indicators included soils saturated to the surface and drainage patterns.

3. Pond

One pond (Pond A) is located in the project area just northeast of the intersection of Bull Street and Blossom Street in northeast portion of the project area. The pond appears to be hydrological connected to Stream 1 via a pipe system located under Blossom Street.

4. Protected Species Habitat Review

The USFWS and SCDNR databases provided existing data concerning the potential occurrence of state and federally protected species in Richland County. These databases indicate that there are seven state and/or federally threatened (T) or endangered (E) species that may occur in Richland County. These species are listed in Table V-1 below.

Table V-1. Richland County Protected Species

Species		Protected Status	
Common Name	**Scientific Name**	**Federal**	**State**
Bald Eagle	*Haliaeetus leucocephalus*	T	E
Pine Barrens Treefrog	*Hyla andersonii*	Not Listed	T
Rafinesque's Big-eared Bat	*Plecotus rafinesquii*	Not Listed	E
Red-cockaded Woodpecker	*Picoides borealis*	E	E
Rough-leaved Loosestrife	*Lysimachia asperulifolia*	E	E
Smooth Coneflower	*Echinacea laevigata*	E	E
Canby's Dropwort	*Oxpolis canbyi*	E	E

T = Threatened; E = Endangered

Reference: U.S. Fish and Wildlife Service-Threatened and Endangered Species System Database (February 2006); and South Carolina Department of Natural Resources-Rare, Threatened, and Endangered Species Inventory Database (Updated January 17, 2006).

No individuals of any of the above-mentioned species were observed in the project area during the preliminary field review. No potential habitat exists in the project area for the bald eagle, pine barrens tree frog, Rafinesque's big-eared bat, red-cockaded woodpecker, rough-leaved loosestrife, or Canby's dropwort. Potential habitat for smooth coneflower is present in the project area within maintained and disturbed roadsides and railroad right-of-way. Additional surveys may be needed to determine if the project will have any impact on the smooth coneflower.

E. Phase I Environmental Site Assessment

STV / Ralph Whitehead Associates performed a Phase I Environmental Site Assessment (ESA) in general accordance with ASTM E-1527 to identify obvious and likely on-site and off-site potential sources of contamination. Any exceptions to, or deletions from the ASTM practice are described in Section 1.0 in the report entitled Phase I Environmental Site Assessment, which is included in Appendix D. A Technical Memorandum from August 18, 2006 is also included in Appendix D and provides a summary of the Environmental Review. A Phase I EAS constitutes an appropriate and reasonable inquiry for the purpose of CERCLA's innocent landowner defense. The results of the assessment are summarized below.

Dreyfus St. Storage Area

Dreyfus Street Site (EPA # SCD980839575) was a drum storage area and has previously been designated as a CERCLIS and state hazardous waste site. This property is at the northwest corner of Assembly Street and Dreyfus Street and is an unoccupied fenced lot that has been cleared and is now overgrown. According to Mr. William Joyner of the EPA, the EPA has assessed the old drum storage site and no further remediation is planned. This property is at a lower elevation than the adjacent Assembly Street and we anticipate the area will require filling if Assembly Street is widened in this area. Therefore, we do not expect this property will have an adverse environmental impact during construction.

Estech General Chemicals Corporation (EPA # SCD980491369) located along Shop Road is 0.25 miles southeast and down gradient of the project area and has a documented no further action required date provided by the EPA. Since this property is outside the southern limits of the project area, and down gradient, we do not expect this property will have an adverse environmental impact during construction.

Carolina Inc. (EPA # SCR000765651) is the only large quantity generator of hazardous materials within the project limits and is along Heyward Street near the western project area boundary. Carolina Inc. has no documented violations.

None of the seventeen small quantity generators within the project area or on adjoining properties have documented violations.

Thirty-seven sites are listed as having had leaking underground storage tanks (LUSTs) with South Carolina Department of Health and Environmental Control (SCDHEC) within the project limits, or within 0.5 miles of the project perimeter. Thirty-three of the sites have "no further action required" status. The remaining four are:

Pantry Express

Pantry Express 640, at 205 Assembly Street (middle of project area). The site is currently under assessment and no corrective actions have been planned. There is a potential of groundwater contamination under Assembly Street from this incident. But due to the anticipated shallow excavation depths needed for road construction, there is a low probability of encountering contaminated soil or groundwater during construction.

Salem Leasing Corporation, 401 Williams Street (one block west of Huger Street outside the western project boundary). The site is currently undergoing aggressive fluid vapor recovery and the site is 81 percent remediated. Since this property is outside the western limits of the project area, and down gradient, it is not expected to have an adverse environmental impact during construction.

Corner Pantry 106, 830 Assembly Street (approximately 0.25 miles north of the project area), and Majik Market 42853, 1002 Sumter Street (0.4 miles north of the project area). These sites are currently under assessment and no corrective actions have been planned. There is a probability of encountering contaminated soil or groundwater during construction since the project area is down gradient from these sites. However, due to the anticipated shallow excavation depths needed for road construction, there is a low probability of adverse environmental impact to the project area.

VI. DRAINAGE

A hydraulic/hydrologic drainage basin study was completed by the LPA Group in August 2007 to identify drainage concerns involving the Assembly Street project study area and is included in Appendix E.

A. Flood Zone

The proposed grade separation could require replacement of an existing bridge and box culvert within the Rocky Branch Flood Zone. The project study area is located within a Federal Emergency Management Agency (FEMA) Zone. A floodway has been established from the railroad bridge downstream to the Congaree River. A detailed hydraulic study will have to be performed to determine if a Conditional Letter of Map Revision (CLOMR) is needed in accordance with FEMA regulations.

B. Existing Studies

All applicable state/government agencies were contacted in order to determine what data exists for the project area. Many of the exiting studies were completed in the past and the area has seen many changes since those studies were completed. As a result, the studies may no longer be valid.

A Rocky Branch Flood Study is currently being conducted by the City of Columbia and includes the Assembly Street project area. As the Assembly Street alternatives are developed, the results of the Rocky Branch Flood Study should be taken into consideration.

C. Site Inspection

A site inspection was conducted in January of 2005 and it was noted that severe erosion problems are occurring along Rocky Branch downstream of the Assembly Street Crossing. Photographs detailing the erosion can be found in Appendix E. The area of Rocky Branch located upstream of the Assembly Street crossing appears to be stable with no major erosion issues.

In addition, two structures are located in the floodway, along Dreyfus Street, just downstream of the Assembly Street Crossing. A third structure was found to be within close proximity to the floodway and could be affected if any changes were made to the Rocky Branch crossings.

In conclusion, the proposed grade separations may require replacement of structures in an established Flood Zone and FEMA coordination will be necessary.

Drainage improvement recommendations include:

- Using the hardcopy Flood Insurance Rate Map or Digital Flood Insurance Rate Map in making official determinations.

- Conducting a detailed hydraulic study in order to determine if a Conditional Letter of Map Revision (CLOMR) is needed in accordance with FEMA regulations.
- Reviewing any update drainage studies within the area (specifically the pending Rocky Branch Flood Study).
- Once the proposed alternative has been selected, the most recent FEMA study should be obtained and modified to reflect the proposed design of the Assembly Street crossing.

VII. RAIL / ROADWAY ALTERNATIVES

Early on in the process, four (4) alternatives were designed and evaluated. Each alternative implemented some type of grade crossing with either the rail going under the existing roadway network or the rail crossing over the roadway network. However, not all existing at-grade rail crossings would be eliminated in any of the alternatives. Following a second group stakeholders meeting, a fifth alternative was developed. In addition, Alternative 5 could be implemented with any of the other four alternatives developed. Designs for the alternatives are included at the end of Section VII.

A. Proposed Alternatives

Alternate 1

Alternate 1 will include grade crossing closures, eliminations, and grade-separations (plans located at the end of this section show the design for Alternate 1). This alternate will require five grade crossings to be closed while four will remain open. A section of the existing tracks will be removed which will result in the elimination of three grade crossings. Two bridges will be constructed in order to grade-separate the proposed tracks from the existing roadway on Whaley Street and Assembly Street. Additionally, Huger Street will be realigned with Olympia Avenue and a third bridge will need to be constructed to separate the realigned roadway from the existing tracks**.** Table VII-1 summarizes the grade crossing changes.

Table VII-1

Road Name	Crossing Number	Crossing To Remain Open	Crossing Closure	Crossing Elimination	Grade-Separation	New At-Grade
Bluff	634648G		X			
Lincoln	634655S		X			
Catawba	634656Y		X			
Gadsden	634657F		X			
Flora	716361K		X			
Assembly	634647A	X				
Huger	715847J	X				
Lincoln	716365M	X				
Gadsden	716366U	X				
Assembly	716363Y			X		
Catawba	Existing			X		
Gadsden	716366U			X		
Whaley	634654K				X	
Assembly	New				X	
Huger	New				X	

Alternate 2B

Alternate 2B will include grade crossing closures, eliminations, and grade-separations (plans located at the end of this section show the design for Alternate 2B). This alternate will require five grade crossings to be closed while three will remain open. A section of Main Street will be closed to allow a new track alignment to cross without installing an at-grade crossing. A section of the existing tracks will be removed which will result in the elimination of six grade crossings. Three bridges will be constructed in order to grade-separate the proposed tracks from the existing roadway on Whaley Street and Assembly Street. As in Alternate 1, Huger Street will be realigned with Olympia Avenue and a fourth bridge will need to be constructed to separate the realigned roadway from the existing tracks. Table VII-2 summarizes the grade crossing changes.

Table VII-2

Road Name	Crossing Number	Crossing To Remain Open	Crossing Closure	Crossing Elimination	Grade-Separation	New At-Grade
Bluff	634648G		X			
Lincoln	634655S		X			
Catawba	634656Y		X			
Gadsden	634657F		X			
Main	New		X			
Flora	716361K		X			
Assembly	634647A	X				
Huger	715847J	X				
Whaley	715403R	X				
Assembly	715620R			X		
Main	715621X			X		
Lincoln	716365M			X		
Gadsden	716366U			X		
Assembly	716363Y			X		
Sumter	Bridge			X		
Whaley	634654K				X	
Assembly	New				X	
Assembly	New				X	
Huger	New				X	

Alternate 3

Alternate 3 will include grade crossing closures, eliminations, and grade-separations (plans located at the end of this section show the design for Alternate 3). This alternate will require four grade crossings to be closed while two will remain open. Several sections of the existing tracks will be removed which will result in the elimination of one grade crossing. Two bridges will grade-separate the proposed tracks from Assembly Street and Whaley Street. As in Alternate 1, Huger Street will be realigned with Olympia Avenue and a fourth bridge will need to be constructed to separate the realigned roadway from the existing tracks. Table VII-3 summarizes the grade crossing changes.

Table VII-3

Road Name	Crossing Number	Crossing To Remain Open	Crossing Closure	Crossing Elimination	Grade-Separation	New At-Grade
Gadsden	716366U		X			
Lincoln	716365M		X			
Catawba	Existing		X			
Flora	716361K		X			
Assembly	716363Y			X	X	
Gadsden	634657F	X				
Huger	715847J	X				

Alternate 4

Alternate 4 includes changes to the existing roadway but not to the existing tracks (plans located at the end of this section show the design for Alternate 4). A section of Bluff Road will be removed and realigned to create a connection with Flora Street. This will eliminate one grade crossing on Bluff Road. The new roadway alignment will cross Assembly Street forming a four-leg intersection. A bridge will have to be constructed on this new alignment over a small creek just east of Assembly Street. Flora Street will no longer intersect Assembly Street but will instead dead end before the existing intersection. Two bridges will be constructed on Assembly Street over the existing tracks which will eliminate two grade crossings. Table VII-4 summarizes the grade crossing changes.

Table VII-4

Road Name	Crossing Number	Crossing To Remain Open	Crossing Closure	Crossing Elimination	Grade-Separation	New At-Grade
Bluff	634648G			X		
Assembly	716363Y			X	X	
Assembly	634647A			X	X	

Alternate 5

Alternate 5 can be built in addition to any other selected alternate (plans located at the end of this section show the design for Alternate 5). This alternate will realign one of the existing CSXT tracks just north of Andrews Yard and will provide a connection between the CSXT tracks and the Norfolk Southern tracks. A section of the existing CSXT tracks would then be removed.

