TRAFFIC SEPARATION STUDY

FOR

HARRISBURG, NORTH CAROLINA

AND

THE NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

RAIL DIVISION

ENGINEERING AND SAFETY BRANCH

VOLUME V

PREPARED BY

GANNETT FLEMING CORDDRY AND CARPENTER, INC.
ENGINEERS AND PLANNERS
CHARLOTTE, NORTH CAROLINA

AUGUST, 1997

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

EXECUTIVE SUMMARY
TRAFFIC SEPARATION STUDY
HARRISBURG, NORTH CAROLINA

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 NS will increase due to the division of CONRAIL routes between NS and CSX.

Vehicular traffic in the Greater Charlotte Metropolitan Area, which encompasses Harrisburg, will continue to increase as growth and expansion continues.

RECOMMENDATIONS:

Near-term

- Install long-gate arms at **Caldwell Road** $15,000.00
  Widen approaches/resurface $40,000.00
- Widen approaches/install median barrier at **Robinson Church Road** . . . $10,000.00
- Close the **Hickory Ridge Road** crossing $8.000.00
  Remove pavement/install barricades/landscape $6,000.00
- Install long gate arms at the **Shamrock Road** crossing $15,000.00
- Re-align the **Pharr Mill Road** intersection $250,000.00

Mid-term

- Close **Millbrook Road** and build connector to **Caldwell Road** $578,000.00

Long-term

- Build an overpass at **Caldwell Road** $2,650,000.00
- Extend **Morehead Road** with an overpass at **NS** $4,700,000.00
  Extend **Industrial Park Drive** to connect to **Stallings Road** $1,670,000.00

Close the **Robinson Church Road** crossing $8,000.00

- Close the **Shamrock Road** crossing/connect to **Southern Loop** . . . . . TBD

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

PURPOSE OF THE STUDY

The **Town of Harrisburg** 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 (NS) Railway** in **Harrisburg.** 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 in Harrisburg and two that will be annexed into the Town on September 30, 1997.

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 Harrisburg Study

Harrisburg is served by the NS mainline railroad* which extends from Raleigh to Charlotte

*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%).

and points north and south. Daily train movements over the six crossings included in this study, range from a high of 38 at Pharr Mill Rd. to 34 from Millbrook Rd. north to Shamrock Rd. Vehicular crossing volumes range from less than 200/day at Millbrook Rd. to almost 10,000 per day on Robinson Church Rd. **See Figures 1-4.**

Accidents are a problem at two of the crossings with fatalities having occurred at Caldwell Rd. and Hickory Ridge Rd. in the last ten years.

The evaluation of the Harrisburg 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 Pharr Mill Rd. crossing to the signalized intersection of NC 49/Pharr Mill Rd., a Level of Service (LOS) analysis was conducted for this intersection.

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

- Data was collected from the Cabarrus County School System, the Town of Harrisburg, 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.

- 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 eight (8) crossings.

- Include preliminary cost estimates for recommended improvements.

EXISTING TRANSPORTATION SETTING

The Town of Harrisburg is located just east of the Cabarrus/Mecklenburg County line in Cabarrus County. The population continues to grow due to developmental impacts from both Cabarrus and Mecklenburg Counties. The current population is approximately 2,200 and is expected to approach 3,000 with the September, 1997 annexation.

Rail traffic along the NS continues to grow with a major multi-modal facility located in Charlotte as well as the expansion of NCDOT sponsored rail passenger service in the corridor.

Of the six (6) roads evaluated, Caldwell Rd. is the only major thoroughfare and Robinson Church Rd. is a minor thoroughfare in the vicinity of the crossing. Hickory Ridge Rd. is a minor thoroughfare south of Stallings Rd. Millbrook Rd. provides access to both residential and industrial properties, while Shamrock serves mostly rural land uses. Pharr Mill Rd. provides access to both industrial and rural land uses. There are no paralleling roadways providing connectivity with the exception of Railroad St. and Stallings Rd. which connect Robinson Church Rd. and Hickory Ridge Rd. west and east of the railroad respectively.

The only crossing with a nearby traffic signal is Pharr Mill Rd. which has a signal at its intersection with NC 49.

Norfolk Southern (NS) operates a single main line track over all the crossings. Operating speeds range from 40 to 50 MPH for merchandise trains, 60 MPH for intermodal, and up to 79 MPH for passenger trains.

EVALUATION CRITERIA

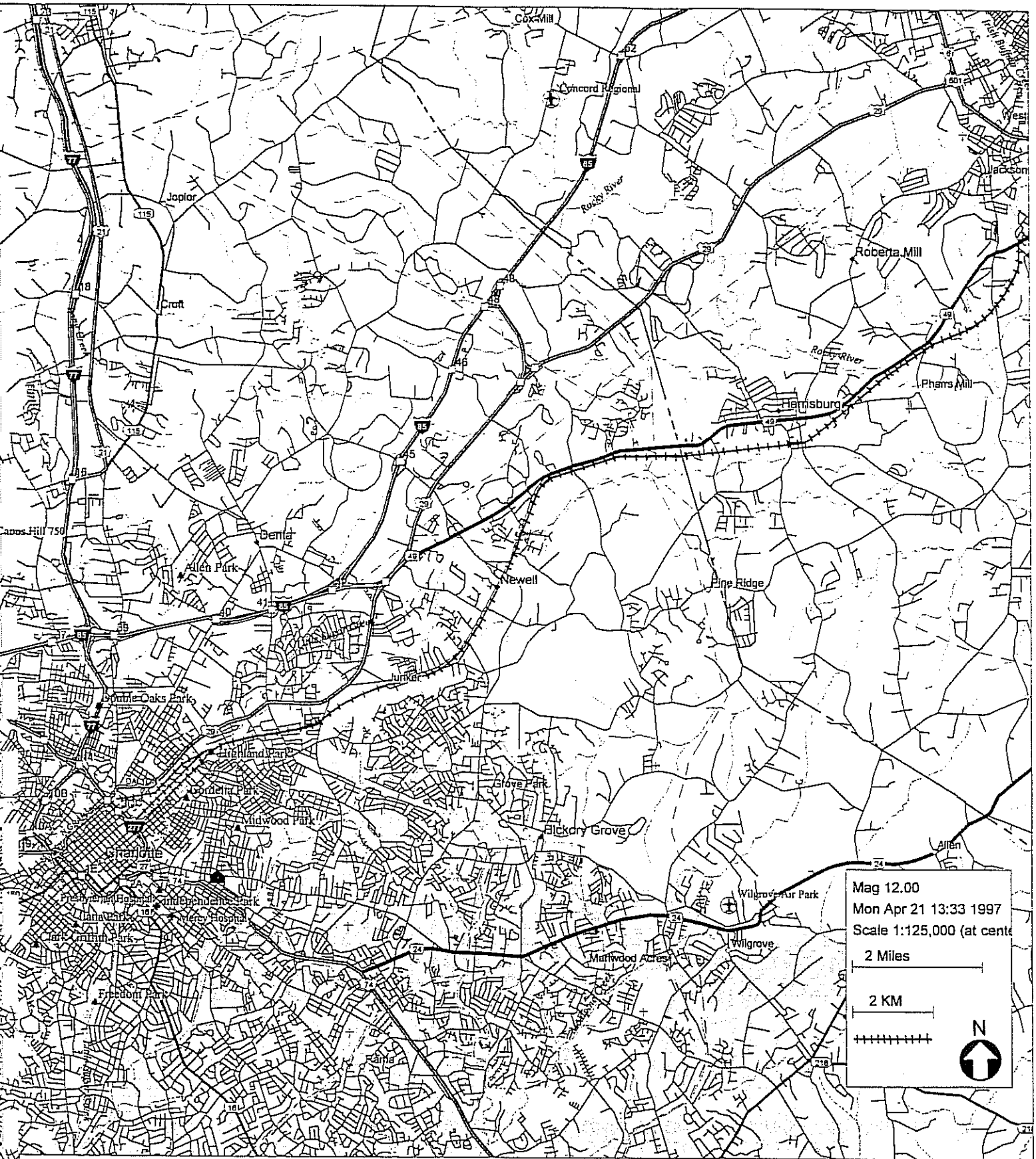
All crossings were initially evaluated using the criteria developed for the NCDOT rail crossing closure program.

Criteria used in evaluating the Harrisburg crossings include:

- Accident history

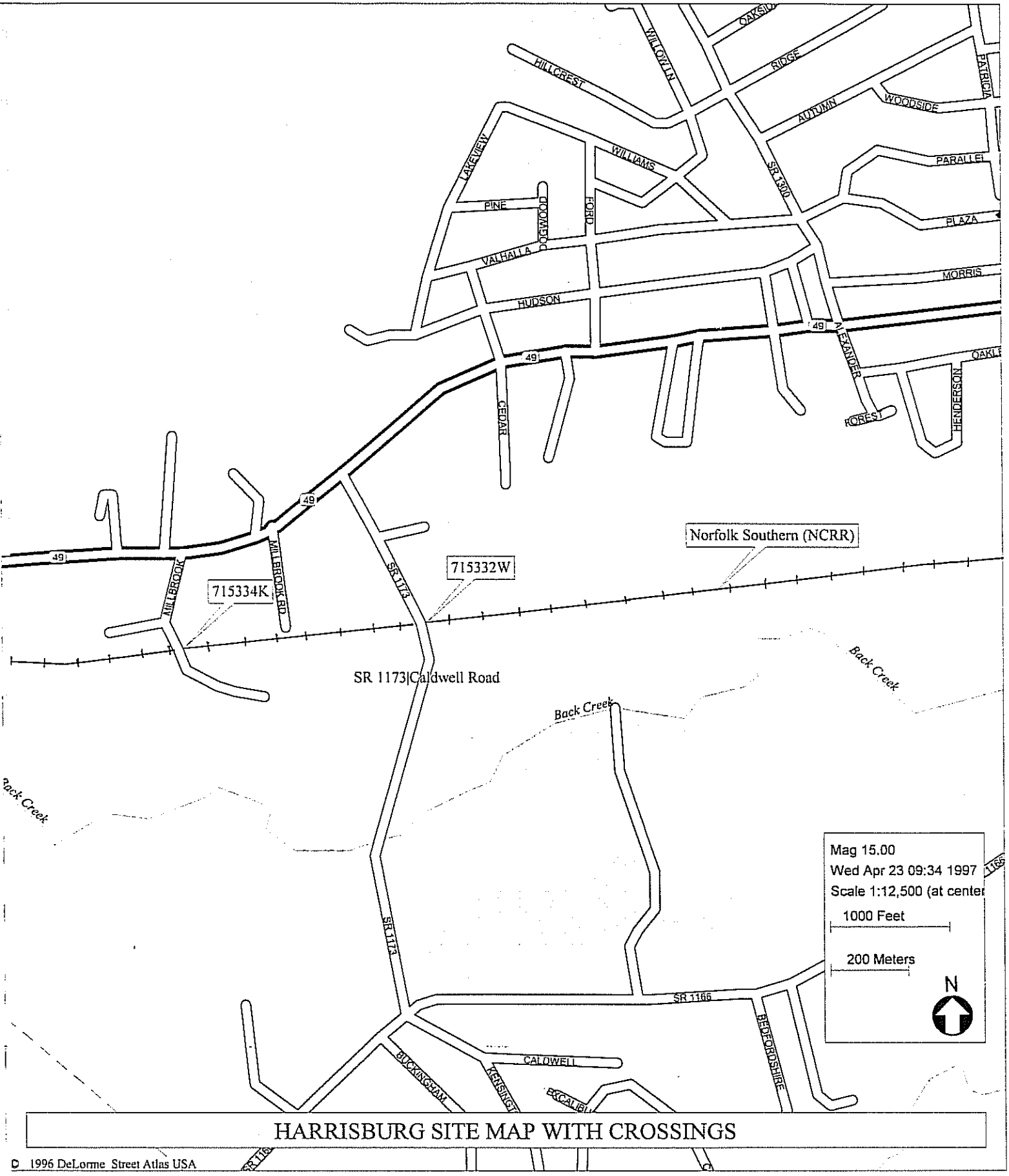
  This report utilizes the accident classification system developed by the Institute of Transportation Engineers and in general use around the country. Under this system, accidents are classified as follows:

  - K - Killed
  - Class A - Injured and transported to hospital
  - Class B - Injured and treated at scene



