

TRAFFIC SEPARATION STUDY
FOR
CHINA GROVE, NORTH CAROLINA
AND

THE NORTH CAROLINA DEPARTMENT OF
TRANSPORTATION
RAIL DIVISION
ENGINEERING AND SAFETY BRANCH

VOLUME I

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

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**EXECUTIVE SUMMARY
TRAFFIC SEPARATION STUDY
CHINA GROVE, 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 Norfolk Southern (NS) will increase due to the division of CONRAIL routes between Norfolk Southern (NS) and CSX.

Vehicular traffic in the China Grove area will continue to increase as growth and expansion in Rowan County continues.

Safety is a concern at Chapel St., Thom St. and Centerview Dr. because of the potential for vehicles to que across the tracks. This situation will only worsen as traffic volume increases, especially at the congested intersections of US 29A/Thom St. and US 29A/ Centerview Dr.

The eastbound approach to the crossings is well below accepted standards for grade crossings at Thom St., Centerview Dr., E. Liberty St. and to a lesser extent at Elm St.

RECOMMENDATIONS:

Near-term

- Close Eudy Road \$ 8,000.00
Remove pavement, install barricades, landscape 15,000.00
- Close Elm Street 8,000.00
Remove pavement, install barricades, landscape 7,500.00
- Install long-gate arms at Thom St. 15,000.00
- Close Chapel St. 8,000.00
Remove pavement/install barricade/landscape \$5,500.00
- Install long-gate arms at Centerview St. 15,000.00
Install left-turn lanes on US 29-A at Centerview St. _1,200.00
- Install long-gate arms at Church St. 15,000.00

- Close the East Liberty St. crossing 8,000.00
- Remove pavement, install barricades, landscape 10,000.00

Subtotal \$116,200.00

Mid-term

- Thom Street-modify the westbound approach grade 30,000.00
- Centerview Drive-modify the westbound approach grade 45,000.00

Subtotal \$ 75,000.00

TOTAL \$191,200.00

**TRAFFIC SEPARATION STUDY
FOR CHINA GROVE, NORTH CAROLINA
AND THE
NORTH CAROLINA DEPARTMENT OF TRANSPORTATION**

PURPOSE OF THE STUDY

The Town of **China Grove** 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 China Grove. 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 seven (7) public street crossings of the railroad in and near China Grove from Eudy Rd. north to East Liberty St.

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 China Grove Study

The Town of China Grove is served by the Norfolk Southern (NS) Railway* main line which extends from Charlotte to Raleigh and points north and south. Train movements over the seven 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 345/day at Chapel St. to over 4,500 at Church St.

Four of the crossings in China Grove have had no reported accidents during the ten years for which records are available. However, a fatality occurred at Centerview Dr. in 1993.

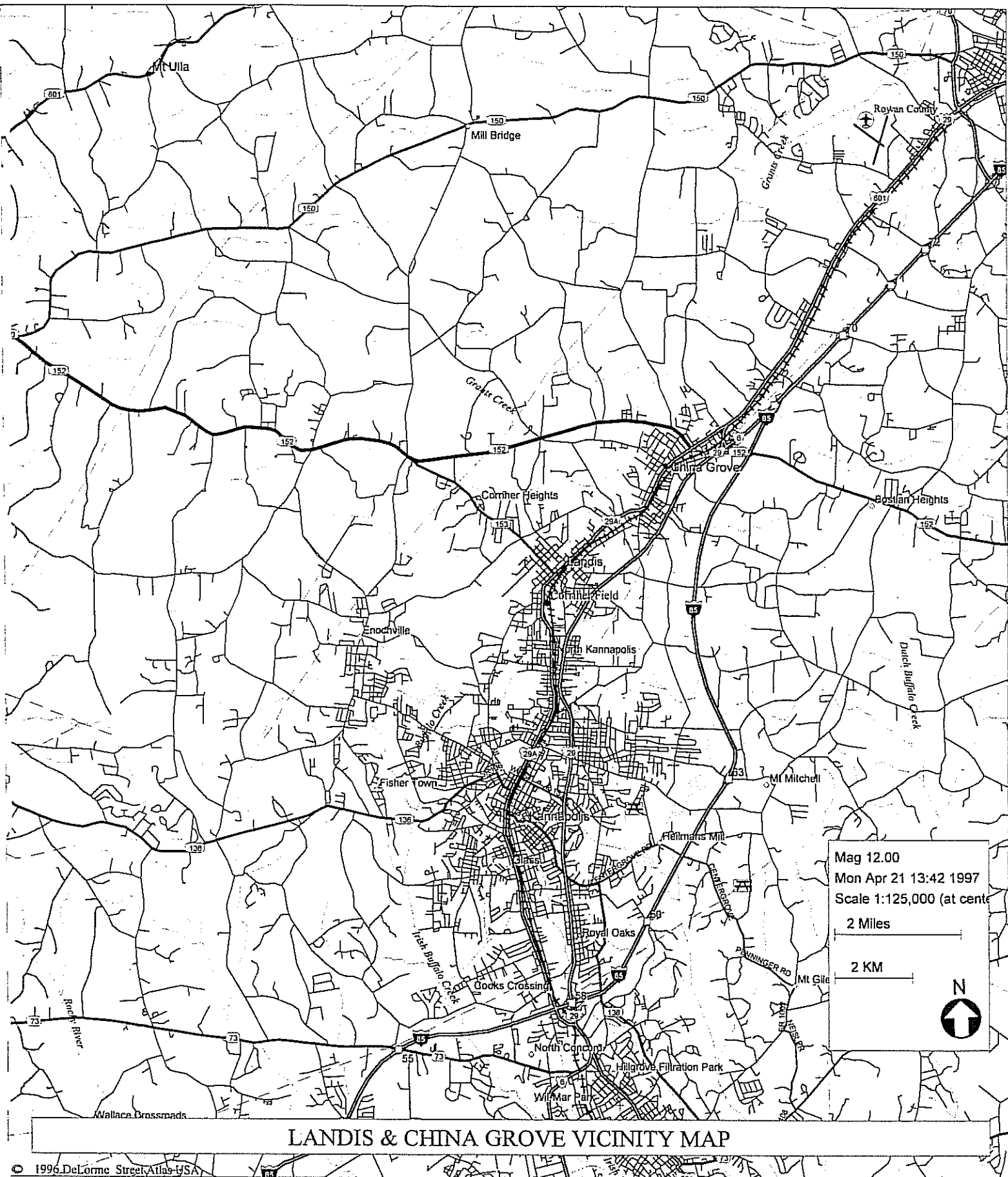
The evaluation of the China Grove crossings included the following:

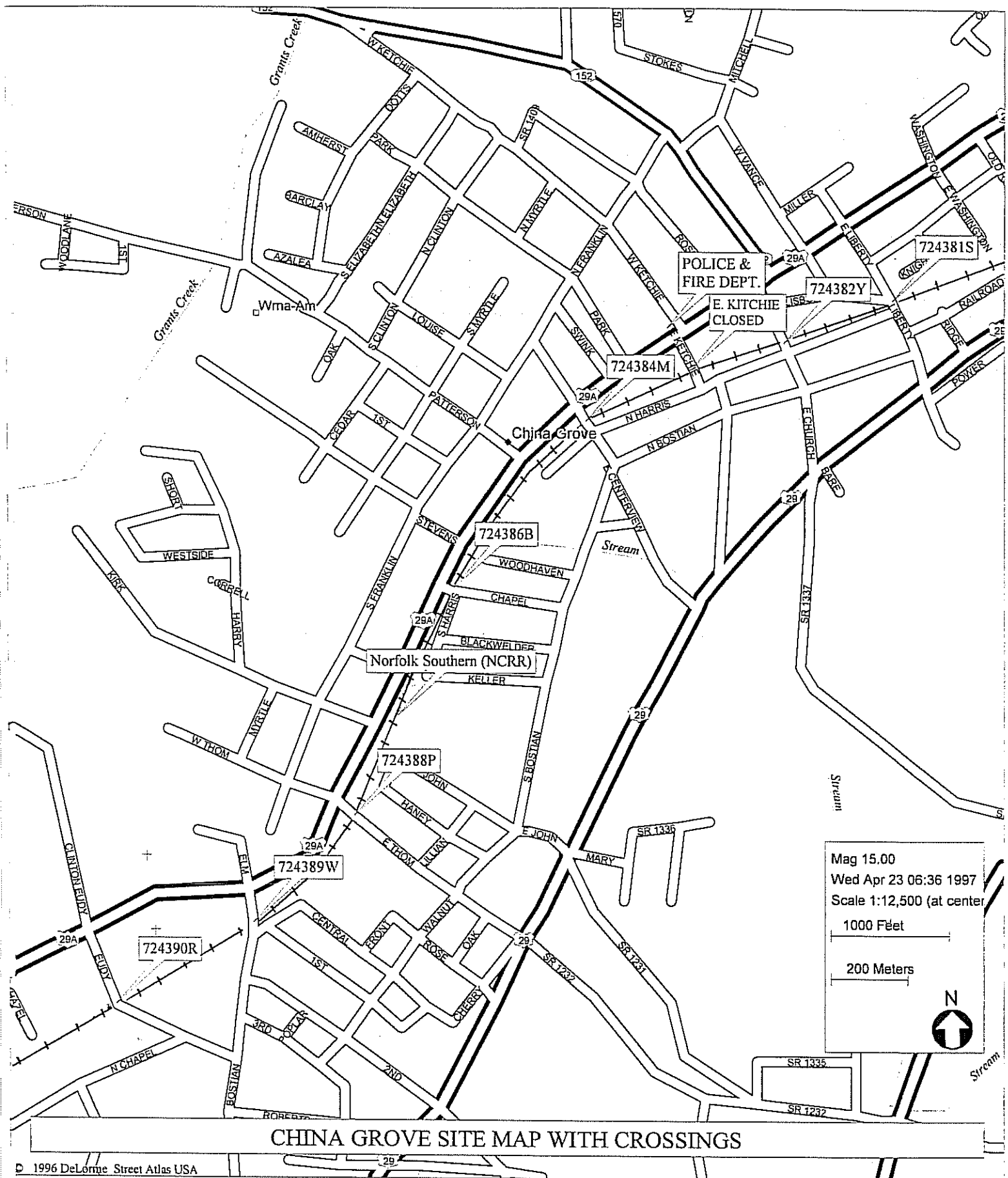
- Twenty-four hour automatic traffic counts were obtained for the crossings as well as other streets within the network.
- A Level of Service (LOS) analysis was conducted for the signalized intersections of US 29A/Thom St. and US 29A/Centerview Dr.
- Interviews with state and local officials were conducted to gain insight into problems and potential improvements to each crossing.
- Data was collected from the Rowan Co. School System, the China Grove Police Chief, members of the Volunteer Fire Department, and the Rowan 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%).





- 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 seven (7) crossings.
- Include preliminary cost estimates for recommended improvements.

EXISTING TRANSPORTATION SETTING

The Town of China Grove is located in southeastern Rowan Co just north of Landis. The estimated 1996 population is just over 3700. Overall population growth in Rowan Co has been about 1.5% for the last several years. For purposes of this report, future traffic volumes were projected at 2% per annum.

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.

Church St. is the most significant of the seven (7) crossings evaluated in and near China Grove serving as the primary connector between US 29A, the central business district (CBD) and US 29 which passes to the east of the downtown. It also provides connectivity between West China Grove and East China Grove. Elm St., Thom St., Centerview Dr., and Liberty St. all connect US 29A (Main St.) To US 29, but are terminated west of US 29A within one or two blocks. Of all the cross streets in China Grove, only Church St. is classified as a thoroughfare.

The only significant roadway that parallels the railroad track is Harris St. which runs between Centerview Dr. and E. Liberty St. just east of the tracks. While not actually paralleling the tracks, Salisbury St. also connects between Church St. and East Liberty St. west of the tracks.

The NS operates one mainline track throughout the China Grove study area. Operating speeds range from 30 to 45 MPH over the seven 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 China Grove crossings include:

- Accident history

This report utilizes the accident classification system developed by the Federal Highway Administration and others, 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 US 29A/Thom St. and US 29A/Centerview Dr. intersections were 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:

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

Signalized Intersections

A Level of Service analysis was conducted for the signalized intersections of US 29A/Thom St. and US 29A/Centerview Dr. The analysis was conducted using 1997 traffic volumes as well as for projected 2010 volumes. The 2010 volumes which were used in the analyses were projected from 1997 volumes at an annual rate of growth of 2%.

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

<u>Level of Service</u>	<u>Description</u>	<u>Stopped Delay Per Vehicle (Seconds)</u>
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.	$> 5 \leq 15$
C	Fair progression and/or longer cycle length: significant number of vehicles stop at intersection than level of service A.	$> 15 \leq 25$
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.	$> 25 \leq 40$
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	> 60

oversaturation (i.e. arrival flow exceeds capacity.)

The results of the analyses follow:

US 29A (Main St.)/Thom St.

1997 Volumes	C
2010 Volumes	D
2010 Volumes-Build*	C

US 29A (Main St.)/Centerview St.

1997 Volumes	Over Capacity
1997 Volumes-Build*	C
2010 Volumes-Build**	B

*Add northbound and southbound left-turn lanes

** Add protected southbound left-turn signal phase

Traffic Volume

Based on the 24-hr. traffic volumes, the seven (7) at-grade crossings in and near China Grove rank in terms of vehicles served:

1. Church St. (SR-1337)	4,550 VPD
2. Thom St. (SR-1232)	3,225 VPD
3. Centerview Dr.	2,700 VPD
4. Elm St. (SR-1221)	720 VPD
5. E. Liberty St.	480 VPD
6. Eudy Rd. (Near) (SR-1220)	460 VPD
7. Chapel St.	345 VPD

ACCIDENT HISTORY

Only two crossings in this study-Centerview Dr. and Eudy Rd-have reported accidents during the ten years for which records are available. A collision occurred at the Centerview crossing in 1992 which resulted in a fatality and a collision at Eudy Rd, also in 1992, resulted in property damage only.

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:

TABLE I

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

TABLE I

Signs & Markings Upgrade

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

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

MENU OF AVAILABLE TRANSPORTATION SYSTEM ENHANCEMENTS

As growth in the greater Rowan Co. area continues, 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, the potential for traffic delays and accidents at the crossings is certain to increase.

The Norfolk Southern (NS) line from Washington, D.C. to Charlotte, NC, 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:

<u>Type</u>	<u>Description</u>
-------------	--------------------

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 China Grove are all protected by **flashing signals, bells and 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 (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

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

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

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.

Although volumes are low on Chapel St. (345 per day), due to the fact that the separation between US 29A and the crossing is about 50 feet, the potential for vehicles to queue across the tracks exists. While the potential is lessened because the separation between US 29A and the track is greater for Thom St. (+/-130 feet) and for Centerview Dr. (+/- 150 feet), queuing across the track can result from congestion at the signalized intersections with US 29 A. The Church St. and East Liberty St. crossings have a paralleling roadway in Harris St., however, the cross streets have the right-of-way, so no queuing should be caused.

- 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. Both the signals on Thom St. and Centerview Dr. at US 29A, meet this criteria. Signal preemption is in place and was operating properly during field observations.

- 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').

All of the crossings in China Grove are humped to some degree with Thom St., Centerview Dr., East Liberty St. and Elm St. being the most severe. Chapel St., Church St. and Eudy Rd. are also humped, but to a lesser degree. There is evidence of vehicles dragging over the crossing at several locations. These will be described 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 China Grove Study are rough and vehicle crossing speeds are in the 5-10 MPH range.

- 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 show this unsafe maneuver occurring at several China Grove 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.