B. Design Issues

After designing the alternatives, it was imperative to analyze any positive/negatives issues relating to each alternative in order to develop recommendations.

Alternate 1

- This option does not relocate the R-line so the crossing frog for the R-line and the CSXT Main Track will remain.
- CSXT1-3 (CSXT Industry Lead) will require a steeper than desired grade to tie in to the west side of the Assembly Street grade crossing. This is because CSXT1-3 will need to be at the same elevation as the NS1 alignment when they cross over Whaley Street.
- The sag vertical curve on the NS1 alignment (Sta. 71+00) does not meet the requirements for the rate of change of vertical curves due to placement of cross-overs and other design restrictions.
- The vertical and/or horizontal alignments for Lincoln Street, Whaley Street, and Bluff Road will have to be significantly altered.
- Spirals were not added to the CSXT1-3 (CSXT Industry Lead) alignment because of the anticipated low speed on the Lead Track.
- The existing rail traffic on the CSXT tracks going east and west will have to be temporarily routed on to the existing Norfolk Southern tracks across Assembly Street

to allow construction of the Norfolk Southern and CSXT elevated tracks between the R-line and Whaley Street.
- Potential impacts to a proposed apartment complex planned along Assembly Street between Whaley Street and Heyward Street.

Alternate 2B

- The sag vertical curve on the NS2A alignment does not meet the requirements for the rate of change of vertical curves due to placement of cross-overs and other design restrictions.
- The vertical and/or horizontal alignments for Lincoln Street, Whaley Street, and Bluff Road will have to be significantly altered if they are to be left open.
- The existing rail traffic on the CSXT tracks going east and west will have to be temporarily routed on to the existing Norfolk Southern tracks across Assembly Street to allow construction of the Norfolk Southern and CSXT elevated tracks between the R-line and Whaley Street.
- Potential impacts to a proposed apartment complex planned along Assembly Street between Whaley Street and Heyward Street.

Alternate 3

- Minimal additional right of way will be required due to the use of existing street and railway right of way.
- A railroad turnout, or otherwise known as a railroad switch (Sta. 96+00) and a railroad crossover allowing trains to cross from one track to another (Sta. 99+50) will be required for the relocated NS R-line due to geometrical constraints.
- The proposed new railroad bridge over Assembly Street will be longer than other alternates because of the severe skew angle.
- The existing grade on Assembly Street will need to be lowered 15'± and the existing grade on Whaley Street will need to be lowered 3'±.
- The existing NS R-line grade crossing at Assembly St. and the existing CSXT Main track grade crossing at Assembly Street will remain.
- A railroad turnout will be required in the new NS Mainline track near Rosewood Avenue (Sta. 52+41) and the existing connection track to the NS R-line will need to be re-aligned (Sta. 52+41 to 60+00).
- Three NS grade crossings (Gadsden Street, Lincoln Street and Catawba Street) will be closed.
- Assembly Street will likely have to close during construction.
- Track construction between Blossom Street and Assembly Street will likely have to be done under rail traffic.

Alternate 4

- A section of Bluff Road will be removed and realigned to create a connection with Flora Street. This will eliminate one grade crossing on Bluff Road.
- The other section of Bluff Road will dead end just after Drefuss Road.
- The new roadway alignment will cross Assembly Street forming a four-leg intersection. A bridge will have to be constructed on this new alignment over a small creek just east

of Assembly Street. Flora Street will no longer intersect Assembly Street but will instead dead end before the existing intersection.
- Long stretches of retaining walls will be required along Assembly Street providing unaesthetic views. However, improved design and community input could help to overcome this issue.
- The existing Rosewood Drive - CSXT main line at-grade crossing would continue to operate with the main line train traffic. The number of trains would not be reduced as in the other alternatives ability to switch the CSXT traffic onto the NS main line.
- Two bridges will be constructed on Assembly Street over the existing tracks which will eliminate two at-grade crossings.
- The existing NS R-line at-grade crossing at Assembly Street will remain open.
- Eliminates access to properties along Assembly Street between Flora Street and the NS-R line.
- ROW needed for the new ramp access to Assembly Street from both Flora Street and Whaley Street.
- Potential impacts to a proposed apartment complex planned along Assembly Street between Whaley Street and Heyward Street.

C. Cost Issues

After designing the alternatives, cost estimates were developed for comparison purposes as well as a tool for budget analysis. A detailed cost estimate for each alternative can be found in the Appendix F document.

Alternate 1

The combined costs for roadway and railroad improvements are estimated to be $63,100,000 in 2009 dollars.

Alternate 2B

The combined costs for roadway and railroad improvements are estimated to be $87,100,000 in 2009 dollars.

Alternate 3

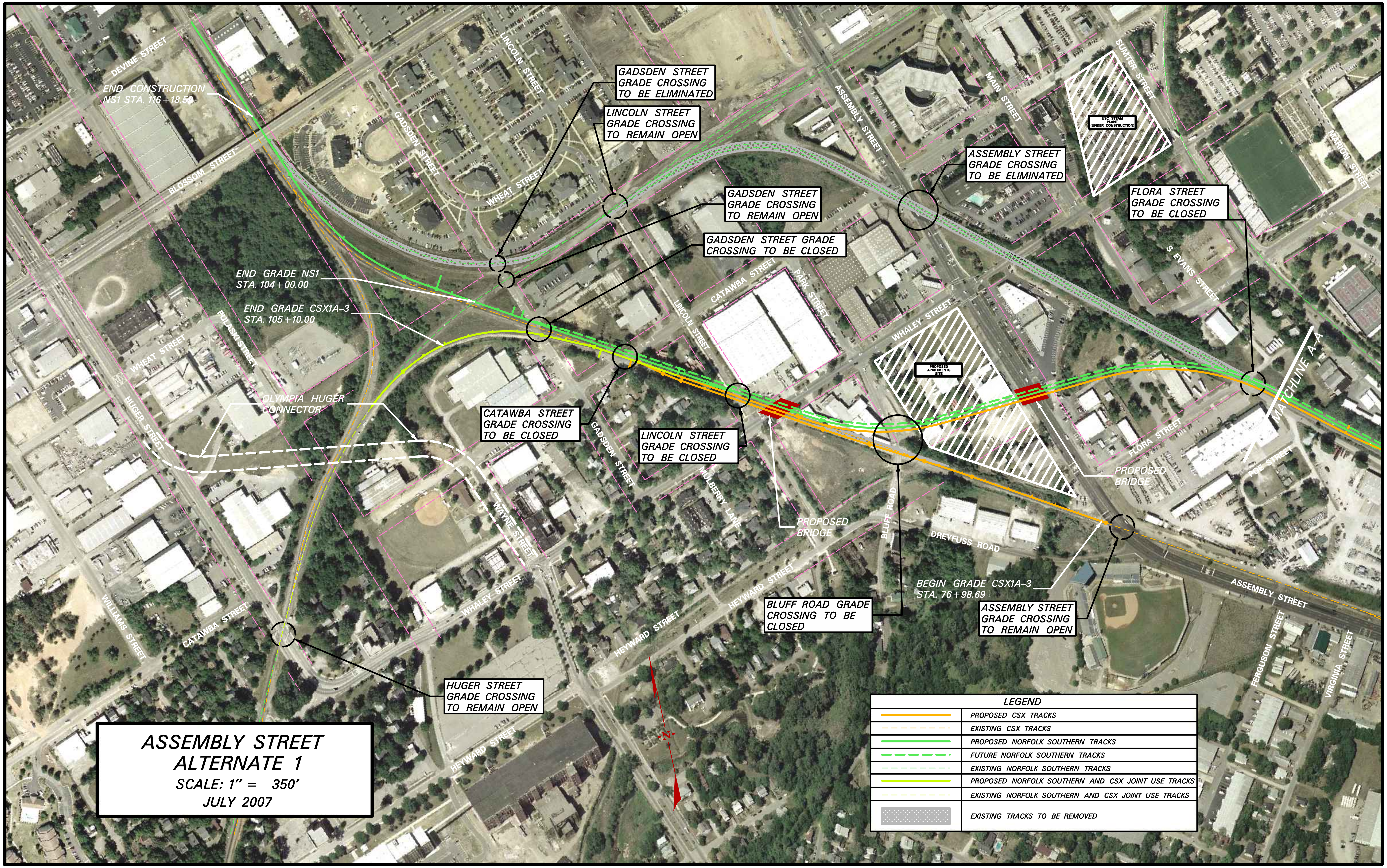
The combined costs for roadway and railroad improvements are estimated to be $63,300,000 in 2009 dollars.

Alternate 4

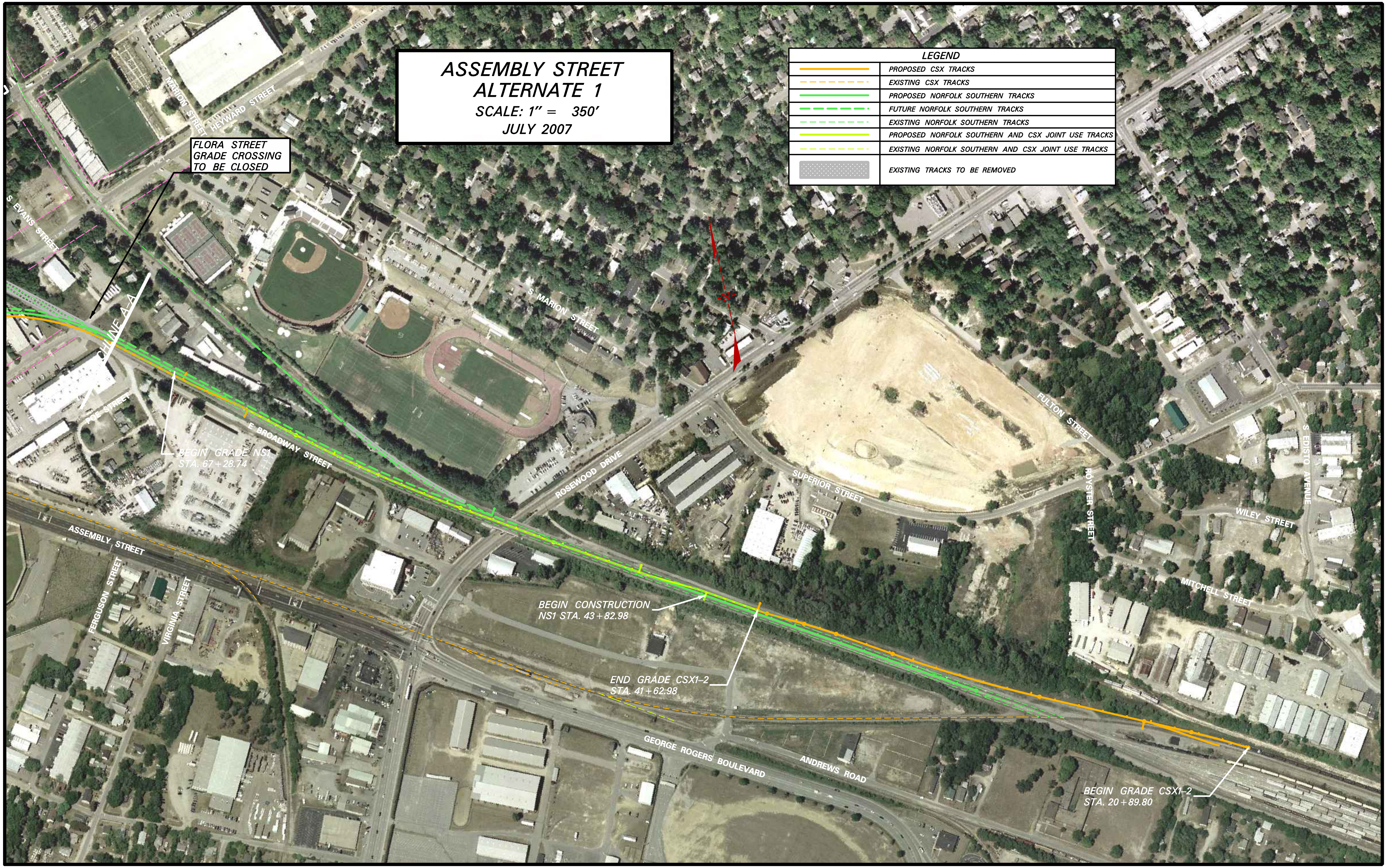
The combined costs for roadway and railroad improvements are estimated to be $23,000,000 in 2009 dollars.