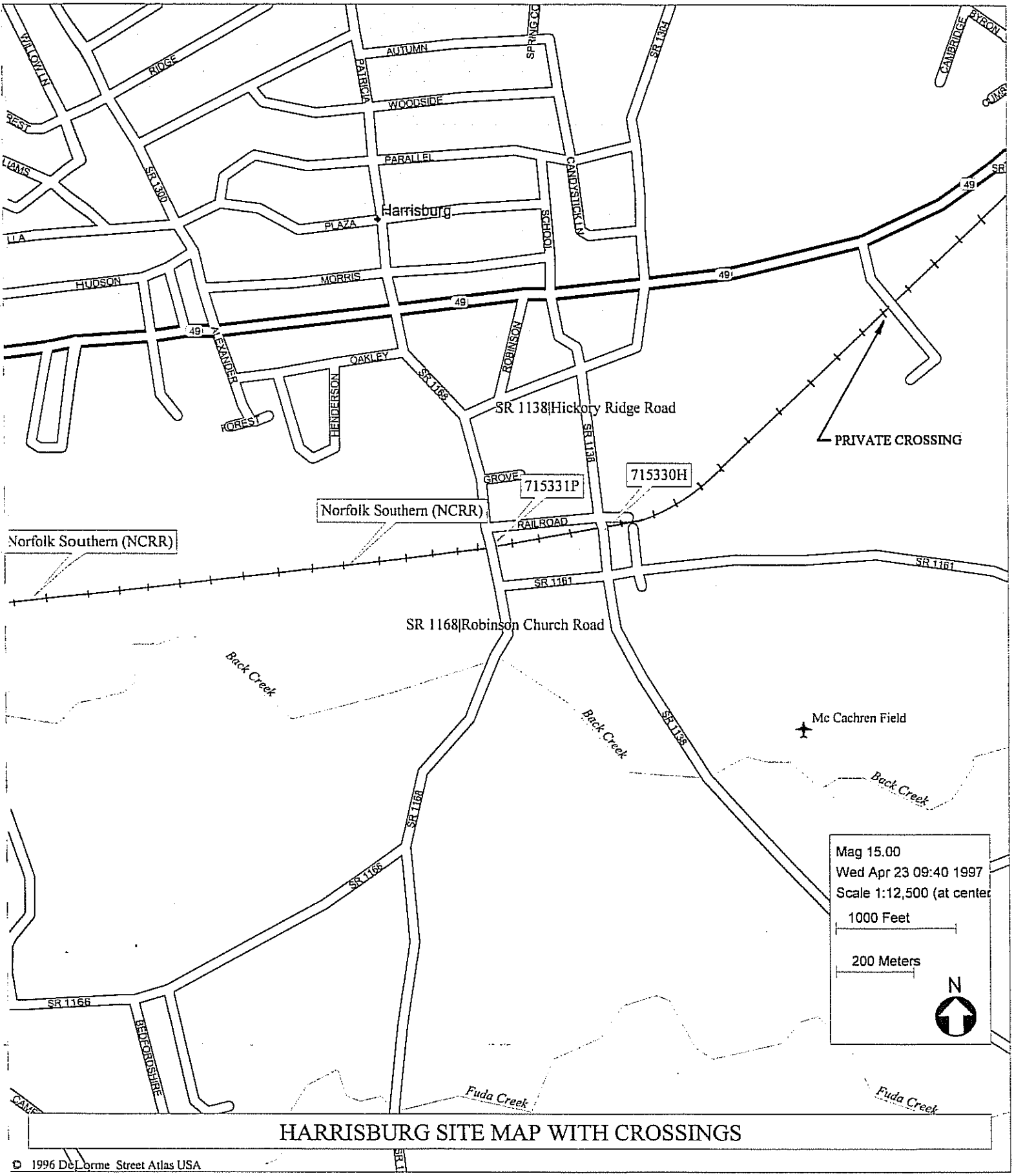
CHARLOTTE & HARRISBURG VICINITY MAP

FIGURE 1



HARRISBURG SITE MAP WITH CROSSINGS

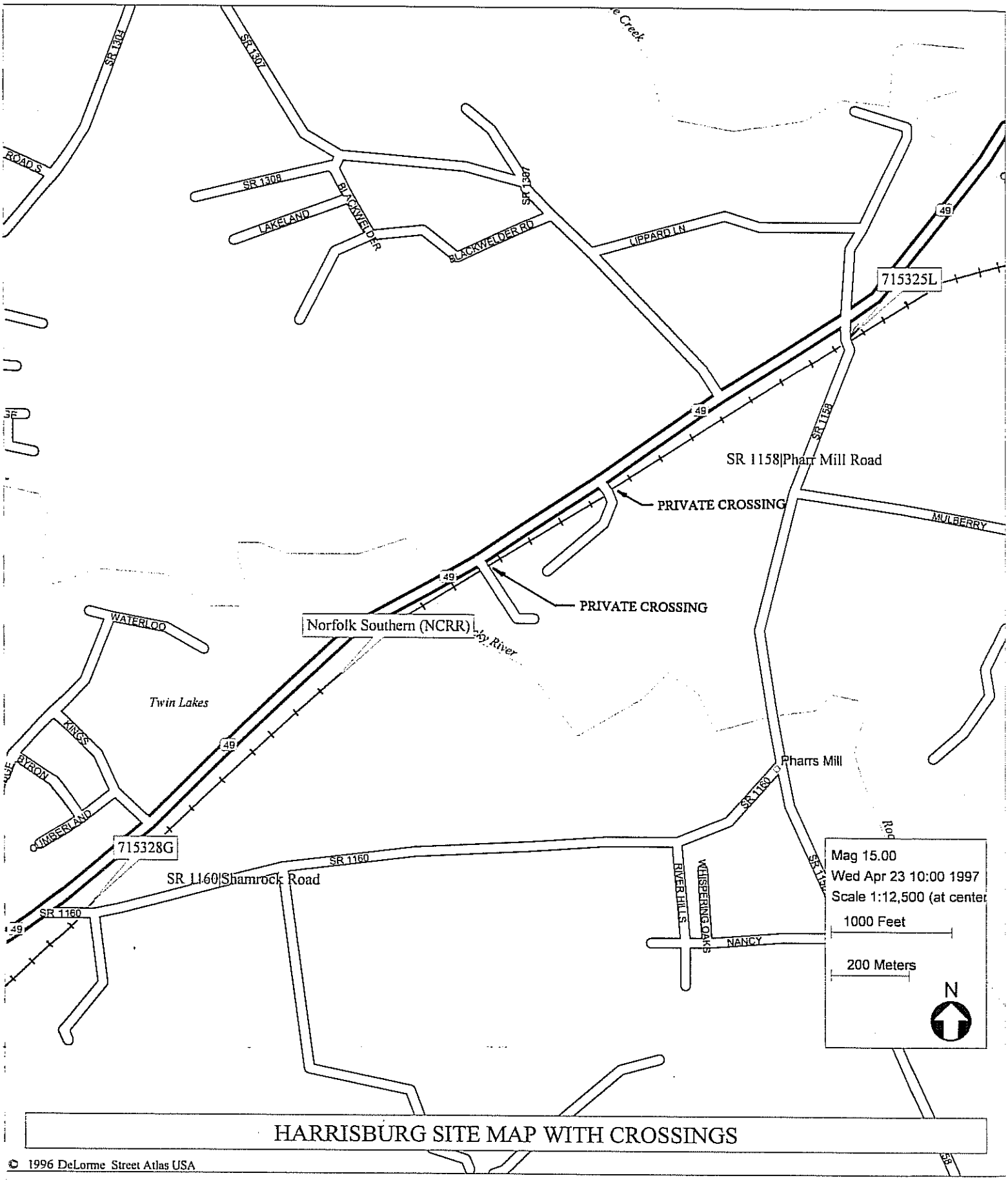
FIGURE 2



HARRISBURG SITE MAP WITH CROSSINGS

© 1996 DeLorme Street Atlas USA

FIGURE 3



HARRISBURG SITE MAP WITH CROSSINGS

FIGURE 4

- 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 NC 49/Pharr Mill 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	$>5 \leq 10$
C	$>10 \leq 20$
D	$>20 \leq 30$
E	$>30 \leq 45$
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 Harrisburg study area.

Signalized Intersections

A Level of Service analysis for the NC 49/Pharr Mill 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≤60
F	Unacceptable delay, frequently an indication of oversaturation (i.e. arrival flow exceeds capacity.)	>60

The results of the analysis for NC 49 and Pharr Mill Road is as follows:

1997 Volumes	Over Capacity
1997 Volumes-Modified Signal Timing	C*

1997 Volumes-Build (Add NB through lane)	B
1997 Volumes-Build (Convert RTOL to Through/RT)	B
2010 Volumes-Build (Add NB through lane)	B

* With the modified timing, the overall intersection will operate at **C**, however, the northbound movement will be at **LOS D.**

Traffic Volume

Based on the 24-hr. traffic volumes, the 6 at-grade crossings in Harrisburg rank in terms of vehicles served:

1. Robinson Church Rd. (SR-1166)	9,200 VPD (Minor thoroughfare)
2. Hickory Ridge Rd. (SR-1138)	3,400 VPD
3. Caldwell Rd. (SR-1173)	2,600 VPD (Thoroughfare)
4. Pharr Mill Rd. (SR-1158)	1,670 VPD
5. Shamrock Rd. (SR-1160)	1,050 VPD
6. Millbrook Rd. (SR-1182)	180 VPD

Accident History

Three of the crossings have had train-vehicle collisions over the last ten years for which records are available. Caldwell Rd. has had a total of five with one fatality in 1986. A fatality occurred at the Hickory Ridge crossing in 1992 and Millbrook Rd. had a Class A injury accident (transported to hospital) in 1990.

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

Utilizing these numbers, the accidents during the recorded 10 years in Harrisburg, have cost the community, in addition to the pain and suffering of the survivors, nearly $6,000,000.00.

MENU OF AVAILABLE TRANSPORTATION SYSTEM ENHANCEMENTS

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

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.	10 YR ACCIDENT HISTORY (NUMBER) 1984-95	SCHOOL BUS ROUTE (Y/N)	EMER-GENCY ROUTE (Y/N)
715325L	NS	Hsbg (NR)	Pharr Mill	NCDOT	1158	Local	5	1670	8300	38	0	Y	Y
715328G	NS	Hsbg (NR)	Shamrock	NCDOT	1160	Local	5	1050	1400	34	0	Y	Y
715330H	NS	Hsbg	Hkry. Ridge	NCDOT	1138	Local	5	3400	4000	34	1(K) (92)	Y	Y
715331P	NS	Hsbg	Rob. Ch.	NCDOT	1166	Min. Th'fare	5	9200	7000	34	0	Y	Y
715332W	NS	Hsbg	Caldwell	NCDOT	1173	Thoroughfare	5	2600	6000	34	5(1K)(86)	Y	Y
715334K	NS	Hsbg	Millbrook	NCDOT	1182	Local	5	180	—	34	1	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 (HARRISBURG)

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								
Pharr Mill	Y	3	Y	Poor	Fair	N	N	Ind	High	Markings	Med	High	Low
Shamrock	N	1	N	Poor	Fair	N	Y	Rural/Res	High	—	High	Med	Low
Hkry. Ridge	N	1	N	Poor	Poor	Y	Y	Mixed	Low	Markings	Low	High	Low
Rob. Ch. Rd.	N	1	N	Poor	Poor	N	Y	Mixed	High	Markings	Low	High	Low
Caldwell	Y	3	Y	Fair	Fair	N	Y	Ind/Rural	High	—	Low	High	High
Millbrook	N	5	N	Poor	Poor	N	Y	Res/Comm	Low	Signs	High	High	Low

The 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 Harrisburg are protected as follows:

Millbrook Rd.	Flashing signals, bells & gates
Caldwell Rd.	Flashing signals, bells, & gates
Robinson Church Rd.	Flashing signals, bells, & gates

Hickory Ridge Rd.	Flashing signals, bells & gates
Shamrock Rd.	Flashing signals, bells & gates
Pharr Mill Rd.	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 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
Warrant 9 - Four hour volumes
Warrant 10 - Peak hour delay
Warrant 11 - Peak hour volume

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

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 nearby presence of NC 49, as well as the traffic signal at Pharr Mill Rd. and NC 49, the potential for vehicles to que across the tracks exists and will be more likely to occur as traffic volumes increase (the distance between the edge of pavement on NC 49 and the nearest rail is less than 100 feet.).

- Traffic Signal Preemption

Preemption of the nearby traffic signal by train operations is in place at NC 49 and Pharr Mill Rd. Field observations show the equipment to be operating properly.

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. Other than the one described immediately above, no other crossings meet this criteria.

- 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').

With the exception of Caldwell Rd. and Pharr Mill Rd., all the Harrisburg crossings are slightly humped. However, none appear to be causing problems for motorists in negotiating the crossing.

- 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 crossings in the Harrisburg Study have recently been reworked and are in good condition. There was no evidence of vehicles dragging at the crossings.

- 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. No incidents of this type were observed at any of the Harrisburg crossings during the time spent gathering field data.

- 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 reworking of all the grade crossings with the exception of Shamrock Rd., pavement markings need to be replaced at all crossings.

- Roadway Improvements

Widening - Millbrook Rd. with eight foot lanes, and Caldwell Rd. and Shamrock Rd. with nine foot lanes should be widened to 11 foot lanes on both approaches.

Grade - The approach grades on all crossings are such as to not warrant any recommendation for changes at this time. The NCDOT has recently reworked the approach grades on both Hickory Ridge Rd. and Robinson Church Rd.

- 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. For the Harrisburg study, previously reported grade separations at Caldwell Rd. and Morehead Rd. connecting to Robinson Church Rd. which will be discussed in the Recommendations Section of this report.

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 NS mainline were not considered.

- Other Mobility Factors

  - All crossings included in this report, except Millbrook Rd., are used on a daily basis by the Cabarrus Co. School System. The Cabarrus Co. Emergency Services routinely uses Millbrook Rd., Robinson Church Rd. and Pharr Mill Rd.

  - Future projects included on the **Kannapolis-Concord Thoroughfare Plan** that will impact recommendations in this report include:

    1. Proposed **Caldwell Rd.** grade separation at the **NS.**

    2. Proposed **Morehead Rd. Extension** and grade separation at the **NS.**

    3. Proposed **Harrisburg Southern Loop.**

  - The only project currently included in the **NCDOT TRANSPORTATION IMPROVEMENT PROGRAM** that will impact any of the recommendations included in this report is Project #R-2533 which is discussed on Page 30.

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 NS will increase due to the division of CONRAIL routes between NS and CSX.

Vehicular traffic in the Greater Charlotte Metropolitan Area, which encompasses Harrisburg, will continue to increase as growth and expansion continues.

RECOMMENDATIONS

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

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

I. Millbrook Rd.

A dead-end street serving industrial and residential property and carrying less than 200 vehicles per day. It is recommended that the crossing be closed and the portion of the road that remains south of the tracks be extended easterly +/- 1,400 feet to connect with Industrial Park Dr. at Caldwell Rd. **See Figures 5 and 6.**

Mid-Term Recommendation - Close crossing and extend easterly remainder to connect to Caldwell Road.

Estimated cost $578,000.00

Impacts of Recommendation: To implement this recommendation will have negative impacts in that approximately 2 acres of privately held property will be placed into public right of way. Also, those property owners east of the tracks will have to drive approximately .7 miles in order to access NC 49 and travel time will increase by about two minutes. However, the overall impacts of the closing are positive. A low-volume grade crossing of a high-speed rail corridor will be eliminated as well as the potential for rail/highway collisions. Closing the crossing will also eliminate the noise impacts associated with the blowing of train horns and the implementation of the **Piedmont High Speed Rail Corridor** will be enhanced. Approximately 2800 linear feet of roadway frontage will be created for property which does not now have direct access to a public street.

It is further recommended that the **Town of Harrisburg** include the extension of **Millbrook Rd.** to **Caldwell Rd.** on its local planning maps such that the proposed right of way is protected from encroachment by future development.

