TRAFFIC SEPARATION STUDY

FOR

CONCORD, NORTH CAROLINA

AND

THE NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

RAIL DIVISION

ENGINEERING AND SAFETY BRANCH

VOLUME IV

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CONCLUSIONS:

Accommodating the **Transit 2001 Plan** goal of two-hour passenger train service between Raleigh, Greensboro, and Charlotte will require a substantial reduction in the number of streets that cross the railroad at grade, as well as major modifications to many of those that remain.

Rail freight traffic along the Norfolk Southern (NS) will increase due to the division of CONRAIL routes between Norfolk Southern (NS) and CSX.

Vehicular traffic in the Concord Area will continue to increase as growth and expansion continues.

Grade crossing safety is an issue at Corban Ave. as demonstrated by the four recorded accidents.

Mobility is an issue for the Concord Fire & Rescue Department at the McGill Ave. crossing.

RECOMMENDATIONS:

Near-term

- Close the **Meisenheimer Drive** crossing $8,000.00
  Remove pavement, install barricade, landscape $5,500.00

- Modify the grade on both approaches of **McGill Avenue** $225,000.00
  to the **NS**, and install two rubberized crossings and
  4-quad gates

- Close the **Winecoff Avenue** crossing $8,000.00
  Modify pavement, install barricade, landscape $7,000.00
  Build Cul-De-Sac Eastside $25,000.00

  $278,500.00

Mid-term

- Close the **Corban Avenue** crossing and build a one-way connector between **Cabarrus Avenue** and **Corban Avenue** east of the **NS** overpass on **Cabarrus**

Avenue. The closing and construction of the connector should be done in conjunction with the replacement of the **Cabarrus Avenue** bridge over the **NS** by the **NCDOT**. To implement the four-lane section on Cabarrus Avenue between the connector to Corban Avenue on the east and Old Charlotte Highway on the west, will require the replacement (or widening) of the Cabarrus Avenue Bridge over Irish Buffalo Creek.

Cost:

Connector **$1,300,000.00**
Replace Irish Buffalo Creek Bridge **$600,000.00**

Long-term

- At such time as the **Brookwood Avenue** extension project is in place, the crossing at **McGill Avenue** should be re-evaluated to determine whether or not it should be closed.

TRAFFIC SEPARATION STUDY
FOR CONCORD, NORTH CAROLINA
AND THE
NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

PURPOSE OF THE STUDY

The **City of Concord** and the **North Carolina Department of Transportation (NCDOT)** have entered into a cooperative agreement to evaluate certain local street at-grade crossings of the **Norfolk Southern Railway** in **Concord.** The purpose of the evaluation is to determine if any of the crossings are candidates for closure or grade separation, or if not, are there improvements that can be made to the local street and crossing network that will enhance public safety. The study includes four (4) public street crossings of the railroad from Corban Ave. north to Winecoff Ave.

Preamble

Highway/railway at-grade crossing collisions are the number one cause of death in the railroad industry. In 1996, there were 4,159 train-vehicle collisions with 471 deaths nationwide. North Carolina had 140 collisions, 9 deaths and 53 injuries. There are 4,756 public street grade crossings of railroads in North Carolina.

Deaths and injuries at grade crossings have steadily declined in this country since 1978 due to an aggressive safety program by the United States Department of Transportation, the various state Departments of Transportation and the railroad companies. These efforts have included improved automatic warning devices, roadway improvements, elimination of sight obstructions, construction of crossing separation structures, and closure of some crossings.

The **NCDOT**, through its **Rail Division** has a substantial program in place to improve rail crossing safety. The program is endorsed and supported by the **USDOT, Federal Railroad Administration** and **Federal Highway Administration,** and the various railroad operating companies. To be successful, however, requires the support of local government and the citizens of North Carolina. Highway/railway safety cannot be mandated from Raleigh, but must be endorsed, supported and enforced at the local level. These series of studies, undertaken through a cooperative agreement between state and local government, are part of a continuing effort to enhance the safety of all who travel North Carolina's streets, highways and railways.

The Concord Study

The City of Concord is served by the Norfolk Southern (NS) Railway* mainline which extends from Charlotte to Raleigh and points north and south. Train movements over the four crossings included in this study are 34 per day according to information supplied by the NS Division Superintendent. **See Figures 1 and 2.**

Vehicular crossing volumes range from a low of approximately 300/day at Meisenheimer Dr. to over 8,100 at McGill Ave.

The only crossing with a significant accident problem is Corban Ave. which suffered a fatality in 1988.

The evaluation of the Concord crossings included the following:

- Twenty-four hour automatic traffic counts were obtained for the crossings as well as other streets within the network.

- Due to the nearness of the Cabarrus Ave./Old Charlotte Rd. intersection to the Corban Ave. crossing, a Level of Service (LOS) analysis was conducted for this intersection.

- Interviews with state and local officials were conducted to gain local insight into problems and potential improvements to each crossing.

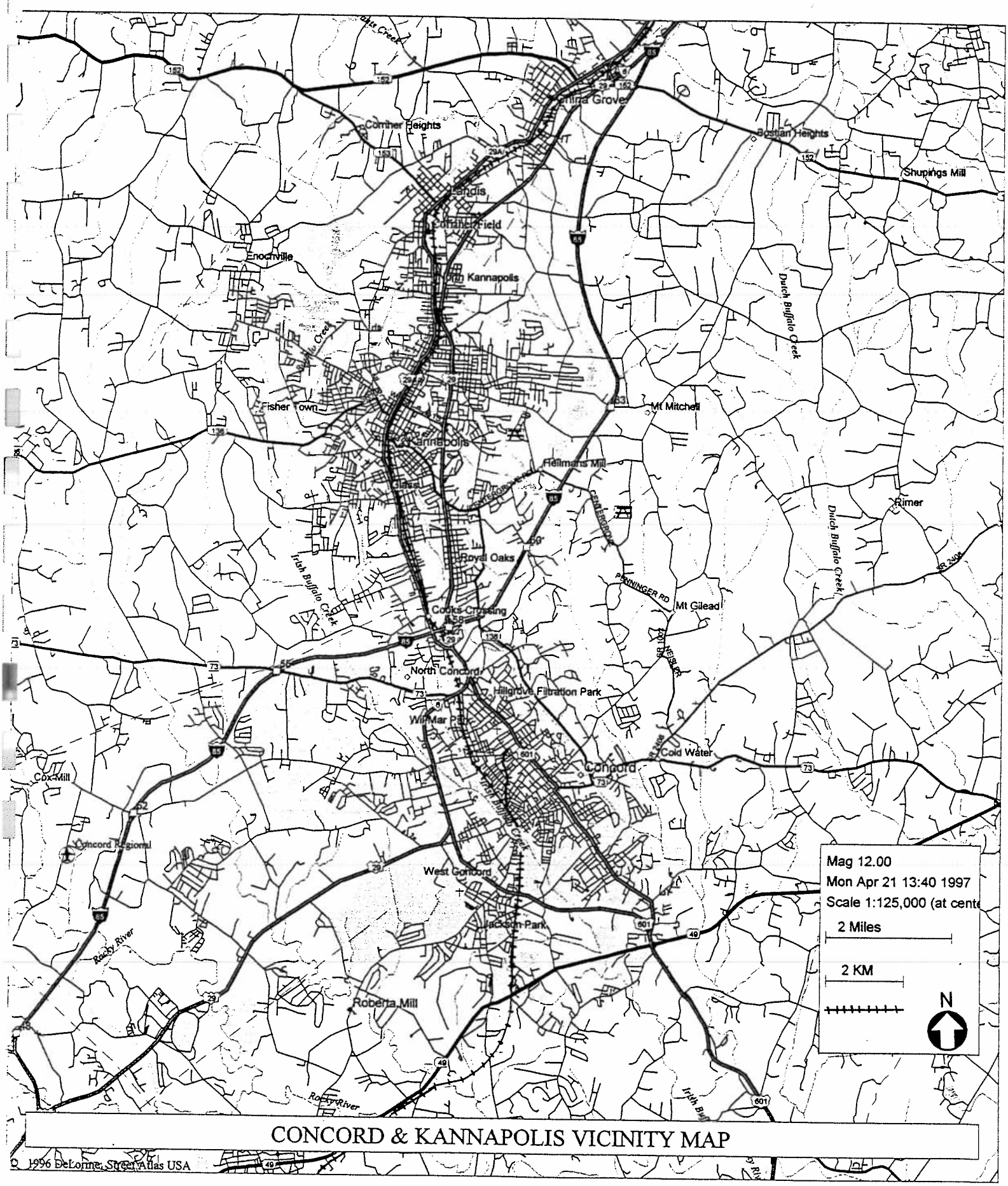
- Data was collected from the Cabarrus Co. School System, the Concord Fire and Rescue Department, and the Cabarrus County Emergency Medical Service as to frequency of use of each crossing, as well as service impacts that might occur should a crossing be closed or modified.

- Available historic information and mapping was utilized in the development of report conclusions and recommendations.

Based upon the above described evaluation, this report will:

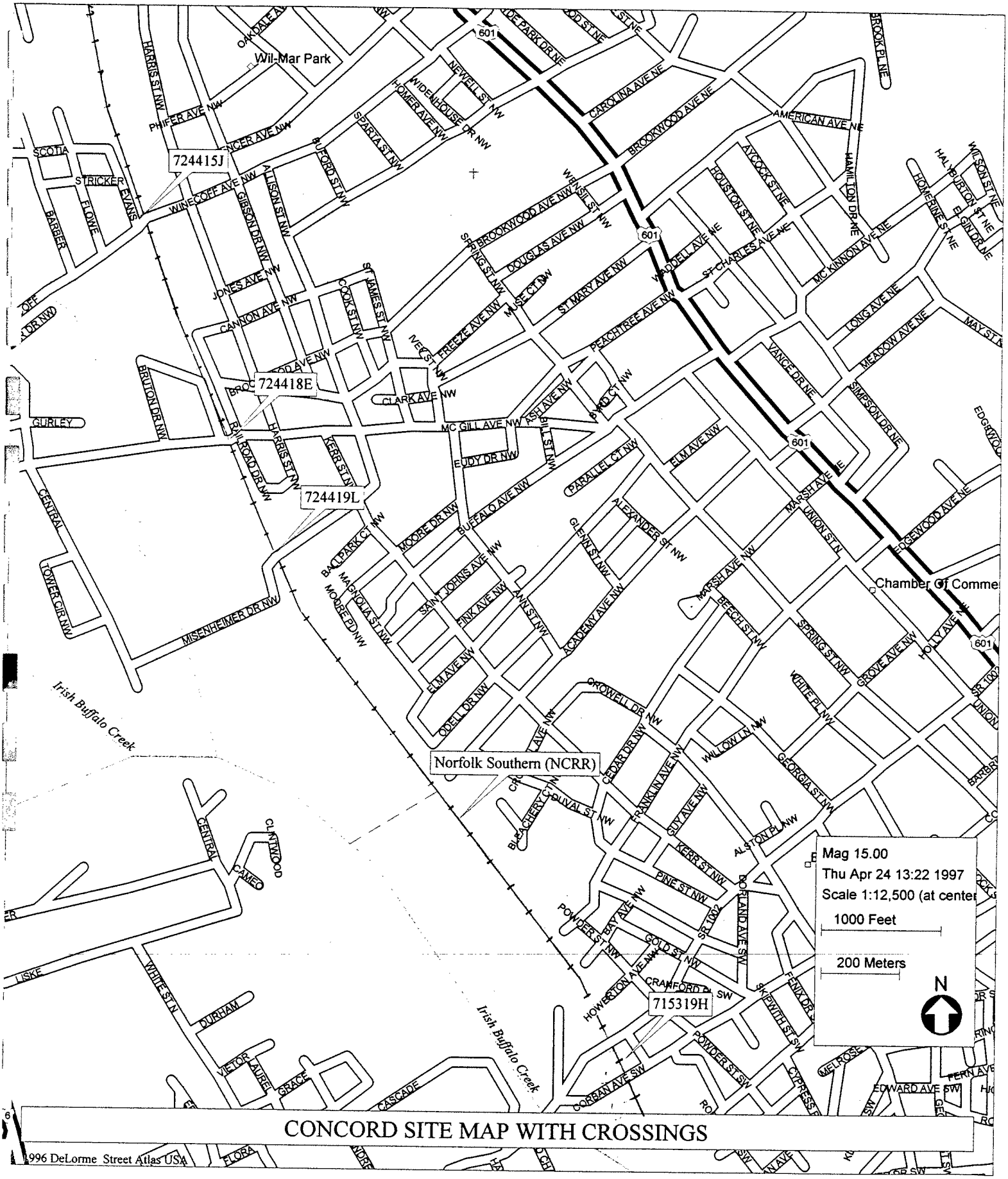
- Identify impacts of any proposed crossing closure on adjacent property and the roadway network.

*For purposes of this study, the railroad will be referred to as the Norfolk Southern (NS); however, Norfolk Southern (NS) is the operating company with the railroad right-of-way being owned by the North Carolina Railroad (NCRR), which is owned by the State of North Carolina (75%) and private shareholders (25%).



CONCORD & KANNAPOLIS VICINITY MAP

FIGURE 1



CONCORD SITE MAP WITH CROSSINGS

FIGURE 2

- Include conclusions and recommendations necessary to accommodate any proposed crossing closure.

- Identify candidate crossings for grade separation.

- Recommend corrective action for any identified safety issues relating to the four (4) crossings.

- Include preliminary cost estimates for recommended improvements.

EXISTING TRANSPORTATION SETTING

The City of Concord is the County Seat for Cabarrus Co. with a population that approaches 42,000 (See Figure 1). Population growth is just over 3%/year and annual job growth is over 2%/year. Based upon these numbers, future traffic volumes were projected to grow at 2%/year.

Traffic along the Norfolk Southern (NS) continues to grow with significant freight operations based in Charlotte to the south and Linwood to the north, as well as the expansion of NCDOT sponsored rail passenger service in the corridor.

Of the four (4) crossings evaluated, McGill Ave. is the most significant, providing a direct link between downtown Concord and I-85 via Poplar Tent Rd. Corban Ave. also provides a direct link to the downtown area, but the same corridor is served by Cabarrus Ave. which is one block to the north of Corban and also connects to US 29 and 601 to the west. Meisenheimer Dr. provides local residential access only. Winecoff Ave., while serving a larger area, also provides mostly local access. The only crossing to be impacted by a paralleling roadway is Meisenheimer Dr.

Of the six municipalities involved in this portion of the **Piedmont High Speed Rail Corridor** study, Concord is unique in that none of the four crossings have a traffic signal within 200 feet of the crossing.

The NS operates two mainline tracks throughout the Concord study area. Operating speeds range from 40 to 50 MPH over all four crossings for merchandise trains, 60 MPH for intermodal, and up to 79 MPH for passenger trains.

EVALUATION CRITERIA

All crossings were initially evaluated using the criteria developed for the NCDOT rail crossing closure program.

Criteria used in evaluating the Concord crossings include:

- Accident history
  This report utilizes the accident classification system developed by the Federal Highway Administration and in general use around the country. Under this system, accidents are classified as follows:

  - K - Killed
  - Class A - Injured and transported to hospital
  - Class B - Injured and treated on-scene
  - Class C - Complains of injury but not treated
  - PDO - Property damage only

- Vehicle traffic - Present and future
- Train traffic
- Truck traffic/Truck route
- Hazardous materials
- Type roadway (thoroughfare, collector, local access, etc.)
- Type of property being served (residential, industrial, commercial)
- School bus route
- Emergency route
- Type warning devices present
- Redundant crossing (yes/no)
- Potential for grade separation (high, med, low)
- Feasibility of implementing roadway improvements (high, med, low)
- Economic impact if crossing closed (high, med, low)

The evaluations are shown on **Table 1.**

Level of Service Analysis

Level of Service (LOS) is a measure of congestion for signalized and unsignalized intersections as well as roadway segments. To the motorist, an intersection or road operating at an LOS of A, would be virtually free of congestion with almost no delay or interruption to

travel. On the other hand, an LOS of F would mean considerable delay, stop and go driving and could require the motorist to sit through 2 or 3 red signal indications before clearing a signalized intersection.

The Cabarrus Ave./Old Charlotte Rd. intersection was subjected to a detailed volume/ capacity analysis in accordance with the procedures contained in the Highway Capacity Manual Special Report 209 (1994) as published by the Transportation Research Board, Washington, D.C. The procedures contained in the Manual for Level of Service Analysis (LOS) have been validated by considerable research and field testing and have been further enhanced by modern computer analysis techniques.

Analysis techniques are prescribed in the Highway Capacity Manual for both unsignalized and signalized intersections. The analysis determines the amount of delay the motorist experiences in clearing the intersection which determines its Level of Service.

Unsignalized Intersections

Operating characteristics of roadway intersections and driver behavior are mandated by the traffic laws of the State of North Carolina. These laws require traffic from minor or side streets to yield right-of-way to traffic on the major or through street. This basic "rule of the road" has yielded the following assumptions being used in the analysis of unsignalized intersections.