Alternate 5

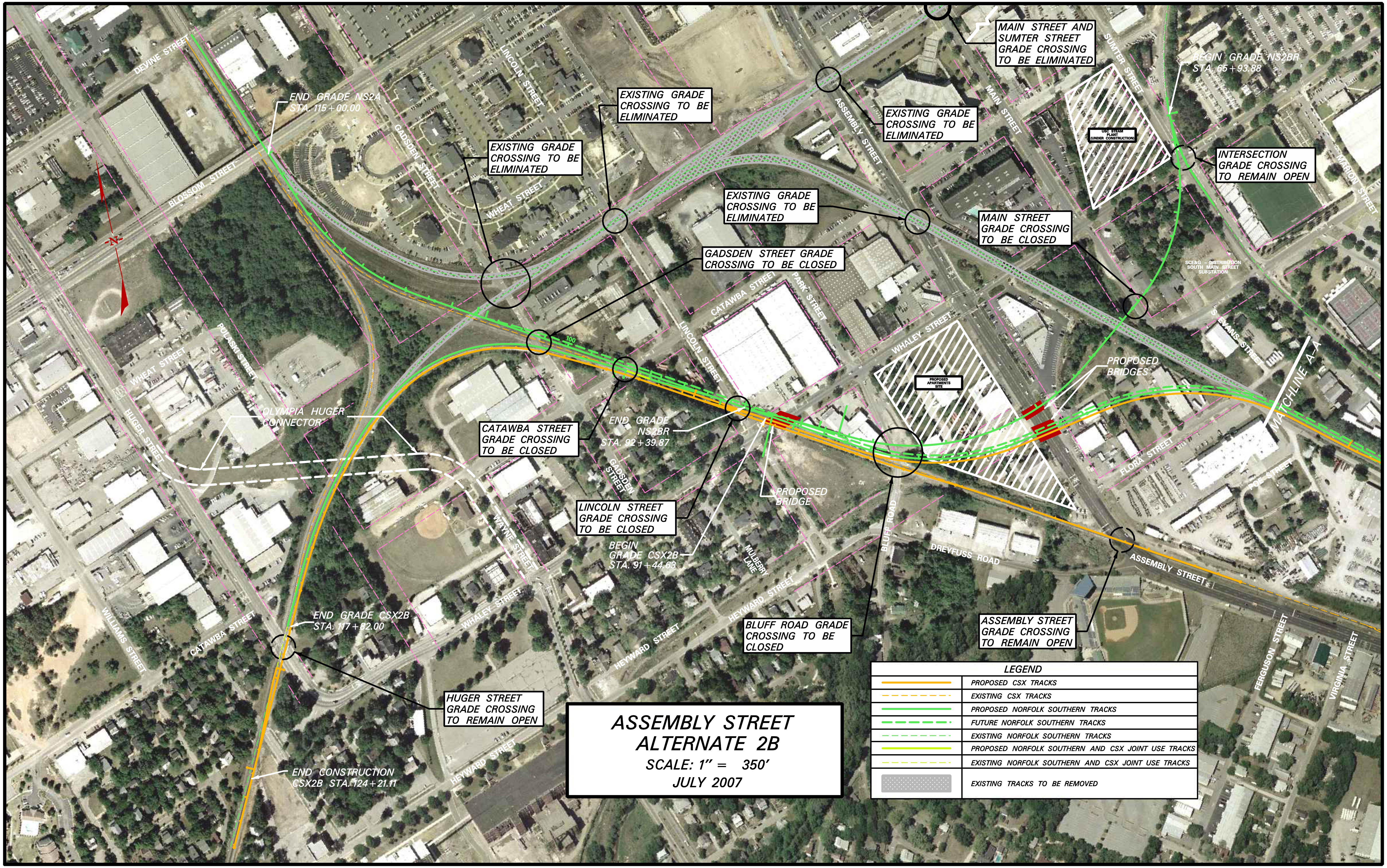
The costs for the additional railroad connection that could be included within any of the first three alternatives, would reduce the overall cost estimate by $500,000 in 2009 dollars.

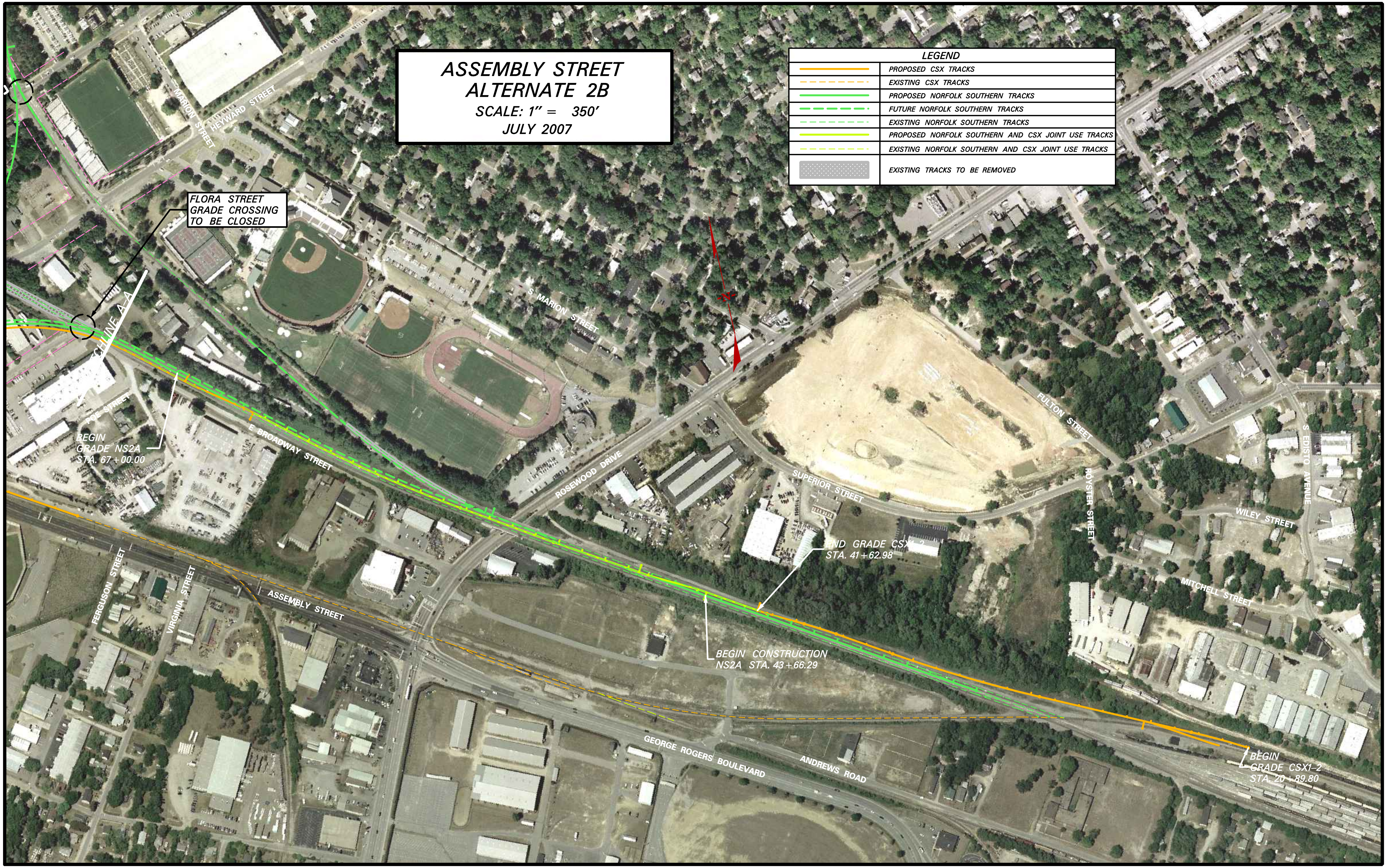


ASSEMBLY STREET
ALTERNATE 1
SCALE: 1" = 350'
JULY 2007
LEGEND
PROPOSED CSX TRACKS
EXISTING CSX TRACKS
PROPOSED NORFOLK SOUTHERN TRACKS
FUTURE NORFOLK SOUTHERN TRACKS
EXISTING NORFOLK SOUTHERN TRACKS
PROPOSED NORFOLK SOUTHERN AND CSX JOINT USE TRACKS
EXISTING NORFOLK SOUTHERN AND CSX JOINT USE TRACKS
EXISTING TRACKS TO BE REMOVED
END CONSTRUCTION NS1 STA. 116+18.50
GADSDEN STREET GRADE CROSSING TO BE ELIMINATED
LINCOLN STREET GRADE CROSSING TO REMAIN OPEN
GADSDEN STREET GRADE CROSSING TO REMAIN OPEN
GADSDEN STREET GRADE CROSSING TO BE CLOSED
ASSEMBLY STREET GRADE CROSSING TO BE ELIMINATED
FLORA STREET GRADE CROSSING TO BE CLOSED
END GRADE NS1 STA. 104+00.00
END GRADE CSX1A-3 STA. 105+10.00
OLYMPIA HUGER CONNECTOR
CATAWBA STREET GRADE CROSSING TO BE CLOSED
LINCOLN STREET GRADE CROSSING TO BE CLOSED
PROPOSED BRIDGE
PROPOSED BRIDGE
MATCHLINE A-A
BEGIN GRADE CSX1A-3 STA. 76+98.69
ASSEMBLY STREET GRADE CROSSING TO REMAIN OPEN
BLUFF ROAD GRADE CROSSING TO BE CLOSED
HUGER STREET GRADE CROSSING TO REMAIN OPEN
PROPOSED APARTMENTS SITE
USC STEAM PLANT (UNDER CONSTRUCTION)
N
DEVINE STREET
BLOSSOM STREET
WHEAT STREET
LINCOLN STREET
GADSDEN STREET
ASSEMBLY STREET
MAIN STREET
SUMTER STREET
MARION STREET
S. EVANS STREET
CATAWBA STREET
PARK STREET
WHALEY STREET
PULASKI STREET
HUGER STREET
WILLIAMS STREET
WAYNE STREET
MULBERRY LANE
BLUFF ROAD
DREYFUSS ROAD
HEYWARD STREET
FLORA STREET
FERGUSON STREET
VIRGINIA STREET



ASSEMBLY STREET
ALTERNATE 1
SCALE: 1" = 350'
JULY 2007
LEGEND
PROPOSED CSX TRACKS
EXISTING CSX TRACKS
PROPOSED NORFOLK SOUTHERN TRACKS
FUTURE NORFOLK SOUTHERN TRACKS
EXISTING NORFOLK SOUTHERN TRACKS
PROPOSED NORFOLK SOUTHERN AND CSX JOINT USE TRACKS
EXISTING NORFOLK SOUTHERN AND CSX JOINT USE TRACKS
EXISTING TRACKS TO BE REMOVED
FLORA STREET GRADE CROSSING TO BE CLOSED
BEGIN GRADE NS1 STA. 67+28.74
BEGIN CONSTRUCTION NS1 STA. 43+82.98
END GRADE CSX1-2 STA. 41+62.98
BEGIN GRADE CSX1-2 STA. 20+89.80
MARION STREET
HEYWARD STREET
S EVANS STREET
S MARION STREET
E BROADWAY STREET
ROSEWOOD DRIVE
SUPERIOR STREET
FULTON STREET
ROYSTER STREET
S EDISTO AVENUE
WILEY STREET
MITCHELL STREET
ASSEMBLY STREET
FERGUSON STREET
VIRGINIA STREET
GEORGE ROGERS BOULEVARD
ANDREWS ROAD