II. Caldwell Rd.

A Major Thoroughfare on the Thoroughfare Plan for the Concord-Kannapolis area. Current traffic volumes are 2,600 vehicles per day with 2,020 volumes expected to reach 6,000 VPD.

Four accidents have occurred at this crossing in the ten year period, but none have been reported since 1990.

Near-term Recommendation: the existing pavement on the **Caldwell Rd.** approaches to the crossing are only 18 feet wide. Also, the crossing is obscured somewhat, especially on the eastbound approach, by a high bank and heavy foliage. It is recommended that the **Division Engineer** give consideration to widening the roadway to a standard 24 feet at such time as **Caldwell Rd.** is programmed for resurfacing. As part of the **NCDOT Rail Division's "Sealed Corridor Program"** it is recommended that long-gate arms be installed at the crossing to deal with the sight-distance problem and to prevent motorists from driving around lowered gates at the crossing.

Estimated Cost:

Widening and resurfacing $40,000.00
Long-gate Arms $15,000.00

Long-Term Recommendation - In order to accommodate the goals of the **High Speed Rail Corridor**, it is recommended that a grade separation structure be planned to allow Caldwell Rd. to overpass the NS. In order to accomplish this recommendation, a concept plan should be developed such that project limits and right-of-way requirements can be established and more detailed cost estimates prepared.

Estimated Cost $2,650,000.00

See Figures 7 and 8.

Impacts of Recommendation: If a preliminary plan for the separation can be developed soon enough (less than 2 years), then most of the negative impact associated with the recommendation can be eliminated. While there will be privately held property required for public right of way, most of the impacted area is currently undeveloped and with an approved plan, the development that does come can accommodate the project. The most significant benefit again, however, is the elimination of a grade crossing of a high-speed rail corridor.

III. Robinson Church Rd./Hickory Ridge Rd.

The Harrisburg Thoroughfare Plan proposes an extension of Morehead Rd. from NC 49 southerly to connect with Robinson Church Rd. at Tom Query Rd. It also proposes that Industrial Park Dr. be extended easterly to connect with the proposed Morehead Rd. Extension and Stallings Rd. at Robinson Church Rd.

It is recommended that:

- Robinson Church Rd. and Hickory Ridge Rd. be closed at the NS.
- Morehead Rd. be extended as described above and a grade separation be built at the NS.
- Industrial Park Dr. be extended from its easterly end to connect to Stallings Rd. at Robinson Church Rd.

Near-term Recommendation:

Close Hickory Ridge Road crossing.
Widen approaches on Robinson Church Rd. and install median barrier.

Estimated Cost:

Hickory Ridge Rd.	
Crossing removal	$8,000.00
Pavement removal/barricades/restoration/landscaping	$6,000.00
Robinson Church Rd.	
Widen approaches/Install median barrier	$10,000.00

Long-Term Recommendation:

1. Build Morehead Rd. Extension
2. Extend Industrial Park Dr.
3. Close Robinson Church Rd. Crossing

See Figures 9 - 12.

Costs:

Morehead Rd. Extension	$4,700,000.00
Industrial Park Dr. Extension	$1,670,000.00
	$6,370,000.00

Impacts of Recommendation:

Near-Term: The closing of Hickory Ridge Rd. will have minor short-term negative impacts in that motorists will have to modify driving habits and patterns. However, the increased travel distance for those wishing to access property either side of the crossing is less than one-half mile. The positive impacts of the recommendation are significant in that a grade crossing of a high-speed rail corridor is eliminated along with the potential for rail/highway collisions. The closing also eliminates the noise impacts associated with the blowing of train horns.

Long-Term: The most significant negative impact of extending Morehead Rd. and building a grade-separation structure at the NS as well as extending Industrial Pard Dr to Stallings Rd., is the loss of privately held land to public right of way. Approximately 11 acres of land will be required to accommodate both extensions. Also, the flood plain of Back Creek will be impacted by both projects and mitigation techniques must be considered in project development.

The positive impacts of the projects are considerable in that two at-grade crossings of a high-speed rail corridor can be eliminated along with the potential for rail/highway collisions. Also, considerable development opportunities should accrue to the community at-large in that a substantial amount of under-utilized property will receive roadway access.

IV. Shamrock Rd.

The Harrisburg Thoroughfare Plan calls for Shamrock Rd. to be closed at the NS and extended southerly to connect to the proposed Southern Urban Loop (a major thoroughfare on new location).

Current traffic volumes on Shamrock Rd. are less than 1,100 VPD. While there have been no reported accidents at the crossing, the intersection of the roadway and the railroad are severely skewed (+/- 30°) which creates an unacceptable sight-distance problem for approaching motorists. Due to the crossing angle, drivers on either approach have to turn their heads sharply to view a train approaching from the right. In that the Shamrock Rd. crossing is ultimately to be eliminated as the Harrisburg Thoroughfare Plan is implemented, rather than reconstruct the crossing to a 90 degree angle, a less expensive near-term solution is to install long-gate arms at the crossing.

Near-Term Recommendation:

Install long-gate arms at the crossing

Estimated Cost: $15,000.00

Long-Term Recommendation:

At such time as the **Harrisburg Southern Loop** is in place, the **Shamrock Road** crossing should be closed at the **NS** and **Shamrock Road** extended southerly to connect with the **Loop.**

See Figures 13 and 14.

V. Pharr Mill Rd.

Current traffic volumes at the crossing are less than 2,000 vehicles per day (1,670) with

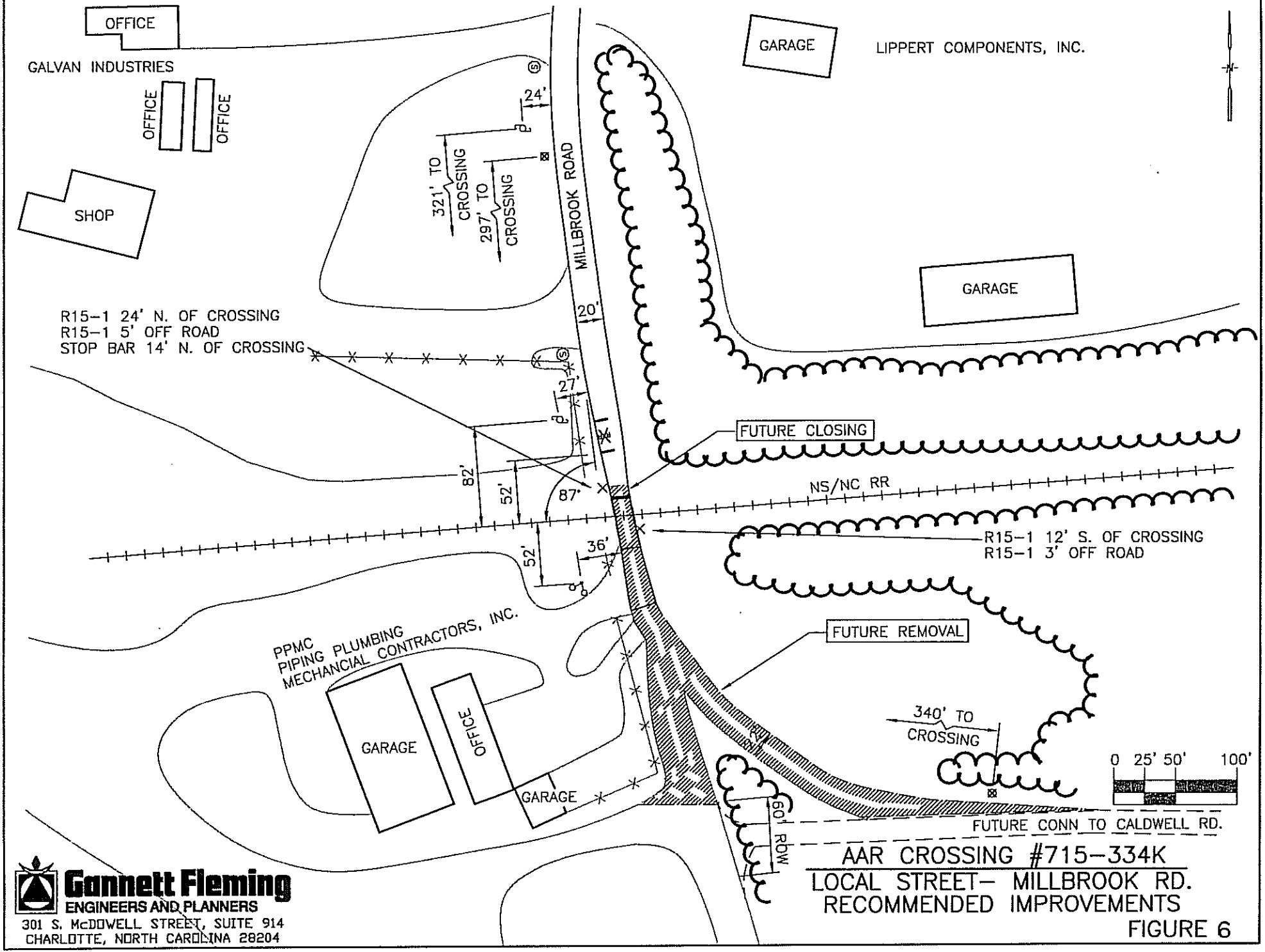
2020 volumes projected to reach 8,300. There have been no reported accidents at the crossing over the last ten years. The NCDOT installed a traffic signal with railroad preemption at NC 49/Pharr Mill Rd. and it was functioning properly during the time of field investigation for this report. The Level of Service analysis shows the intersection to be operating in a congested mode (worse than Level F) in the P.M. peak. This is brought about by the heavy northbound through movement on NC 49. This problem can be corrected by the addition of another northbound through lane or by converting the exclusive right-turn-only lane into a shared through and right lane. To accommodate the additional through movement will require widening the southbound approach to the intersection approximately 500 feet on the east side.

Near-term Recommendation:

The **NCDOT Transportation Improvement Program** includes the widening of **NC 49 (Project No. R-2533)** from Harrisburg to the Yadkin River to a multi-lane facility with construction scheduled in 1998. This project should take care of the congestion problem at the Pharr Mill Rd. intersection. It is recommended, however, that the **NCDOT** give consideration to realigning the **Pharr Mill Rd. intersection with NC 49** such that Pharr Mill intersects NC 49 at a 90 degree angle as shown on **Figure 16.**

Estimated Cost: $250,000.00

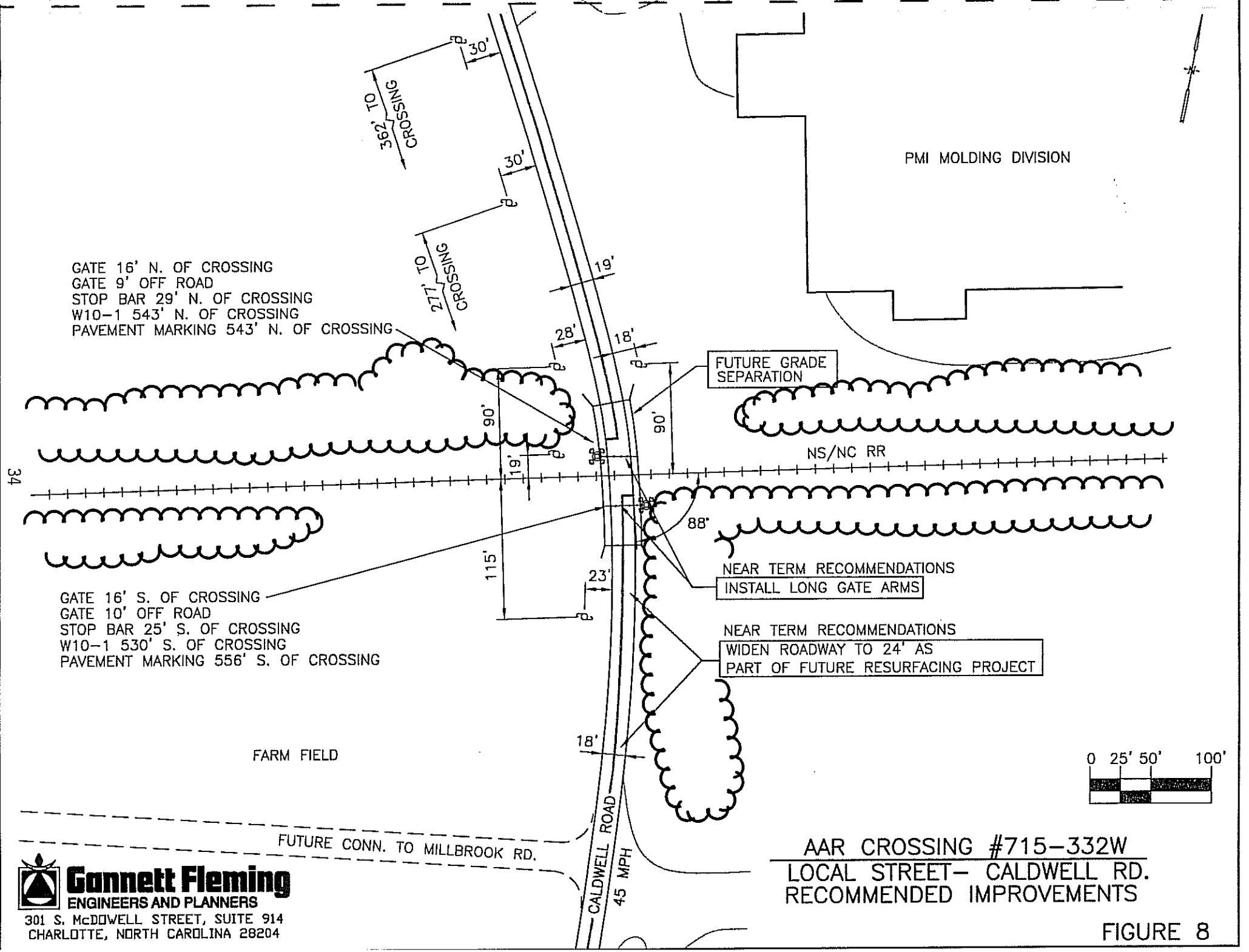
Impacts of Recommendation: The impacts of this recommendation are all positive. While it will require right of way to realign the intersection as currently configured, the existing right of way can be abandoned with the result being only a minor loss of private property to public right of way. Other positive aspects of the recommendation are that Pharr Mill Rd can intersect NC 49 at a 90 degree angle and the spur track crossing can be eliminated.