- Major street flows are not affected by minor (stop sign controlled) street movements.
- Left turns from the major street to the minor street are influenced only by opposing major street through-flow.
- Minor street right turns are impeded only by the major street traffic coming from the left.
- Minor street left turns are impeded by all major street traffic plus opposing minor street traffic.
- Minor street through traffic is impeded by all major street traffic.

The LOS for both unsignalized and signalized intersections is based upon the amount of delay (calculated in seconds/vehicle) to a motorist waiting to execute a maneuver. Delay is calculated for all vehicles through the intersection during the peak hour or peak 15-minute analysis period. Criteria used to determine LOS of unsignalized intersections are as follows:

Level of Service	Average Total Delay (Sec/Veh)
A	≤5
B	>5 ≤10
C	>10 ≤20
D	>20 ≤30
E	>30 ≤45
F	>45

Due to the spacing of adjacent streets within the network and the lack of conflict between railroad and roadway traffic due to the absence of roads paralleling the Norfolk Southern (NS), no LOS analyses of unsignalized intersections where conducted for the Concord study area.

Signalized Intersections

A Level of Service analysis for the Cabarrus Ave./Old Charlotte Rd. intersection was conducted for both 1997 traffic volumes and projected 2010 volumes. The 2010 volumes were derived by projecting the 1997 volumes at a 2%/annum growth rate.

The LOS criteria for signalized intersections is based upon stopped delay per vehicle in seconds. The criteria from the Highway Capacity Manual are:

Level of Service	Description	Stopped Delay Per Vehicle (Seconds)
A	Very low delay, good progression; most vehicles do not stop at intersection	5.0
B	Generally good signal progression and/or short cycle length; more vehicles stop at intersection than level of service A.	>5≤15
C	Fair progression and/or longer cycle length: significant number of vehicles stop at intersection than level of service A.	>15≤25
D	Congestion becomes noticeable; individual cycle failures; longer delays from unfavorable progression, long cycle length, or high volume/ capacity ratios; most vehicles stop at intersection.	>25≤40

E	Considered limit of acceptable delay, indicative of poor progression, long cycle length, high volume/ capacity ratio; frequent individual cycle failures.	$>40 \leq 60$
F	Unacceptable delay, frequently an indication of oversaturation (i.e. arrival flow exceeds capacity.)	>60

Turning movements counts at the Cabarrus Ave./Old Charlotte Rd. intersection were taken on 2/19/97. Based upon the 24 hour automatic traffic count, the peak traffic volumes occur at the intersection between 4 PM and 6 PM. The two-hour count revealed 4 PM to 5 PM as the peak hour. The Level of Service analysis (See Appendix) shows the intersection currently operating at an **LOS of B**. With projected 2010 volumes, the intersection drops to an **LOS of C**. However, by converting the eastbound exclusive right-turn lane to a shared through and right-turn, the **LOS** can be returned to **B**. Projecting the volumes to 2020 and putting the recommendations associated with closing Corban Ave. in place as described later in the **Recommendations Section** of this report, the intersection will still operate at an **LOS of B**.

TRAFFIC VOLUME

Based on the 24-hr. traffic volumes, the 4 at-grade crossings in Concord rank in terms of vehicles served:

1. McGill Ave.	8,700 VPD
2. Corban Ave.	3,500 VPD
3. Winecoff Ave.	2,800 VPD
4. Meisenheimer Ave.	300 VPD

ACCIDENT HISTORY

The only crossing with any significant accident history is Corban Ave. which had a fatality in 1988, a Class A injury in 1986, a Class C accident in 1992 and a Property Damage Only accident in 1995. The only other accident reported during the 10-year period, was a Property Damage Only accident at Winecoff Ave. in 1988.

COST OF RAILWAY/HIGHWAY COLLISIONS

According to a report prepared by, and first published by, the Federal Highway Administration in 1991, accident costs by 1995 were as follows:

Fatal accident	$2,780,000.00
Injury accident	$55,000.00
Property damage only accident	$3,000.00

TABLE 1
EVALUATION OF STREET/RAILROAD AT-GRADE CROSSINGS

CROSSING #	RAILROAD	MUNICI-PALITY OR COUNTY	STREET NAME	MAINTENANCE RESPONSIBILITY (CITY/NCDOT)	SECONDARY ROAD NUMBER	STREET CLASS.	WARNING DEVICES (TYPE)*	24 HR ADT	2020 ADT (PRO-JECTED)	24 HR TRAIN VOL.	12 YR ACCIDENT HISTORY (NUMBER) 1984-95	SCHOOL BUS ROUTE (Y/N)	EMER-GENCY ROUTE (Y/N)
724415J	NS	Concord	Winecoff	City	---	Local	5	2800	---	34	1	N	N
724418E	NS	Concord	McGill	City	---	Thoroughfare	5	8700	3300	34	0	Y	Y
724419L	NS	Concord	Misenheimer	City	---	Local	5	300	---	34	0	N	N
715319H	NS	Concord	Corban	City	---	Collector	5	3500	---	34	4(1K)(88)	N	N

* Type 1: Unmarked
Type 2: Crossbucks
Type 3: Stop signs/Crossbucks
Type 4: Flashing signals & bells
Type 5: Flashing signals, bells & gates

TABLE 1
EVALUATION OF STREET/RAILROAD AT-GRADE CROSSINGS (CONCORD)

STREET NAME	DESIG-NATED TRUCK ROUTE (Y/N)	% TRUCKS	HAZARDOUS MATERIALS (Y/N)	CROSSING CONDITION (GOOD, FAIR, POOR)		REDUN-DANT CROSSING (Y/N)	ADEQUATE STORAGE SPACE (Y/N)	PROPERTY SERVED	ECONOMIC IMPACT IF CLOSED (HI,MED, LOW)	NEED FOR ENHANCED WARNING DEVICES**	NEED FOR ROADWAY IMPVTS (HI, MED, LOW)	FEASI-BILITY OF IMPLE-MENTING RDWAY IMPVTS (HI,MED, LOW)	POTEN-TIAL FOR GRADE SEPARA-TION (HI,MED LOW)
				GEOMETRY	SIGHT DISTANCE								
Winecoff	N	0	N	Poor	Fair	N	Y	Res/Com	Low	S,S&M	High	High	Med
McGill	N	1	N	Fair	Fair	N	Y	Res/Ind	High	S&M	Med	High	Low
Misenheimer	N	0	N	Fair	Fair	N	Y	Res/Ind	Low	S&M	Low	High	Low
Corban	N	0	N	Good	Fair	Y	Y	Ind/Res	Low	S	Low	High	Med

** S,S&M - Signs, signals & markings (8" lenses)

Utilizing these numbers, the accidents occurring in Concord during the 10-year period have cost the community, in addition to the pain and suffering of the survivors, over $2,800,000.00.

MENU OF AVAILABLE TRANSPORTATION SYSTEM ENHANCEMENTS

As the Concord area continues to grow and expand, and with train traffic expected to increase along the Norfolk Southern (NS) due to the recent agreement between Norfolk Southern (NS) and CSX to purchase CONRAIL, traffic delays and accidents at the crossings are certain to increase.

The Norfolk Southern (NS) line from Washington, D.C. to Charlotte, including the segment that comprises this report, has been designated by the USDOT as a **High Speed Rail Corridor**. Governor Jim Hunt has declared the line from Raleigh to Charlotte as a vital link in the **Transit 2001 Program**. A significant objective of the Program is to have two-hour passenger train service in place between Raleigh and Charlotte early in the next century. In order to accomplish this goal, significant changes will have to be made to the rail line that will affect many of the crossing streets and the communities they serve. The menu of system enhancements available for consideration follows:

- **Grade Separation Structures**

In recommending highway/railroad grade separation structures, there are many factors that must be considered. Among these factors are:

- Traffic volumes (both vehicle & train)
- Accident history
- Topography
- Construction impacts
- Costs

Traffic Volumes in the 15,000 to 20,000 vehicles per day (VPD) range and above are generally considered to be the threshold for consideration of a grade separation structure for local streets. Volumes of 30,000 VPD and more can be accommodated without significant delay provided train traffic is low.

The **NCDOT** uses an **"exposure index"** to determine whether or not a grade separation structure is warranted at either an existing or proposed railway/highway crossing. The exposure index is determined by multiplying the number of trains per day over the railroad by the number of vehicles per day (in the design year)* on the roadway. In other words, for a railroad with 5 trains per day and a roadway with 2,000 vehicles per day, the exposure index would be 10,000. The threshold for consideration for construction of either an overpass or an underpass is an exposure index of 15,000 in rural areas and 30,000 in urban areas.

*The Design Year is that future year when the improved roadway is expected to reach its theoretical vehicle carrying capacity. In other words, a roadway designed with a 20-year design life, and constructed in 1997, would reach its capacity in 2017. In computing the exposure index, the projected traffic volumes for 2017 would be used in the formula.

Accident History is another of the factors used when considering grade separation structures. Even though traffic volumes for vehicles and trains may be low, if frequent collisions between railroad and highway traffic is occurring, then a separation structure may be warranted.

Topography, or the lay of the land, is another important consideration. Where the street, railroad and surrounding land are all at about the same elevation, the construction of grade separation structures is made considerably more difficult.

Construction Impacts are of considerable importance in that they may be of such a magnitude as to do greater harm to the community than if the present conditions remain. Construction impacts can include acquisition and the subsequent relocation of families and businesses; destruction of the natural environment such as woodlands and wetlands; and, disruption of historical and archaeological sites. While the effects of some of the impacts may only be temporary, some can forever alter the character of a neighborhood or community.

Costs for grade separation structures can easily exceed $1 million and must, therefore, receive careful consideration before proceeding with funding and construction.

- **Crossing Protection Devices Upgrade**

Generally, the most cost effective way to deal with safety issues at an at-grade railroad crossing is to upgrade the crossing protection devices.

Crossing protection devices include signs, signals, bells and gates used to warn motorists of the pending crossing and, in the case of bells, signals and gates, alert the motorist to the train approaching the crossing. Passive devices, which include advance warning signs, railroad crossbucks and standard stop signs, are generally used on low volume crossings with good site distance. Active devices, which include signals, bells and gates, are used on higher volume crossings with greater accident potential or where existing conditions warrant more positive control. These devices rank from lowest to highest as follow:

Type	Description
1.	Unmarked
2.	Railroad crossbucks
3.	Standard stop signs (limited sight distance) & crossbucks
4.	Flashing signals and bells
5.	Flashing signals, bells & gates

The crossings in Concord are protected as follows:

Corban Ave.	Flashing signals, bells & gates
Meisenheimer Dr.	Flashing signals, bells & gates
McGill Ave.	Flashing signals, bells & gates
Winecoff Ave.	Flashing signals, bells & gates

- **Advanced Crossing Protection Devices**

The NCDOT Rail Division has recently completed testing of more advanced crossing protection devices in the form of four-quadrant gates and barrier medians. These devices are appropriate for use on multi-lane, high-volume crossings of high-speed mainline railroads where significant numbers of motorists are ignoring the existing devices. The installation consists of dual gates across the entire approach width, and a barrier median on each approach to prevent motorists from crossing the roadway centerline in an attempt to get around the gates.

In tests recently completed at Sugar Creek Rd. in Charlotte in 1996 in cooperation with Norfolk Southern (NS), violations dropped from almost 45 per week with standard gates and signals, to less than 2 per week with the advanced protection devices.

Video imaging is another technique that is being used to improve crossing safety. Under this program, video cameras are set up at certain crossings to record events as well as the vehicle and license plate of violators. This information is then provided to law enforcement officials for enforcement purposes.

- **Crossing Closure/Crossing Consolidation**

The most effective way to deal with railroad/highway crossing safety issues is to close low-volume redundant crossings. Crossings that connect to the same street network and are within a quarter mile (+/- 1300 feet) of each other, are considered to be redundant. Crossing consolidation is another way to treat crossings that may be relatively close to each other. Consolidation of two or more crossings into one can be accomplished by utilizing or building roads that parallel the tracks or by replacing several crossings with a grade separation structure.

- **Street Improvements**

Street improvements are an effective way to treat capacity and safety problems associated with a particular section of roadway, an intersection or a railroad crossing. These improvements can range from simply remarking the existing pavement to obtain a turn lane

to total reconstruction of the roadway. In many cases, the more minor the improvement, the greater the benefits.

- **Traffic Signals**

As traffic volumes increase within a roadway network or at a particular intersection, the addition of a traffic signal(s) to the system may be warranted. Traffic signals are not a "cure-all" for traffic problems. Signals have distinct advantages and disadvantages. They are:

Advantages[1]

1. They can provide for the orderly movement of traffic.
2. Where proper physical layouts and control measures are used, they can increase the traffic-handling capacity of the intersection.
3. They can reduce the frequency of certain types of accidents, especially the right-angle type.
4. Under favorable conditions, they can be coordinated to provide for continuous or nearly continuous movement of traffic at a definite speed along a given route.
5. They can be used to interrupt heavy traffic at intervals to permit other traffic, vehicular or pedestrian, to cross.

Disadvantages[1]

1. Excessive delay may be caused.
2. Disobedience of the signal indications is encouraged.
3. The use of less adequate routes may be induced in an attempt to avoid such signals.
4. Accident frequency (especially the rear-end type) can be significantly increased.

Because of these advantages/disadvantages, it became necessary to develop a series of "warrants" for signal installation. The warrants are prescribed in the Manual on Uniform Traffic Control Devices (MUTCD) and are:

Warrant 1 - Minimum vehicular volume
Warrant 2 - Interruption of continuous traffic
Warrant 3 - Minimum pedestrian volume
Warrant 4 - School crossings
Warrant 5 - Progressive movement
Warrant 6 - Accident experience
Warrant 7 - Systems
Warrant 8 - Combination of warrants

(1) Manual on Uniform Traffic Control Devices, USDOT, Federal Highway Adm., Washington, D.C. 1988

Warrant 9 - Four hour volumes
Warrant 10 - Peak hour delay
Warrant 11 - Peak hour volume

Minimum criteria are established for each of the warrants and one or more must be met before installation of a new traffic signal can be considered.

SAFETY AND MOBILITY ISSUES

- Vehicles Queuing Across Railroad Tracks

Queuing of vehicles across the tracks usually occurs due to the nearby presence of traffic signals, intersections or paralleling roadways.

Due to the lack of paralleling roadways and adjacent traffic signals, queuing of vehicles across the tracks is not a problem at this time in Concord and is not expected to become a problem in the future.

- Traffic Signal Preemption

The Manual on Uniform Traffic Control Devices requires that preemption of traffic signals occur when the signal is within 200 feet or less of the crossing. There are no signals adjacent any of the Concord crossings, therefore, there is no signal preemption.

- Humped Crossings

A "humped" crossing is one at which the elevation of the railroad is generally higher than that of the approaching roadway. This humped affect causes cars and trucks to ascend on one approach to cross the track and descend on the other side. When the humping is severe enough, vehicles, especially low-hanging trucks, tend to drag over the crossing and can become hung such that the vehicle can go neither forward nor backwards. Maintenance of the railroad tends to exacerbate the hump over time in that work on the track ballast generally raises the roadbed about three inches per occurrence. Over a ten-year period, the railroad will rise about one foot (1').

Crossing profiles are generally acceptable on all crossings with the exception of McGill Ave. which will be discussed in detail in the **Recommendations** section of this report.

- Grade Crossing Condition

The condition of the grade crossing surface can affect both safety and mobility. A poorly maintained crossing surface can contribute to accidents that may or may not involve a train. Also, a crossing in poor condition may also cause operating speeds over the crossing to be

lowered, thereby, impacting roadway capacity.

All crossing surfaces in the Concord Study have recently been reworked and are in good condition.

- Vehicles Driving Around Automatic Gates

This occurs when motorists perceive that the automatic gates have lowered but a train is not approaching the crossing; when the gates fail in the lowered position (Fail Safe); or when impatience causes a driver or pedestrian to maneuver around the gates even when an approaching train is in sight. Field observations did not indicate a problem of this nature at any of the four crossings.

- Improved Signs and Markings

Installation and maintenance of required traffic control signs and markings is consistently an issue with state and municipal street and highway departments. And, to some extent, maintenance of the railroad signs, signals, and gates at crossings can be an issue with the railroad company.

Due to the recent maintenance work along the NS, pavement markings require replacement at both Corban and McGill Avenues.

- Roadway Improvements

Roadway improvements form a key part of the recommendations for Corban Ave., McGill Ave. and Winecoff Ave. These proposed improvements are discussed in detail in the **Recommendations** section of this Report. No other roadway improvements are recommended.

- Roadway Grade Separation

Providing a roadway grade separation can eliminate safety, queuing and delay problems at a railroad grade crossing. Highway grade separations can either be on a bridge over the railway or the roadway can cross beneath the rail line.