MAIN STREET AND SUMTER STREET GRADE CROSSING TO BE ELIMINATED
BEGIN GRADE NS2BR STA. 65+93.88
END GRADE NS2A STA. 115+00.00
EXISTING GRADE CROSSING TO BE ELIMINATED
EXISTING GRADE CROSSING TO BE ELIMINATED
EXISTING GRADE CROSSING TO BE ELIMINATED
EXISTING GRADE CROSSING TO BE ELIMINATED
INTERSECTION GRADE CROSSING TO REMAIN OPEN
MAIN STREET GRADE CROSSING TO BE CLOSED
GADSDEN STREET GRADE CROSSING TO BE CLOSED
PROPOSED BRIDGES
MATCHLINE A-A
OLYMPIA HUGER CONNECTOR
CATAWBA STREET GRADE CROSSING TO BE CLOSED
END GRADE NS2BR STA. 92+39.87
PROPOSED BRIDGE
LINCOLN STREET GRADE CROSSING TO BE CLOSED
BEGIN GRADE CSX2B STA. 91+44.63
END GRADE CSX2B STA. 117+82.00
HUGER STREET GRADE CROSSING TO REMAIN OPEN
BLUFF ROAD GRADE CROSSING TO BE CLOSED
ASSEMBLY STREET GRADE CROSSING TO REMAIN OPEN
END CONSTRUCTION CSX2B STA. 124+21.11
DEVINE STREET
BLOSSOM STREET
LINCOLN STREET
GADSDEN STREET
WHEAT STREET
ASSEMBLY STREET
MAIN STREET
SUMTER STREET
MARION STREET
CATAWBA STREET
PARK STREET
WHALEY STREET
PULASKI STREET
HUGER STREET
WAYNE STREET
MULBERRY LANE
HEYWARD STREET
BLUFF ROAD
DREYFUSS ROAD
FLORA STREET
WILLIAMS STREET
FERGUSON STREET
VIRGINIA STREET
N
LEGEND
PROPOSED CSX TRACKS
EXISTING CSX TRACKS
PROPOSED NORFOLK SOUTHERN TRACKS
FUTURE NORFOLK SOUTHERN TRACKS
EXISTING NORFOLK SOUTHERN TRACKS
PROPOSED NORFOLK SOUTHERN AND CSX JOINT USE TRACKS
EXISTING NORFOLK SOUTHERN AND CSX JOINT USE TRACKS
EXISTING TRACKS TO BE REMOVED
ASSEMBLY STREET
ALTERNATE 2B
SCALE: 1" = 350'
JULY 2007



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ALTERNATE 2B
SCALE: 1" = 350'
JULY 2007
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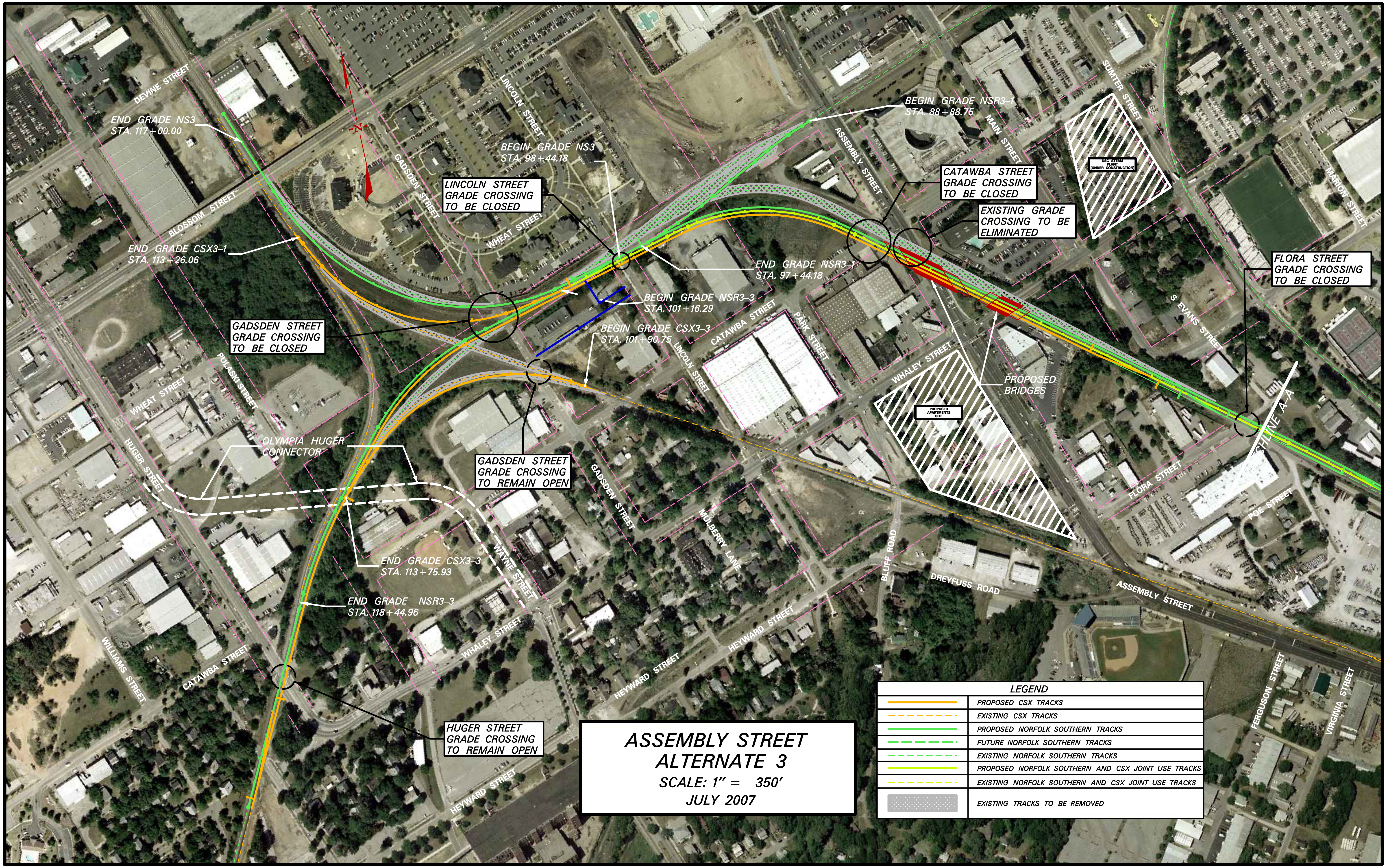
EXISTING CSX TRACKS
PROPOSED NORFOLK SOUTHERN TRACKS
FUTURE NORFOLK SOUTHERN TRACKS
EXISTING NORFOLK SOUTHERN TRACKS
PROPOSED NORFOLK SOUTHERN AND CSX JOINT USE TRACKS
EXISTING NORFOLK SOUTHERN AND CSX JOINT USE TRACKS
EXISTING TRACKS TO BE REMOVED
FLORA STREET
GRADE CROSSING
TO BE CLOSED
MARION STREET
HEYWARD STREET
S. MARION STREET
CUTLINE A-A
BEGIN
GRADE NS2A
STA. 67+00.00
E BROADWAY STREET
ROSEWOOD DRIVE
SUPERIOR STREET
FULTON STREET
ROYSTER STREET
S EDISTO AVENUE
WILEY STREET
MITCHELL STREET
END GRADE CSX1-2
STA. 41+62.98
BEGIN CONSTRUCTION
NS2A STA. 43+66.29
FERGUSON STREET
VIRGINIA STREET
ASSEMBLY STREET
GEORGE ROGERS BOULEVARD
ANDREWS ROAD
BEGIN
GRADE CSX1-2
STA. 20+89.80