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

AAR CROSSING #715-334K
LOCAL STREET- MILLBROOK RD.
RECOMMENDED IMPROVEMENTS

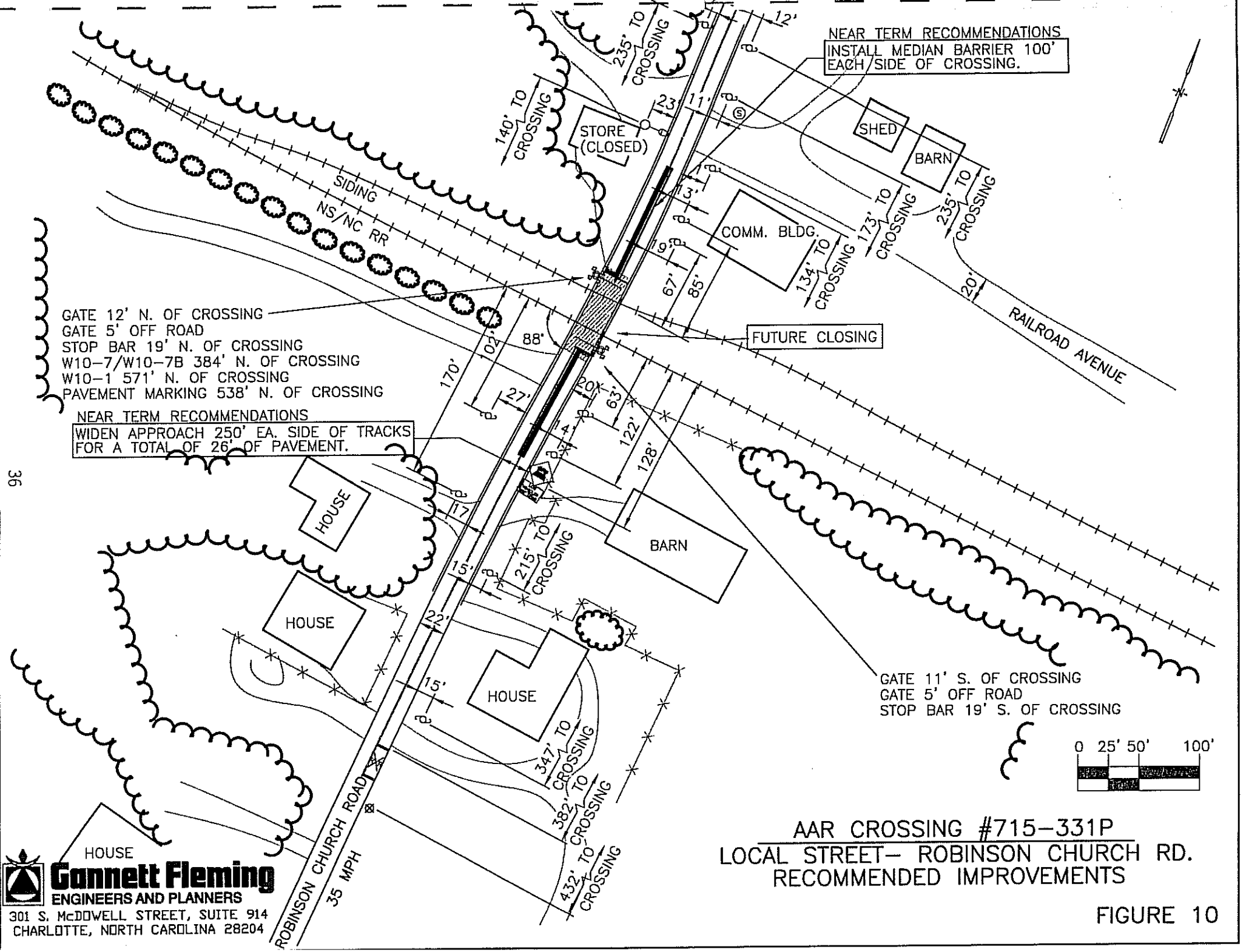
FIGURE 6



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

AAR CROSSING #715-332W
LOCAL STREET- CALDWELL RD.
RECOMMENDED IMPROVEMENTS

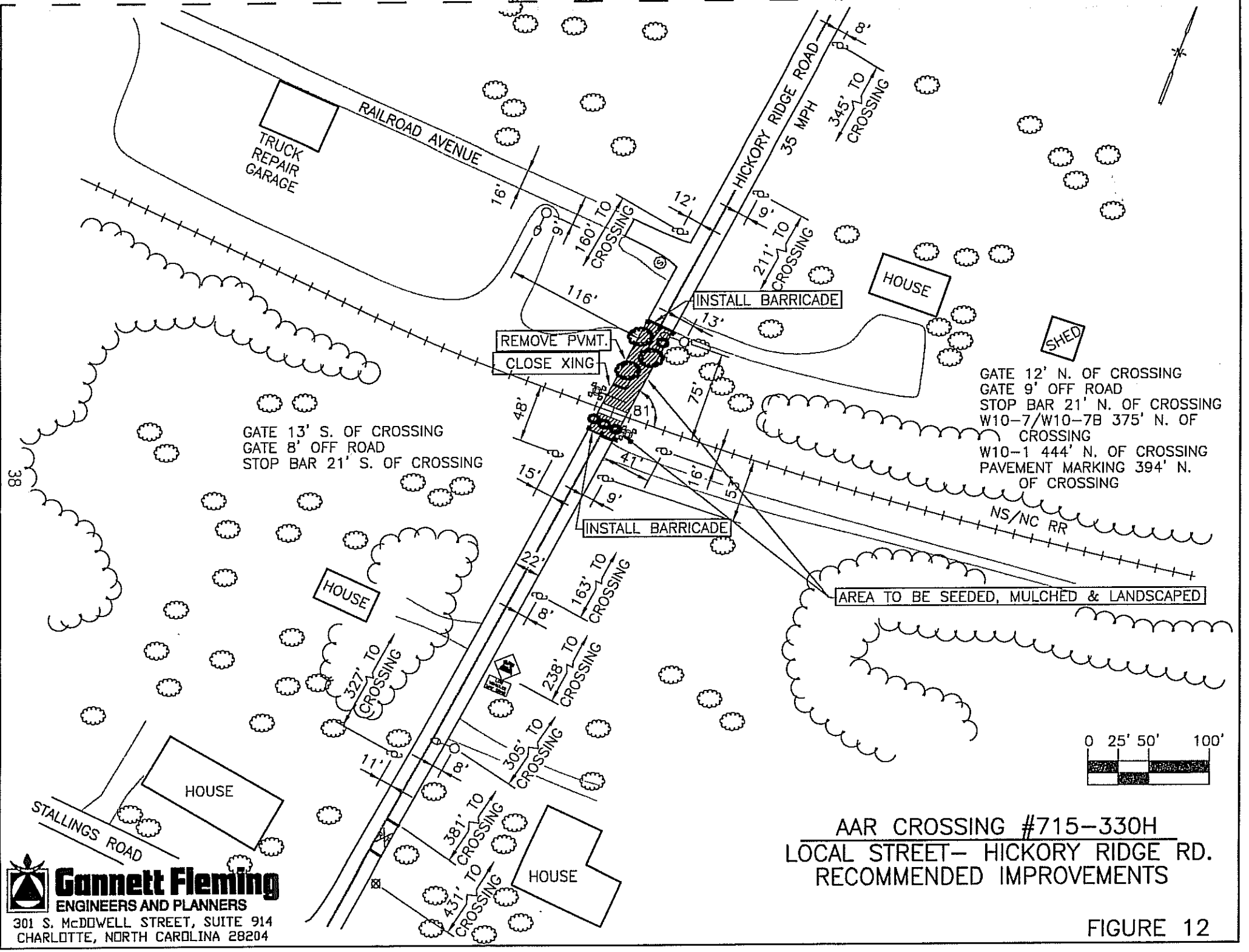
FIGURE 8



AAR CROSSING #715-331P
LOCAL STREET- ROBINSON CHURCH RD.
RECOMMENDED IMPROVEMENTS

FIGURE 10

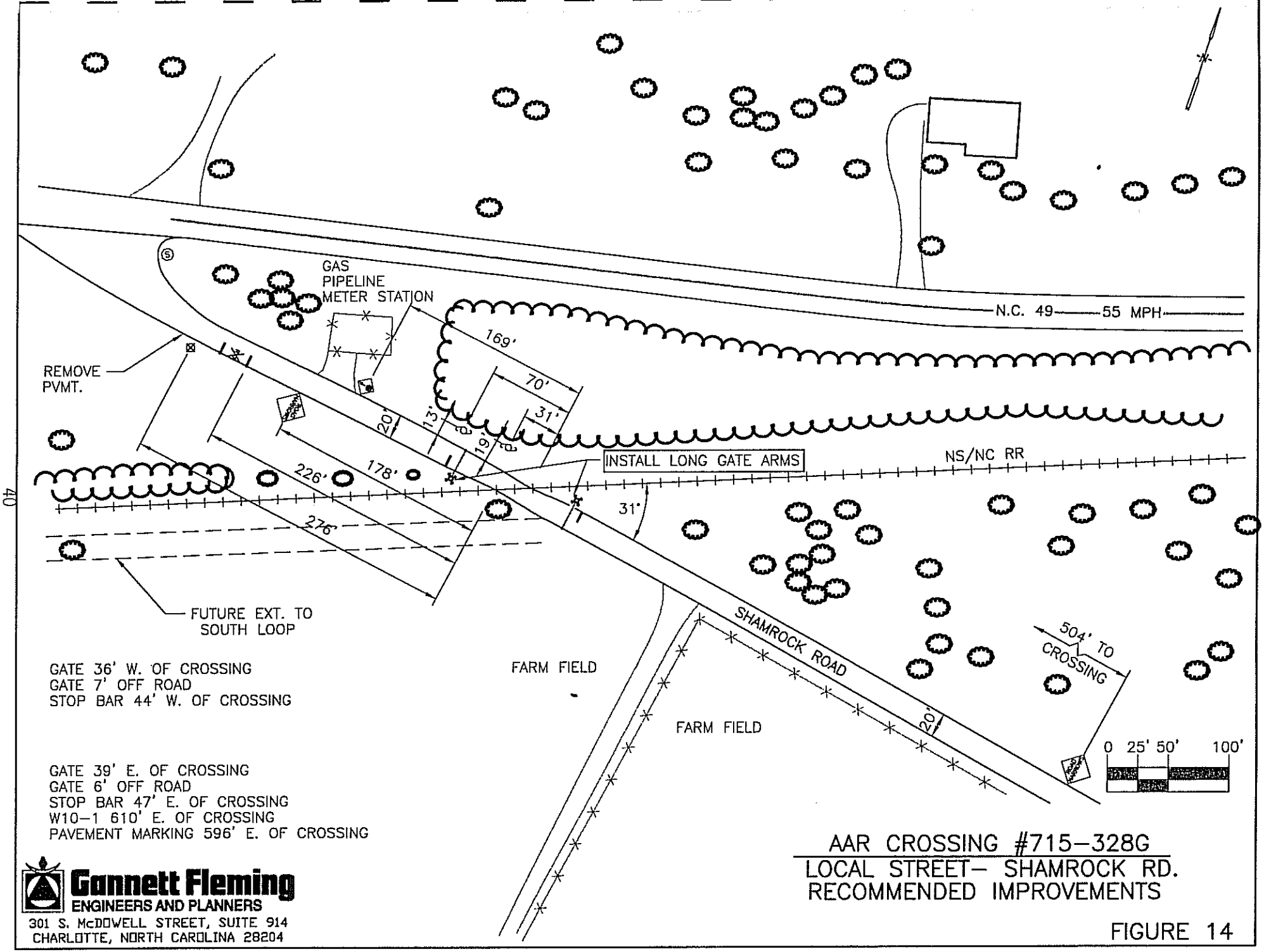
Gannett Fleming
ENGINEERS AND PLANNERS
301 S. McDOWELL STREET, SUITE 914
CHARLOTTE, NORTH CAROLINA 28204