Overpasses require greater length for the same design speed. The total elevation difference is greater because the standard rail vertical clearance of 23 feet exceeds the typical highway clearance of 16 or 16-1/2 feet (even though the structure depth is usually greater for the rail bridge typically provided at an underpass). More importantly, the vertical curve in the middle of the facility, the "crest" curve on an overpass is longer for a given design speed than the "sag" curve at an underpass, due to stopping sight distance requirements.

The visual and noise impacts associated with overpasses can make them undesirable for use in residential zones, downtown zones, or near historic structures.

The design, and ultimately the feasibility, of a highway grade separation is heavily influenced by property access considerations and the location and connectivity of roadways which parallel the tracks and connect to the cross street. Where an existing frontage road is immediately adjacent to the railroad, the street crossing can clear this facility as well. If necessary, a connection to the frontage road can be provided by directional ramps similar to freeway on-and-off ramps that provide access to the frontage road for traffic to-and-from points on the same side of the railway line as the frontage roadway.

Design standards for mainline railroads are very restrictive as far as the ability to modify the railroad grade or profile. For purposes of the study, changes in the profile of the Norfolk Southern (NS) line were not considered.

- Other Mobility Factors

  - Of the four crossings in Concord, only McGill Ave. is used as a bus route by the Cabarrus County School System. McGill is also used by the Cabarrus County Emergency Medical Service in providing emergency response. The Concord Fire & Rescue Department utilizes all four crossings in providing fire and rescue services.

  - The **Kannapolis-Concord Thoroughfare Plan** includes a project to extend Brookwood Ave. westerly across the **NS** with an overpass and connecting to McGill Ave. west of the current crossing of the railroad.

  - The **NCDOT Transportation Improvement Program** includes project **B-3421** which is the replacement of the bridge over the **NS** on Cabarrus Ave. which is just north of the crossing at Corban Ave.

CONCLUSIONS

Accommodating the **Transit 2001 Plan** goal of two-hour passenger train service between Raleigh and Charlotte will require a substantial reduction in the number of streets that cross the railroad at grade, as well as major modifications to many of those that remain.

Freight train traffic along the Norfolk Southern (NS) will increase due to the division of CONRAIL routes between Norfolk Southern (NS) and CSX.

Vehicular traffic in the Concord Area will continue to increase as growth and expansion continues.

Grade crossing safety is an issue at Corban Ave. as demonstrated by the four recorded

accidents.

Mobility is an issue for the Concord Fire & Rescue Department at the McGill Ave. crossing.

RECOMMENDATIONS

For purposes of this report, recommendations are classified as follows:

Near-term (0-2 years)
Mid-term (2-5 years)
Long-term (5+ years)

I. Corban Ave. - is paralleled by Cabarrus Avenue to the North which overpasses the NS. The current average daily traffic on Corban is 3500 vehicles per day with 2010 volumes projected to approach 4400. There have been four (4) accidents at the crossing with one fatality in 1988.

A level of service analysis was run on the Cabarrus Avenue/Old Charlotte Road intersection with Corban closed at the NS and with 1997 and 2010 traffic volumes. The analysis shows that the intersection operating at an LOS of B in 1997 and at an LOS of C in 2010.

The City of Concord plans to close Corban Avenue and connect it into Cabarrus Avenue east of the NS crossing and then use the two streets as a one-way pair. This proposal will require that the existing bridges over the NS and Irish Buffalo Creek be widened to four-lane facilities and a connector roadway be built from Cabarrus Ave. to Corban Ave. between Scott St. and Powder St.

The NCDOT Transportation Improvement Program includes Project # B-3421, which is the replacement of the existing overpass of the NS on Cabarrus Ave. The project is currently scheduled for right of way acquisition in 2001 and construction in 2002. The total estimated cost is $1,210,000, but a determination has not been made as to the project scope. The **Kannapolis-Concord Thoroughfare Plan** recommends a four-lane cross-section for Cabarrus Avenue to meet 2020 projected traffic volumes. In order to comply with the Thoroughfare Plan and the recommendations of this Report, it is recommended that the project Scope of Work include a four-lane overpass of the railroad as well as a four-lane bridge at Irish Buffalo Creek.

Mid-term Recommendation: Close Corban Ave. at the NS and build a connector roadway between Cabarrus Ave and Corban Ave. east of the crossing in conjunction with the construction of the new four-lane Cabarrus Ave. bridges over the NS and Irish Buffalo Creek.

Estimated Costs:

Bridge over NS (Programmed in NCDOT TIP) $1,210,000.00
Replace Bridge over Irish Buffalo Creek $600,000.00
Connector between Cabarrus Ave. and Corban Ave. $1,300,000.00

See Figures 3 and 4.

Impacts of Recommendation: The closing of Corban Ave. will not detrimentally affect any of the properties immediately adjacent the crossing. All will continue to have street access, however, the properties just east of the crossing will experience a short increase in driving distance in order to travel west on Cabarrus Ave. to access US highways 29 and 601. The estimated increase in travel distance is 0.3 miles.

The implementation of this recommendation will have an overall impact on the neighborhood in that properties currently in residential use will be acquired for construction of the connector. The construction will impact approximately 18 properties and will take 8 structures. The estimated value of the property (from tax records) is $435,000.00. The overall impact of the recommendation is positive, however, in that it enhances overall community safety by the removal of an at-grade railroad crossing and the associated potential for rail/vehicle collisions. The noise impacts associated with the blowing of train horns will also be eliminated by the closure of the crossing. Facilitation of the **Piedmont High Speed Rail Corridor** is enhanced by the elimination of the crossing.

II. Misenheimer Drive - provides access to residential property with the exception of a playground located near the NS crossing. At one time the street also provided access to a large Fieldcrest Cannon plant, however, the plant now has its primary access onto adjacent McGill Avenue. Also, a connector roadway (Bruton St.) paralleling the NS tracks is now in place between Meisenheimer and McGill. Traffic volumes on Meisenheimer Dr. are under 300 per day.

While the crossing is not in and of itself redundant, all nearby property will retain adequate access should it be closed.

Near-term Recommendation: Close the Meisenheimer Drive crossing. Remove the existing crossing and safety equipment (signals, bells, gates).

Estimated Cost:

Remove crossing $8,000.00
Remove pavement/install barricade/landscape $5,500.00

See Figures 5 and 6.

Impacts of Recommendation: All impacts associated with this recommendation are anticipated to be positive. Closing the crossing will not deny access to any property in that the residential property retains access to Kerr Street and the Fieldcrest Cannon property will have access to McGill Ave. via Central Drive and Bruton Drive, which parallels the tracks on the west side and connects Meisenheimer and McGill.

Closing the crossing will have a positive impact on the overall community in that the potential for train/vehicle collisions is eliminated as are the noise impacts associated with the blowing of train horns. Elimination of the crossing also enhances the potential for implementation of the **Piedmont High Speed Rail Corridor.**

III. McGill Avenue - is a through street currently carrying 8700 vehicles per day near the crossing with 2020 volumes expected to drop to 3300 VPD. This expected drop is brought about by the extension of Brookwood Avenue across the NS connecting to McGill west of the crossing. Brookwood Avenue then becomes the major facility in the area connecting Poplar Tent Road west of downtown Concord with NC 136 east of downtown.

Brookwood Avenue is proposed for widening from Church Street westward and extending across the NS with a grade-separation structure and connecting to McGill Avenue west of the railroad. **See Figure 11.** The NCDOT Statewide Planning Branch estimates the cost to exceed $1.1 million in 1994 dollars. A construction schedule has not been set.

While the McGill Ave. crossing is not "humped", due to the approach grades, it does offer a less than desirable crossing situation for heavy vehicles. The Concord Fire Chief advises that his trucks must slow considerably when negotiating the crossing causing an increase in response times.

Near-term Recommendation: Modify the grade on both approaches to reduce the approach angle, install rubberized grade crossing material on each track, and install 4-quad gates.

Estimated Cost:

Modify approach grades	$40,000.00
Install rubberized crossing (2)	$60,000.00
Install 4-quad gates	$125,000.00
TOTAL	$225,000.00

Long-Term Recommendation: At such time as the Brookwood Ave. Extension project is in place, the McGill Avenue crossing should be re-visited to determine whether or not it should be closed. Based upon the existing and projected traffic volumes, it appears that the crossing could be closed at a future date with no adverse effect on the system. However, a Level of Service analysis on the network should be run at that time to determine feasibility and impacts.

Impacts of Recommendation: All impacts associated with these recommendations are

anticipated to be positive. Improving the crossing approach grades will provide a smoother transition of the crossing, especially for heavy vehicles, and will provide for improved response time for emergency vehicles. Closing the crossing at a future date will adversely impact those properties immediately adjacent the crossing by imposing increased travel distance and time, however, the positive impacts of enhanced safety to the overall community by elimination of an at-grade railroad crossing and the potential for rail/vehicle collisions, more than offsets the negative aspects.

See Figures 7 and 8.

IV. Winecoff Ave---provides access to primarily residential properties between Central Drive and North Church St. Traffic volumes on the road today are 2800 vehicles per day with 2010 volumes projected at 3500 VPD.

The Concord Fire Dept. advises that closing the Winecoff Ave. crossing would cause an increase in the response time for a second unit responding to the same fire west of the tracks. This increase in time is caused by the fact that the second unit must respond from east of the tracks using the McGill Ave. crossing as described above. The increase in response time for the second unit would be 2.8 minutes for a total response time of 4.8 minutes. Service standards for the Fire Dept. require the 2nd unit to be on-scene within 7 minutes of the alarm. Closing the crossing would still allow the Department to operate within its standards. The Fire Chief recommends that should the Winecoff Ave. crossing be closed, the McGill Ave. crossing should be upgraded to allow fire equipment to negotiate the crossing at 35 MPH.

Near-Term Recommendation: Close the Winecoff Ave. crossing.

Estimated Cost:

Removal of existing crossing	$8,000.00
Modify pavement, install barricade, landscape	$7,000.00
Build Cul-De-Sac Eastside	$25,000.00

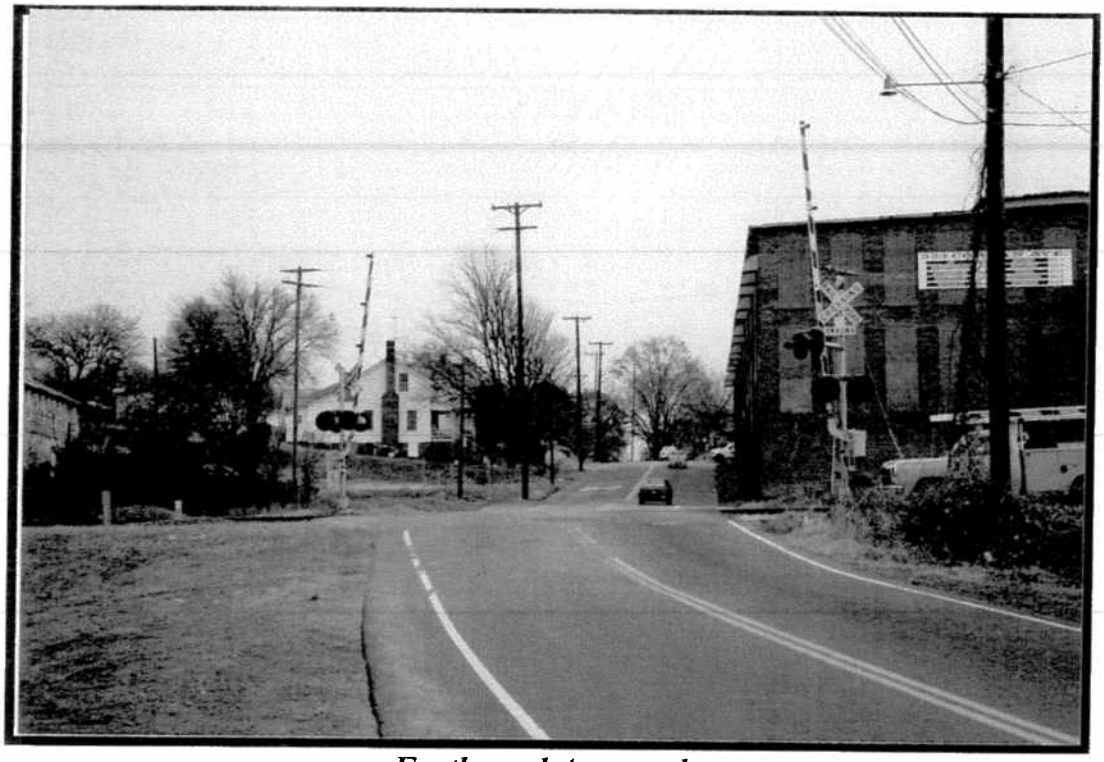
See Figures 9 and 10.

Impacts of Recommendation: Closing the crossing will have an impact on the properties immediately adjacent the crossing on either side by an increase in travel time and distance. The estimated distance and time for properties immediately east of the crossing to reach the Winecoff/Central Ave intersection is 0.8 miles and 3 minutes respectively. The estimated distance and time for properties immediately west of the crossing to reach the intersection of Winecoff/Harris Ave is 1.25 miles and 4 minutes respectively.

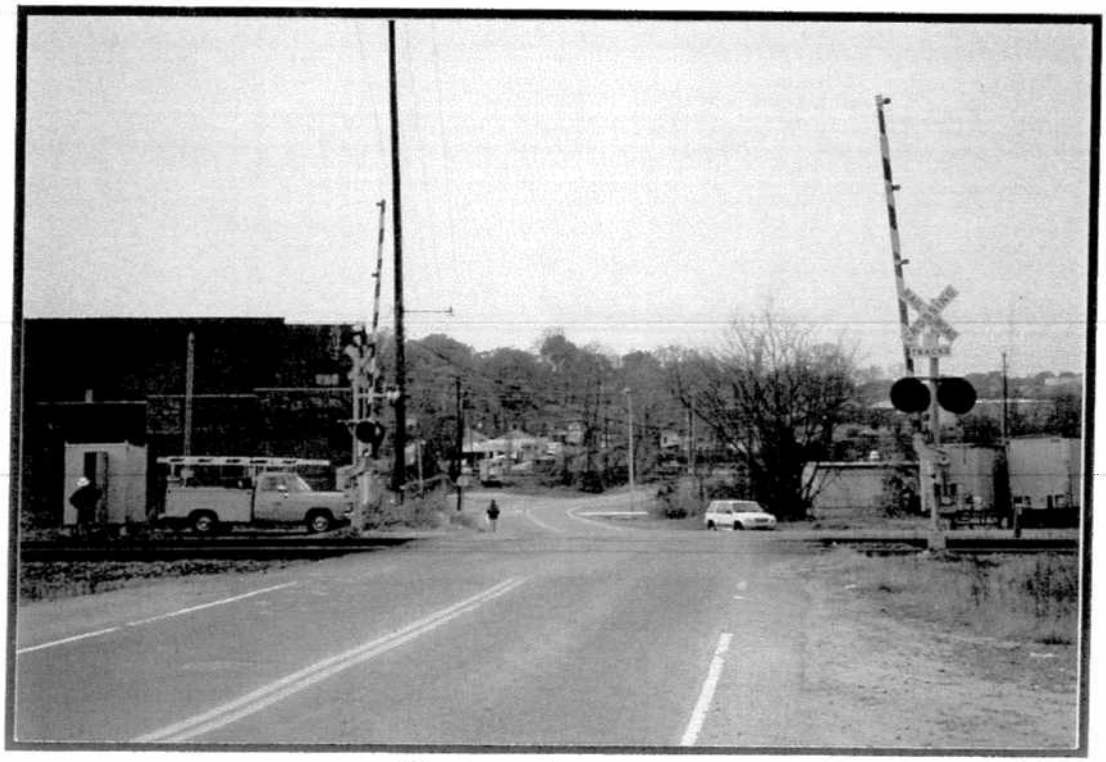
The overall impact of the recommendation is positive, however, in that it eliminates a low-volume at-grade crossing and, thereby, enhances community safety by eliminating the potential for rail/vehicle collisions. Closing the crossing eliminates the noise impacts associated with the blowing of train horns. It also facilitates the implementation of the **Piedmont High Speed Rail Corridor.**