Signs and/or pavement markings need attention at all of the crossings. Railroad legends (RR) are required by the Manual on Uniform Traffic Control Devices for all crossings protected by signals and gates. These are badly worn at several of the crossings and need replacement.

- Roadway Improvements

Roadway improvements are proposed for several of the China Grove crossings. Details and cost estimates are contained in the **Recommendations Section** of this report.

- 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 areas, downtowns, or near historic structures. For the China Grove study, none of the crossings meet the criteria for a grade separation structure as described above under **Menu of Available Transportation System Enhancements**.

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**

- The Rowan Co School System reports utilization of all the crossings in the China Grove study with the exception of Church St. Crossing volume ranges from three buses per day at Chapel St. to eight per day at Liberty St.
- Town officials advise that the Volunteer Fire Dept makes significant use of Elm St., Centerview Dr. and Church St. The Police Chief also advised that motorists driving around the gates at the Church Street crossing is a problem that needs to be addressed, as well as the profile (hump) of the Thom St. crossing.
- **KANNAPOLIS-CONCORD THOROUGHFARE PLAN:** was adopted by the Town of China Grove on March 5, 1996. The **PLAN** has two proposed projects that impact the recommendations that follow in the **Recommendations Section** of this report.
 - North of Landis and south of China Grove, Kimball Rd. is proposed to be

extended with a grade separation structure at the NS, to connect to Old Beattys Ford Road.

- North of China Grove, NC 152 is to be realigned from Mt. Moriah Church Rd. connecting to Shue Road and over to I-85 with a new interchange. The existing grade separation structure at the NS will be maintained.
- **NCDOT Transportation Improvement Program (TIP)**- there are no projects scheduled in the **TIP** for China Grove. Also, the **Division Engineer** for the **9th Division** reports no planned projects in the area that would affect the China Grove crossings.

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 China Grove area will continue to increase as growth and expansion in Rowan County continues.

Safety is a concern at Chapel St., Thom St. and Centerview Dr. because of the potential for vehicles to queue across the tracks. This situation will only worsen as traffic volume increases, especially at the congested intersections of US 29A/Thom St. and US 29A/ Centerview Dr.

The eastbound approach is well below accepted standards for grade crossings at Thom St., Centerview Dr. and Liberty St., and to a lesser extent at Elm St.

RECOMMENDATIONS

I. Eudy Road

Eudy Road is located just outside the corporate limits of China Grove and provides access primarily to two churches. Both churches also have access to other roadways, either US 29A or Chapel St. Eudy Road carries an average of 460 vehicles per day. A recent mid-day 15 minute count showed a total of eight (8) vehicles using the crossing. The crossing is humped and the average crossing speed is 10 MPH. While there has been only one accident at the crossing in the ten-year period, the potential certainly exists for more to occur as rail traffic in the corridor increases. See **Figures 3 and 4**.

Near-term recommendation:

Close the crossing maintaining access on the west side to the driveway into the cemetery for the Mount Zion Church of Christ. On the east side, the Lutheran Chapel has a circular driveway which can be incorporated into the remaining roadway basically for the exclusive use of the chapel.

Estimated Cost:

Remove crossing	\$8,000.00
Remove pavement, install barricades, landscape	\$15,000.00

Impact of the Recommendation: The closing of Eudy Road will require some adjustment in local driving habits as well as in the routing of area school buses and emergency responders. If Eudy Rd. is closed, as well as Elm St., those traveling in the area wishing to access US 29A will have to use 3rd St., Walnut St. and Thom St. This change in routing will increase travel distances by about 1.2 miles and require about 4 minutes of additional driving time due to signal operations at US 29A and Thom St. Closing the crossing will eliminate the potential for grade-crossing collisions to occur and will facilitate the implementation of the **Piedmont High Speed Rail Corridor**. The closing will also eliminate the noise impacts associated with the blowing of train horns.

II. Elm Street

Elm Street is just inside the corporate limits of China Grove on the south side. It is a low-volume street carrying 720 vehicles per day. A recent mid-day 15 minute count showed 12 vehicles using the crossing. It is badly humped (about 2 feet) and shows signs of vehicles dragging over the track. The average crossing speed is 5 MPH. The crossing is also compromised, from a safety standpoint, by the presence of Central Ave. approximately 50 feet east of the crossing and parallel to the track. There are no reported accidents during the ten years for which records are available. See **Figures 5 and 6**.

Elm Street provides access to a residential area east of the track and connectivity to US 29A on the west side. It also connects to US 29 on the east and to downtown China Grove by way of Third Ave, Walnut St. and Bostian St. In light of the low volume of traffic served, the availability of alternative access, and the goals of the **Piedmont High Speed Rail Corridor**, it is recommended that **Elm Street** be closed. The recommendation includes modifying access to the driveway and parking area of the Oakgrove Baptist Church on the west side of the track. On the east side, the pavement leading up to the crossing can be removed and the Elm St. traffic can turn right onto Central Ave.

Near-term Recommendation:

Close the crossing.

Estimated cost:

Remove crossing \$ 8,000.00
Remove pavement, install barricades and landscape \$ 7,500.00

Impacts of Recommendation:

There are some negative impacts associated with the closing of Elm Street. Driving habits will have to be modified by local residents, however, the average driving distance for those wishing to access US 29A south only increases by about 500 feet. The routing of school buses and emergency responders will also be affected and will require modification. While the additional traffic using Thom St. to access US 29A is not considerable, the intersection is currently operating at an LOS of C.

The major benefit to closing the crossing comes in the form of improved public safety. The potential for collisions is eliminated and, thereby, helping to facilitate the implementation of the **Piedmont High Speed Rail Corridor**. The closing will also eliminate the noise impacts associated with the blowing of train horns.

III. East Thom Street

East Thom Street is one of the higher volume crossings in the China Grove study carrying over 3200 vehicles per day. The eastbound approach grade is very bad leading to a humped crossing that shows evidence of vehicles dragging over the track. The track is also superelevated (banked), resulting in crossing speeds of 10 MPH or less. An analysis of the signalized intersection of Thom St. and US 29-A (Main St.), shows that the intersection operates in a mildly congested mode that will only get worse as traffic volumes grow. Vehicles were also observed driving around the lowered crossing gates during field work for this report. There have been no reported accidents during the ten years for which records are available. See **Figures 7 and 8**.

Near-term Recommendation:

Install long-gate arms at the crossing.

Estimated Cost: \$15,000.00

Mid-term Recommendation:

Raise the grade of the westbound approach approximately 18 inches in order to facilitate overall crossing maneuverability.

Estimated Cost: \$30,000.00

Long-term Recommendation:

Remove parking on both sides of southbound US 29-A approach to Thom St. intersection in order to add left-turn lanes on both approaches .

IV. Chapel St

Provides access to a primarily residential area between US 29-A and Bostian St. Of all the crossing streets in China Grove, it carries the least amount of daily traffic at 345 vehicles per day. A recent 15 minute mid-day count taken at Chapel, showed a total of four vehicles crossing during the period. The crossing is humped and shows signs of vehicles dragging over the track. The track is superelevated (banked) causing an uneven condition resulting in crossing speeds in the 5-10 MPH range. The crossing itself is very close to US 29-A (less than 50 feet) which can cause vehicles to que across the track while waiting to enter the flow of traffic on 29-A. Although it does not cause a safety problem because of low volumes of traffic, Harris St. also parallels the track about 35 feet to the east. There have been no reported accidents at the crossing during the 10-year period for which records are available.

Alternative access is available to the neighborhood served by Chapel St. from Thom St. on the south and Centerview St. on the north via Bostian St., which parallels US 29-A approximately 1000 feet to the east. See Figures 9 and 10.

Near-term Recommendation:

Close the Chapel Street crossing.