AAR CROSSING #715-330H
LOCAL STREET- HICKORY RIDGE RD.
RECOMMENDED IMPROVEMENTS

FIGURE 12

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

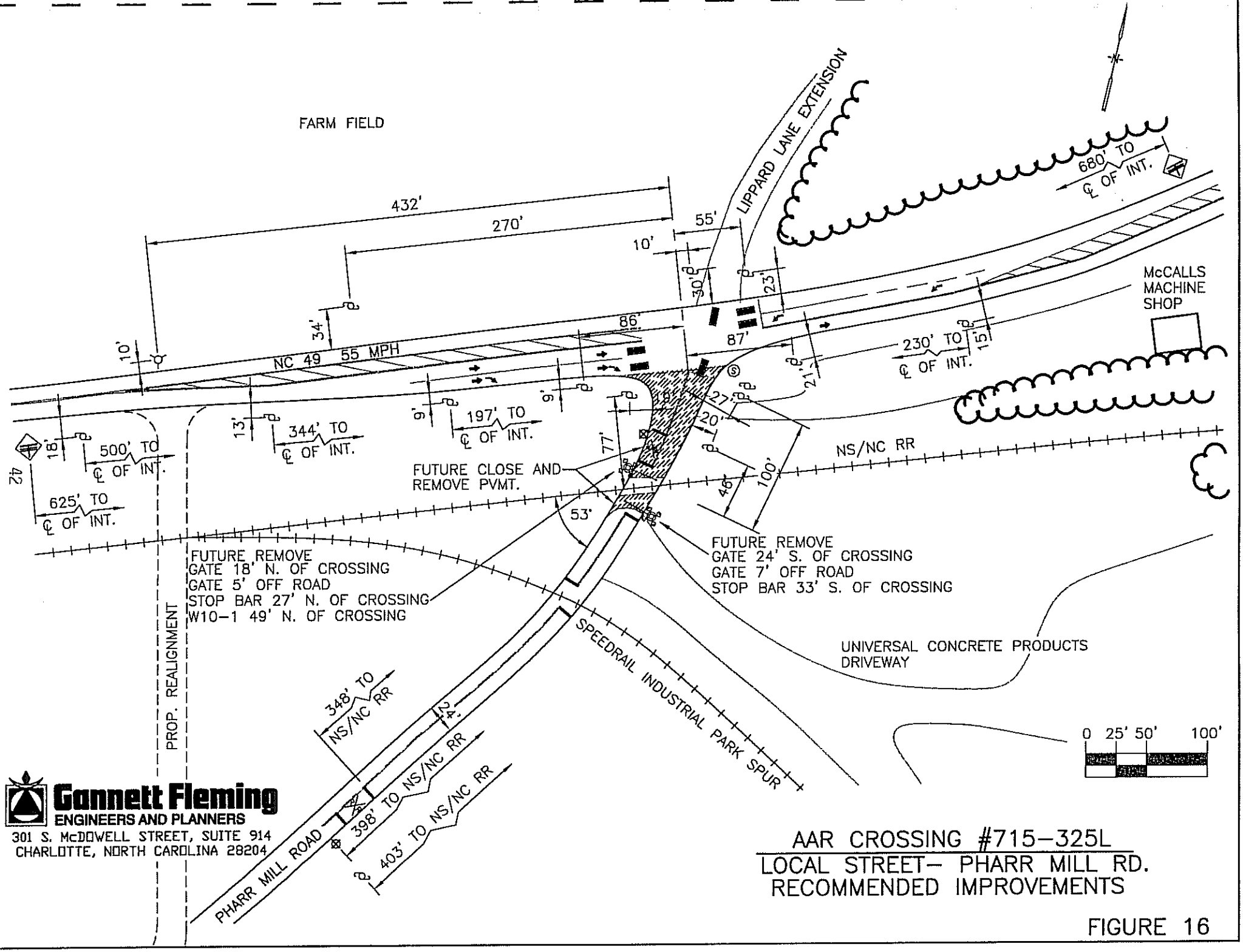


40

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

AAR CROSSING #715-328G
LOCAL STREET- SHAMROCK RD.
RECOMMENDED IMPROVEMENTS

FIGURE 14



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

AAR CROSSING #715-325L
LOCAL STREET- PHARR MILL RD.
RECOMMENDED IMPROVEMENTS

FIGURE 16

APPENDIX

HCM: SIGNALIZED INTERSECTION SUMMARY Version 2.4d 04-16-1997
Gannett Fleming Corddry And Carpenter, Inc.

Streets: (N-S) NC 49 (E-W) Pharr Mill Rd.
Analyst: RNP File Name: NC49(1).HC9
Area Type: Other 4-16-97 4-5 PM
Comment: LOS 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	3	788	25	44	368	1	1	4	1	33	1	50
Lane W (ft)		12.0	12.0	13.0	12.0			10.0			13.0	
RTOR Vols			0			0			0			0
Lost Time	3.00	3.00	3.00	3.00	3.00	3.00	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		*			EB Left *			
Thru		*			Thru *			
Right		*			Right *			
Peds	*				Peds *			
SB Left	*	*			WB Left *			
Thru	*	*			Thru *			
Right	*	*			Right *			
Peds	*				Peds *			
EB Right					NB Right			
WB Right					SB Right			
Green	19.0A	24.0A			Green 16.0A			
Yellow/AR	0.0	6.5			Yellow/AR 6.1			

Cycle Length: 72 secs Phase combination order: #1 #2 #5

Intersection Performance Summary

	Lane Mvmts	Group: Cap	Adj Sat Flow	v/c Ratio	g/C Ratio	Delay	LOS	Approach: Delay	LOS
NB	LT	696	1811	1.264	0.384	*	*	*	*
	R	472	1230	0.059	0.384	9.0	B		
SB	L	492	1743	0.100	0.649	6.2	B	4.1	A
	TR	1122	1727	0.366	0.649	3.8	A		
EB	LTR	401	1503	0.015	0.267	12.5	B	12.5	B
WB	LTR	356	1335	0.264	0.267	13.4	B	13.4	B

Intersection Delay = * (sec/veh) Intersection LOS = *

(g/C)*(V/c) is greater than one. Calculation of D1 is infeasable.

HCM: SIGNALIZED INTERSECTION SUMMARY Version 2.4d 04-16-1997

Gannett Fleming Corddry And Carpenter, Inc.

Streets: (N-S) NC 49 (E-W) Pharr Mill Rd.
Analyst: RNP File Name: NC49(2).HC9
Area Type: Other 4-16-97 4-5 PM
Comment: LOS 1997 Volumes (Mod. Timing)

	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	3	788	25	44	368	1	1	4	1	33	1	50
Lane W (ft)		12.0	12.0	13.0	12.0			10.0			13.0	
RTOR Vols			0			0			0			0
Lost Time	3.00	3.00	3.00	3.00	3.00	3.00	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		*			EB Left	*			
Thru		*			Thru	*			
Right		*			Right	*			
Peds	*				Peds	*			
SB Left	*	*			WB Left	*			
Thru	*	*			Thru	*			
Right	*	*			Right	*			
Peds	*				Peds	*			
EB Right					NB Right				
WB Right					SB Right				
Green	19.0A	39.0A			Green	16.0A			
Yellow/AR	0.0	6.5			Yellow/AR	6.1			

Cycle Length: 87 secs Phase combination order: #1 #2 #5

Intersection Performance Summary

	Lane Mvmts	Group: Cap	Adj Sat Flow	v/c Ratio	g/C Ratio	Delay	LOS	Approach: Delay	LOS
NB	LT	889	1812	0.988	0.491	34.8	D	33.9	D
	R	604	1230	0.046	0.491	7.4	B		
SB	L	407	1743	0.120	0.710	9.0	B	3.8	A
	TR	1226	1727	0.334	0.710	3.1	A		
EB	LTR	331	1502	0.018	0.221	17.1	C	17.1	C
WB	LTR	294	1333	0.320	0.221	18.5	C	18.5	C

Intersection Delay = 23.4 sec/veh Intersection LOS = C

Lost Time/Cycle, L = 9.0 sec Critical v/c(x) = 0.651

HCM: SIGNALIZED INTERSECTION SUMMARY Version 2.4d 04-16-1997

Gannett Fleming Corddry And Carpenter, Inc.

Streets: (N-S) NC 49 (E-W) Pharr Mill Rd.
Analyst: RNP File Name: NC49(3).HC9
Area Type: Other 4-16-97 4-5 PM
Comment: LOS 1997 Volumes Build

	Northbound			Southbound			Eastbound			Westbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes		> 2	1	1	1 <			> 1 <			> 1 <	
Volumes	3	788	25	44	368	1	1	4	1	33	1	50
Lane W (ft)		12.0	12.0	13.0	12.0			10.0			13.0	
RTOR Vols			0			0			0			0
Lost Time	3.00	3.00	3.00	3.00	3.00	3.00	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		*			EB	Left *			
	Thru		*				Thru *			
	Right		*				Right *			
	Peds	*					Peds *			
SB	Left	*	*			WB	Left *			
	Thru	*	*				Thru *			
	Right	*	*				Right *			
	Peds	*					Peds *			
EB	Right					NB	Right			
WB	Right					SB	Right			
Green		19.0A	24.0A			Green	16.0A			
Yellow/AR		0.0	6.5			Yellow/AR	6.1			

Cycle Length: 72 secs Phase combination order: #1 #2 #5

Intersection Performance Summary

	Lane Mvmts	Group: Cap	Adj Sat Flow	v/c Ratio	g/C Ratio	Delay	LOS	Approach: Delay	LOS
NB	LT	1324	3446	0.697	0.384	13.1	B	13.0	B
	R	472	1230	0.059	0.384	9.0	B		
SB	L	492	1743	0.100	0.649	4.1	A	3.9	A
	TR	1122	1727	0.366	0.649	3.8	A		
EB	LTR	401	1503	0.015	0.267	12.5	B	12.5	B
WB	LTR	356	1335	0.264	0.267	13.4	B	13.4	B

Intersection Delay = 10.2 sec/veh Intersection LOS = B

Lost Time/Cycle, L = 9.0 sec Critical v/c(x) = 0.419

HCM: SIGNALIZED INTERSECTION SUMMARY Version 2.4d 04-16-1997
Gannett Fleming Corddry And Carpenter, Inc.

Streets: (N-S) NC 49 (E-W) Pharr Mill Rd.
Analyst: RNP File Name: NC49(3).HC9
Area Type: Other 4-16-97 4-5 PM
Comment: LOS 1997 Volumes Build

	Northbound			Southbound			Eastbound			Westbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes		> 2 <		1	1 <			> 1 <			> 1 <	
Volumes	3	788	25	44	368	1	1	4	1	33	1	50
Lane W (ft)		12.0		13.0	12.0			10.0			13.0	
RTOR Vols			0			0			0			0
Lost Time	3.00	3.00	3.00	3.00	3.00	3.00	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		*			EB	Left	*			
	Thru		*				Thru	*			
	Right		*				Right	*			
	Peds	*					Peds	*			
SB	Left	*	*			WB	Left	*			
	Thru	*	*				Thru	*			
	Right	*	*				Right	*			
	Peds	*					Peds	*			
EB	Right					NB	Right				
WB	Right					SB	Right				
Green		19.0A	24.0A			Green		16.0A			
Yellow/AR		0.0	6.5			Yellow/AR		6.1			

Cycle Length: 72 secs Phase combination order: #1 #2 #5

Intersection Performance Summary

	Lane Mvmts	Group: Cap	Adj Sat Flow	v/c Ratio	g/C Ratio	Delay	LOS	Approach: Delay	LOS
NB	LTR	1305	3398	0.729	0.384	13.7	B	13.7	B
SB	L	492	1743	0.100	0.649	4.2	A	3.9	A
	TR	1122	1727	0.366	0.649	3.8	A		
EB	LTR	401	1503	0.015	0.267	12.5	B	12.5	B
WB	LTR	356	1335	0.264	0.267	13.4	B	13.4	B

Intersection Delay = 10.7 sec/veh Intersection LOS = B

Lost Time/Cycle, L = 9.0 sec Critical v/c(x) = 0.433

HCM: SIGNALIZED INTERSECTION SUMMARY Version 2.4d 04-16-1997

Gannett Fleming Corddry And Carpenter, Inc.

Streets: (N-S) NC 49 (E-W) Pharr Mill Rd.
Analyst: RNP File Name: NC49(4).HC9
Area Type: Other 4-16-97 4-5 PM
Comment: LOS 2010 Volumes Build

	Northbound			Southbound			Eastbound			Westbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes		> 2	1	1	1 <			> 1 <			> 1 <	
Volumes	3	788	25	44	368	1	1	4	1	33	1	50
Lane W (ft)		12.0	12.0	13.0	12.0			10.0			13.0	
RTOR Vols			0			0			0			0
Lost Time	3.00	3.00	3.00	3.00	3.00	3.00	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		*			EB	Left	*			
	Thru		*				Thru	*			
	Right		*				Right	*			
	Peds	*					Peds	*			
SB	Left	*	*			WB	Left	*			
	Thru	*	*				Thru	*			
	Right	*	*				Right	*			
	Peds	*					Peds	*			
EB	Right					NB	Right				
WB	Right					SB	Right				
Green		19.0A	24.0A			Green		16.0A			
Yellow/AR		0.0	6.5			Yellow/AR		6.1			

Cycle Length: 72 secs Phase combination order: #1 #2 #5

Intersection Performance Summary

	Lane Mvmts	Group: Cap	Adj Sat Flow	v/c Ratio	g/C Ratio	Delay	LOS	Approach: Delay	LOS
NB	LT	1313	3418	0.886	0.384	18.8	C	18.5	C
	R	472	1230	0.074	0.384	9.0	B		
SB	L	492	1743	0.126	0.649	5.1	B	4.4	A
	TR	1122	1727	0.461	0.649	4.3	A		
EB	LTR	398	1492	0.020	0.267	12.5	B	12.5	B
WB	LTR	355	1329	0.333	0.267	13.8	B	13.8	B

Intersection Delay = 13.9 sec/veh Intersection LOS = B

Lost Time/Cycle, L = 9.0 sec Critical v/c(x) = 0.531

Date: 2/18/97 Time: 4:00-6:00PM Weather: SUNNY		MANUAL TRAFFIC COUNT SUMMARY IN PASSENGER CAR EQUIVALENTS (PCE'S)		Counted by: BKC Location: NC 49 @ Pharr Mill Road	
Time	**Approach**	**Left-Turn**	**Through**	**Right-Turn**	**Total**
4:00-4:15	NB	0	156	9	165
4:15-4:30	NB	0	153	5	158
4:30-4:45	NB	1	211	9	221
4:45-5:00	NB	2	268	2	272
5:00-5:15	NB	0	213	10	223
5:15-5:30	NB	1	200	2	203
5:30-5:45	NB	1	185	4	190
5:45-6:00	NB	1	159	12	172
TOTAL		6	1545	53	1604
4:00-4:15	SB	13	102	0	115
4:15-4:30	SB	10	84	0	94
4:30-4:45	SB	10	83	0	93
4:45-5:00	SB	11	99	0	110
5:00-5:15	SB	16	102	0	118
5:15-5:30	SB	8	25	0	33
5:30-5:45	SB	5	93	0	98
5:45-6:00	SB	11	82	0	93
TOTAL		84	670	0	754

Date: 2/18/97 Time: 4:00-6:00 PM Weather: SUNNY		MANUAL TRAFFIC COUNT SUMMARY IN PASSENGER CAR EQUIVALENTS (PCE'S)		Counted by: BKC Location: Pharr Mill Rd. @ NC 49	
Time	**Approach**	**Left-Turn**	**Through**	**Right-Turn**	**Total**
4:00-4:15	EB	0	2	0	2
4:15-4:30	EB	0	1	0	1
4:30-4:45	EB	0	1	1	2
4:45-5:00	EB	0	0	0	0
5:00-5:15	EB	0	0	0	0
5:15-5:30	EB	0	0	0	0
5:30-5:45	EB	0	0	0	0
5:45-6:00	EB	0	0	0	0
TOTAL		0	4	1	5
(Pharr Mill Road)					
4:00-4:15	WB	8	0	15	23
4:15-4:30	WB	3	1	12	16
4:30-4:45	WB	13	0	14	27
4:45-5:00	WB	9	0	9	18
5:00-5:15	WB	15	0	27	42
5:15-5:30	WB	12	0	10	22
5:30-5:45	WB	10	0	9	19
5:45-6:00	WB	7	0	10	17
TOTAL		77	1	106	184

2020 volumes projected to reach 8,300. There have been no reported accidents at the crossing over the last ten years. The NCDOT installed a traffic signal with railroad preemption at NC 49/Pharr Mill Rd. and it was functioning properly during the time of field investigation for this report. The Level of Service analysis shows the intersection to be operating in a congested mode (worse than Level F) in the P.M. peak. This is brought about by the heavy northbound through movement on NC 49. This problem can be corrected by the addition of another northbound through lane or by converting the exclusive right-turn-only lane into a shared through and right lane. To accommodate the additional through movement will require widening the southbound approach to the intersection approximately 500 feet on the east side.