Municipality: Concord

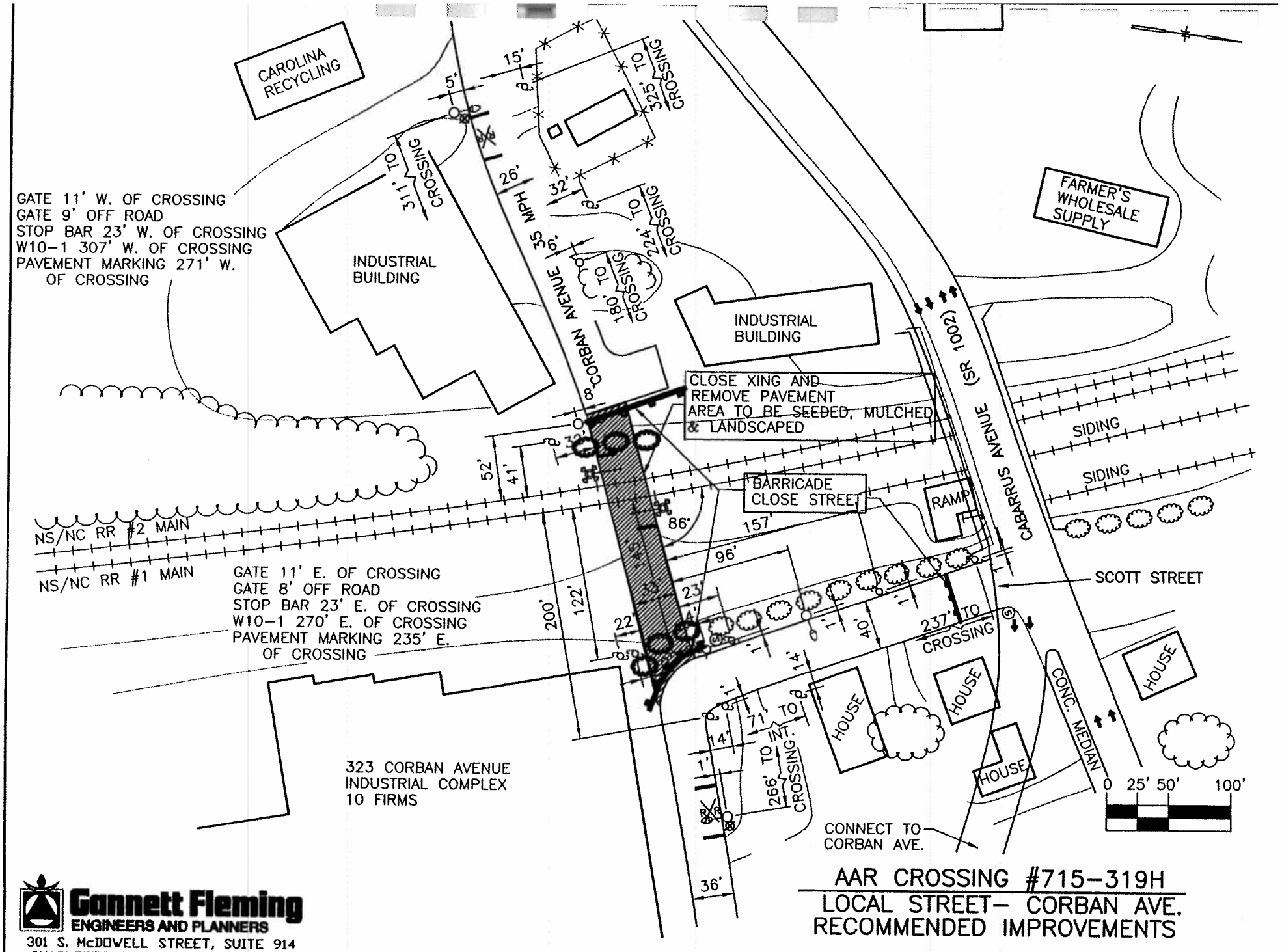
Crossing Number: 715319H *Street Name:* Corban Ave.



Eastbound Approach



Westbound Approach



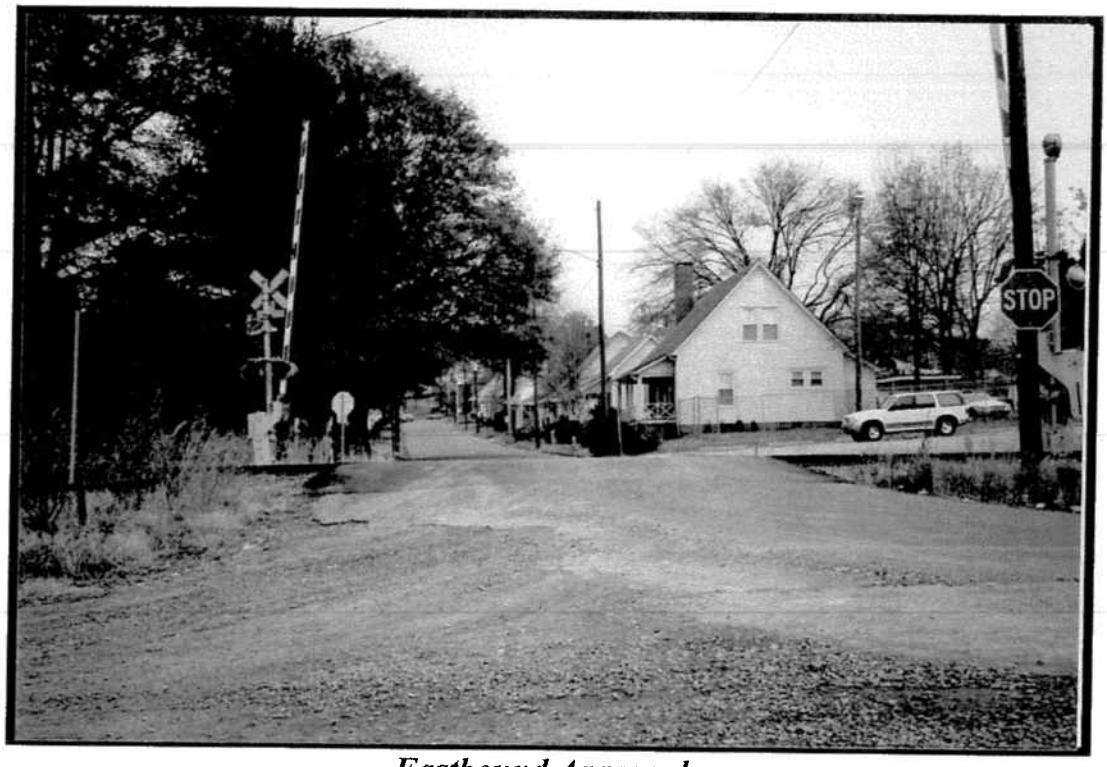
AAR CROSSING #715-319H
LOCAL STREET- CORBAN AVE.
RECOMMENDED IMPROVEMENTS

FIGURE 4

Gannett Fleming
ENGINEERS AND PLANNERS
301 S. McDOWELL STREET, SUITE 914
CHARLOTTE, NORTH CAROLINA 28204

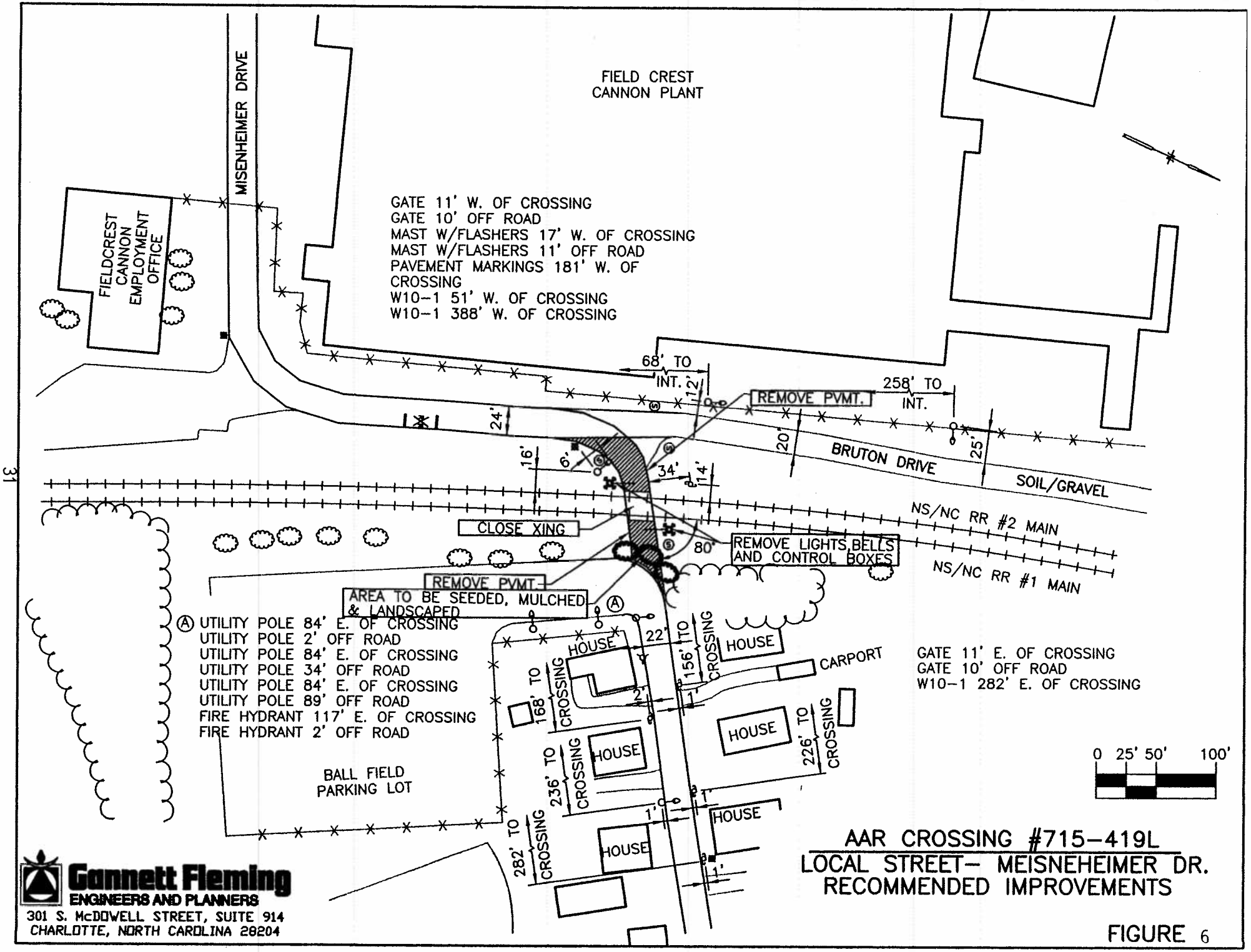
Municipality: Concord

Crossing Number: 715419L *Street Name:* Meisenheimer Dr.



Eastbound Approach

Westbound Approach



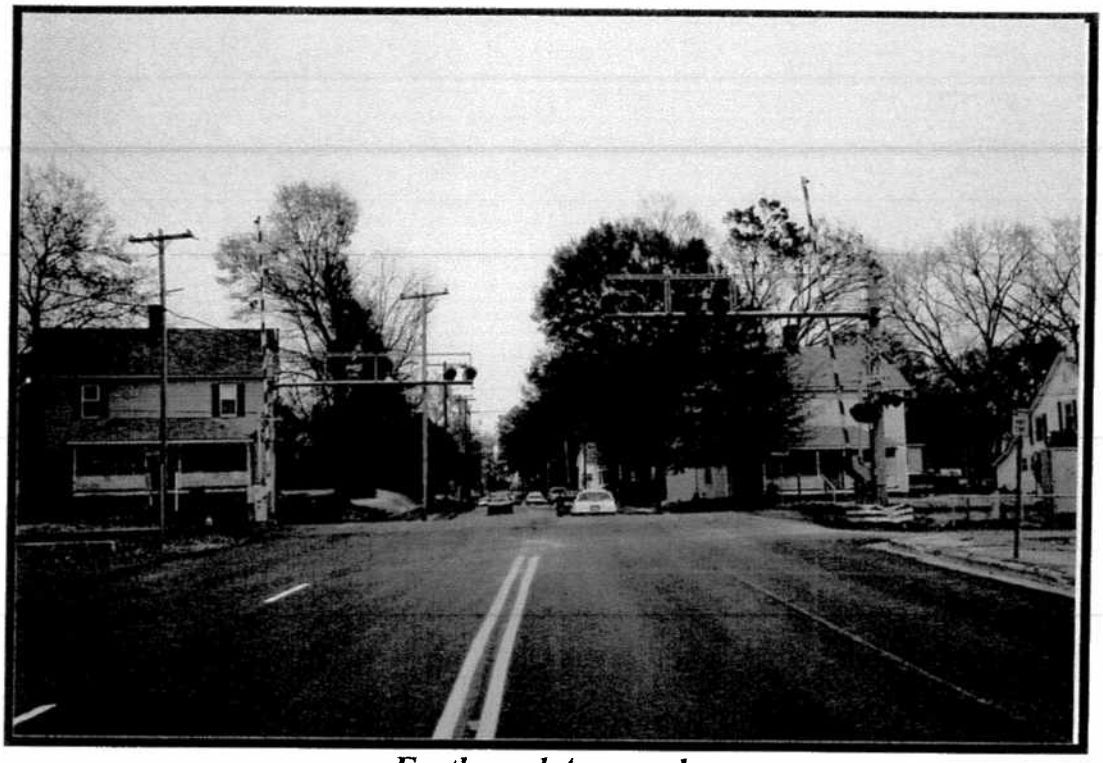
Gannett Fleming
ENGINEERS AND PLANNERS
301 S. McDOWELL STREET, SUITE 914
CHARLOTTE, NORTH CAROLINA 28204