Estimated Cost:

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

Impacts of Recommendation:

The primary impact of closing Chapel St. will be that driving habits of area residents will have to be modified. For a driver leaving a residence mid-block along Chapel St. and wishing to access US 29-A South, the actual increase in driving distance is 0.35 miles and the drive-time will increase less than two minutes. For one wishing to access US 29-A North, there is no increase in travel distance or time. Given the low volume of traffic using the crossing, however, the impact of increased traffic on other streets in the neighborhood will be negligible. Some minor re-routing of school buses in the area will have to occur as well as designated routes for area emergency responders. The overall result of the recommendation is positive, however, in that the potential for grade-crossing collisions to occur will have been eliminated and it will facilitate the implementation of the **Piedmont High Speed Rail Corridor**. The closing will also eliminate the noise impacts associated with the blowing of train horns.

V. Centerview Drive

Serves the central business district of China Grove, carries 2700 vehicles per day and connects between US 29A and US 29. There has been one collision at the crossing during the ten years for which records are available, resulting in a fatality in 1993. The crossing is humped, especially on the eastbound approach, and shows signs of vehicles dragging over the track. The track itself is superelevated (banked), resulting in a rough overall condition and crossing speeds of +/- 10 MPH. The China Grove Police Chief reports vehicles sometimes drive around lowered crossing gates.

The level of service analysis conducted for the intersection of US 29A and Centerview Dr. shows the intersection to be operating in a congested mode during the p.m. peak period. Without improvements to the intersection, the congestion problem will only get worse as traffic volumes continue to grow. See Figures 11 and 12.

Near-term Recommendation:

Install long-gate arms at the crossing. Remove on street parking a sufficient distance north and south of the intersection along US 29A to enable the installation of north and southbound left-turn lanes.

Estimated Cost:

Long-gate arms	\$15,000.00
Left-turn lanes on US 29-A	\$1,200.00

Impacts of Recommendation:

The removal of on-street parking will be viewed by area merchants as a loss of access and, thereby, a loss of income. However, congestion can also cause the same problems for merchants in that shoppers will elect to go someplace else if they perceive that access and parking are an issue. During field observations for this report, on-street parking appeared to be under-utilized and off-street parking in the vicinity of the intersection was plentiful.

Mid-term Recommendation:

Raise the grade on the westbound approach approximately 15" to facilitate overall crossing maneuverability.

Estimated Cost:	\$45,000.00
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VI. Church Street

Church Street is classified as a minor thoroughfare in the **Kannapolis-Concord Thoroughfare Plan** and carries just over 4500 vehicles per day. It provides connectivity between US 29A and US 29 as well as providing local access to mostly residential property. Church St. is not used by the Rowan Co. School system, but is used by local emergency responders. The crossing has become humped over the years because of rail maintenance activities. While the crossing itself is in relatively good condition, the ride profile is compromised by an adjacent spur track which results in operating speeds over the crossing in the 15-20 MPH range. There have been no accidents in the ten years for which records are available, however, the Police Chief reports motorists driving around the lowered gates on occasion. Harris Street parallels the track to the east of the crossing and intersects Church St. about 25 feet from the railroad. While apparently not a problem in the past, a northbound vehicle turning from Harris St. to go west on Church St., could easily drive around the lowered gate arms and onto the tracks. See **Figures 13 and 14.**

Near-term Recommendation:

Install long gate arms at the crossing.

Estimated Cost: **\$15,000.00**

Long-term Recommendation: The intersection of Church St. at US 29A is offset with West Church St. intersecting US 29A approximately 150 feet north of East Church Street. This offset arrangement makes for an inefficient intersection in that left- and right-turns have to be made in order to continue a through movement along Church St. from either direction. The offset also causes additional delay at the traffic signal resulting in unwarranted congestion. It is recommended that a **Feasibility Study** be conducted to determine the costs and impacts of eliminating the offset through the intersection.

VII. East Liberty Street

Provides local access to properties between US 29A and US 29 and carries less than 500 vehicles per day. A recent 15 minute mid-day count reported 12 vehicles used the crossing. The eastbound approach to the crossing is poor and is further compromised by Salisbury St. which intersects with Liberty approximately 45 feet west of the crossing. On the east side, Harris St. parallels the track and intersects with Liberty approximately 35 feet from the edge of track. On the westbound approach, the elevation of the track is approximately two feet higher than Liberty St., and crossing speeds are about 5 MPH. Liberty St. is used by the school system and local emergency responders.

As is the case at Church St., a northbound vehicle turning from Harris St. to go west on Liberty could easily drive around the lowered gates and onto the track. Vehicles were observed driving around the lowered gates during field work for this report. There have

been no accidents reported at the crossing for the ten years for which records are available. See Figures 15 and 16.

Near-term Recommendation:

Close the crossing. (Given the existence of Salisbury St. on the west side of the crossing, and Harris St. on the east, the crossing can be closed and mobility maintained without the construction of cul-de-sacs.)

Estimated Cost:

Remove crossing	\$8,000.00
Remove pavement, install barricades, landscape	\$10,000.00

Impacts of Recommendation:

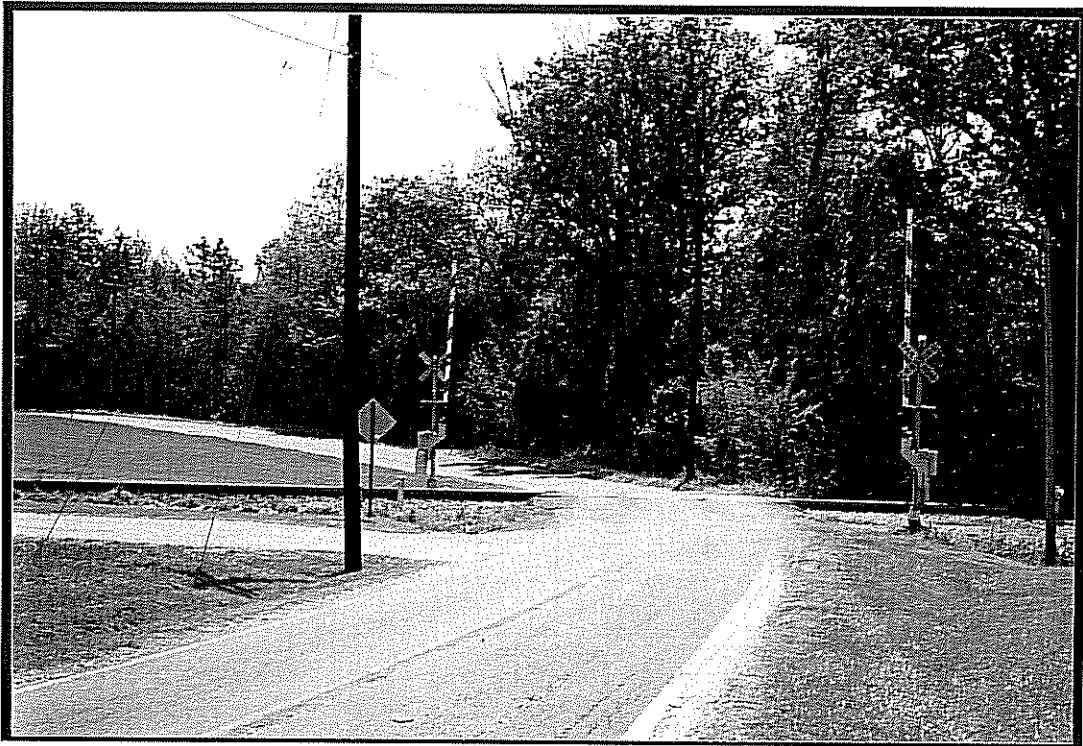
The closing of East Liberty St. will require some modification in local driving habits as well as the re-routing of school buses and emergency responders to other nearby local streets. For someone wishing to access US 29A South, there is no measurable increase in either travel time or distance. For one wishing to go north on US 29A, the increase in travel distance is approximately 600 feet. The travel time may increase as much as a minute, however, due to the signal operation at Church St. and US 29A. Due to the low volumes of traffic involved, however, there should be no perceptible increase in traffic on other streets in the area.

The overall impacts of the recommendation are positive. A crossing with high potential for rail/highway collisions will be eliminated and the implementation of the **Piedmont High Speed Rail Corridor** facilitated. The crossing can be removed and mobility maintained without the need to make extensive revisions to the remaining street system. The closing will also eliminate the noise impacts associated with the blowing of train horns.