Near-term Recommendation:

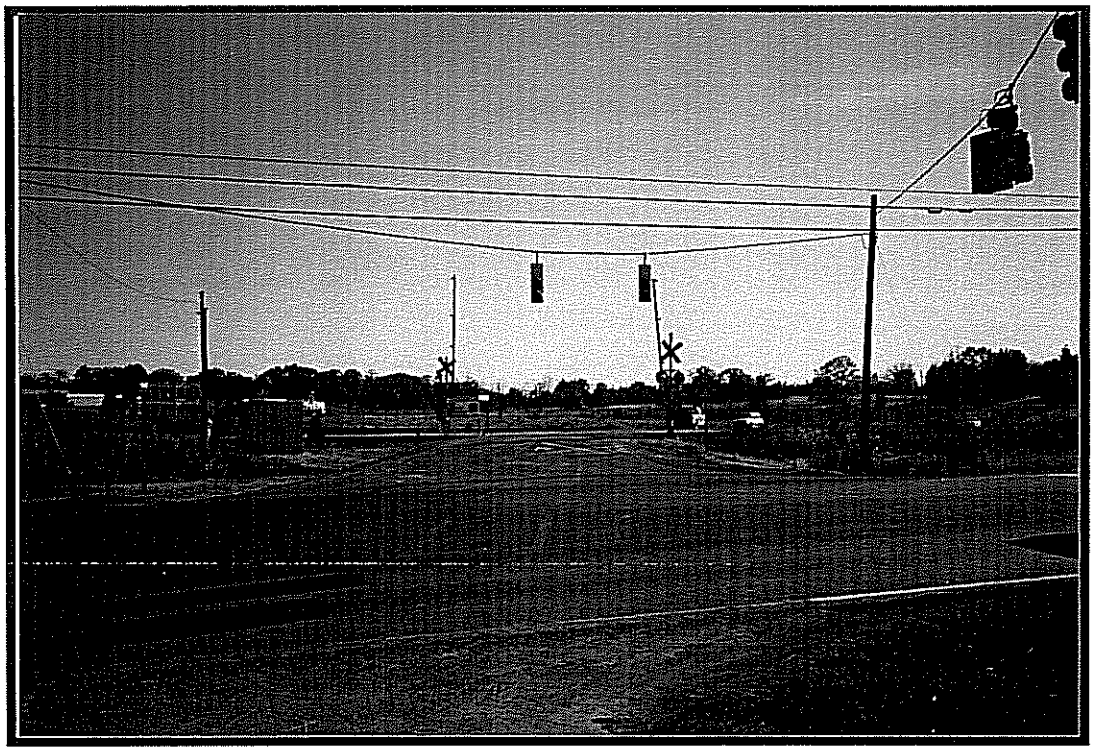
The **NCDOT Transportation Improvement Program** includes the widening of **NC 49 (Project No. R-2533)** from Harrisburg to the Yadkin River to a multi-lane facility with construction scheduled in 1998. This project should take care of the congestion problem at the Pharr Mill Rd. intersection. It is recommended, however, that the **NCDOT** give consideration to realigning the **Pharr Mill Rd. intersection with NC 49** such that Pharr Mill intersects NC 49 at a 90 degree angle as shown on **Figure 16.**

Estimated Cost: $250,000.00

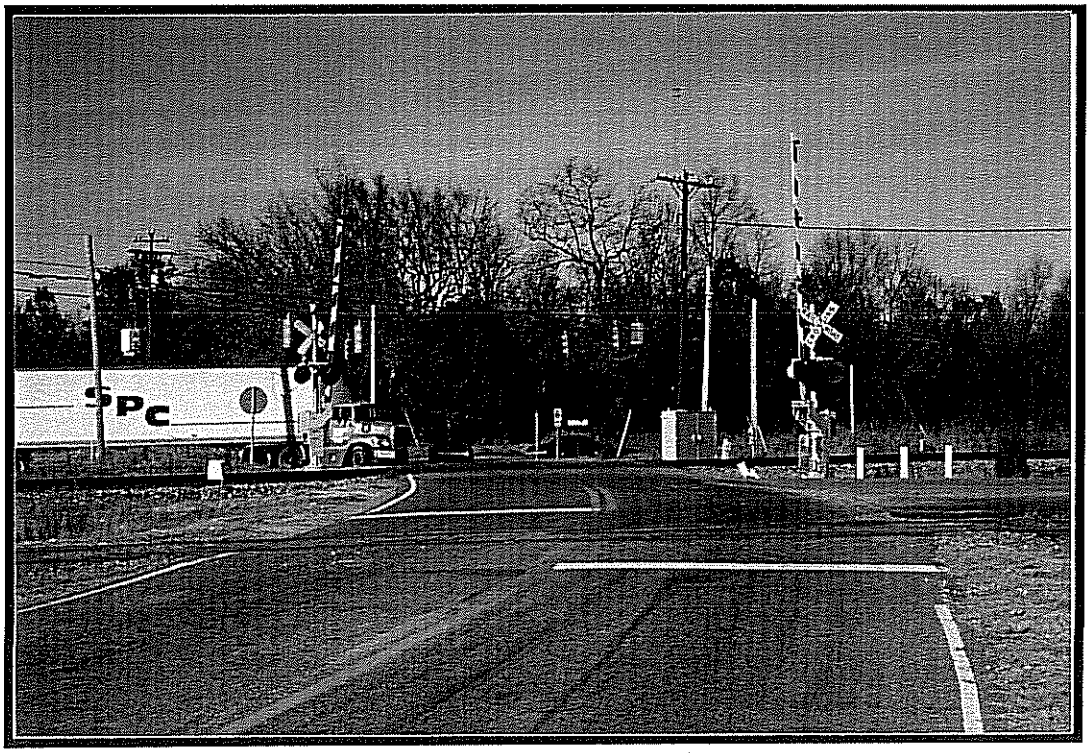
Impacts of Recommendation: The impacts of this recommendation are all positive. While it will require right of way to realign the intersection as currently configured, the existing right of way can be abandoned with the result being only a minor loss of private property to public right of way. Other positive aspects of the recommendation are that Pharr Mill Rd can intersect NC 49 at a 90 degree angle and the spur track crossing can be eliminated.

Municipality: Near Harrisburg

Crossing Number: 715325L *Street Name:* Pharr Mill Rd.



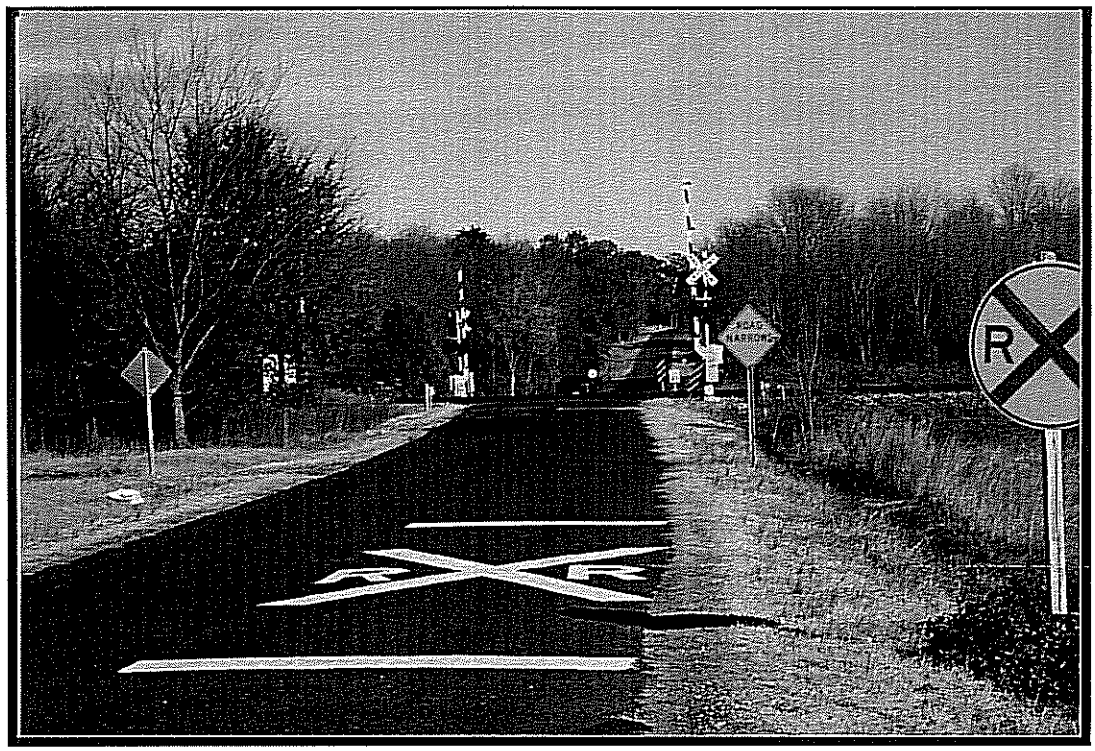
Eastbound Approach



Westbound Approach

Municipality: Near Harrisburg

Crossing Number: 715328G *Street Name:* Shamrock Rd.

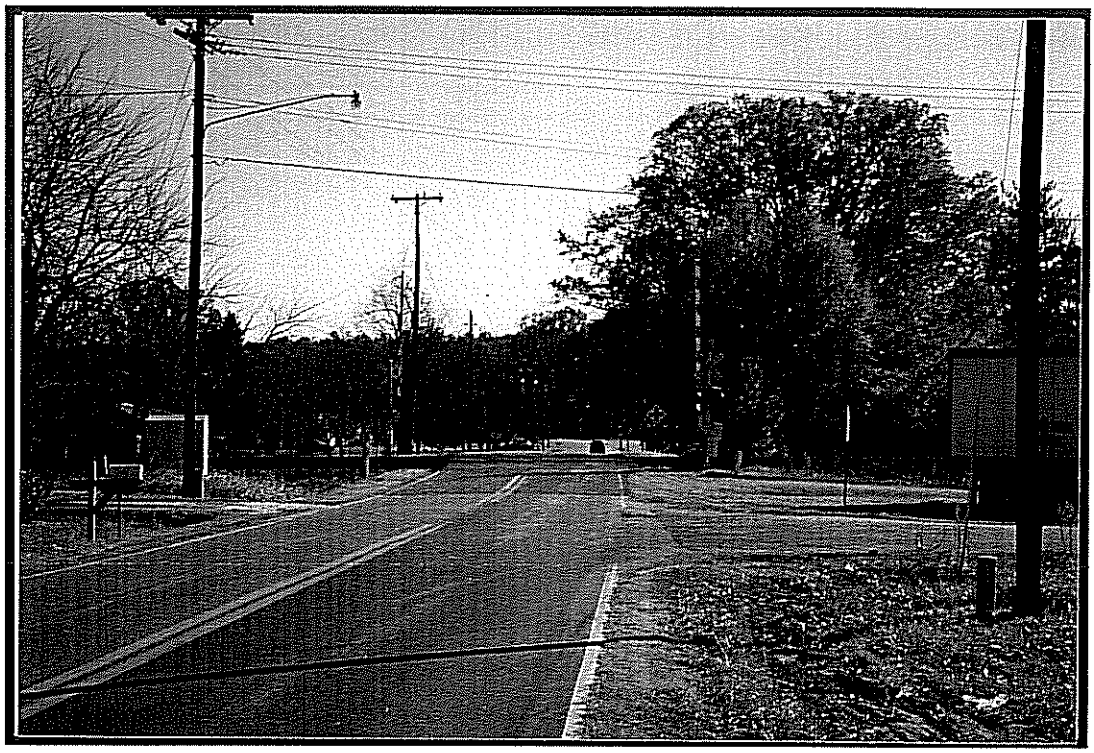


Eastbound Approach

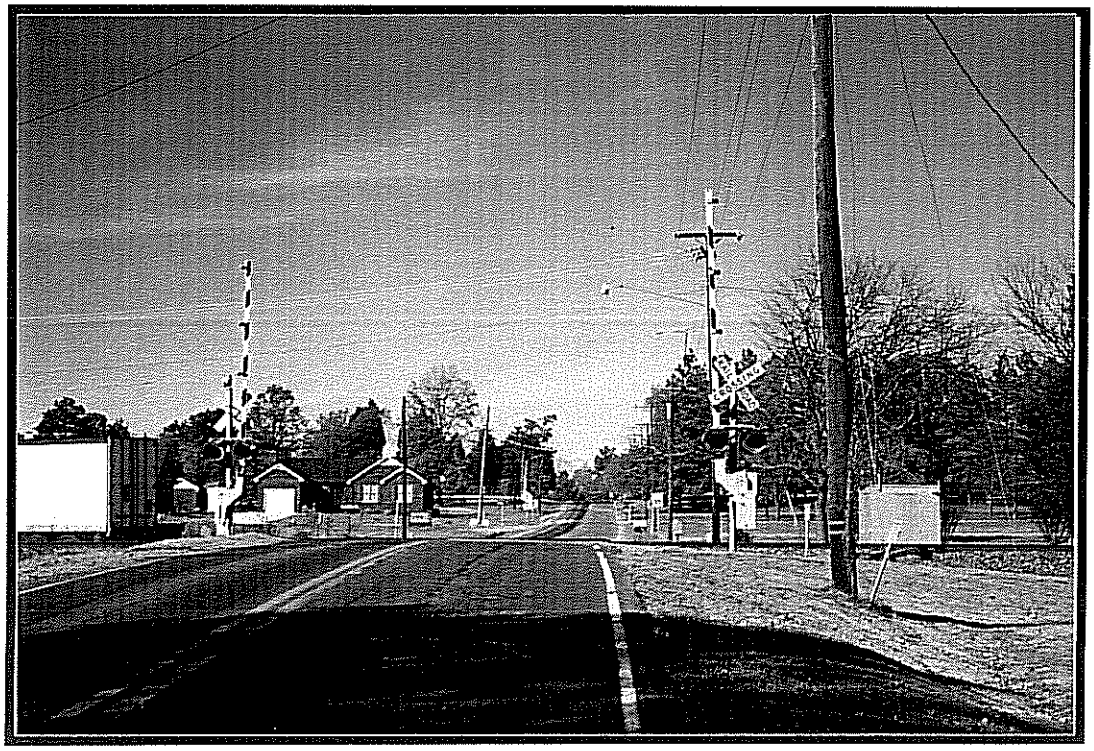
Westbound Approach

Municipality: Harrisburg

Crossing Number: 715330H *Street Name:* Hickory Ridge Rd.