ASSEMBLY STREET
ALTERNATE 3
SCALE: 1" = 350'
JULY 2007
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EXISTING CSX TRACKS
PROPOSED NORFOLK SOUTHERN TRACKS
FUTURE NORFOLK SOUTHERN TRACKS
EXISTING NORFOLK SOUTHERN TRACKS
PROPOSED NORFOLK SOUTHERN AND CSX JOINT USE TRACKS
EXISTING NORFOLK SOUTHERN AND CSX JOINT USE TRACKS
EXISTING TRACKS TO BE REMOVED
N
END GRADE NS3
STA. 117+00.00
BEGIN GRADE NS3
STA. 98+44.18
LINCOLN STREET
GRADE CROSSING
TO BE CLOSED
END GRADE CSX3-1
STA. 113+26.06
BEGIN GRADE NSR3-1
STA. 88+88.75
CATAWBA STREET
GRADE CROSSING
TO BE CLOSED
EXISTING GRADE
CROSSING TO BE
ELIMINATED
END GRADE NSR3-1
STA. 97+44.18
BEGIN GRADE NSR3-3
STA. 101+16.29
BEGIN GRADE CSX3-3
STA. 101+90.75
GADSDEN STREET
GRADE CROSSING
TO BE CLOSED
FLORA STREET
GRADE CROSSING
TO BE CLOSED
PROPOSED
BRIDGES
MATCHLINE A-A
OLYMPIA HUGER
CONNECTOR
GADSDEN STREET
GRADE CROSSING
TO REMAIN OPEN
END GRADE CSX3-3
STA. 113+75.93
END GRADE NSR3-3
STA. 118+44.96
HUGER STREET
GRADE CROSSING
TO REMAIN OPEN
DEVINE STREET
BLOSSOM STREET
LINCOLN STREET
GADSDEN STREET
WHEAT STREET
ASSEMBLY STREET
MAIN STREET
SUMTER STREET
MARION STREET
S. EVANS STREET
CATAWBA STREET
PARK STREET
WHALEY STREET
PULASKI STREET
HUGER STREET
WAYNE STREET
MULBERRY LANE
BLUFF ROAD
DREYFUSS ROAD
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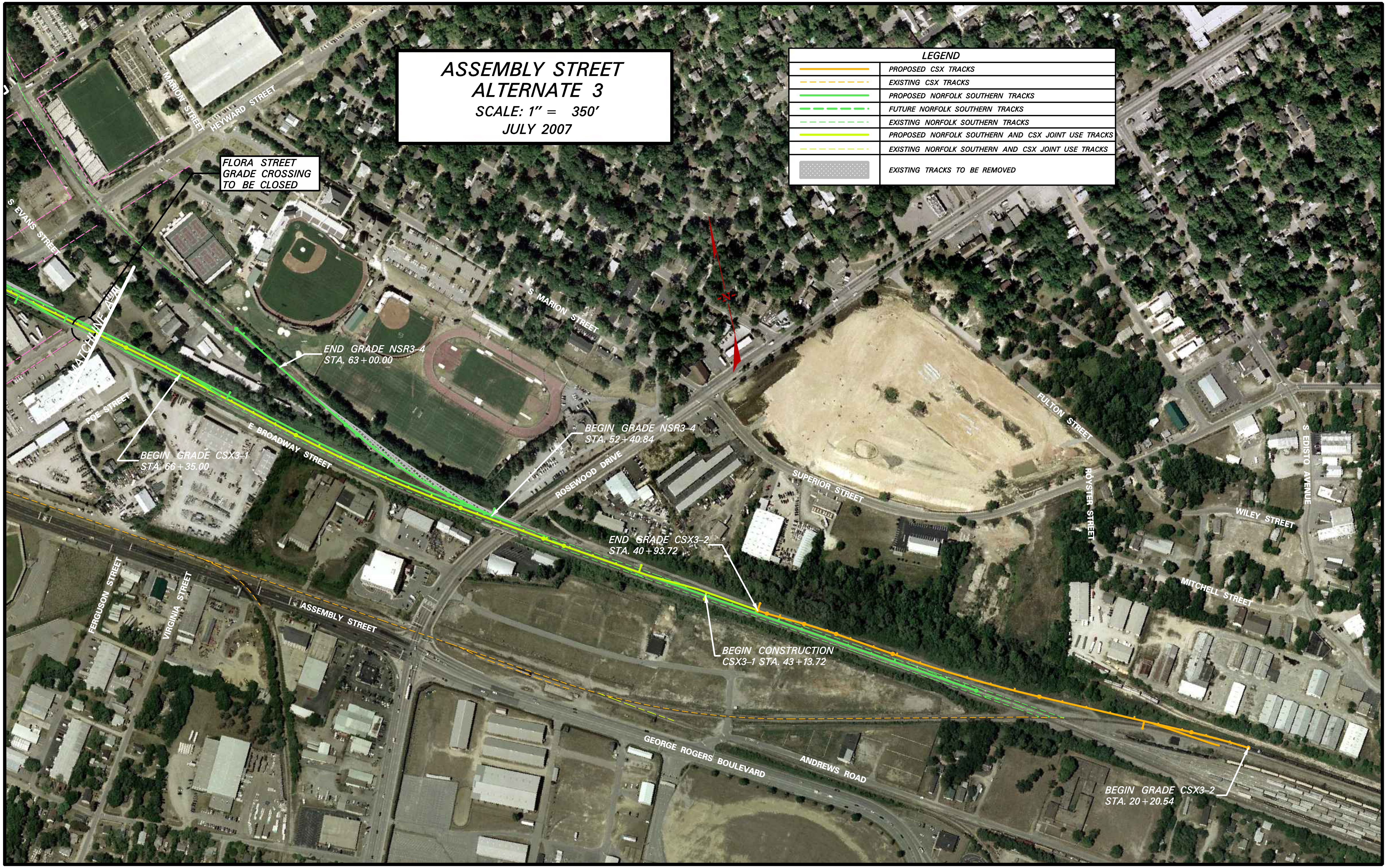
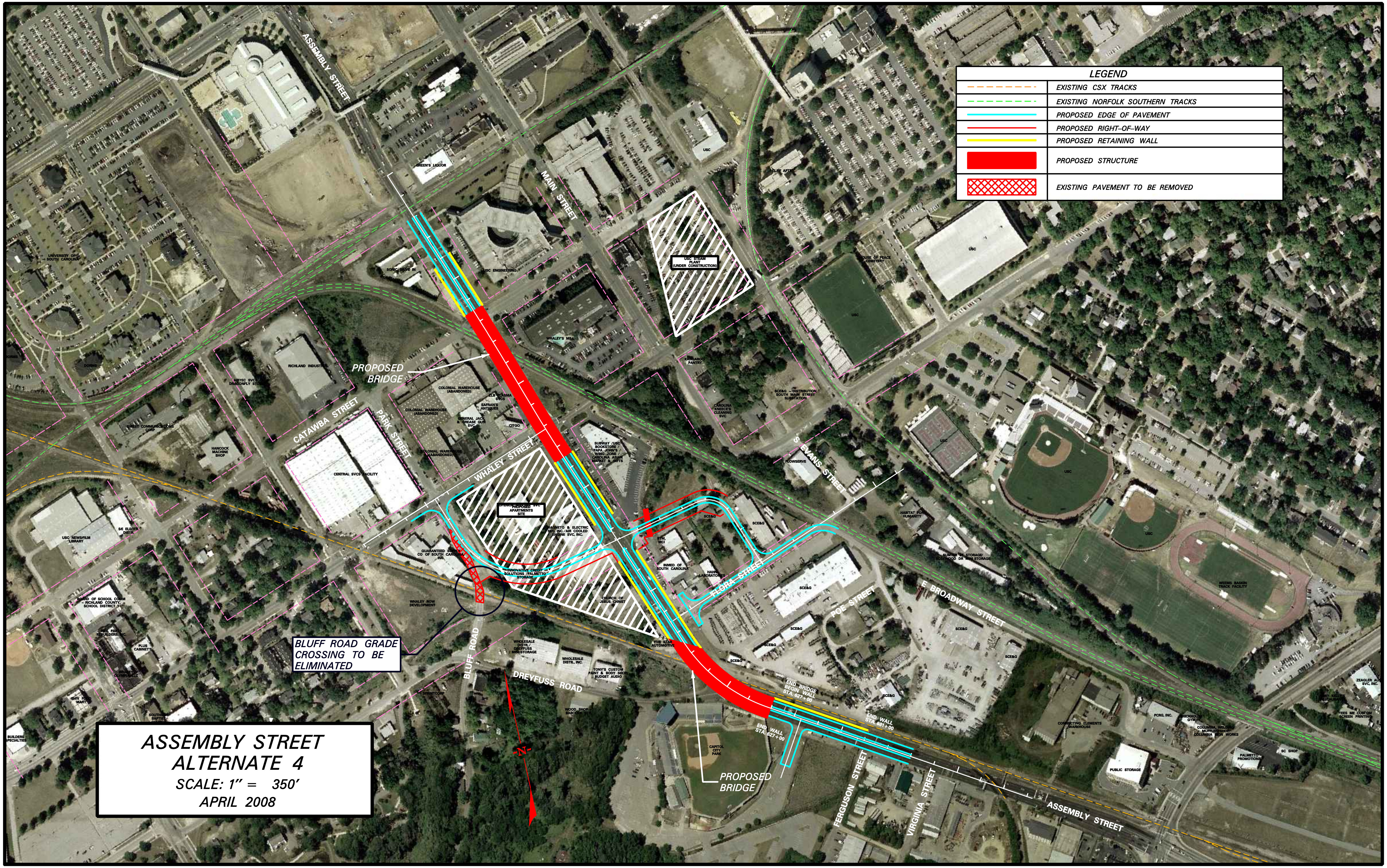
POE STREET
HEYWARD STREET
WILLIAMS STREET
FERGUSON STREET
VIRGINIA STREET



ASSEMBLY STREET
ALTERNATE 3
SCALE: 1" = 350'
JULY 2007
LEGEND
PROPOSED CSX TRACKS
EXISTING CSX TRACKS
PROPOSED NORFOLK SOUTHERN TRACKS
FUTURE NORFOLK SOUTHERN TRACKS
EXISTING NORFOLK SOUTHERN TRACKS
PROPOSED NORFOLK SOUTHERN AND CSX JOINT USE TRACKS
EXISTING NORFOLK SOUTHERN AND CSX JOINT USE TRACKS
EXISTING TRACKS TO BE REMOVED
FLORA STREET GRADE CROSSING TO BE CLOSED
MARION STREET
HEYWARD STREET
S EVANS STREET
MATCHLINE A
S MARION STREET
END GRADE NSR3-4 STA. 63+00.00
POE STREET
BEGIN GRADE CSX3-1 STA. 66+35.00
E BROADWAY STREET
BEGIN GRADE NSR3-4 STA. 52+40.84
ROSEWOOD DRIVE
FULTON STREET
SUPERIOR STREET
ROYSTER STREET
S EDISTO AVENUE
WILEY STREET
END GRADE CSX3-2 STA. 40+93.72
MITCHELL STREET
FERGUSON STREET
VIRGINIA STREET
ASSEMBLY STREET
BEGIN CONSTRUCTION CSX3-1 STA. 43+13.72
GEORGE ROGERS BOULEVARD
ANDREWS ROAD
BEGIN GRADE CSX3-2 STA. 20+20.54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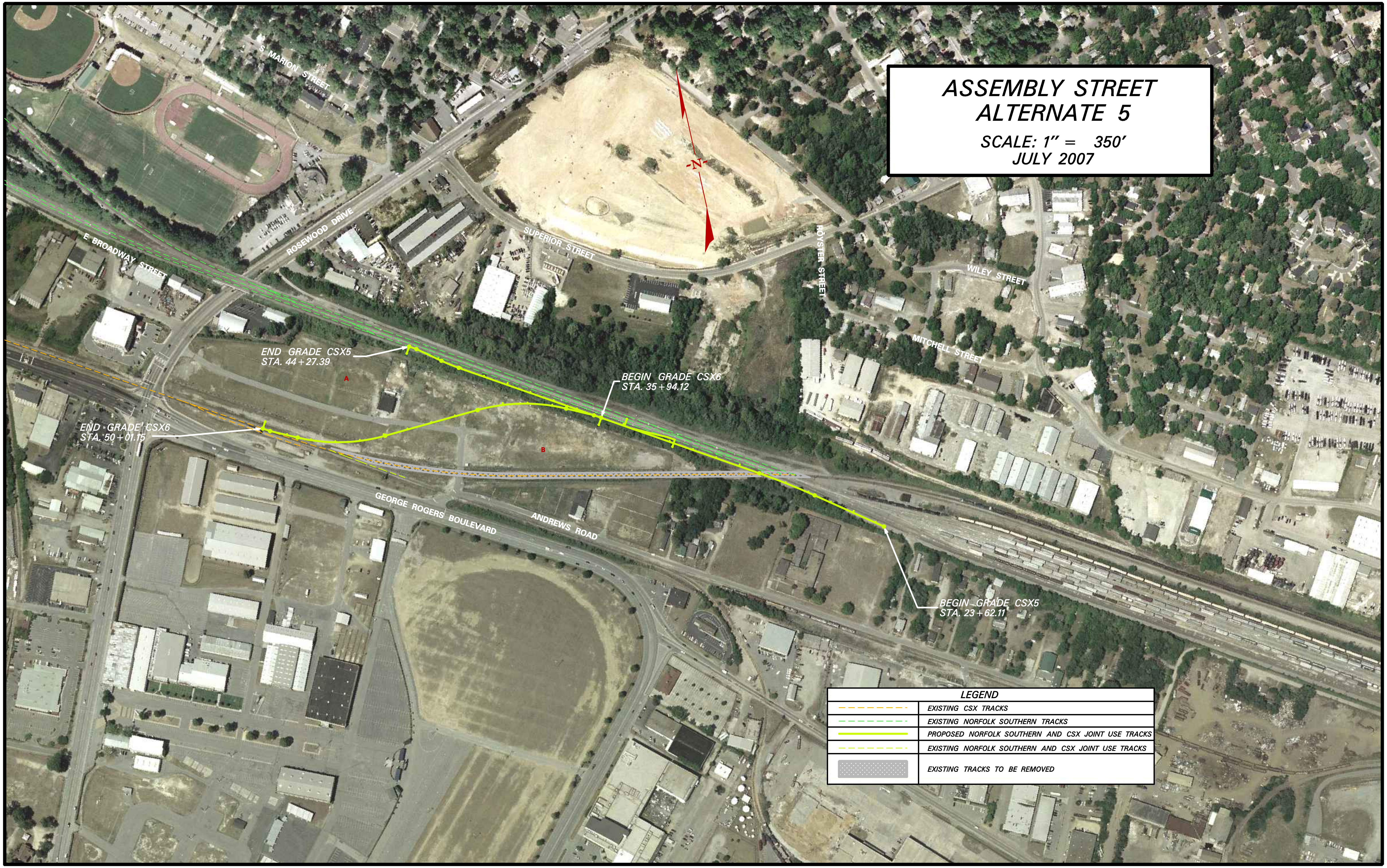
EXISTING NORFOLK SOUTHERN TRACKS
PROPOSED EDGE OF PAVEMENT
PROPOSED RIGHT-OF-WAY
PROPOSED RETAINING WALL
PROPOSED STRUCTURE
EXISTING PAVEMENT TO BE REMOVED
ASSEMBLY STREET
MAIN STREET
CATAWBA STREET
PARK STREET
WHALEY STREET
S. SAVANNAH STREET
FLORA STREET
POE STREET
E BROADWAY STREET
FERGUSON STREET
VIRGINIA STREET
BLUFF ROAD
DREYFUSS ROAD
PROPOSED BRIDGE
PROPOSED BRIDGE
BLUFF ROAD GRADE CROSSING TO BE ELIMINATED
ASSEMBLY STREET
ALTERNATE 4
SCALE: 1" = 350'
APRIL 2008


ASSEMBLY STREET
ALTERNATE 5
SCALE: 1" = 350'
JULY 2007
N
S. MARION STREET
ROSEWOOD DRIVE
E BROADWAY STREET
SUPERIOR STREET
ROYSTER STREET
WILEY STREET
MITCHELL STREET
GEORGE ROGERS BOULEVARD
ANDREWS ROAD
END GRADE CSX5
STA. 44+27.39
BEGIN GRADE CSX6
STA. 35+94.12
END GRADE CSX6
STA. 50+01.15
BEGIN GRADE CSX5
STA. 23+62.11
A
B
LEGEND
EXISTING CSX TRACKS
EXISTING NORFOLK SOUTHERN TRACKS
PROPOSED NORFOLK SOUTHERN AND CSX JOINT USE TRACKS
EXISTING NORFOLK SOUTHERN AND CSX JOINT USE TRACKS
EXISTING TRACKS TO BE REMOVED

VIII. UTILITIES

A total of fourteen (14) separate public and private utilities are located throughout the project area and these companies were engaged through group and individual meetings (see Section II.B Utility Stakeholders). A survey of major utilities within the project area was completed as well as an assessment of prior rights. As detailed in the table at the end of this section, the majority of utility entities have some degree of prior rights.