Municipality: Near China Grove

Crossing Number: 724390R

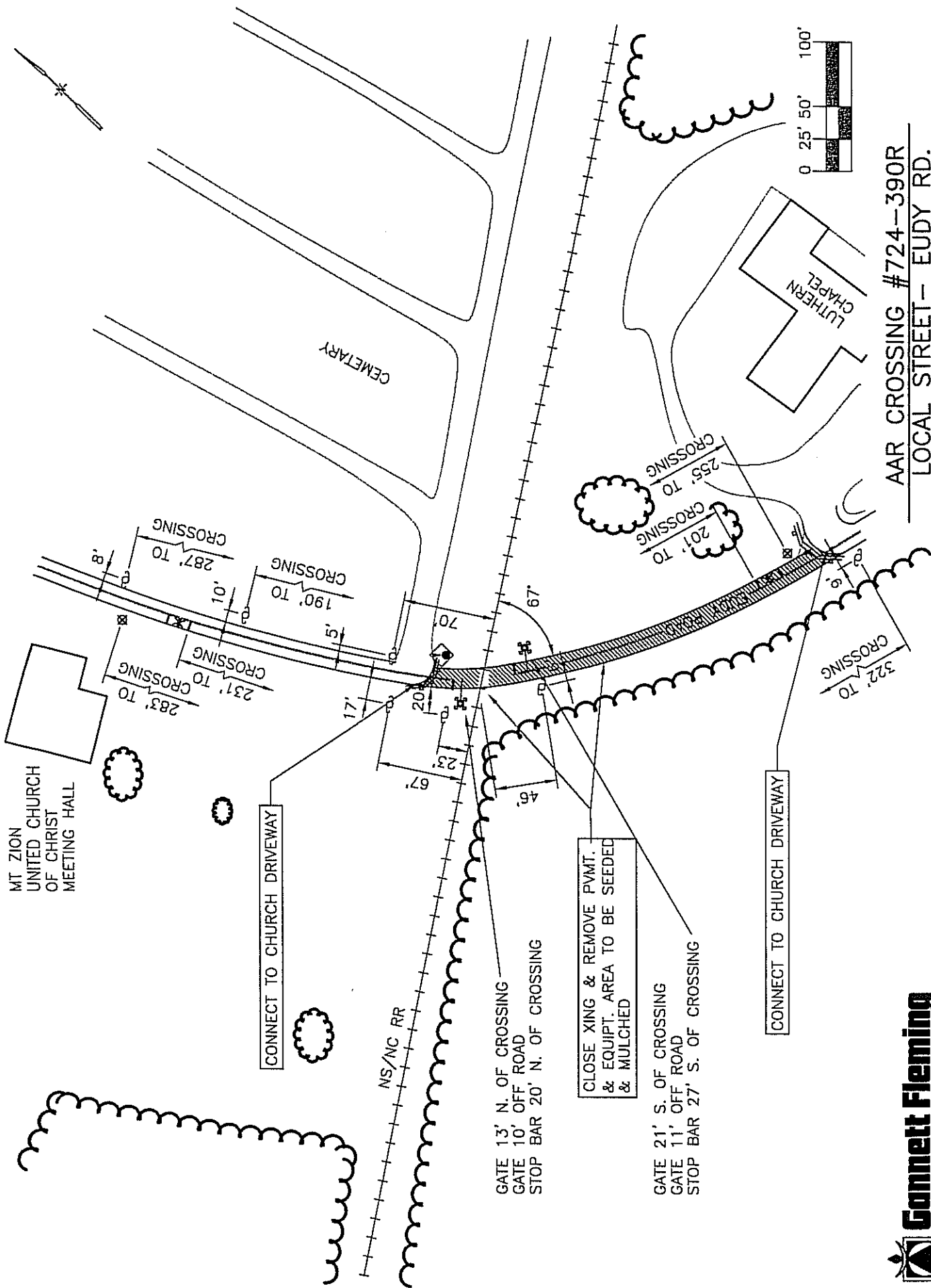
Street Name: Eudy Rd.



Eastbound Approach



Westbound Approach



AAR CROSSING #724-390R
LOCAL STREET- EUDY RD.
RECOMMENDED IMPROVEMENTS

FIGURE 4

Municipality: China Grove

Crossing Number: 724389W

Street Name: Elm St.



Eastbound Approach



Westbound Approach

GATE 11' S. OF CROSSING
GATE 6' OFF ROAD
STOP BAR 23' S. OF CROSSING
W10-1 351' S. OF CROSSING
PAVEMENT MARKING 302' S. OF CROSSING

301 S. McDOWELL STREET, SUITE 914
CHARLOTTE, NORTH CAROLINA 28204

AAR CROSSING #724--389W
LOCAL STREET-- ELM (BOSTIAN) ST.
RECOMMENDED IMPROVEMENTS

FIGURE 6

Municipality: China Grove

Crossing Number: 724388P

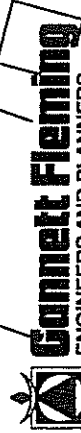
Street Name: Thom St.



Eastbound Approach



Westbound Approach



AAR CROSSING #724-388P
LOCAL STREET- THOM ST.
RECOMMENDED IMPROVEMENTS

36

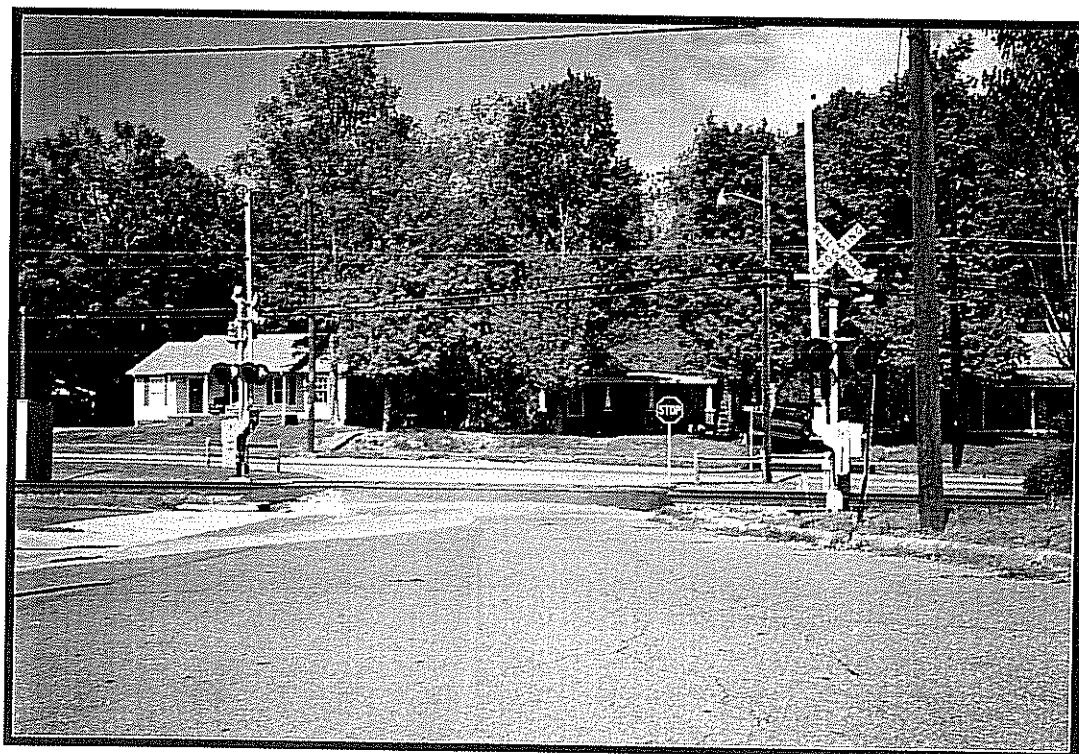
Municipality: China Grove

Crossing Number: 724386B

Street Name: Chapel St.