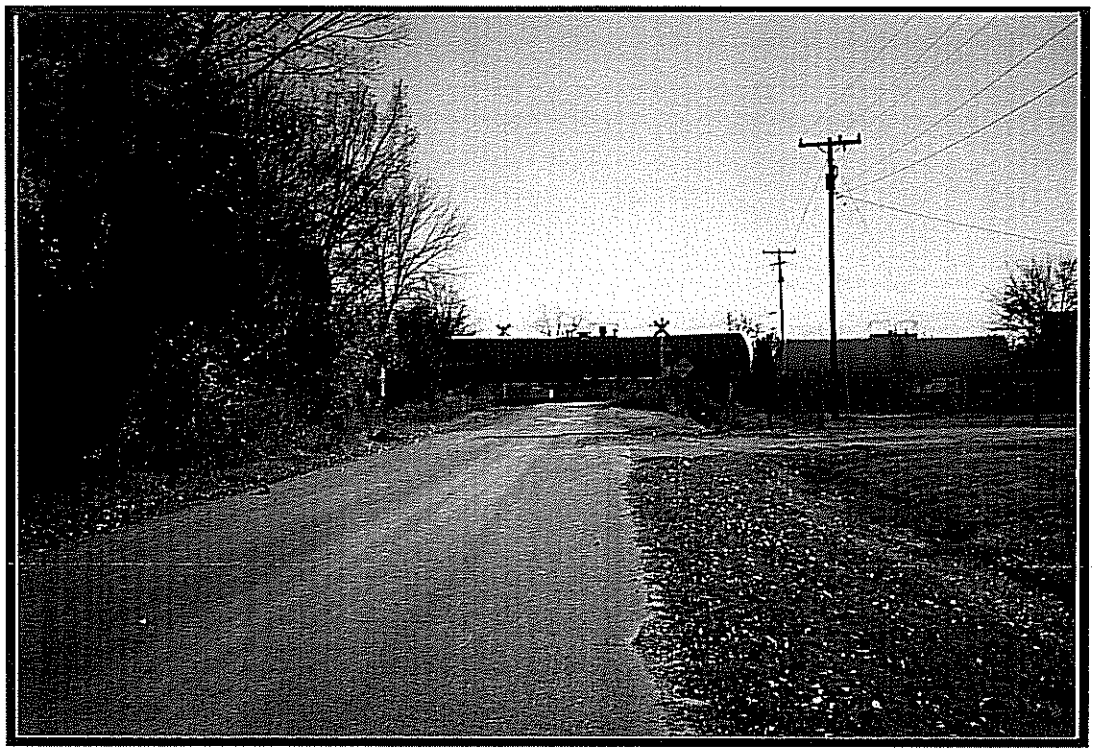
Eastbound Approach



Westbound Approach

Municipality: Harrisburg

Crossing Number: 715334K *Street Name:* Millbrook Rd.

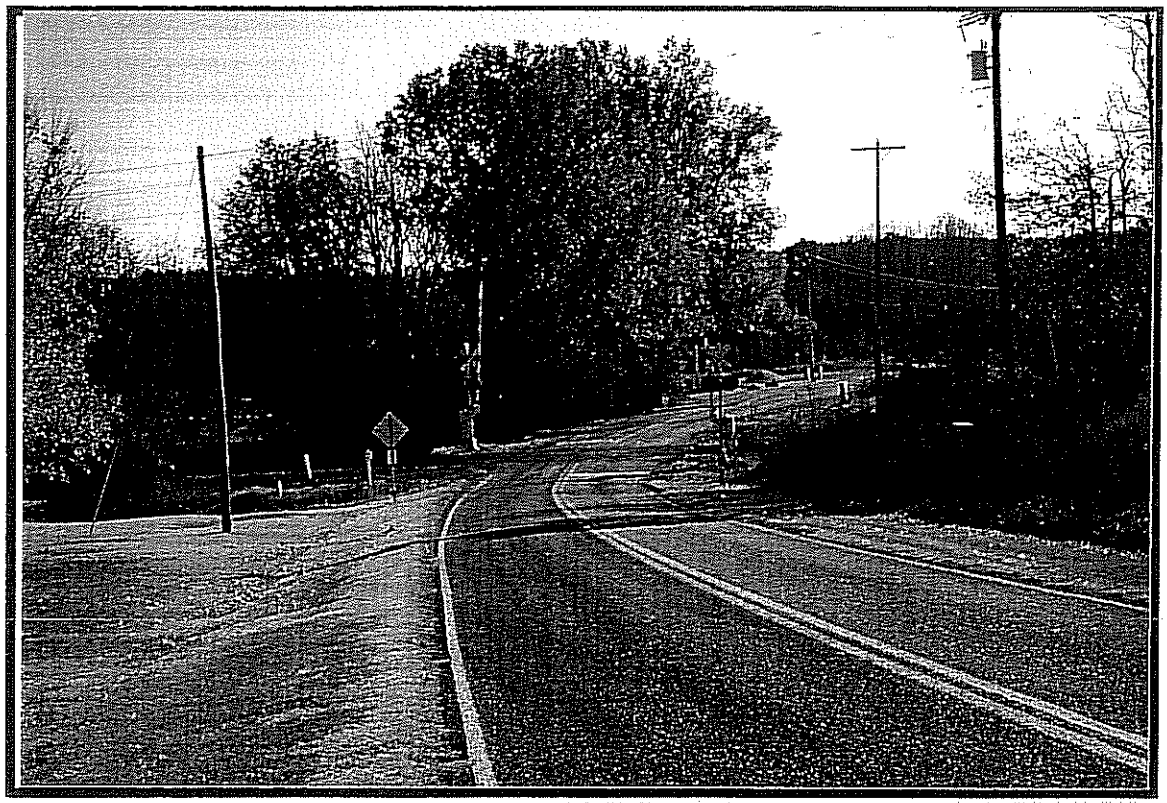


Eastbound Approach

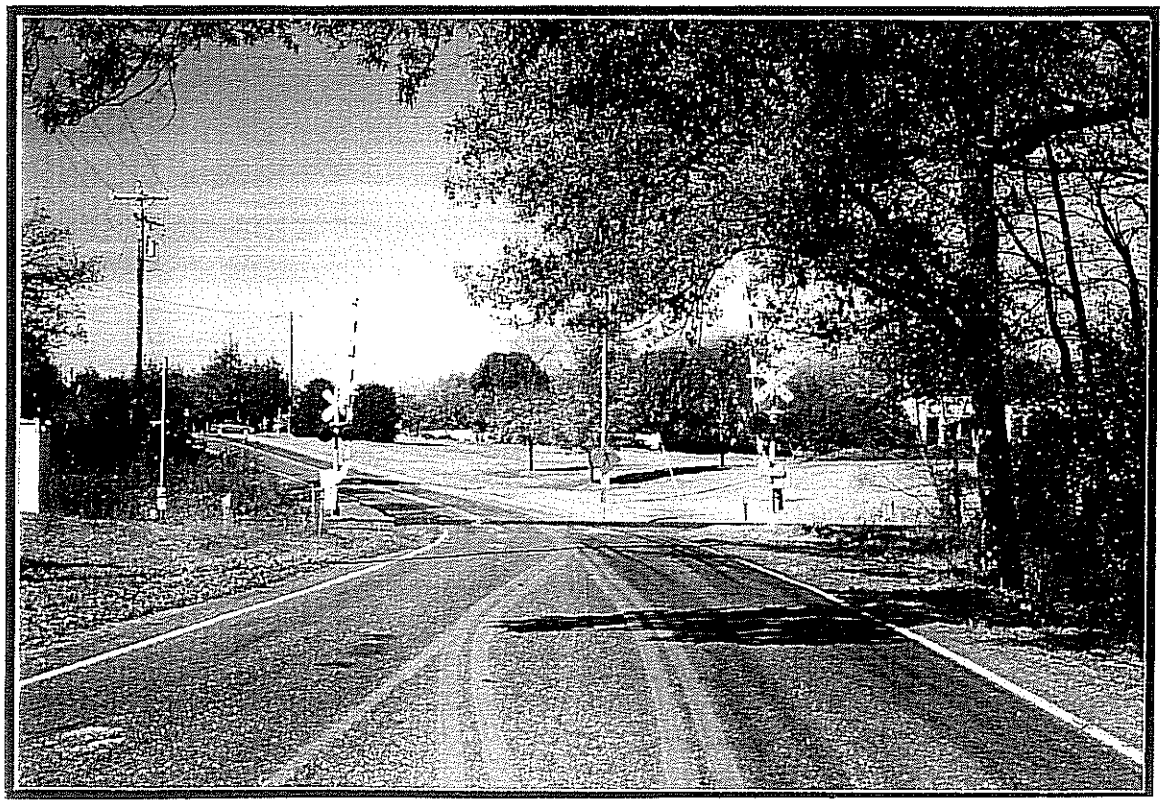
Westbound Approach

Municipality: Harrisburg

Crossing Number: 715332W *Street Name:* Caldwell Rd.



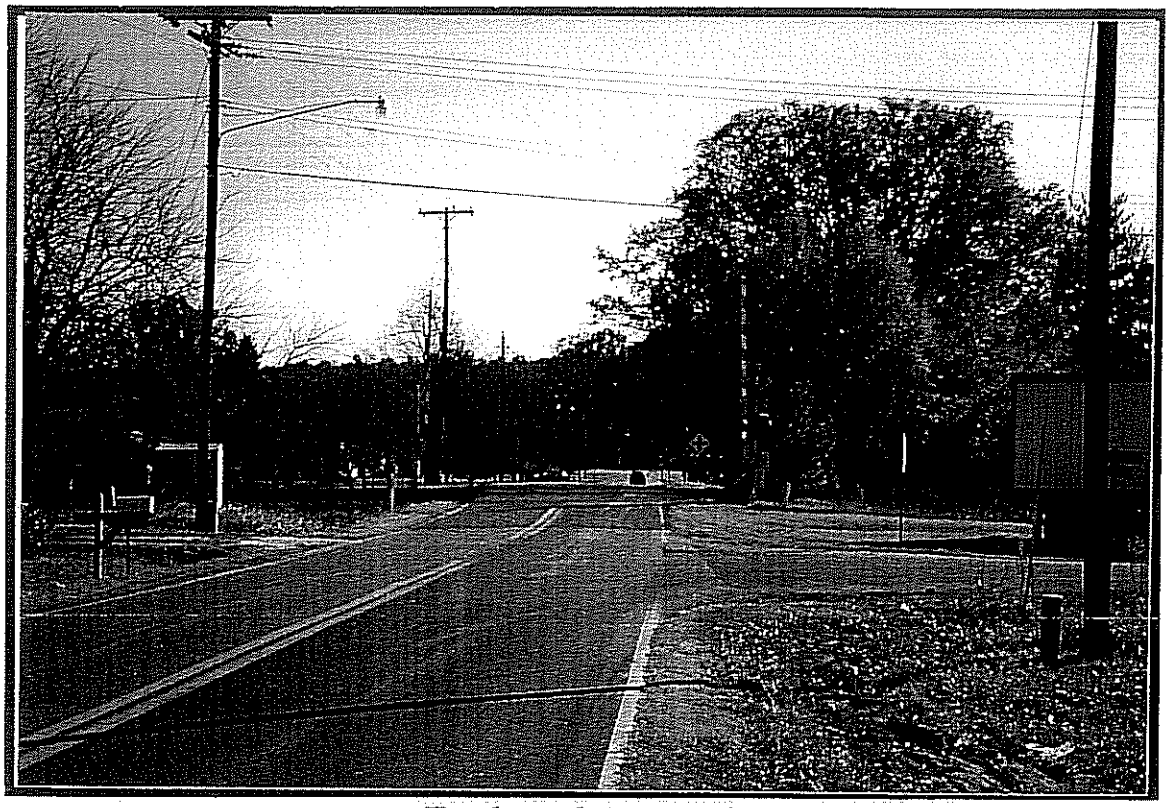
Eastbound Approach



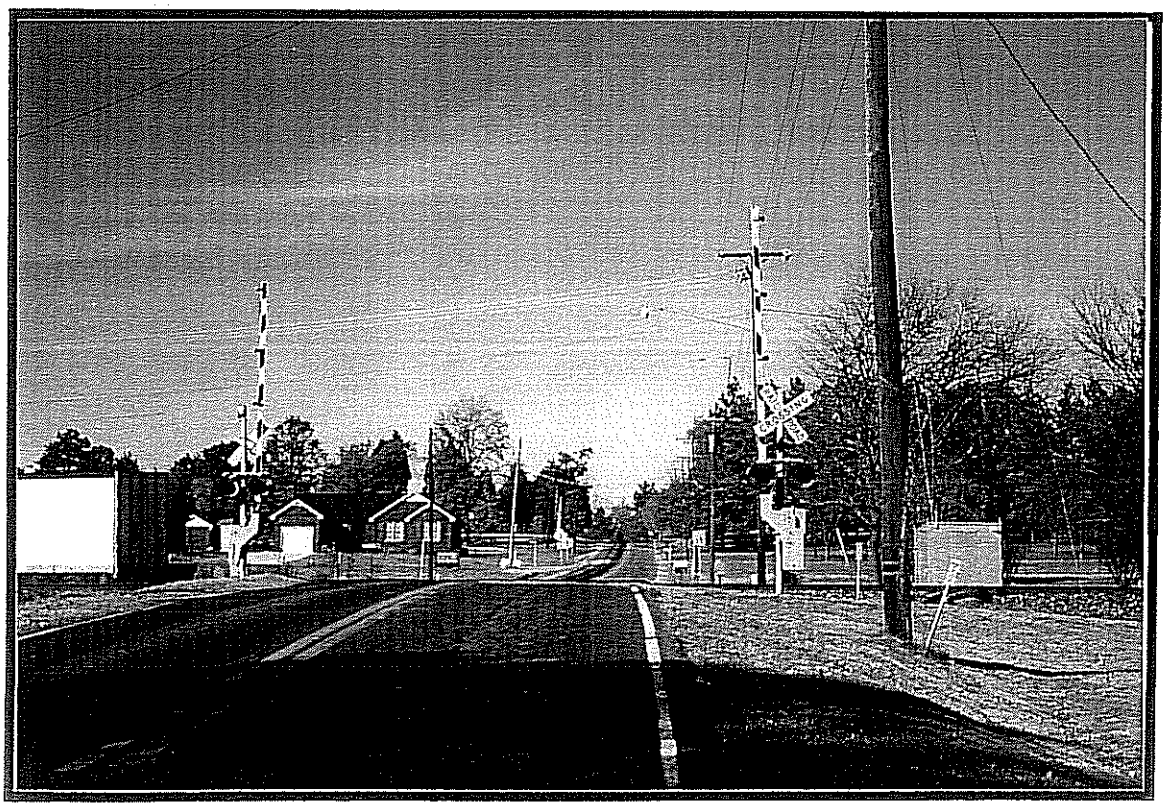
Westbound Approach

Municipality: Harrisburg

Crossing Number: 715330H *Street Name:* Hickory Ridge Rd.