AAR CROSSING #715-419L
LOCAL STREET- MEISNEHEIMER DR.
RECOMMENDED IMPROVEMENTS

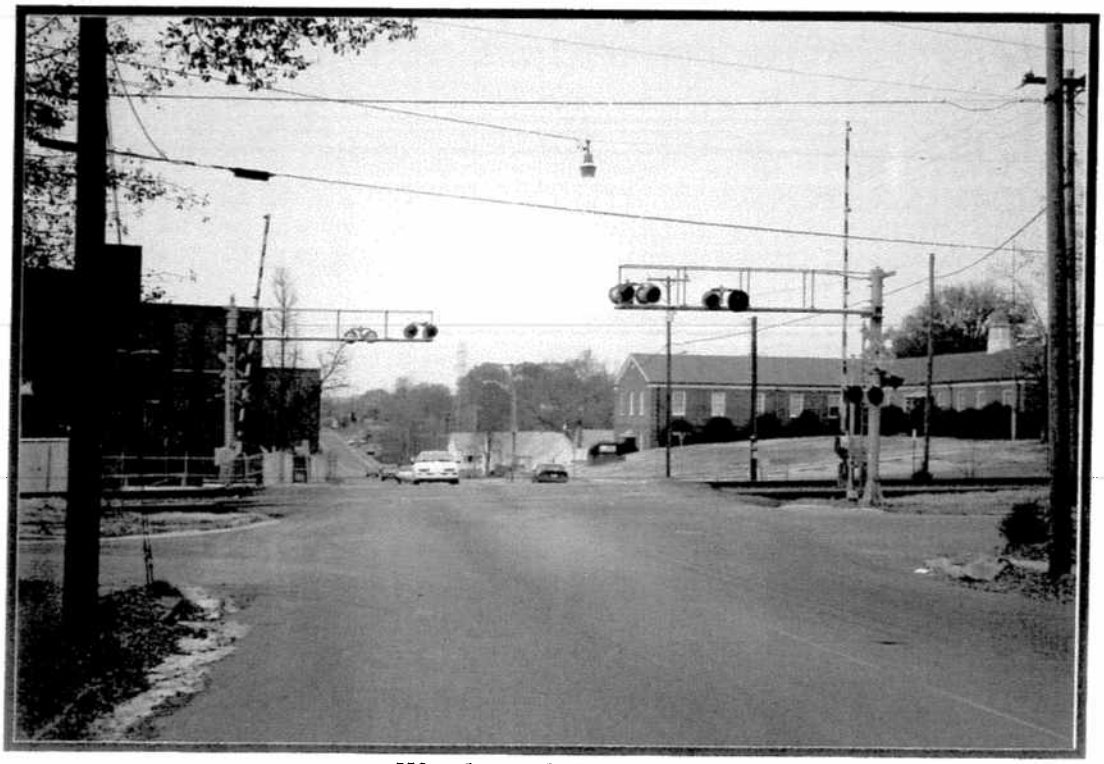
FIGURE 6

Municipality: Concord

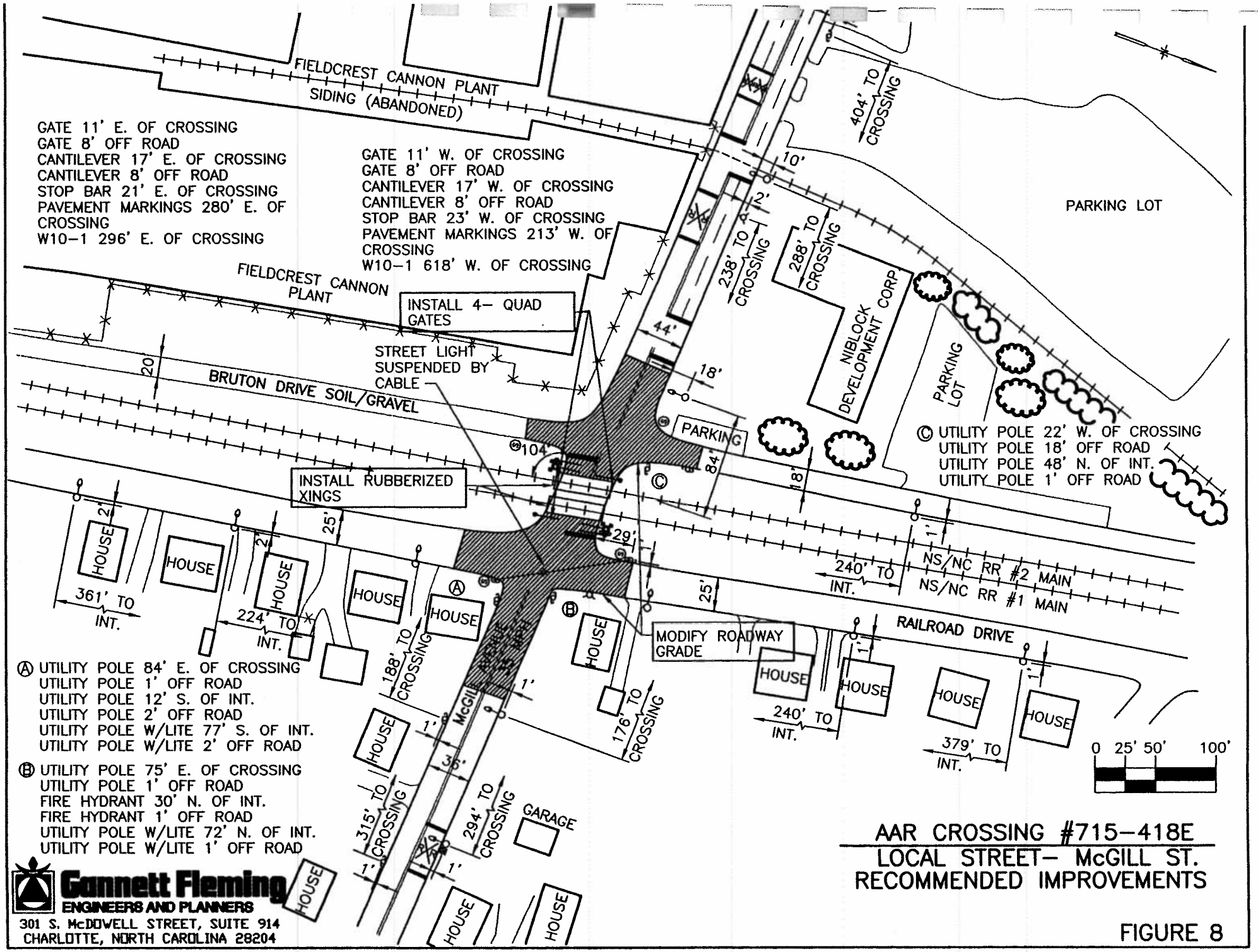
Crossing Number: 715418E *Street Name:* McGill St.



Eastbound Approach



Westbound Approach



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CHARLOTTE, NORTH CAROLINA 28204

AAR CROSSING #715-418E
LOCAL STREET- McGILL ST.
RECOMMENDED IMPROVEMENTS

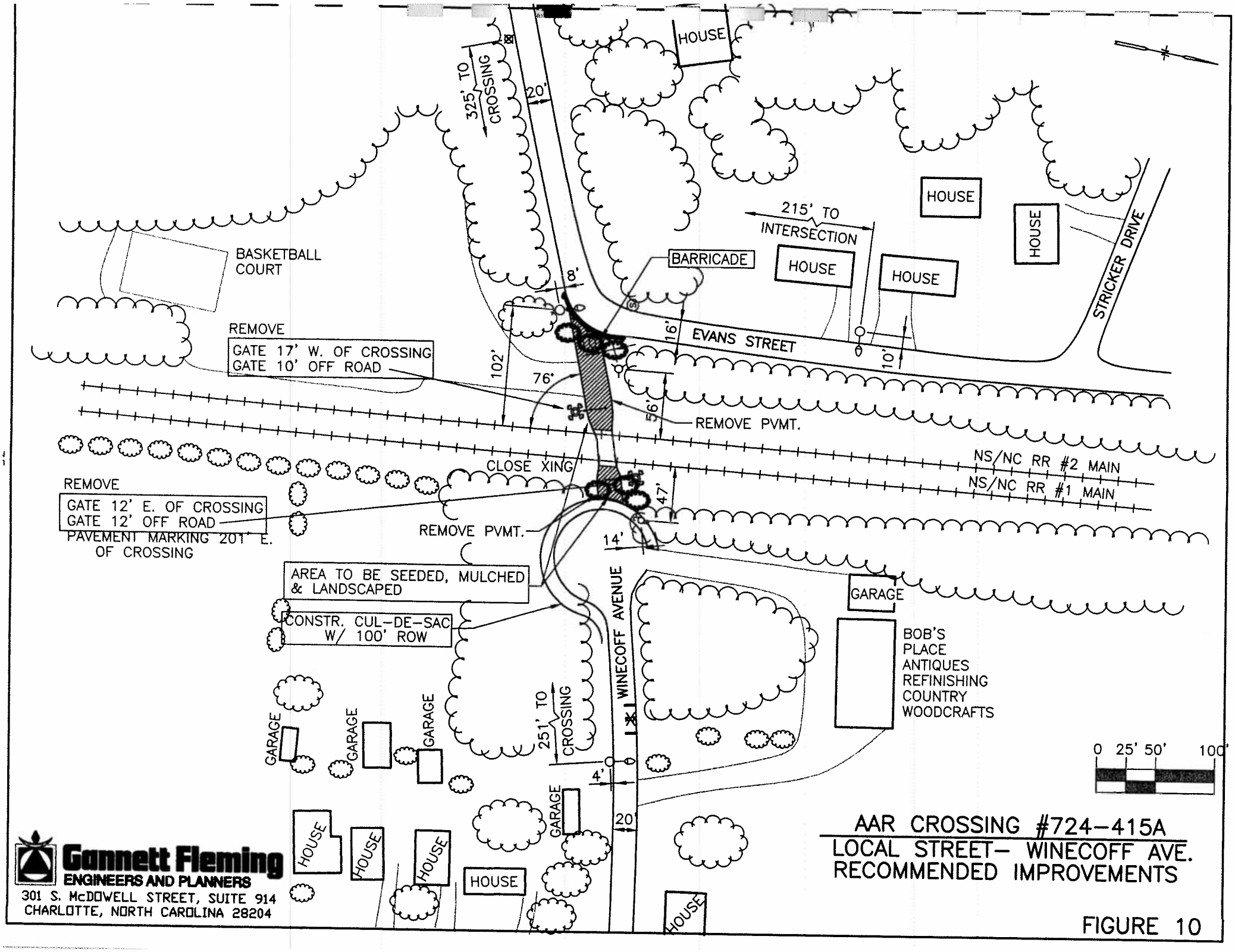
FIGURE 8

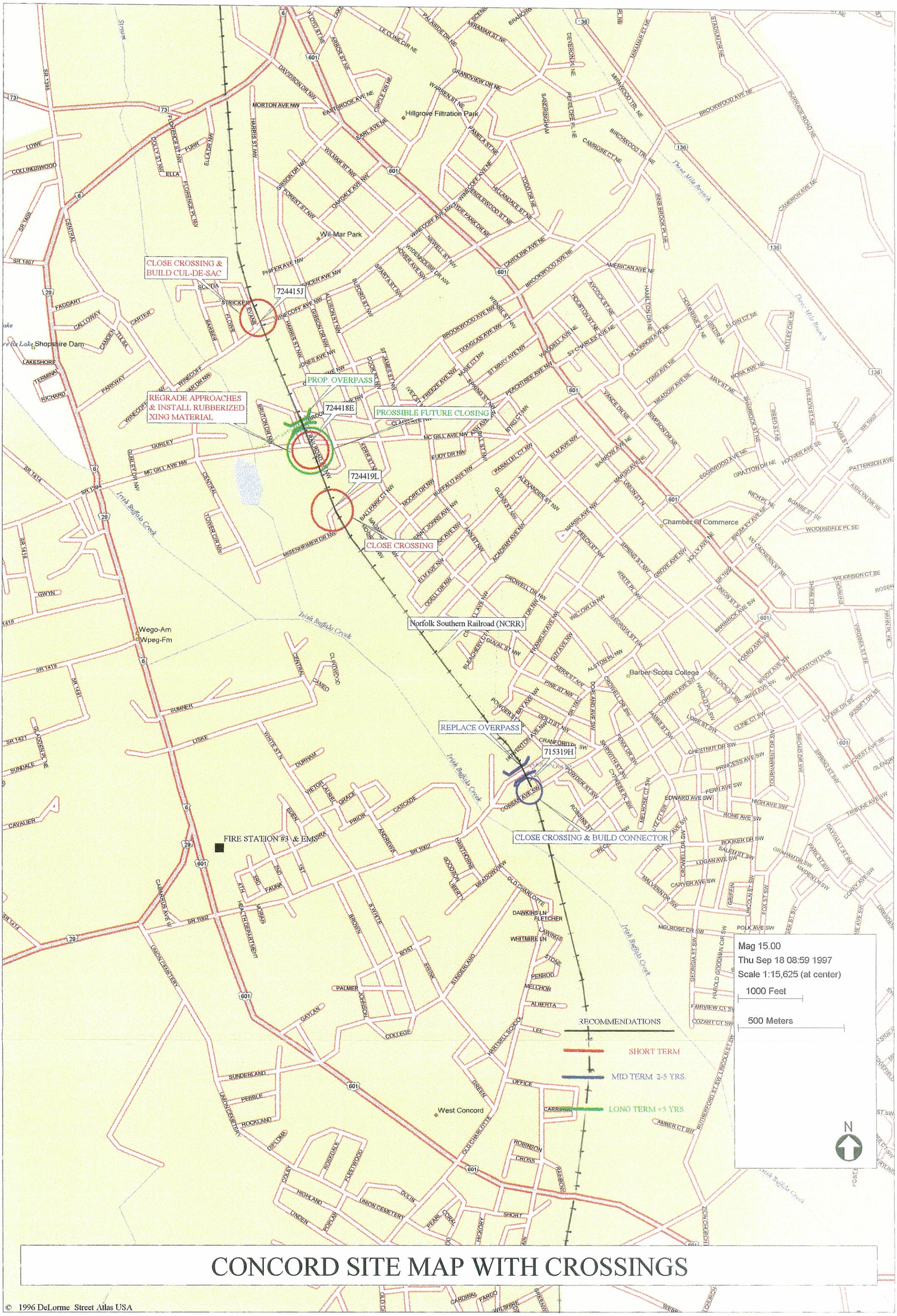
Municipality: Concord

Crossing Number: 724415J *Street Name:* Winecoff Ave.

Eastbound Approach

Westbound Approach


HOUSE
325' TO CROSSING
20'
HOUSE
215' TO INTERSECTION
HOUSE
HOUSE
HOUSE
STRICKER DRIVE
BASKETBALL COURT
BARRICADE
8'
16'
EVANS STREET
10'
REMOVE
GATE 17' W. OF CROSSING
GATE 10' OFF ROAD
102'
76'
56'
REMOVE PVMT.
NS/NC RR #2 MAIN
NS/NC RR #1 MAIN
CLOSE XING
REMOVE
GATE 12' E. OF CROSSING
GATE 12' OFF ROAD
PAVEMENT MARKING 201' E. OF CROSSING
REMOVE PVMT.
47'
14'
AREA TO BE SEEDED, MULCHED & LANDSCAPED
CONSTR. CUL-DE-SAC W/ 100' ROW
WINECOFF AVENUE
GARAGE
BOB'S PLACE ANTIQUES REFINISHING COUNTRY WOODCRAFTS
GARAGE
GARAGE
GARAGE
251' TO CROSSING
4'
20'
GARAGE
HOUSE
HOUSE
HOUSE
HOUSE
HOUSE
0 25' 50' 100'
Gannett Fleming
ENGINEERS AND PLANNERS
301 S. McDOWELL STREET, SUITE 914
CHARLOTTE, NORTH CAROLINA 28204
AAR CROSSING #724-415A
LOCAL STREET- WINECOFF AVE.
RECOMMENDED IMPROVEMENTS
FIGURE 10



CONCORD SITE MAP WITH CROSSINGS

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APPENDIX

HCM: SIGNALIZED INTERSECTION SUMMARY Version 2.4d 04-08-1997

Gannett Fleming Corddry & Carpenter, Inc.

Streets: (N-S) Old Charlotte Hwy. (E-W) Cabarrus Ave.
Analyst: TWL File Name: 715319HC.HC9
Area Type: CBD 4-8-97 4-5 PM
Comment: T Intersection for Railroad Crossing Study-1997 Volumes

	Northbound			Southbound			Eastbound			Westbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	1		1					1	1	1	1	
Volumes	21		210					559	24	244	429	
Lane W (ft)	10.0		12.0					12.0	12.0	11.0	11.0	
RTOR Vols			0						0			0
Lost Time	3.00		3.00					3.00	3.00	3.00	3.00	

Signal Operations

Phase Combination	1	2	3	4	5	6	7	8
NB Left	*							
Thru								
Right	*							
Peds	*							
SB Left								
Thru								
Right								
Peds	*							
EB Right	*							
WB Right								
Green	15.0A							
Yellow/AR	5.2							
EB Left								
Thru						*		
Right						*		
Peds					*			
WB Left					*			
Thru					*	*		
Right								
Peds					*			
NB Right					*			
SB Right								
Green					25.0A	40.0A		
Yellow/AR					5.5	5.7		

Cycle Length: 96 secs Phase combination order: #1 #5 #6

Intersection Performance Summary

	Lane Mvmts	Group: Cap	Adj Sat Flow	v/c Ratio	g/C Ratio	Delay	LOS	Approach: Delay	LOS
NB	L	230	1289	0.100	0.178	21.4	C	10.7	B
	R	690	1395	0.338	0.495	9.6	B		
EB	T	761	1718	0.816	0.443	18.8	C	18.2	C
	R	900	1379	0.030	0.652	3.8	A		
WB	L	455	1594	0.596	0.285	20.3	C	9.0	B
	T	1274	1678	0.374	0.759	2.6	A		

Intersection Delay = 12.9 sec/veh Intersection LOS = B

Lost Time/Cycle, L = 9.0 sec Critical v/c(x) = 0.606

HCM: SIGNALIZED INTERSECTION SUMMARY Version 2.4d 04-08-1997

Gannett Fleming Corddry & Carpenter, Inc.

Streets: (N-S) Old Charlotte Hwy. (E-W) Cabarrus Ave.
Analyst: TWL File Name: 715319HF.HC9
Area Type: CBD 4-8-97 4-5 PM
Comment: T Intersection for Railroad Crossing Study-2010 Volumes

	Northbound			Southbound			Eastbound			Westbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	1		1					1	1	1	1	
Volumes	21		210					559	24	244	429	
Lane W (ft)	10.0		12.0					12.0	12.0	11.0	11.0	
RTOR Vols			0						0			0
Lost Time	3.00		3.00					3.00	3.00	3.00	3.00	

Signal Operations

Phase Combination	1	2	3	4	5	6	7	8
NB Left	*							
Thru								
Right	*							
Peds	*							
SB Left								
Thru								
Right								
Peds	*							
EB Right	*							
WB Right								
Green	15.0A							
Yellow/AR	5.2							
EB Left								
Thru						*		
Right						*		
Peds					*			
WB Left					*			
Thru					*	*		
Right								
Peds					*			
NB Right					*			
SB Right								
Green					25.0A	40.0A		
Yellow/AR					5.5	5.7		

Cycle Length: 96 secs Phase combination order: #1 #5 #6

Intersection Performance Summary

	Lane Mvmts	Group: Cap	Adj Sat Flow	v/c Ratio	g/C Ratio	Delay	LOS	Approach: Delay	LOS
NB	L	230	1289	0.126	0.178	21.5	C	11.3	B
	R	690	1395	0.426	0.495	10.3	B		
EB	T	761	1718	1.028	0.443	46.2	E	44.4	E
	R	900	1379	0.038	0.652	3.9	A		
WB	L	455	1594	0.750	0.285	23.8	C	10.5	B
	T	1274	1678	0.472	0.759	3.0	A		

Intersection Delay = 23.9 sec/veh Intersection LOS = C

Lost Time/Cycle, L = 9.0 sec Critical v/c(x) = 0.763

HCM: SIGNALIZED INTERSECTION SUMMARY Version 2.4d 04-08-1997

Gannett Fleming Corddry & Carpenter, Inc.

Streets: (N-S) Old Charlotte Hwy. (E-W) Cabarrus Ave.
Analyst: TWL File Name: 715319HB.HC9
Area Type: CBD 4-8-97 4-5 PM
Comment: T Intersection for Railroad Crossing Study-2010 Volumes(Bld.)