Eastbound Approach



Westbound Approach

Municipality: China Grove

Crossing Number: 724384M

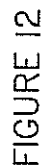
Street Name: E. Centerview St.



Eastbound Approach



Westbound Approach



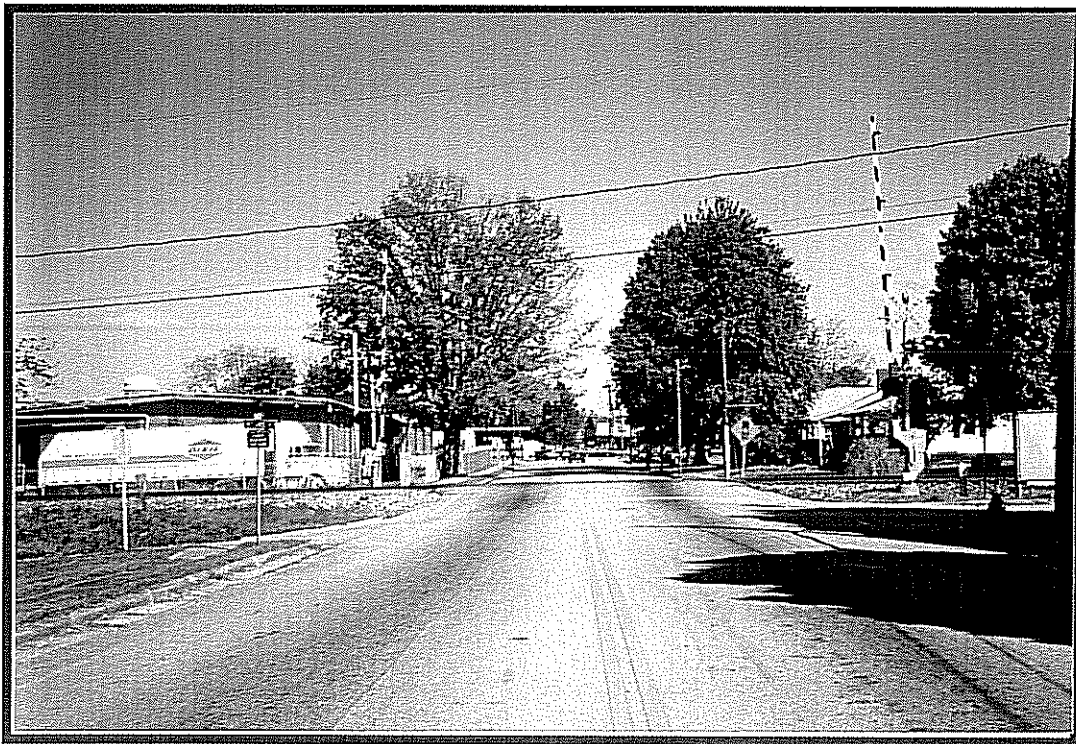
Municipality: China Grove

Crossing Number: 324382Y

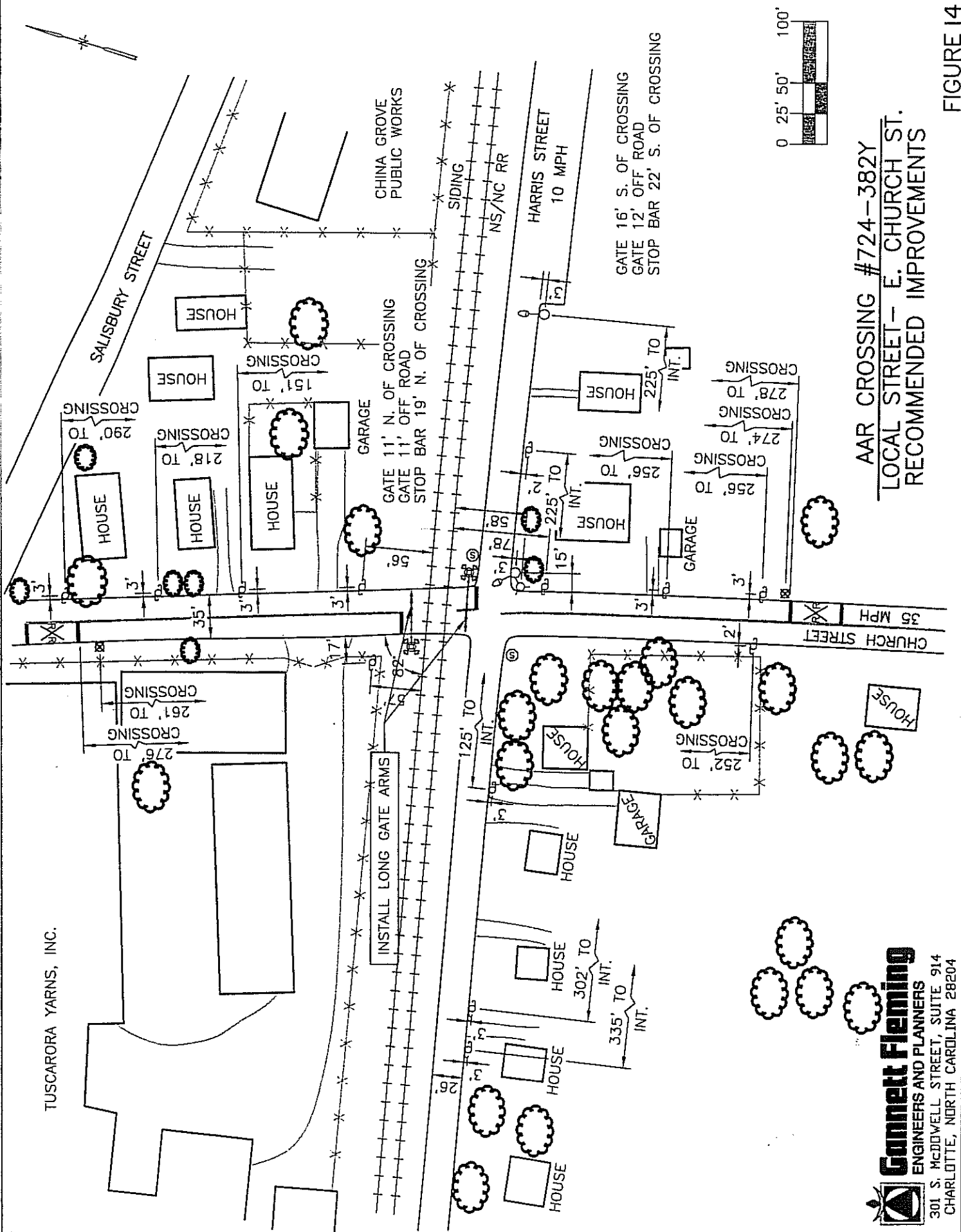
Street Name: E. Church St.