The proposed alternatives vary and include options to take the railroad over Assembly Street and well as taking the railroad under Assembly Street. If the roadway were lowered so that the railroad could cross over Assembly Street, a bigger impact would be made on the underground utilities. However, an accurate assessment on the true impact to utilities can not be ascertained until an alternative is selected and the exact grade change requirement can be calculated.

Approximate utility locations have been incorporated into the mapping and construction cost estimates will reflect conceptual impacts to the major utilities. Figure VIII-1compares the impacts to utilities based on the selected alternative.

ASSEMBLY STREET GRADE SEPARATION STUDY

COLUMBIA, SC
RICHLAND COUNTY
SCDOT FILE NO.

UTILITY	CONTACT	PRIOR RIGHTS (Y/N)	ALTERNATIVE 1	ALTERNATIVE 2B	ALTERNATIVE 3	ALTERNATIVE 4	ALTERNATIVE 5	REMARKS
SCE&G Transmission	Danny Hicks MC:033 Columbia, SC 29218 803-217-9504	Yes	$175,000.00	$175,000.00	$100,000.00	$500,000.00	$75,000.00	Conflicts are at crossings. Conflicts could include clearance and poles. Alternate 1 has 3; Alternate 2B has 3 crossings; Alternate 3 has 2 crossings; and Alternate 5 has 1 crossing. Alternate 4 parallels a few transmission runs.
SCE&G Distribution	Kelvin Rogers 803-217-6464 Joe Grooms 803-217-8440 MC: J40 Columbia, SC 29218	Yes	$600,000.00	$700,000.00	$400,000.00	$250,000.00	$80,000.00	Conflicts are at crossings. Conflicts could include clearance and poles. Alternate 1 has 9 crossings; Alternate 2B has 10 crossings; Alternate 3 has 7 crossings; and Alternate 5 has 1 crossing. Alternate 4 mainly conflicts with Assembly Street poles.
City of Columbia - Water	Joey Jaco City Engineer PO Box 147 Columbia, SC 29217 803-545-3400	Yes/No	$75,000.00	$75,000.00	$40,000.00	$130,000.00	$0.00	Present on all legs of the project. Their lines range from 2-inches to 24-inches. They have prior rights on some of their facilites. Alternate 4 parallels assembly street which contains water…assume one line has prior rights.
City of Columbia - Sewer	Joey Jaco City Engineer PO Box 147 Columbia, SC 29217 803-545-3400	Yes/No	$80,000.00	$80,000.00	$20,000.00	$20,000.00	$0.00	Sewer has some prior rights on their gravity line that follows Rocky Creek. Their other lines appear to be inside roadway right of way. The gravity lines are deep for the most part, so I don't think there will be major impacts.
SCE&G - Gas	Doug Whittle 803-217-8574	Yes/No	$50,000.00	$50,000.00	$50,000.00	$50,000.00	$20,000.00	Present throughout project limits on most roadways. Appear to have prior rights on some private property, but should not be affected by proposed project. Impacts will be made where they do not have prior rights. Cost estimate is on the safe side just in case plans are misleading and they do have more areas of prior rights.
AT&T - Telephone	Ron Brown Area Manager 3737 Howard Circle Columbia, SC 29210 803-731-1452	Yes/No	$450,000.00	$450,000.00	$260,000.00	$150,000.00	$100,000.00	AT&T (formerly BellSouth) has been present in most areas prior to 1901. They should have prior rights on many of their facilities. They are located throughout the project with copper and fiber lines. The assumptions are that the fiber will have to be replaced back to the splice nodes and the copper can be replaced at the conflict points.
Level 3 Communications (Tel-Cove) - Communications	Russ Wheat 803-206-9563	Yes/No	$600,000.00	$600,000.00	$600,000.00	$50,000.00	$0.00	They have prior rights ONLY where they are located inside RR right of way. They are located on RR right of way, Assembly Street, Whaley Street, Heyward St., and Catawba Street. Cost estimate is for ONLY prior rights. Alternate 4 affects Assembly Street, which communications will be inside by permit. Some minor relocations could have prior rights.
Verizon Business (formerly MCI) - Communications	John McNeil 904-355-0187	Yes/No	$650,000.00	$650,000.00	$650,000.00	$50,000.00	$0.00	They have prior rights ONLY where they are located inside RR right of way. They are located on RR right of way, Assembly Street, and, Heyward St. Cost estimate is for ONLY prior rights. Alternate 4 affects Assembly Street, which communications will be inside by permit. Some minor relocations could have prior rights.

Figure VIII-1

ASSEMBLY STREET GRADE SEPARATION STUDY

COLUMBIA, SC
RICHLAND COUNTY
SCDOT FILE NO.

UTILITY	CONTACT	PRIOR RIGHTS (Y/N)	ALTERNATIVE 1	ALTERNATIVE 2B	ALTERNATIVE 3	ALTERNATIVE 4	ALTERNATIVE 5	REMARKS
Qwest - Communications	Dale Noe 401 Brookfield Parkway Suite 200 Greenville, SC 29607 864-627-7827 (contact George McElvain at 303-837-3926)	Yes/No	$850,000.00	$850,000.00	$850,000.00	$50,000.00	$0.00	Located in Norfolk Southern RR right of way. Also located on Whaley Street (rt side), Huger, and Lincoln by permit. Only have prior rights when they are located in RR right of way. Cost estimate is for ONLY prior rights area.
Time Warner - CATV	Stephen Jones 6539-D Frost Avenue Columbia, SC 29203 803-518-1100	No	$0.00	$0.00	$0.00	$0.00	$0.00	Attached to SCE&G poles throughout project limits. Attached by permit.
Time Warner Telecom - Communications	Bill Hallman Plant Manager 1401 Main Street Suite 102 Columbia, SC 29201 803-753-5005; 803-348-4263 (	Yes	$135,000.00	$150,000.00	$70,000.00	$50,000.00	$0.00	Fiber with 1-2 crossings.
Sprint	Steve Thompson 404-649-2355 Need to contact McCoy Ingalls. New contact person. Hank is no longer working	Yes/No	$0.00	$0.00	$0.00	$0.00	$0.00	Sprint has a building on corner of Silver Street and Heyward Street. From their facility, they have a short piece that belongs to them and then they lease their remaining lines from Verizon. Verizon has been contracted to maintain their lines. See Verizon's cost for relocation.'
State Government Communications	UNKNOWN	Yes	$25,000.00	$25,000.00	$25,000.00	$25,000.00	$25,000.00	Local utility owners have noted that they are present, but the exact location and contact person is not known at this time. These costs are just estimates.
SCANA Communications	UNKNOWN	Yes	$25,000.00	$25,000.00	$25,000.00	$25,000.00	$25,000.00	Local utility owners have noted that they are present, but the exact location and contact person is not known at this time. These costs are just estimates.
TOTALS			**3,715,000.00**	**3,830,000.00**	**3,090,000.00**	**1,350,000.00**	**325,000.00**	

****NOTE: The reason the costs are the same for the fiber communication companies on all the alternates is because they cannot replace just a piece of their line that is in conflict. They have to go to a splice node which can be 1000's of feet away on either side. If they are in conflict anywhere on the project, then they will have to replace the entire line. Assumed alternate 5 will be chosen to accompany one of the other alternates; therefore, fiber communication was included in the other alternates. If for any reason Alternate 5 stands alone, then fiber costs will be the same as other alternates.**

Figure VIII-1

IX. ECONOMIC ANALYSIS

A. Benefit/Cost Ratios Analysis

The economic analysis portion of a feasibility study requires a benefit-cost analysis of the preferred alternative. In general, this involves the calculation of the stream of benefits and costs over the lifetime of the project. In addition to the benefit-cost analysis, non-monetary but quantifiable considerations, and non-quantifiable considerations should be evaluated to determine if a project is economically justified.

Two separate Benefit/Cost Analyzes were conducted, a Railroad Benefit/Cost Analysis and a roadway Benefit/Cost Analysis. Mainly due to the modeling programs, each mode of transportation conducts their own Benefit/Cost Analysis.

1. Railroad Benefit/Cost Analysis

Benefit/cost ratios were determined using the Federal Railroad Administration's "GradeDec 2000 System for Grade Crossing Investment Analysis." GradeDec determines the effects rail corridor investments will have on safety, and highway delay and queuing. Improvements will result in the following economic benefits:

- Improvements in safety and reduced accident cost;
- Reduced travel time costs;
- Improves rail operations and service ability;
- Improved air quality;
- Reduced vehicle operating costs; and
- Network benefits.

The program was used to evaluate the rail lines separately and with all combined as a regional model. The benefit/cost ratio is based on a factor of 1.00 with a benefit of $1.00 for every $1.00 spent. The following results are based on our recommendations outlined in this section.

Alternative 1

The benefit-cost analysis for Alternative 1 is based on the following:

- Under existing conditions Main Street (715621X), Assembly Street (715620R), Bluff Road (634635F), Catawba Street (634656Y), and Gadsden Street (634657F) crossings are closed.
- Assembly Street (716363Y) and Lincoln Street (634655S) are grade separated.

Using the assumptions listed above, the Average Benefit/Cost Ratio = 5.72

Alternative 2B

Alternative 2B has a similar outcome in respect to which crossings are proposed to be closed and grade separated, however the design of the rail relocation is different.

- Under existing conditions Main Street (715621X), Assembly Street (715620R), Bluff Road (634635F), Catawba Street (634656Y), and Gadsden Street (634657F) crossings are closed.
- Assembly Street (716363Y) and Lincoln Street (634655S) are grade separated.

Using the assumptions listed above, the Average Benefit/Cost Ratio = 5.72

Alternative 3

The benefit-cost analysis for Alternative 3 is based on the following:

- Under existing conditions Assembly Street (715620R) and Lincoln Street (634655S) crossings are closed.
- Assembly Street (716363Y) and Whaley Street (634654K) are grade separated.

Using the assumptions listed above, the Average Benefit/Cost Ratio = 3.92

Alternative 4

The benefit-cost analysis for Alternative 4 is based on the following:

- Bluff Road (634635F) is closed.
- Assembly Street (716363Y, 715620R and 634647A) are grade separated.

Using the assumptions listed above, the Average Benefit/Cost Ratio = 6.72

2. Roadway Benefit/Cost Analysis

Since a preferred alternative was not selected during the course of this study, benefit-cost ratios have been computed for all four roadway alternatives to determine which route provides the most benefits to the motoring public. Only one roadway alternative was analyzed in the sensitivity analysis.

Assembly Street was analyzed from Rosewood Drive to Wheat Street for each of the alternatives. Under existing conditions this section of roadway includes two traffic signals and four at-grade railroad crossings.

The methodology used for the benefit-cost analysis for the roadway portion of this project is based on the procedures outlined in AASHTO's *A Manual on User Benefit Analysis of Highway and Bus-Transit Improvements*, 1977, Office of Management and Budget (OMB) circular No. A-94, *Guidelines and Discount Rates for Benefit-Cost*

Analysis of Federal Programs; and, National Cooperative Highway research Program (NCHRP) Project 7-12, *MicroBENCOST Software and User's Manual.* For the purposes of this study, the *MicroBENCOST* program was used to compute the benefits and costs of the proposed alternatives.

Input for *MicroBENCOST* consists of:

- Descriptions of the proposed route and the existing route for each alternative (i.e. type of facility, geometric data, length, control of access);
- Traffic projections for the existing route without improvements, the existing route with improvements, and the proposed route;
- Estimated design and construction costs; and,
- Year of completion.