	Northbound			Southbound			Eastbound			Westbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	1		1					2 <		1	1	
Volumes	21		210					559	24	244	429	
Lane W (ft)	10.0		12.0					12.0		11.0	11.0	
RTOR Vols			0						0			0
Lost Time	3.00		3.00					3.00	3.00	3.00	3.00	

Signal Operations

Phase Combination	1	2	3	4	5	6	7	8
NB Left	*							
Thru								
Right	*							
Peds	*							
SB Left								
Thru								
Right								
Peds	*							
EB Right								
WB Right								
Green	15.0A							
Yellow/AR	5.2							

EB Left								
Thru						*		
Right						*		
Peds					*			
WB Left					*			
Thru					*	*		
Right								
Peds					*			
NB Right					*			
SB Right								
Green					25.0A	40.0A		
Yellow/AR					5.5	5.7		

Cycle Length: 96 secs Phase combination order: #1 #5 #6

Intersection Performance Summary

	Lane Mvmts	Group: Cap	Adj Sat Flow	v/c Ratio	g/C Ratio	Delay	LOS	Approach: Delay	LOS
NB	L	230	1289	0.126	0.178	21.5	C	11.3	B
	R	690	1395	0.426	0.495	10.3	B		
EB	TR	1513	3415	0.567	0.443	13.2	B	13.2	B
WB	L	455	1594	0.750	0.285	23.8	C	10.5	B
	T	1274	1678	0.472	0.759	3.0	A		

Intersection Delay = 11.7 sec/veh Intersection LOS = B

Lost Time/Cycle, L = 9.0 sec Critical v/c(x) = 0.538

HCM: SIGNALIZED INTERSECTION SUMMARY Version 2.4d 04-08-1997
Gannett Fleming Corddry & Carpenter, Inc.

Streets: (N-S) Old Charlotte Hwy. (E-W) Cabarrus Ave.
Analyst: TWL File Name: 715319HP.HC9
Area Type: CBD 4-8-97 4-5 PM
Comment: T Intersection for Railroad Crossing Study-2020 Volumes(Bld.)

	Northbound			Southbound			Eastbound			Westbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	1		1					2 <		1	2	
Volumes	21		210					559	24	244	429	
Lane W (ft)	10.0		12.0					12.0		11.0	11.0	
RTOR Vols			0						0			0
Lost Time	3.00		3.00					3.00	3.00	3.00	3.00	

Signal Operations

Phase Combination	1	2	3	4	5	6	7	8
NB Left	*							
Thru								
Right	*							
Peds	*							
SB Left								
Thru								
Right								
Peds	*							
EB Right								
WB Right								
Green	15.0A							
Yellow/AR	5.2							

EB Left								
Thru						*		
Right						*		
Peds					*			
WB Left					*			
Thru					*	*		
Right								
Peds					*			
NB Right					*			
SB Right								
Green					25.0A	40.0A		
Yellow/AR					5.5	5.7		

Cycle Length: 96 secs Phase combination order: #1 #5 #6

Intersection Performance Summary

	Lane Mvmts	Group: Cap	Adj Sat Flow	v/c Ratio	g/C Ratio	Delay	LOS	Approach: Delay	LOS
NB	L	230	1289	0.148	0.178	21.6	C	11.8	B
	R	690	1395	0.493	0.495	10.9	B		
EB	TR	1513	3415	0.656	0.443	14.2	B	14.2	B
WB	L	455	1594	0.871	0.285	30.3	D	12.2	B
	T	2548	3355	0.287	0.759	2.3	A		

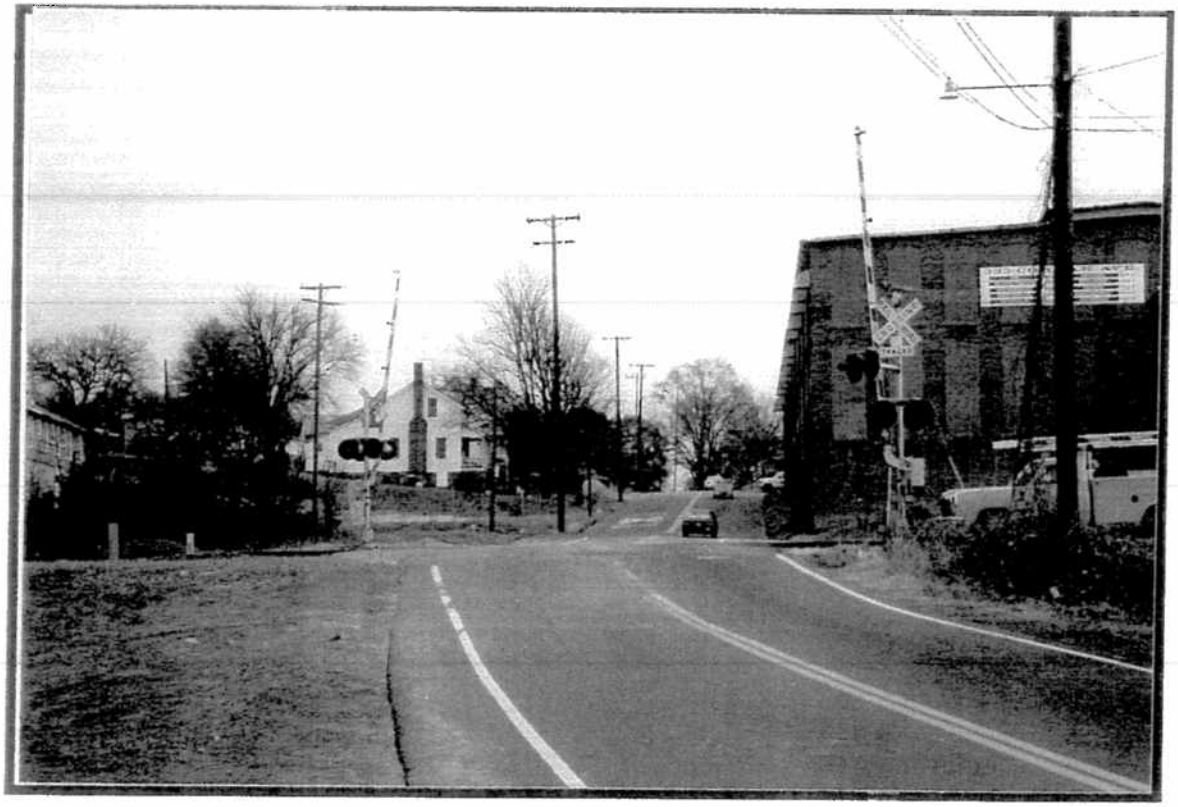
Intersection Delay = 12.9 sec/veh Intersection LOS = B
Lost Time/Cycle, L = 9.0 sec Critical v/c(x) = 0.624

Date: 2/19/97 Time: 4:00-6:00 PM Weather: Cloudy		MANUAL TRAFFIC COUNT SUMMARY IN PASSENGER CAR EQUIVALENTS (PCE'S)		Counted by: BKC Location: Cabarrus @ Old Charlotte Rd.	
Time	**Approach**	**Left-Turn**	**Through**	**Right-Turn**	**Total**
4:00-4:15	EB	N/A	142	5	147
4:15-4:30	EB	N/A	125	10	135
4:30-4:45	EB	N/A	161	5	166
4:45-5:00	EB	N/A	131	4	135
5:00-5:15	EB	N/A	144	2	146
5:15-5:30	EB	N/A	97	3	100
5:30-5:45	EB	N/A	116	8	124
5:45-6:00	EB	N/A	78	4	82
TOTAL			994	41	1035
4:00-4:15	WB	71	120	N/A	191
4:15-4:30	WB	46	96	N/A	142
4:30-4:45	WB	70	105	N/A	175
4:45-5:00	WB	57	108	N/A	165
5:00-5:15	WB	82	160	N/A	242
5:15-5:30	WB	71	87	N/A	158
5:30-5:45	WB	70	126	N/A	196
5:45-6:00	WB	40	68	N/A	108
TOTAL		507	870		1377

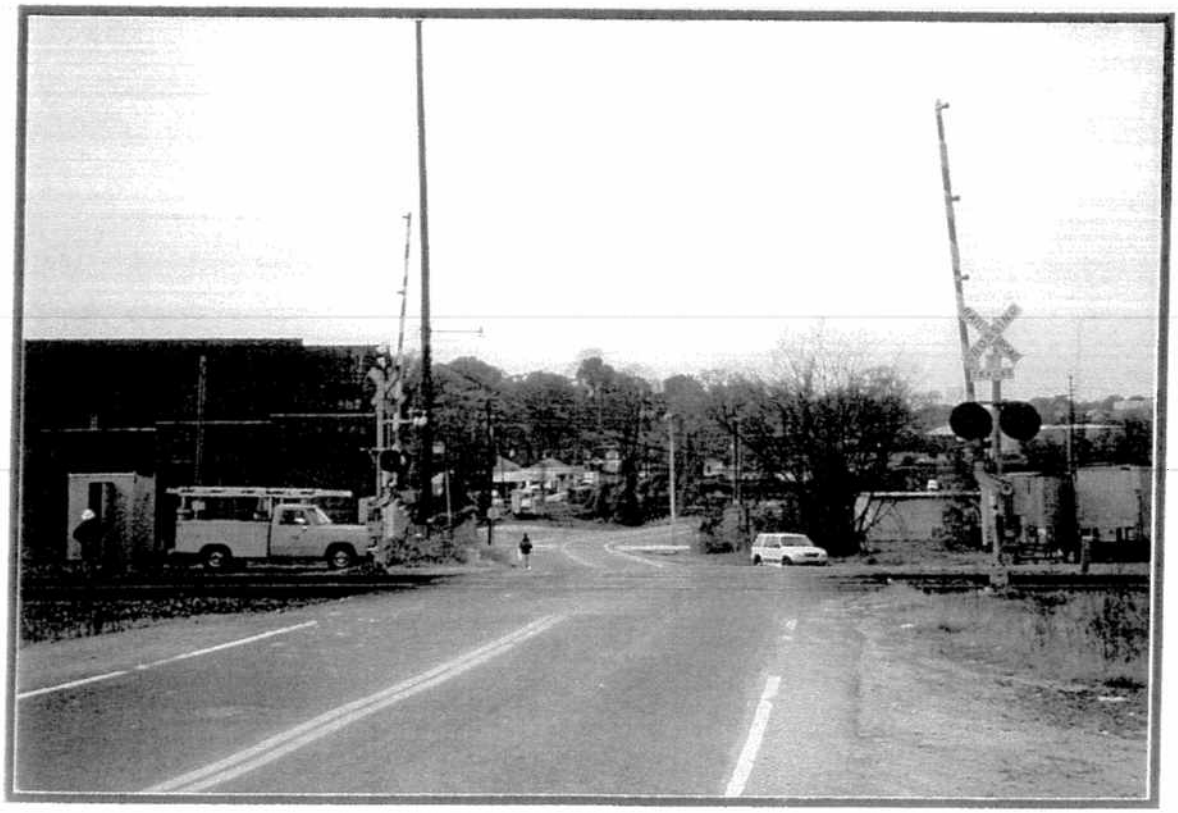
Date: 2/19/97 Time: 4:00-6:00 PM Weather: Cloudy		MANUAL TRAFFIC COUNT SUMMARY IN PASSENGER CAR EQUIVALENTS (PCE'S)		Counted by: BKC Location: Old Charlotte Rd. @ Cabarrus	
Time	**Approach**	**Left-Turn**	**Through**	**Right-Turn**	**Total**
4:00-4:15	NB	8	N/A	55	63
4:15-4:30	NB	6	N/A	54	60
4:30-4:45	NB	2	N/A	61	63
4:45-5:00	NB	5	N/A	40	45
5:00-5:15	NB	5	N/A	57	62
5:15-5:30	NB	2	N/A	56	58
5:30-5:45	NB	3	N/A	44	47
5:45-6:00	NB	2	N/A	29	31
TOTAL		33		396	429
4:00-4:15					
4:15-4:30					
4:30-4:45					
4:45-5:00					
5:00-5:15					
5:15-5:30					
5:30-5:45					
5:45-6:00					
TOTAL					

Municipality: Concord

Crossing Number: 715319H *Street Name:* Corban Ave.



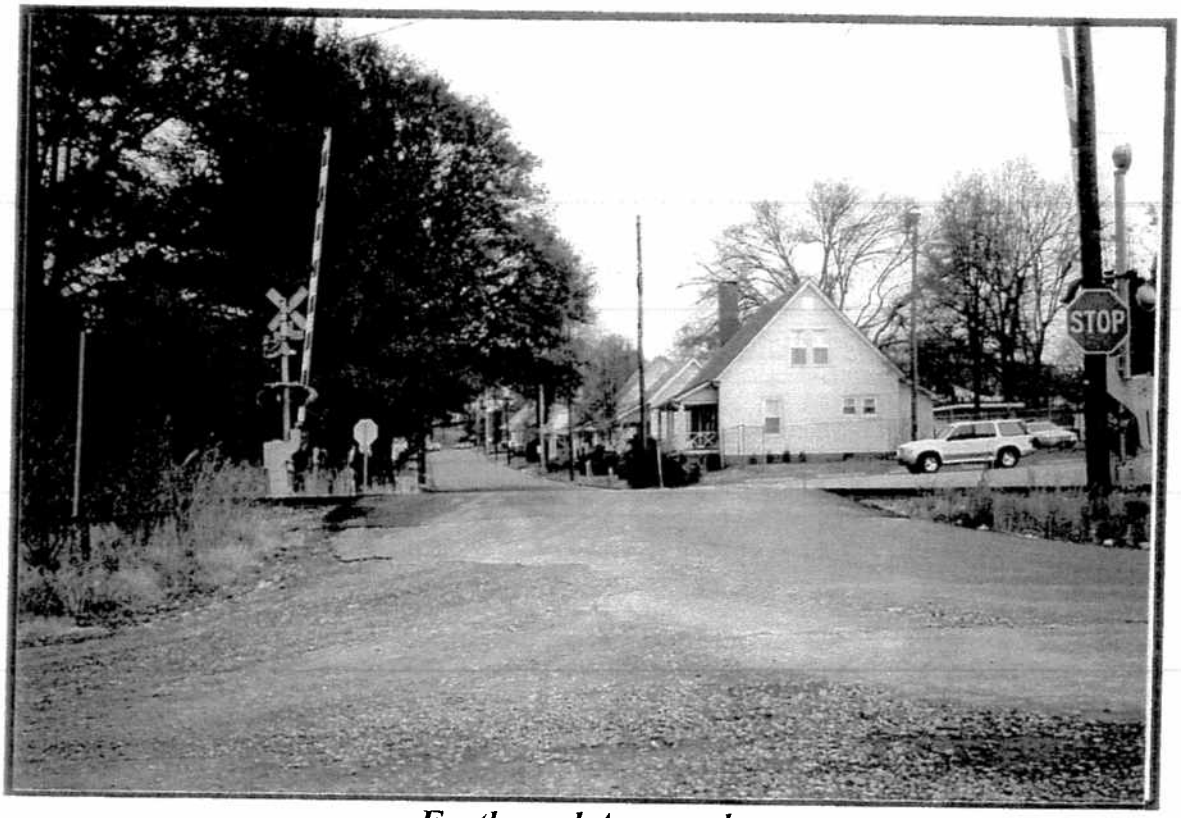
Eastbound Approach



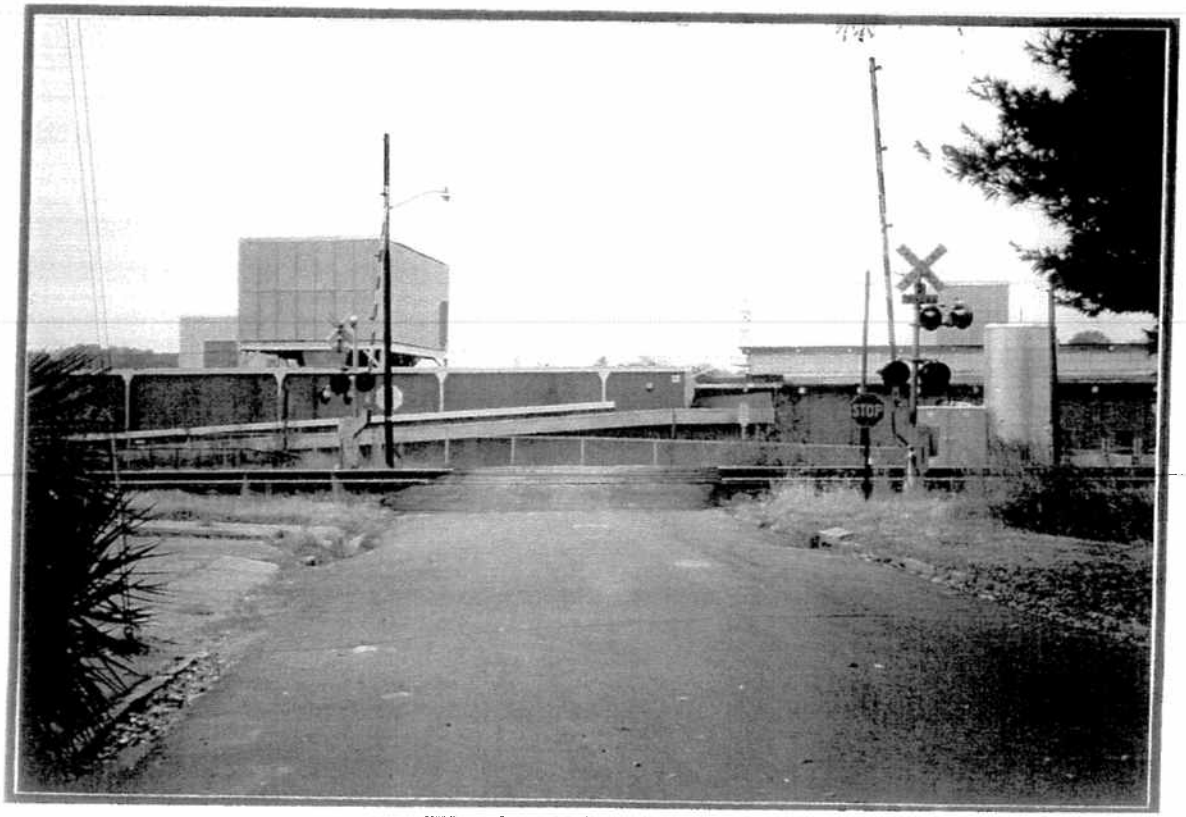
Westbound Approach

Municipality: Concord

Crossing Number: 715419L *Street Name:* Meisenheimer Dr.