Eastbound Approach



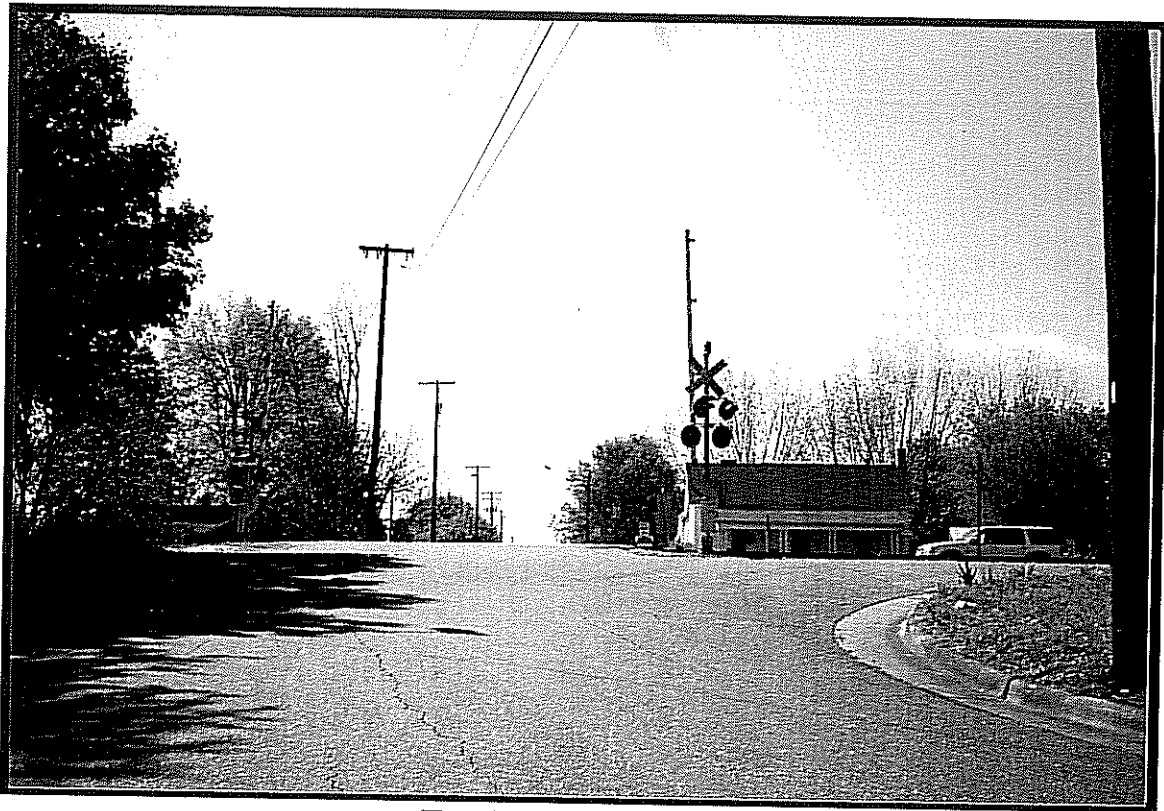
Westbound Approach



Municipality: China Grove

Crossing Number: 724381S

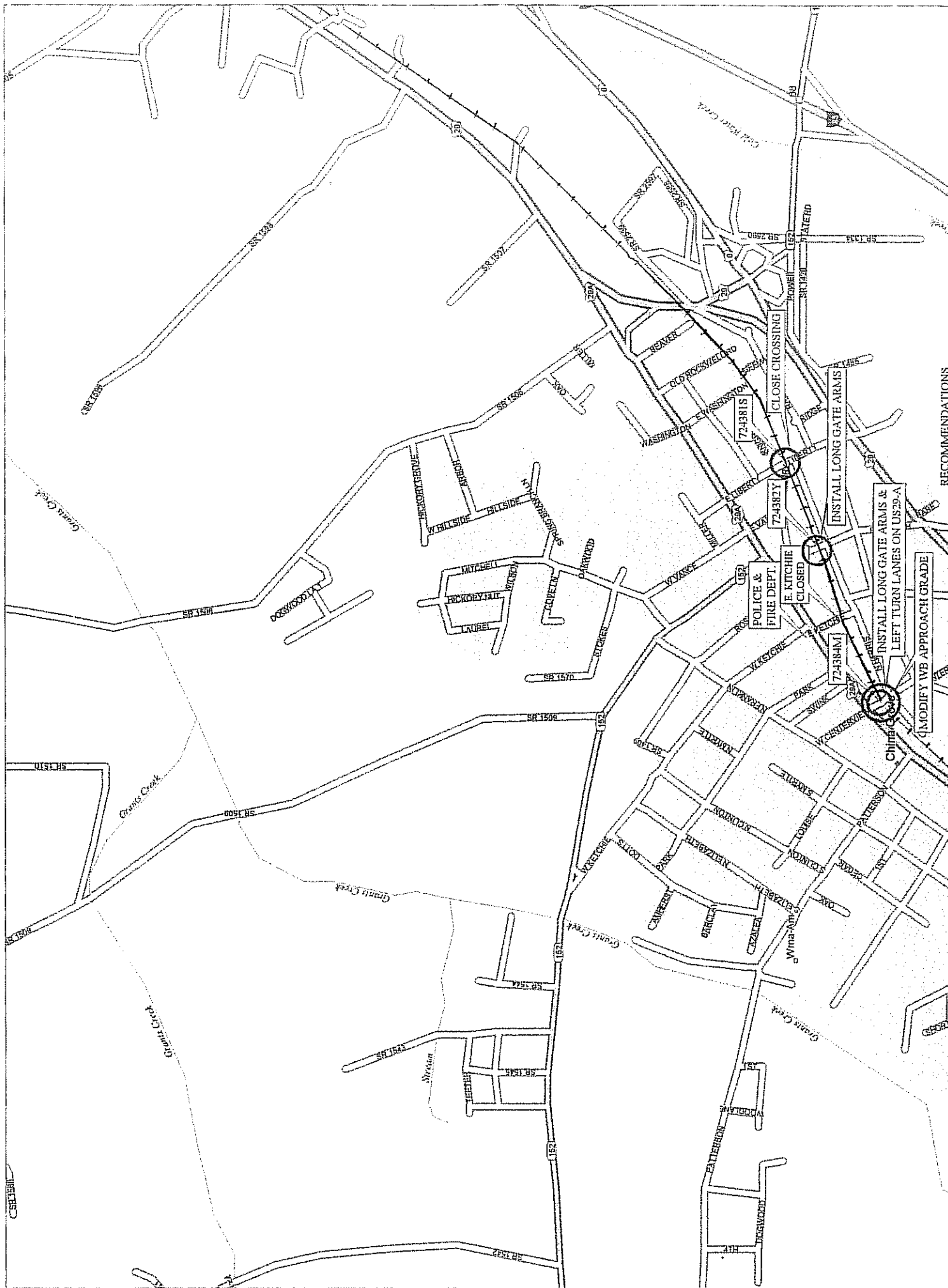
Street Name: E. Liberty St.



Eastbound Approach



Westbound Approach



APPENDIX

Intersection Performance Summary

Streets: (N-S) US 29 A (E-W) Thom Street
Analyst: RNP File Name: US29ATHOM.HC9
Area Type: CBD 4-16-97 4-5 PM
Comment: LOS 2010 Volumes

	Northbound			Southbound			Eastbound			Westbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	> 1	<		> 1	<		> 1	<		> 1	<	
Volumes	14	243	58	38	242	19	1	9	16	82	7	28
Lane W (ft)	16.0			16.0			14.0			14.0		
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		20.0A				Green		40.0P				
Yellow/AR		5.7				Yellow/AR		5.4				
Cycle Length:		71 secs	Phase combination order: #1 #5									

Intersection Performance Summary									
Lane Group:		Adj Sat	v/c	g/C			Approach:		
Mvmnts	Cap	Flow	Ratio	Ratio	Delay	LOS	Delay	LOS	
NB	LTR	501	1570	0.880	0.319	26.5	D	26.5	D
SB	LTR	448	1402	0.934	0.319	33.7	D	33.7	D
EB	LTR	880	1475	0.042	0.596	2.6	A	2.6	A
WB	LTR	859	1440	0.191	0.596	6.9	B	6.9	B
Intersection Delay = 25.5 sec/veh Intersection LOS = D									
Lost Time/Cycle, L =		6.0 sec	Critical v/c(x)		= 0.450				

Intersection Performance Summary									
	Lane	Group:	Adj Sat	v/c	g/C			Approach:	
	Mvmnts	Cap	Flow	Ratio	Ratio	Delay	LOS	Delay	LOS
	-----	-----	-----	-----	-----	-----	---	-----	---
NB	L	131	409	0.153	0.319	13.2	B	23.1	C
	TR	502	1572	0.839	0.319	23.6	C		
SB	L	101	297	0.525	0.319	18.9	C	18.4	C
	TR	522	1634	0.700	0.319	18.3	C		
EB	LTR	880	1475	0.042	0.596	2.6	A	2.6	A
WB	LTR	859	1440	0.191	0.596	6.9	B	6.9	B
Intersection Delay = 18.0 sec/veh Intersection LOS = C									
Lost Time/Cycle, L = 6.0 sec Critical v/c(x) = 0.417									

(E-W) Centerview St.