Although all input data affects the results of the analysis, the traffic data is probably the most critical. The projected traffic volumes for each year of the analysis period were generated using historic traffic counts obtained from SCDOT (refer to Table IX-1). Study area traffic counts from 1997 through 2007 were used to estimate a historic growth rate of one percent per year. This annual growth rate was applied to the 2007 counts to determine the projected volumes.

Table IX-1

SCDOT Traffic Counts

	SCDOT Station	1997 AADT	2007 AADT
Rosewood Dr	233	21,800	22,800
Assembly St	237	22,000	23,800
Pickens St	340	7,800	9,400
Blossom St	141	24,700	21,600
Sumter St	549	5,600	4,300
Heyward St	577	4,800	3,800
Whaley St	619	8,200	8,300
Marion St	613	2,800	2,000

MicroBENCOST software contains fifty-one tables with default values that establish the pertinent economic analysis data (i.e. geometric data, fuel costs, value of time, depreciation, etc.). The default dollar values in the tables are based on 1990 costs information. In order to escalate these costs to 2007 dollars, each value was adjusted using the Consumer Price Index.

3. Economic Benefits

In FHWA funded benefit-cost analysis, the most important benefits are the monetary equivalent value of time savings to transportation users and the monetary equivalent value of the reduction in accidents, injuries, and fatalities that would result from the use of a new facility. Another important benefit to consider is the reduction in the vehicle operating costs.

a. Vehicle Operating Costs

If the proposed project is constructed, there should be savings in the cost of operating a vehicle traveling in the study area. These savings would come from reduced consumption of motor fuels and oil, as well as reduced wear and tear on the vehicle itself.

For this feasibility study, the vehicle operating costs (VOC's) were computed using *MicroBENCOST.* This requires a comparison of traffic assignments with and without the proposed project. The VOC's are calculated by multiplying the projected traffic volumes by speed related unit operating costs. The savings in VOC's are then calculated by subtracting the VOC's with the project from the VOC's without the project.

b. Travel Time Savings

The *FHWA's Procedural Guidelines for Highway Feasibility Studies* emphasizes the importance of the benefit of time-savings to transportation users. This benefit is computed by determining how much time motorists might save as a result of eliminating at-grade crossings. For this study, the value of time corresponding to each class of automobile vehicle (small passenger, medium/large passenger, pickup/van, and bus) and truck vehicle (2-axle/3-axle single unit truck and various types of semi-tractor trailer trucks) is considered. As mentioned previously, the vehicle values of time were inflated from 1990 values to 2007 values using the Consumer Price Index.

c. Accident Savings

In order to consider the safety benefits to society resulting from the construction of the Assembly Street project, costs must be assigned to the various types of accidents that may occur on the existing routes and the proposed routes. Three types of accident costs are used by *MicroBENCOST* to determine the monetary value of accidents, injuries, and fatalities. These include costs per incident for fatal, injury, and property based on the latest historical information for accidents. The costs used in this analysis were obtained from the National Safety Council's document titled *Estimating the Cost of Unintentional Injuries, 2006*. Table IX-2 shows these costs inflated to reflect 2007 costs.

Table IX-2

Estimated Accident Costs

Accident Type	**Cost per incident (2007)**
Fatality	$ 1,835,500
Injury	$ 58,350
Property Damage Only	$ 8,700

4. Costs for the Project

The costs for the proposed project consist of three main components:

- Project Investment Costs;
- Maintenance, Operations, and Administrative Costs; and,
- Salvage Value Considerations.

These costs have been estimated and included in the economic feasibility analyses in order to provide the basis from which to compare resulting benefits of the alternatives.

a. Project Investment Costs

After completing the conceptual design, the initial project investment costs were estimated for each of the alternatives. These costs include planning, engineering, grading, drainage, paving, railroad relocation, bridges and other structures, as well as a 40% contingency for the construction items. In addition, costs were estimated for right-of-way acquisition, utility relocations, and relocation of residential and commercial buildings.

b. Maintenance, Operations, and Administrative Costs

The yearly cost for maintenance, operation, and administrative expenses for the proposed projects have been included in the costs for the analysis to recognize the expense required to operate the facility in a safe and serviceable condition. The values used in *MicroBENCOST* were based on values given in *Highway Statistics 1989* and updated to 2007 costs.

c. Salvage Value Considerations

Since the life of the proposed roadway facility is much longer that the analysis period used in the benefit-cost analysis, the value of the roadway at the end of the analysis should be considered. This residual value at the end of the analysis period should be estimated and the present worth of this value should be included as an offset to the present worth of the project costs.

B. Economic Benefits

As mentioned above, the estimated engineering, right-of-way, and construction costs for the alternatives have been computed in 2007 dollars. In addition, the traffic counts obtained from SCDOT for the existing roads in the study area were taken in 2007. Therefore, the base year used for the economic analysis is 2007. The analysis period used is 30 years from the completion of construction. The estimated completion date for the Assembly Street project is 2020. Therefore, the analysis period ends in 2050.

In any economic analysis, future costs and benefits must be discounted. Discounting refers to the translation of specified amounts of costs and benefits occurring in different time periods into a single amount at a single time period (usually the present). In accordance with the recommendations in OMB circular No. A-94, a seven percent discount rate was used for the base model benefit-cost calculations.

Using *MicroBENCOST*, three indicators of economic feasibility have been computed:

1. Net Present Value – the costs and benefits in future years are discounted back to the base year using the analysis discount rate. The future stream of discounted costs is subtracted from the future stream of discounted benefits. If this difference is a positive number, the proposed improvements are deemed to be economically feasible.
2. Discounted Benefit/Cost (B/C Ratio) – this ratio is computed by dividing the sum of the discounted benefits by the sum of the discounted costs. If the ratio is greater than or equal to 1.0, the proposed improvements are economically feasible.

   For this study, two values of B/C are given:

   Gross B/C Ratio: For this ratio, the benefits include the savings in user costs between the existing and the improved alternatives plus the salvage value minus the increase in the maintenance and operation costs.

   Netted B/C Ratio: The benefits used in computing this ratio represent the savings in user costs between the existing and the improved alternatives plus the salvage value minus the increase in the maintenance and operation costs. The costs represent the project investment costs only.

3. Internal Rate of Return – This number represents the discount rate at which the net present value difference between the costs and the benefits is zero. If the rate of return is equal to or greater than the adopted discount rate then the highway improvement is economically feasible.

Alternative 1

The benefit-cost analysis for Alternative 1 is based on the following:

- Under existing conditions Assembly Street from Rosewood Drive to Wheat Street includes 2 traffic signals and 4 at-grade railroad crossings and,
- With the proposed project, one of the at-grade crossings would be eliminated. Three at-grade crossings and the two traffic signals would remain.

Using the assumptions listed above, Table IX-3 summarizes the results of the benefit-cost analysis for Alternative 1.

Table IX-3

Alternative 1

Summary of Benefits, Costs, and Economic Measures

Total Discounted User Benefits (Mill. $)	47.040
Discounted Construction Cost (Mill. $)	42.563
Discounted Salvage Value (Mill. $)	3.004
Discounted Increase in Maintenance and Rehab. (Mill. $)	0.590
Fuel Consumption Savings (Mill. Gal.)	18.787
Fuel Savings, Adj. for Induced Traffic (Mill. Gal.)	18.809
Carbon Monoxide Emission Reduction (Mill. Kg.)	3.550
Net Present Value (Mill. $)	6.891
Gross Benefit-Cost Ratio	**1.172**
Netted Benefit-Cost Ratio	**1.162**
Internal Rate of Return (Percent)	**7.981**

Alternative 2B

The benefit-cost analysis for Alternative 2B is based on the following:

- Under existing conditions Assembly Street from Rosewood Drive to Wheat Street includes 2 traffic signals and 4 at-grade railroad crossings and,
- With the proposed project, two of the at-grade crossings would be eliminated. Two at-grade crossings and the two traffic signals would remain.

Using the assumptions listed above, Table IX-4 summarizes the results of the benefit-cost analysis for Alternative 2B.

Table IX-4 Alternative 2B Summary of Benefits, Costs, and Economic Measures	
Total Discounted User Benefits (Mill. $)	47.122
Discounted Construction Cost (Mill. $)	59.190
Discounted Salvage Value (Mill. $)	4.153
Discounted Increase in Maintenance and Rehab. (Mill. $)	0.590
Fuel Consumption Savings (Mill. Gal.)	18.779
Fuel Savings, Adj. for Induced Traffic (Mill. Gal.)	18.801
Carbon Monoxide Emission Reduction (Mill. Kg.)	3.550
Net Present Value (Mill. $)	-8.505
Gross Benefit-Cost Ratio	**0.847**
Netted Benefit-Cost Ratio	**0.856**
Internal Rate of Return (Percent)	**6.055**

Alternative 3

The benefit-cost analysis for Alternative 3 is based on the following:

- Under existing conditions Assembly Street from Rosewood Drive to Wheat Street includes 2 traffic signals and 4 at-grade railroad crossings and,
- With the proposed project, one of the at-grade crossings would be eliminated. Three at-grade crossings and the two traffic signals would remain.

Using these assumptions for the *MicroBENCOST* models, the benefit-cost analysis was performed for Alternative 3. Table IX-5 summarizes the results of the analysis.

Table IX-5 **Alternative 3** **Summary of Benefits, Costs, and Economic Measures**	
Total Discounted User Benefits (Mill. $)	47.040
Discounted Construction Cost (Mill. $)	41.439
Discounted Salvage Value (Mill. $)	2.849
Discounted Increase in Maintenance and Rehab. (Mill. $)	0.590
Fuel Consumption Savings (Mill. Gal.)	18.787
Fuel Savings, Adj. for Induced Traffic (Mill. Gal.)	18.809
Carbon Monoxide Emission Reduction (Mill. Kg.)	3.550
Net Present Value (Mill. $)	7.860
Gross Benefit-Cost Ratio	**1.201**
Netted Benefit-Cost Ratio	**1.190**
Internal Rate of Return (Percent)	**8.148**

Alternative 4

The benefit-cost analysis for Alternative 4 is based on the following:

- Under existing conditions Assembly Street from Rosewood Drive to Wheat Street includes 2 traffic signals and 4 at-grade railroad crossings and,
- With the proposed project, two of the at-grade crossings would be eliminated. Two at-grade crossings and the two traffic signals would remain.

Using the assumptions listed above, Table IX-6 summarizes the results of the benefit-cost analysis for Alternative 4.

Table IX-6 Alternative 4 Summary of Benefits, Costs, and Economic Measures	
Total Discounted User Benefits (Mill. $)	47.127
Discounted Construction Cost (Mill. $)	14.274
Discounted Salvage Value (Mill. $)	0.991
Discounted Increase in Maintenance and Rehab. (Mill. $)	0.590
Fuel Consumption Savings (Mill. Gal.)	18.787
Fuel Savings, Adj. for Induced Traffic (Mill. Gal.)	18.809
Carbon Monoxide Emission Reduction (Mill. Kg.)	3.550
Net Present Value (Mill. $)	33.254
Gross Benefit-Cost Ratio	**3.397**
Netted Benefit-Cost Ratio	**3.330**
Internal Rate of Return (Percent)	**17.227**

Summary of Benefit Cost Analysis

Alternative 4 has the highest benefit cost ratio of the four concepts. Although Alternatives 2 and 4 both result in two less at-grade crossings within the study area, Alternative 2 costs approximately $65 million more than Alternative 4. If the costs for Alternative 2 were reduced significantly through private contributions, the Benefit-Cost Ratio would increase to a value greater than 1.

Alternatives 1 and 3 result in only one less at-grade crossing within the study area and have much lower Benefit-Cost Ratios than Alternative 4.

Table IX-7 Summary of Benefit-Cost Ratios				
	Alternative			
	1	**2**	**3**	**4**
Gross Benefit-Cost Ratio	1.172	0.847	1.201	**3.397**
Netted Benefit-Cost Ratio	1.162	0.856	1.190	**3.330**

Sensitivity Tests

In order to verify the reasonableness of the economic analysis and determine how the final results would be affected by variations in the assumptions made to perform the analysis, various sensitivity tests have been performed. The results of these sensitivity test models are compared to the results obtained using the base model conditions that have been described in this section.