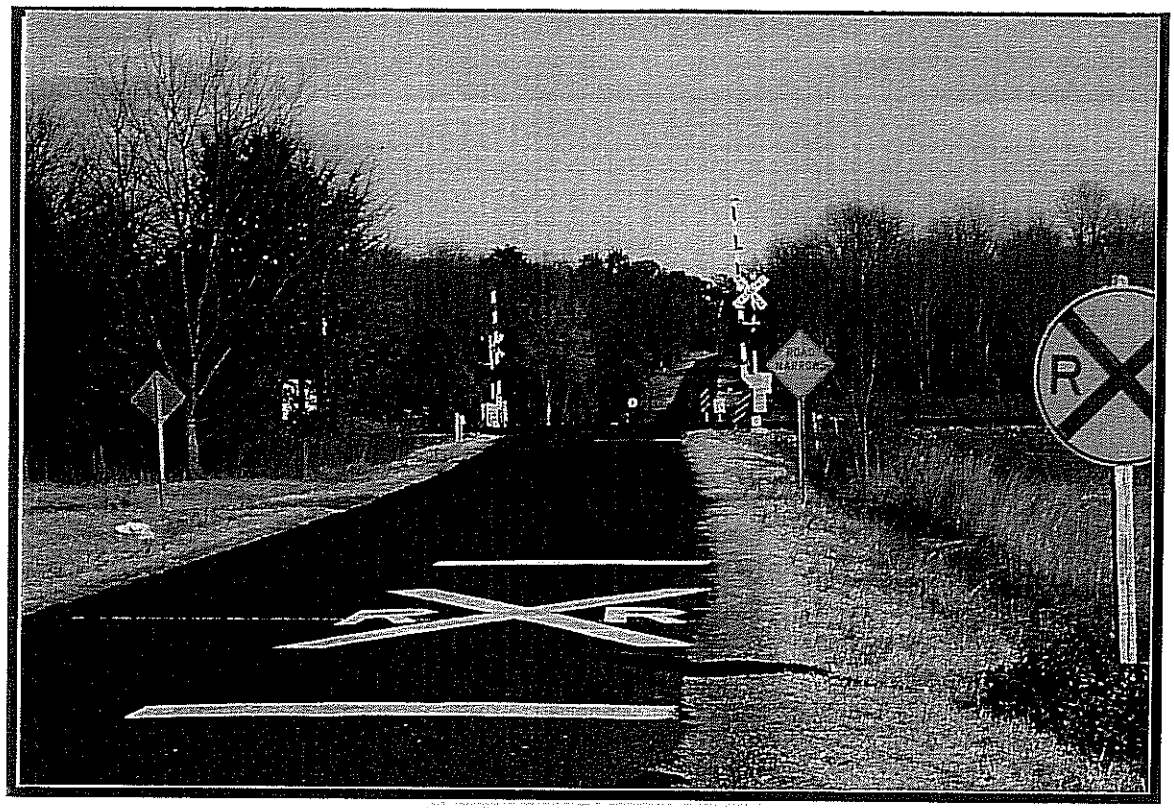
Eastbound Approach



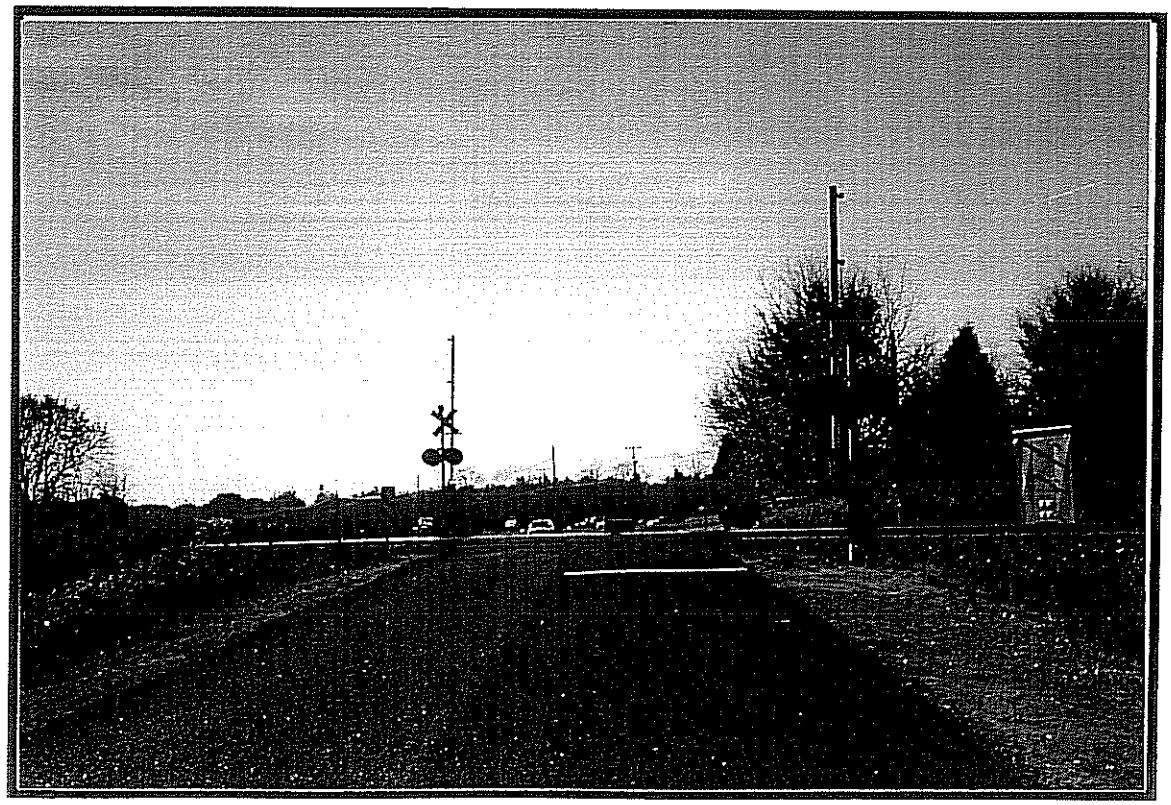
Westbound Approach

Municipality: Near Harrisburg

Crossing Number: 715328G *Street Name:* Shamrock Rd.



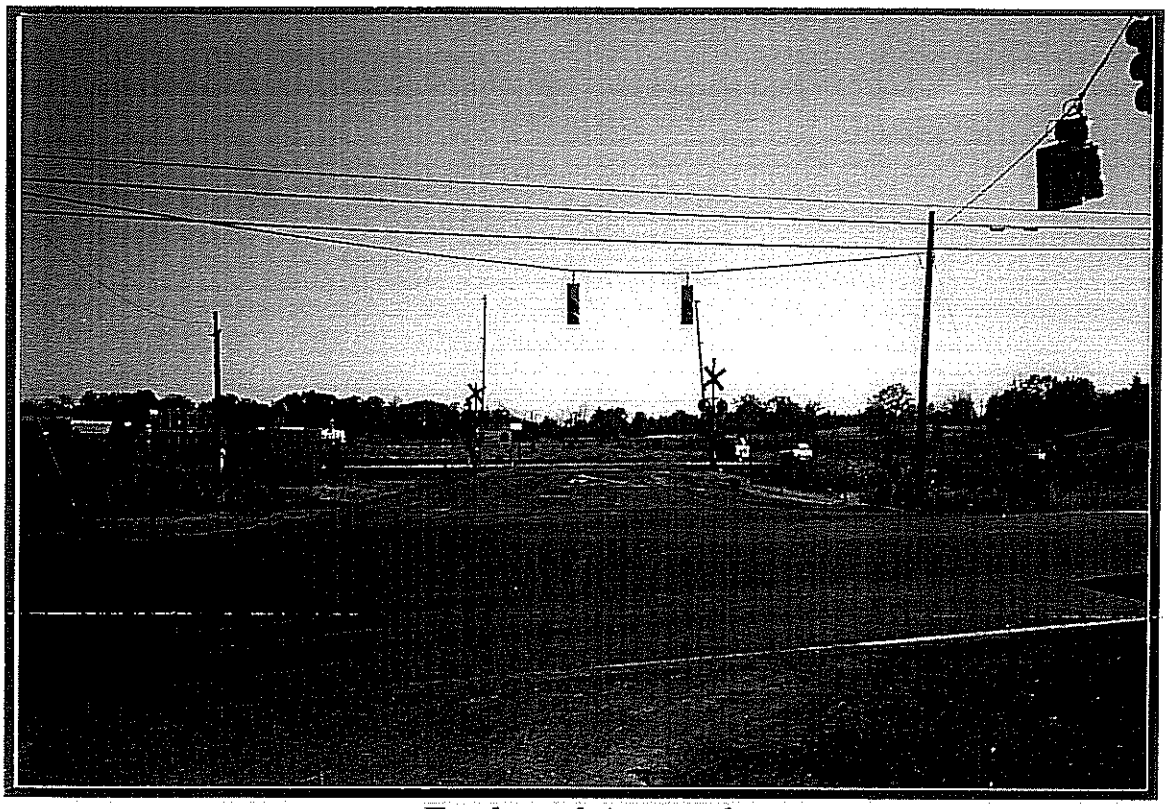
Eastbound Approach



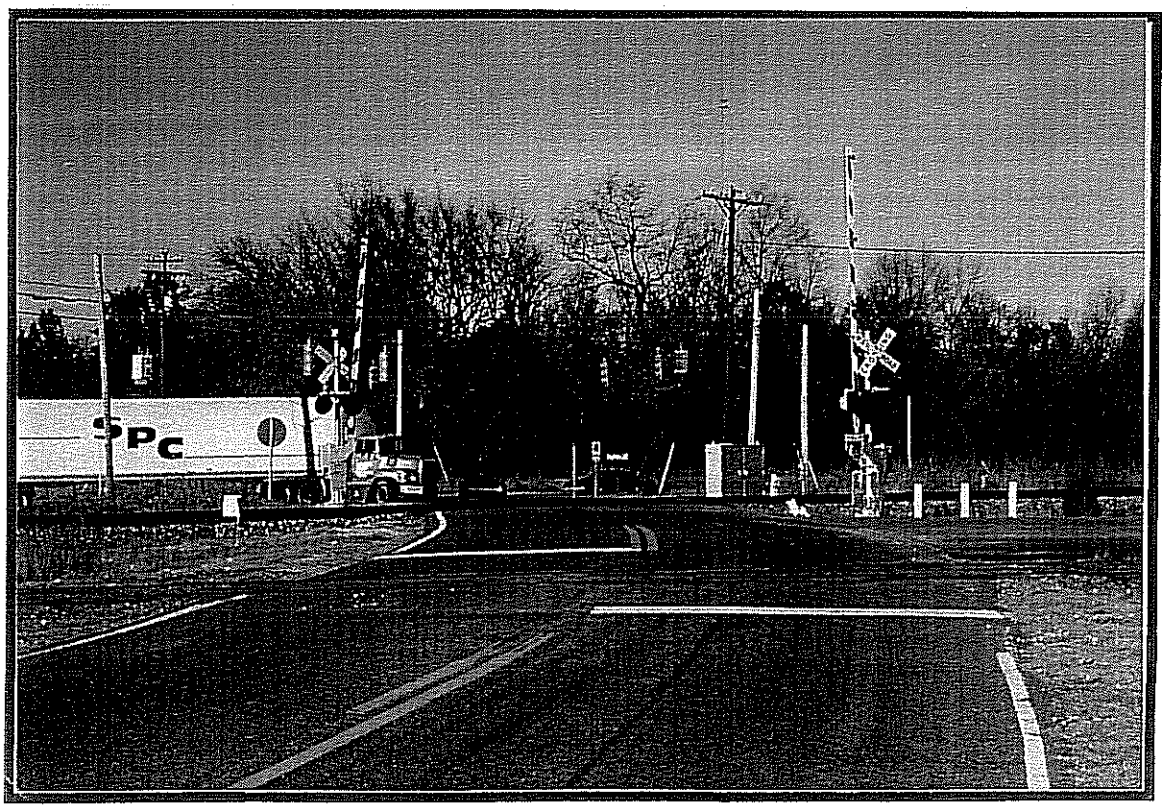
Westbound Approach

Municipality: Near Harrisburg

Crossing Number: 715325L *Street Name:* Pharr Mill Rd.



Eastbound Approach



Westbound Approach