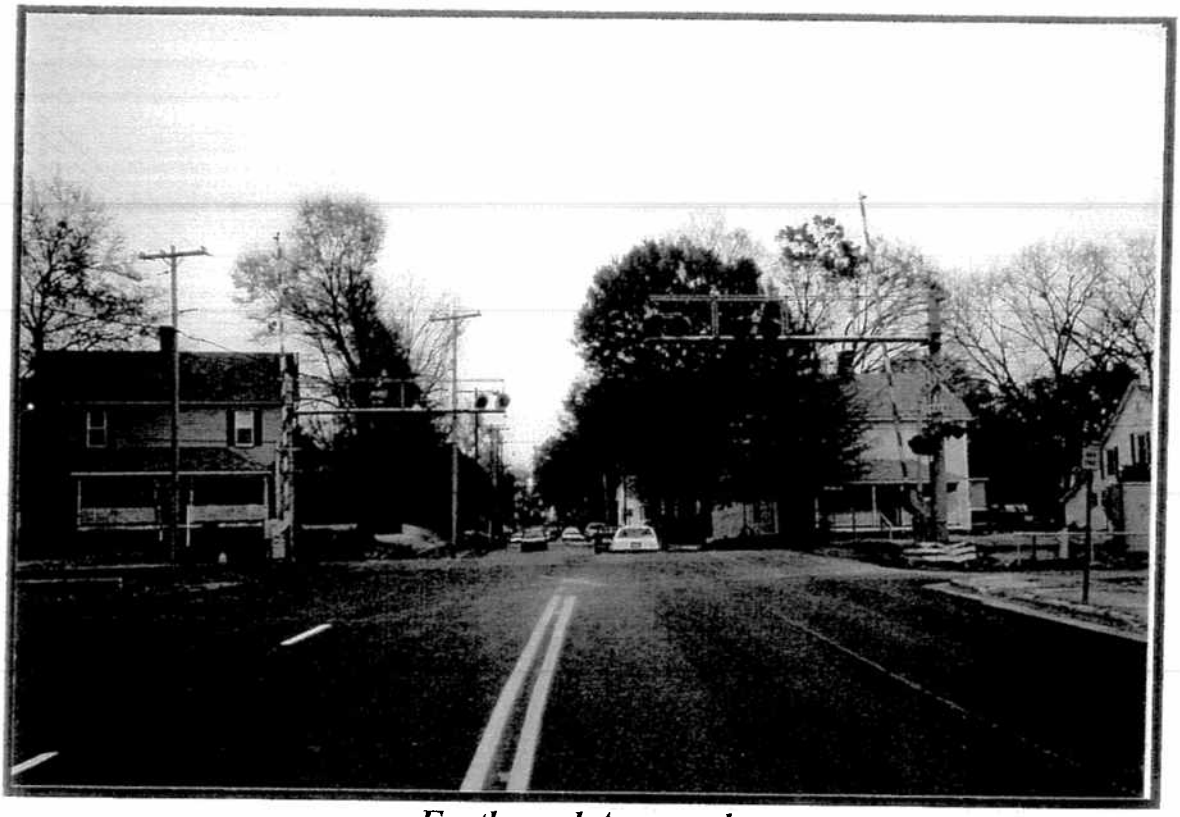
Eastbound Approach



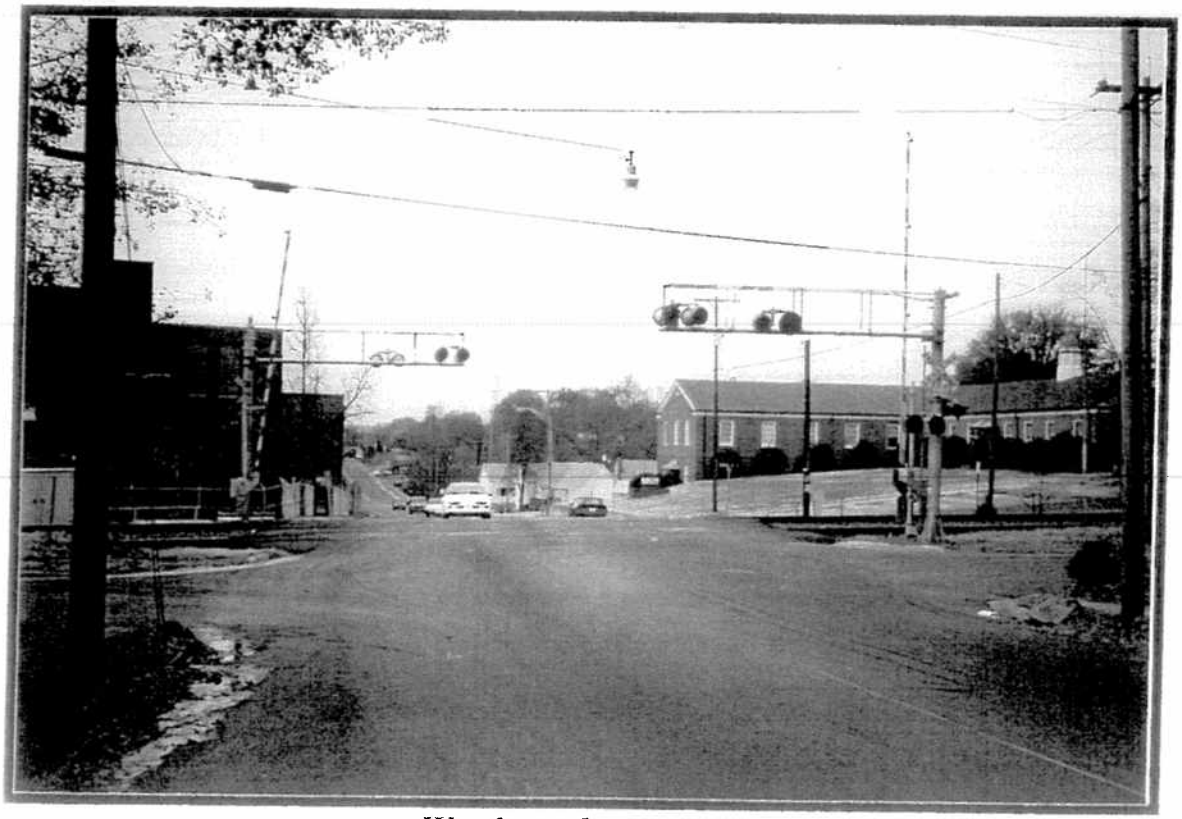
Westbound Approach

Municipality: Concord

Crossing Number: 715418E *Street Name:* McGill St.



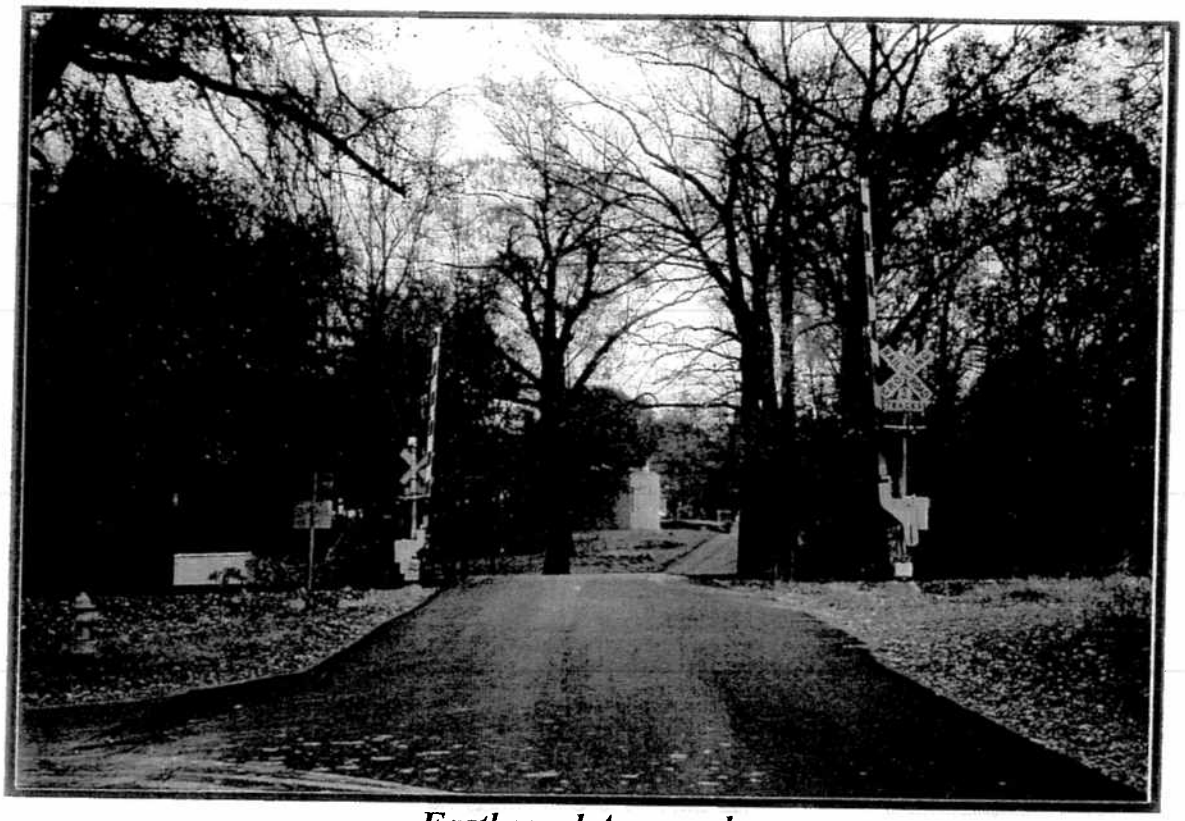
Eastbound Approach



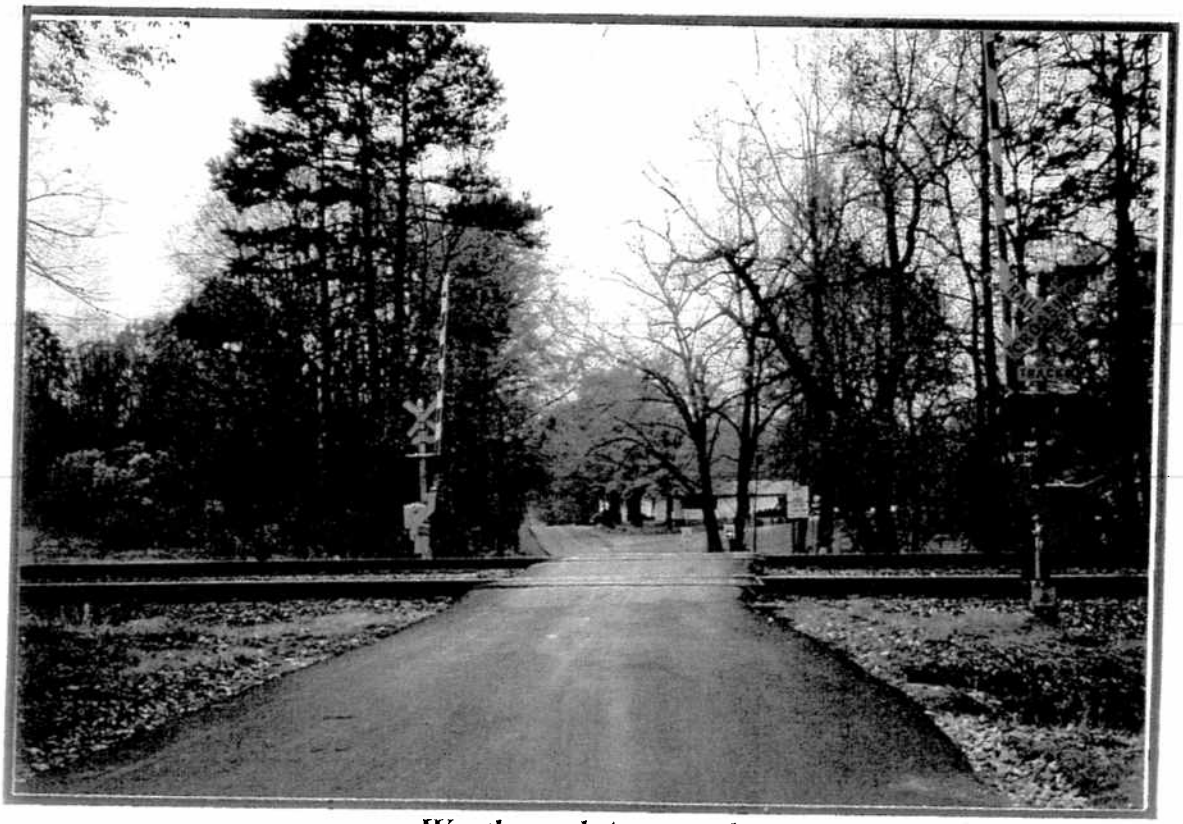
Westbound Approach

Municipality: Concord

Crossing Number: 724415J *Street Name:* Winecoff Ave.