The sensitivity tests were run on Alternative 4 which had the highest Benefit-Cost Ratio. These tests were used to ensure that even with variances in the assumptions made for this analysis; the project would remain economically feasible. Four major variables in the model were modified to determine the affect on the benefit-cost analysis:

1. The assumed discount rate;
2. The estimated Project Investment Costs;
3. The projected growth in traffic; and
4. An alternate route was included.

Discount Rate

A seven percent discount rate was assumed for the base condition in all of the benefit-cost analyses summarized above. In accordance with the FHWA's *Procedural Guidelines for Highway Feasibility Studies*, the benefit-cost models have been revised to reflect a five percent discount rate. The results are compared with the base condition results in Table IX-8.

Table IX-8
Sensitivity Test Results
Comparison of Different Discount Rates

	Gross B/C	**Netted B/C**
Base Condition (7%)	3.397	3.330
5% Discount Rate	4.847	4.570

Project Investment Costs

In order to determine the benefit-cost ratios that would result if the initial project investment costs were different from the estimates (refer to Table 3), the base condition analyses have been modified to reflect a 20% and a 50% cost overrun. The economic measures resulting from these projected cost overruns are summarized in Table IX-9

Table IX-9 Sensitivity Test Results Comparison of Different Initial Investment Costs		
	Gross B/C	**Netted B/C**
Base Condition	3.397	3.330
20% Cost Overrun	2.851	2.786
50% Cost Overrun	2.297	2.243

Projected Growth

Since the amount of projected traffic traveling on the proposed alternatives and the existing routes greatly affects the results of the economic analysis, a sensitivity test was performed to determine the affect of varying traffic volumes in the analysis period. Three different cases were modeled to determine the benefit-cost ratios resulting from changes in the projected traffic: 75%, 90%, and 120% of the base condition traffic growth rate. Table IX-10 provides a comparison of the economic analysis results for these three cases.

Table IX-10 Sensitivity Test Results Comparison of Different Traffic Growth Rates		
	Gross B/C	**Netted B/C**
Base Condition (1%/year)	3.397	3.330
75% Traffic Projections	2.454	2.413
90% Traffic Projections	3.005	2.949
120% Traffic Projections	4.260	4.168

Alternate Route

The benefit-cost model network was revised to reflect an alternate route around the segment of Assembly Street from Rosewood Drive to Wheat Street. The alternate route includes Rosewood Drive, Pickens Street and Wheat Street. The results are compared with the base condition results in Table IX-11.

Table IX-11
Sensitivity Test Results
Comparison with Alternative Route

	Gross B/C	Netted B/C
Base Condition	3.397	3.330
With Alternate Route	3.404	3.336

Non-Monetary but Quantifiable Considerations

There are other benefits of the proposed Assembly Street project that cannot be translated into monetary, dollar equivalent terms. They include improved access to the University of South Carolina and the central business district of Columbia.

Non-Quantifiable Considerations

Non-quantifiable considerations are those impacts that cannot be stated in dollars or quantified in other understandable measures, but are still important to the economic justification of the proposed transportation facility. For the Assembly Street project, the construction of the project would help the local economy through the beautification and revitalization of the area. Assembly Street would be more pedestrian friendly and would support the long-range development/revitalization plan for this area, which includes the Olympia Community.

X. FUNDING STRATEGIES

Investing in grade separation projects has long term benefits for all users (trains, auto users, transit users, pedestrians/bicyclists). As detailed in the previous section (Economic Analysis), a project of this magnitude comes with significant cost. Due to the complexity and high estimated cost of this project, it is necessary to look for several funding options and potentially a combination of methods to pay for its development and construction. It is very unlikely that one source will be able to cover the entire cost of the project. Various funds could be available at different phases of the project (planning, design, and construction). These may include local public funds, private business funds, federal appropriations or grants, and even property or sales tax revenues.

The materialization of this project will require a great deal of collaboration from all parties involved. Potential sources should include anything and anyone associated with transportation and/or economic development as well as State and Federal entities. The inception of this project will have beneficial economic impacts throughout the local region as well as the national transportation network. This includes local government (Richland County and the City of Columbia), state (SCDOT) and federal sources as well as the private railroad companies. Specifically, funds and/or grants may be available from the Federal Railroad Administration (FRA) and/or the Federal Highway Administration (FHWA).

Transportation has a direct impact on the overall quality of everyday life for the residents of this area. The overall benefits of removing the track/road intersection should offset any potential negative financial impacts. However, it can be difficult to place a dollar value on the gains of the increasing safety, improving mobility, stimulating redevelopment, and reconnecting the community. With growth and subsequent population increases, redevelopment of the downtown, and expansion of the USC campus, the number of cars on Assembly Street will only increase with time. In addition, passenger and rail freight transportation is also projected to have a significant increase over the next decade. A recent report released in January of 2008 from the United States Government Accountability Office (GAO) on Freight Transportation predicts that the amount of goods moved by freight will increase by 88% by 2035 from 2002 levels. In addition, an increase is also expected for passenger rail service due to the increase in fuel costs. These variables will only create more delays for everyone and produces the general assumption that costs may continue to increase without providing congestion relief in the immediate future. As a result, financial decisions should be made based on the long term user cost savings, not just the initial development and construction costs. The project may result in the following economic benefits:

- Safety improvements due to the reduction of train/vehicle accidents that will reduce property damage and insurance claims
- Improving the redevelopment potential in the area.
- Improved air quality and pollution mitigation (from idling vehicles).
- Reduced travel time for automobiles (driver delay cost savings).
- Decrease spillover congestion on the rest of the local road network.
- Improved emergency vehicle response and access.

- Reduced train derailment costs.
- Decrease of wear and tear on automobiles going over uneven tracks.
- Overall network benefits for the railroad including reduced delivery time.

Potential funding sources can stem from transportation related programs and economic incentives originating from local, state, federal or private entities.

Transportation Funding Sources include:

- SAFETEA (Section 1401)
- Congressional Earmarks such as the High Priority Funds from SAFETEA-LU
- Federal Railway Programs
  - -Rail Relocation Grant (FRA)
  - -Highway/Rail Grade Crossing Program (Section 130/152)
  - -Safety-Rail/Highway Grade Crossings (FHWA)
  - -Railroad Rehabilitation and Improvement Financing Program (RRIF)
  - -Transportation Infrastructure Finance and Innovation Act (TIFIA)
- Capital Grants for Rail Line Relocation Projects (Section 9002 of SAFETEA-LU) – this legislation provides financial assistance for local rail line relocation and improvement projects. The project must identify a need for mitigating adverse effects of rail traffic on safety, motor vehicle traffic flow, community quality of life, including noise mitigation, or economic development, or involve a lateral or vertical relocation of any portion of the rail line, in order to reduce the number of grade crossings and/or serve to mitigate noise, visual issues, or other externality that negatively impacts a community.
- President Barack Obama's $787 billion economic stimulus bill
- Highway Programs
  - -City Funds
  - -County Funds
  - -State Funds
- Railroad (CSXT and NS)
- Private funding (USC, surrounding development)

Economic Development Sources include:

- Community Development Block Grants (CDBG) and Loans
- Tax Increment Financing

Direct Tax Sources include:

- Property Taxes
- Sales Tax Revenue

Historically, the government has not funded railroads as they have heavily funded other modes of transportation (auto and air travel). Railroad development has primarily occurred from private market investment. Recognizing the importance of freight movement in this county, U.S. railroads have lobbied Congress to support tax-credit legislation to boost investments in rail. Unlike roads, there are no dedicated funding sources for freight rail facilities. However, with the increase in fuel costs, the government is beginning to explore increased federal investment in rail projects, both for passenger and freight rail.

The Freight Rail Infrastructure Capacity Expansion Act of 2007 (H.R. 6003) has been proposed with bipartisan support. If passed, it would provide a 25% infrastructure tax credit for projects such as new track, grade separations, transfer yards, terminals and intermodal facilities. The proposed bill is a sign that lawmakers understand the demand for rail facilities and recognize that funding rail infrastructure is a wise investment for this country. The bill is currently in discussion in the House of Representatives.

The House of Representatives also passed a $15 billion bill in June of 2008 to fund Amtrak to set up or expand passenger rail service. The Passenger Rail Investment Improvement Act of 2008 (H.R. 6003) was also a bipartisan bill that passed with a veto-proof margin of 311-104. Support from all sides for both of these bills may be a strong indication that federal funding for rail projects will increase in our country. While sufficient funds may not be readily available for projects like the Assembly Street Project, there are strong indicators that the funding could be available in the very near future.

In addition, the Richland County Transportation Study Commission (TSC) was created in 2006 by the Richland County Council and is charged with reviewing the county's current and future transportation needs (including roadway, transit, greenway, bike, and pedestrian). It has developed a 25-year plan entitled the Richland County Transportation Study and it lists short-, medium-, and long-term recommendations. It has the Assembly Street Railroad Grade Separation project listed first on its High-Priority list with a projected cost/funding of $32,100,000.

The TSC recommended that the County Council place a local sales tax referendum on the ballot for November 4, 2008 and raise the Richland County sales tax from 7% to 8%. These funds would be appropriated for roadway, transit, greenway, bike and pedestrian improvements in Richland County. The projected tax was estimated to yield approximately $394 million dollars over the next seven years and cover the majority of the costs for recommendations in the Richland County Transportation Study, including almost $40,000,000 for the Assembly Street crossing.

A similar sales tax has been approved in York County entitled Pennies for Progress. The referendum for York County narrowly passed in 1997 but 73% voted to renew it in 2003. The success of the referendum passing in York was attributed to rapid growth and residents wanting to maintain their quality of life by ensuring adequate transportation facilities would be available in their community. The phenomenon of rapid growth in the south is causing communities to take control of their infrastructure funding instead of being dependent on the State and Federal government for those responsibilities. Having adequate transportation facilities is not only seen as a quality of life issue but also as an economic development booster as it can lead to better commercial/industrial growth that can bring better and additional jobs to the area.

However, in July of 2008 the Richland County Council voted against allowing the referendum on the sales tax. The referendum was not included on the ballot in November of 2008.

With the change in our presidential seat, the newly Presidential Barack Obama has signed a $787 billion economic stimulus bill. The newly signed bill includes funding for new transportation infrastructure projects. Projects that not only repair our aging transportation network, but improve and enhance our transportation network by constructing multi-modal transportation systems. The City of Columbia has plans to investigate funding through this opportunity for the Assembly Street Project, since this is one of their top priority infrastructure projects.

In addition, the state of South Carolina has utilized the State Infrastructure Bank (SIB) as a funding source for transportation projects. The State Infrastructure Bank (SIB) was introduced in 1995 and is a “revolving” fund created by states utilizing Federal transportation dollars. These revolving funds are used as credit assistance, such as a loan, for local transportation projects and require a 25% state match. These revenue bonds are issued against annual gas taxes and registration fees. The funds are termed “revolving” because the repaid loans go back into the fund for further lending.

South Carolina has utilized the SIB in the past and provides the best example of a large, leveraged SIB. SCDOT has also developed the “27 in 7” program in which the SIB was used to compress 27 years of road and bridge projects into a 7 year accelerated schedule. The next SIB is expected to issue another $800 million in revenue bonds over the next several years. Once FHWA requests submittals, South Carolina plans on requesting bonds through the SIB once again.

The railroad companies (CSXT and NS) have not, at this time, dedicated any funding for this project. However, they have continued to participate in the planning phase of this project and have vested interests in its materialization. At-grade crossings can delay rail traffic and as a result slow down the delivery of passengers and commercial goods. A track that is no longer impacted by Assembly Street traffic has value to the railroads and vehicular traffic along Assembly Street due to not having delays at the rail crossing.

As noted, there are a number of funding options out there. The ability to work with and coordinate with the numerous agencies and sources for cost sharing will only enhance and expedite the ability to construct improvements along the Assembly Street corridor.

XIII. REFERENCES

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