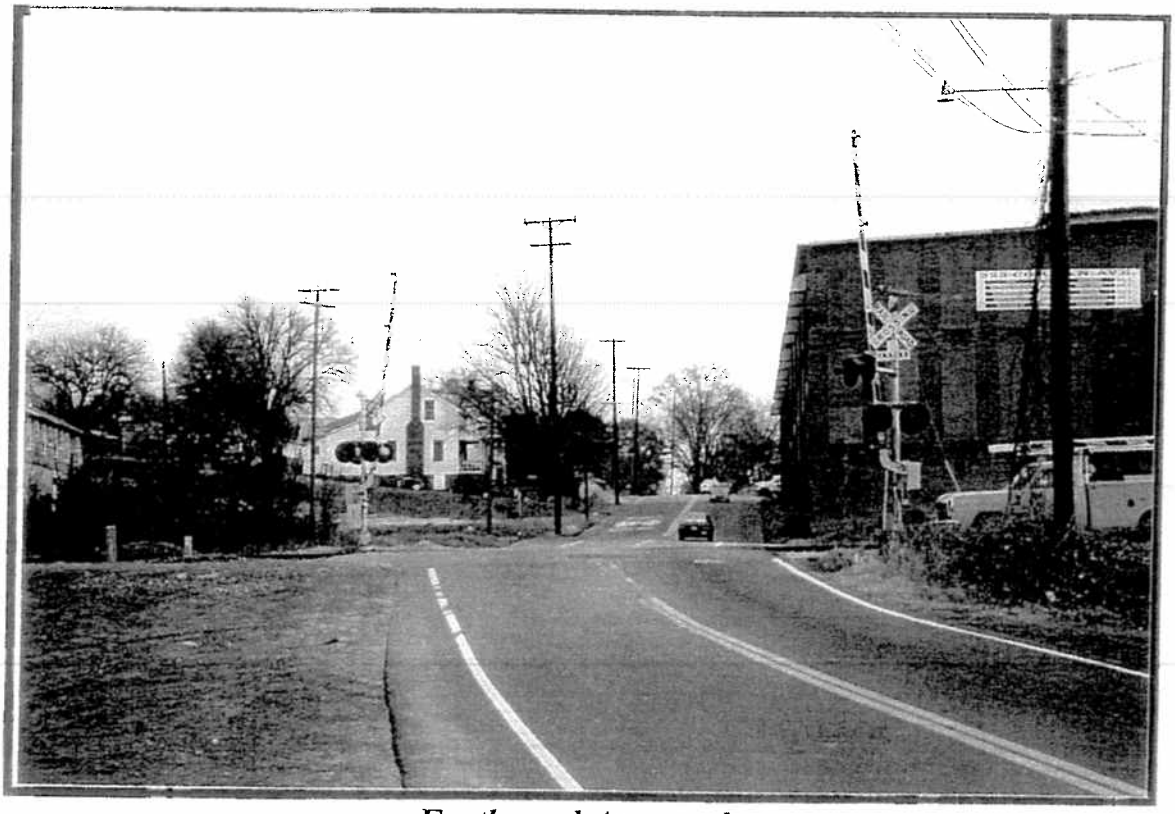
Eastbound Approach



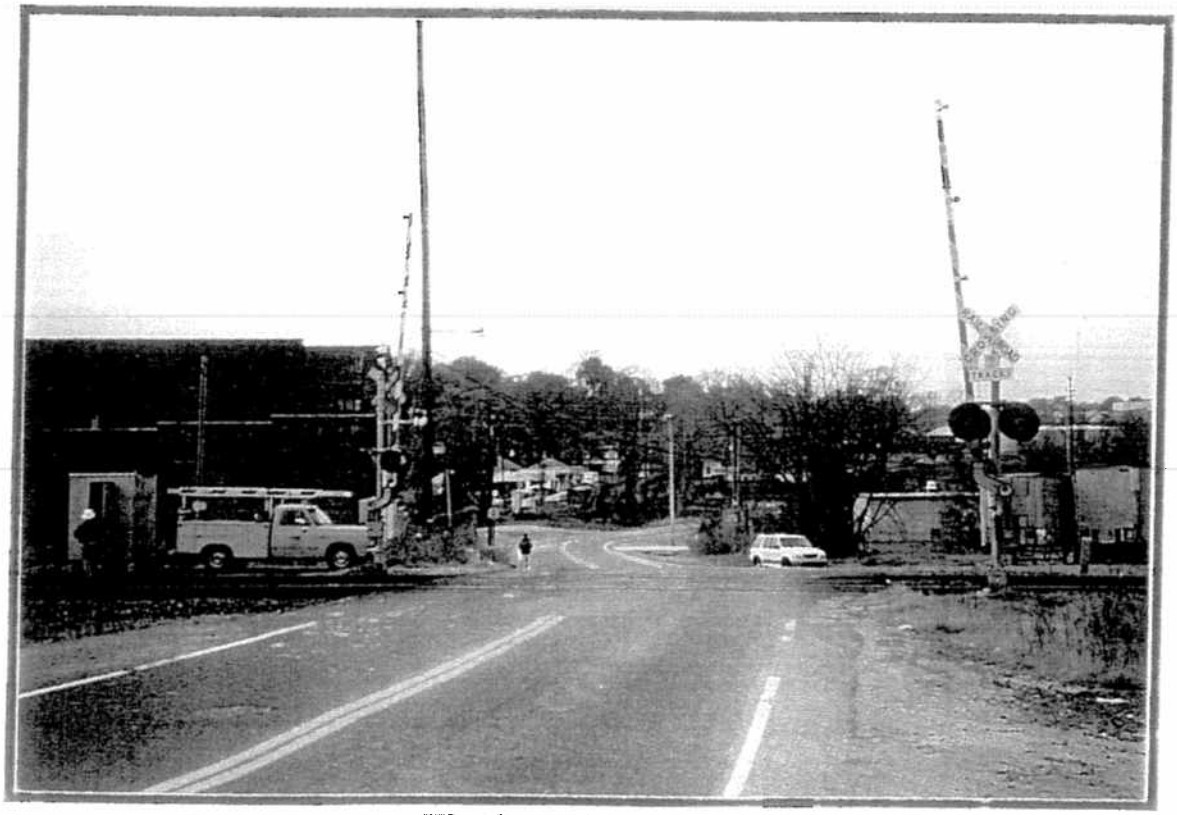
Westbound Approach

Municipality: Concord

Crossing Number: 715319H *Street Name:* Corban Ave.



Eastbound Approach

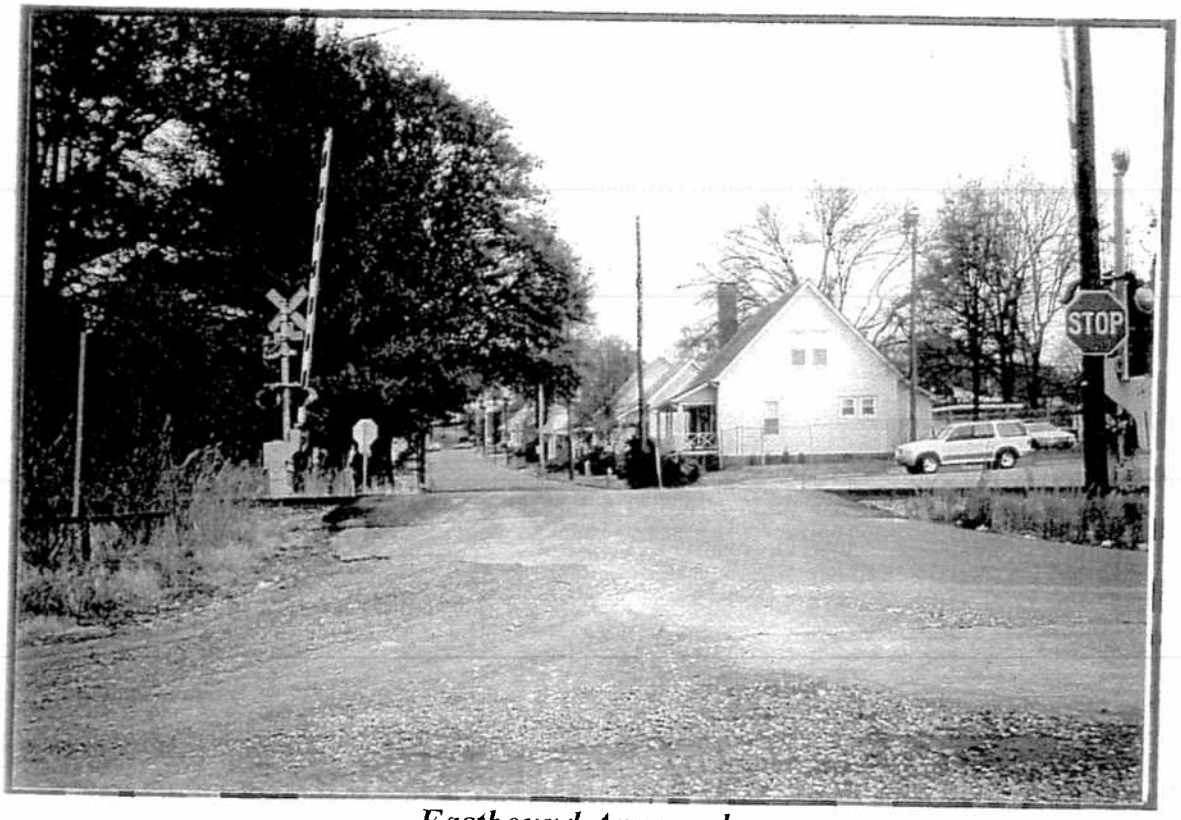


Westbound Approach

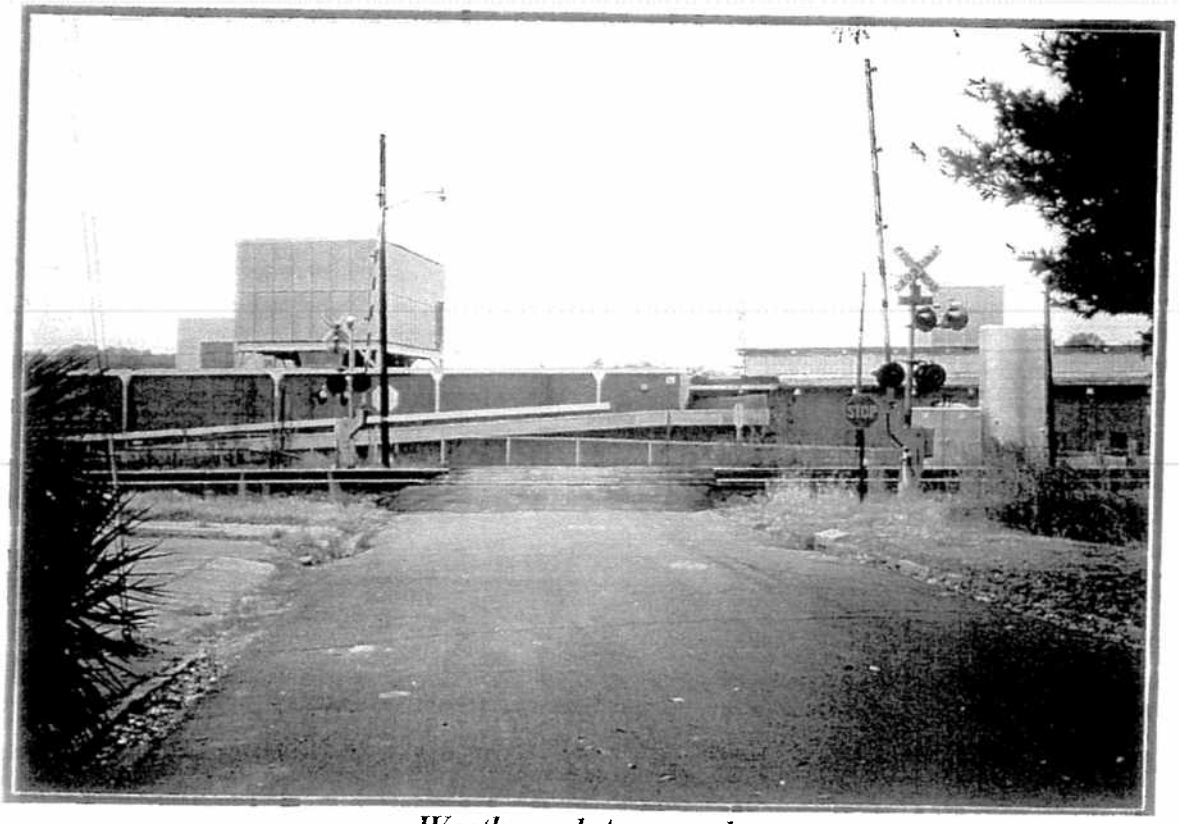
FIGURE 3

Municipality: Concord

Crossing Number: 715419L *Street Name:* Meisenheimer Dr.



Eastbound Approach

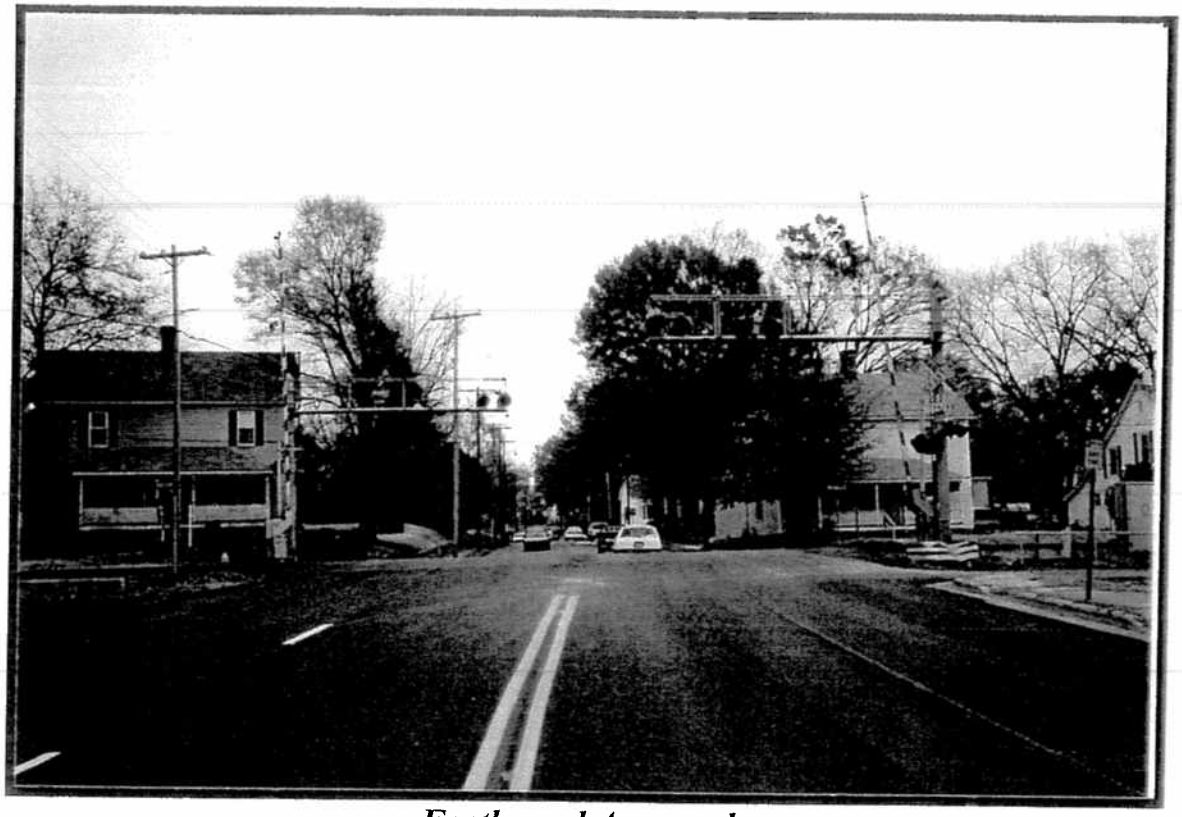


Westbound Approach

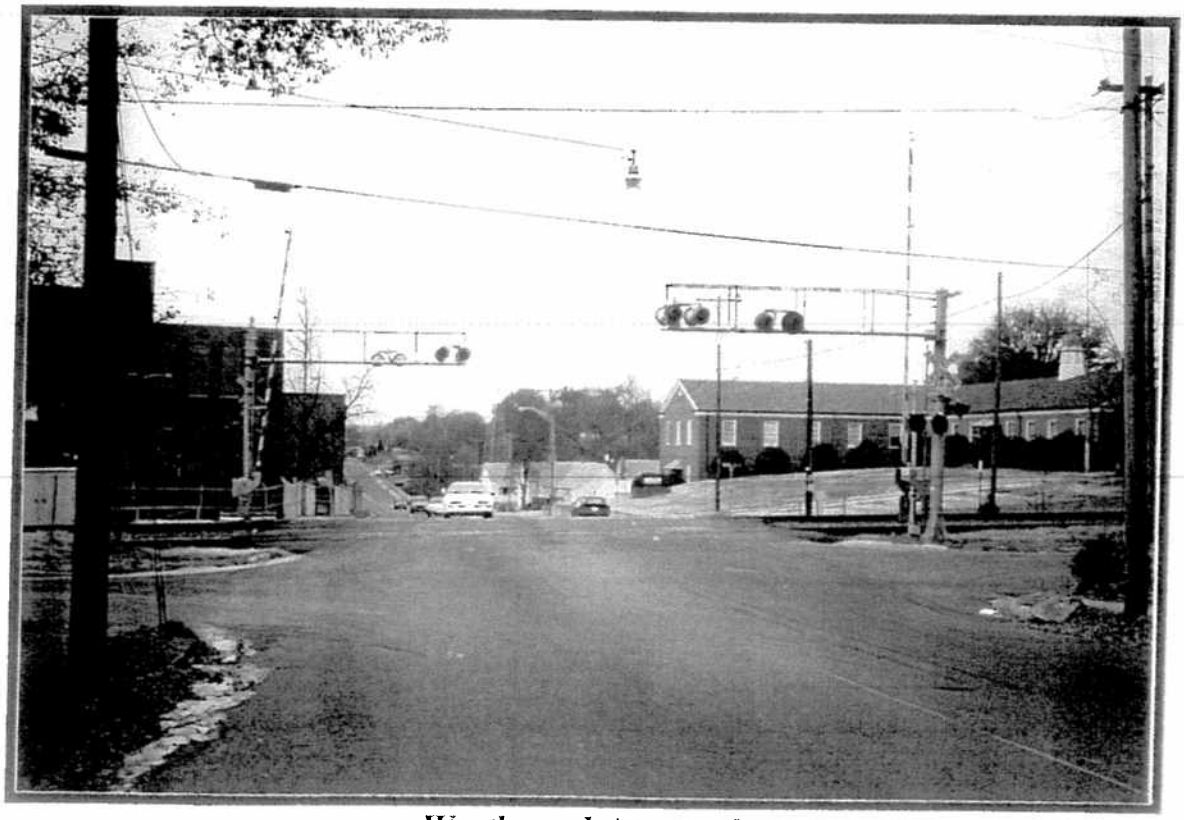
FIGURE 5

Municipality: Concord

Crossing Number: 715418E *Street Name:* McGill St.



Eastbound Approach



Westbound Approach

FIGURE 7

Municipality: Concord

Crossing Number: 724415J *Street Name:* Winecoff Ave.

Eastbound Approach

Westbound Approach

FIGURE 9