File Name: THOM3.HC9

4-16-97 4-5 PM

Comment: LOS 1997 Volumes

[illegible]

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	20.0A				Green	40.0P		
Yellow/AR	5.7				Yellow/AR	5.4		
Cycle Length:	71 secs	Phase combination order: #1 #5						

Intersection Performance Summary

	Lane	Group:	Adj Sat	v/c	g/C			Approach:	
	Mvmnts	Cap	Flow	Ratio	Ratio	Delay	LOS	Delay	LOS
	-----	-----	-----	-----	-----	-----	---	-----	---
NB	LTR	446	1397	0.854	0.319	25.4	D	25.4	D
SB	LTR	295	925	1.547	0.319	*	*	*	*
EB	LTR	787	1320	0.042	0.596	2.6	A	2.6	A
WB	LTR	846	1419	0.240	0.596	3.0	A	3.0	A

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

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

Center For Microcomputers In Transportation

Comment: LOS 1997 Volumes Build

[illegible]

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		20.0A				Green	40.0P		
Yellow/AR		5.7				Yellow/AR	5.4		
Cycle Length:		71 secs	Phase combination order: #1 #5						

	Lane	Group:	Adj Sat	v/c	g/C			Approach:	
	Mvmnts	Cap	Flow	Ratio	Ratio	Delay	LOS	Delay	LOS
	-----	-----	-----	-----	-----	-----	---	-----	---
NB	L	145	453	0.007	0.319	12.5	B	20.2	C
	TR	497	1556	0.765	0.319	20.3	C		
SB	L	124	387	0.923	0.319	58.5	E	28.0	D
	TR	505	1582	0.679	0.319	17.9	C		
EB	LTR	787	1320	0.042	0.596	2.6	A	2.6	A
WB	LTR	846	1419	0.240	0.596	3.0	A	3.0	A
Intersection Delay =						19.8 sec/veh	Intersection LOS = C		
Lost Time/Cycle, L =			6.0 sec	Critical v/c(x)		= 0.478			

Streets: (N-S) US 29 A (E-W) Centerview St.
Analyst: RNP File Name: CENVIEW2.HC9
Area Type: CBD 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	1	1	<	1	1	<	>	1	<	>	1	<
Volumes	1	269	73	103	298	11	8	20	2	79	17	86
Lane W (ft)	10.0	11.0		10.0	11.0		10.5			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		7.0P	35.0P		Green	15.0A						
Yellow/AR		5.7	4.0		Yellow/AR	5.4						
Cycle Length:	72	secs		Phase combination order: #1 #2 #5								

Intersection Performance Summary									
	Lane	Group:	Adj Sat	v/c	g/C	Delay	LOS	Approach:	
	Mvmts	Cap	Flow	Ratio	Ratio			Delay	LOS
NB	L	193	387	0.005	0.499	6.9	B	9.4	B
	TR	705	1412	0.679	0.499	9.4	B		
SB	L	330	1531	0.436	0.675	4.8	A	2.4	A
	TR	1000	1480	0.432	0.675	1.6	A		
EB	LTR	289	1196	0.146	0.241	16.4	C	16.4	C
WB	LTR	327	1354	0.783	0.241	25.7	D	25.7	D
Intersection Delay =						9.7 sec/veh	Intersection LOS = B		
Lost Time/Cycle, L =				9.0 sec	Critical v/c(x)		= 0.711		

Date: 3/5/97 Time: 4:00-6:00 PM Weather: Sunny		MANUAL TRAFFIC COUNT SUMMARY IN PASSENGER CAR EQUIVALENTS (PCE'S)		Counted by: BKC Location: Thom St. @ 29A /Main St.	
Time	Approach	Left-Turn	Through	Right-Turn	Total
4:00-4:15	EB	0	4	0	4
4:15-4:30	EB	0	3	1	4
4:30-4:45	EB	0	1	4	5
4:45-5:00	EB	1	1	11	13
5:00-5:15	EB	0	2	8	10
5:15-5:30	EB	0	2	5	7
5:30-5:45	EB	0	1	6	7
5:45-6:00	EB	0	3	2	5
TOTAL		1	17	37	55
4:00-4:15	WB	23	3	6	32
4:15-4:30	WB	15	1	6	22
4:30-4:45	WB	9	0	7	16
4:45-5:00	WB	35	3	9	47
5:00-5:15	WB	24	4	11	39
5:15-5:30	WB	16	1	10	27
5:30-5:45	WB	25	1	11	37
5:45-6:00	WB	22	1	7	30
TOTAL		169	14	67	250

Date: 3/5/97 Time: 4:00-6:00PM Weather: Sunny		MANUAL TRAFFIC COUNT SUMMARY IN PASSENGER CAR EQUIVALENTS (PCE'S)		Counted by: BKC Location: 29A/Main St. @ Thom St.	
Time	Approach	Left-Turn	Through	Right-Turn	Total
4:00-4:15	NB	3	63	21	87
4:15-4:30	NB	6	41	9	56
4:30-4:45	NB	2	69	15	86
4:45-5:00	NB	3	70	13	86
5:00-5:15	NB	6	57	10	73
5:15-5:30	NB	1	70	17	88
5:30-5:45	NB	4	70	10	84
5:45-6:00	NB	3	63	5	71
TOTAL		28	503	100	631
4:00-4:15	SB	7	65	10	82
4:15-4:30	SB	8	47	4	59
4:30-4:45	SB	8	73	4	85
4:45-5:00	SB	15	57	1	73
5:00-5:15	SB	6	52	2	60
5:15-5:30	SB	11	50	1	62
5:30-5:45	SB	5	50	2	57
5:45-6:00	SB	7	50	0	57
TOTAL		67	444	24	535

Date: 3/11/97 Time: 4:00-6:00 PM Weather: SUNNY-75°		MANUAL TRAFFIC COUNT SUMMARY IN PASSENGER CAR EQUIVALENTS (PCE'S)		Counted by: RLC Location: Centerview @ 29A/Main St.	
Time	Approach	Left-Turn	Through	Right-Turn	Total
4:00-4:15	EB	1	6	2	9
4:15-4:30	EB	1	5	0	6
4:30-4:45	EB	2	4	0	6
4:45-5:00	EB	4	5	0	9
5:00-5:15	EB	1	4	1	6
5:15-5:30	EB	1	2	4	7
5:30-5:45	EB	1	4	2	7
5:45-6:00	EB	1	5	1	7
TOTAL		12	35	10	57
4:00-4:15	WB	19	5	22	46
4:15-4:30	WB	10	5	12	27
4:30-4:45	WB	28	4	26	58
4:45-5:00	WB	22	3	26	51
5:00-5:15	WB	18	5	23	46
5:15-5:30	WB	15	9	18	42
5:30-5:45	WB	14	3	13	30
5:45-6:00	WB	11	2	15	28
TOTAL		137	36	155	328

Date: 3/11/97 Time: 4:00-6:00PM Weather: SUNNY-75°		MANUAL TRAFFIC COUNT SUMMARY IN PASSENGER CAR EQUIVALENTS (PCE'S)		Counted by: RLC Location: 29A/Main St. @ Centerview	
Time	Approach	Left-Turn	Through	Right-Turn	Total
4:00-4:15	NB	0	70	26	96
4:15-4:30	NB	1	72	15	88
4:30-4:45	NB	0	62	15	77
4:45-5:00	NB	0	65	17	82
5:00-5:15	NB	1	60	17	78
5:15-5:30	NB	2	66	12	80
5:30-5:45	NB	0	59	16	75
5:45-6:00	NB	1	81	17	99
TOTAL		5	535	135	675
4:00-4:15	SB	23	69	3	95
4:15-4:30	SB	27	75	3	105
4:30-4:45	SB	35	79	2	116
4:45-5:00	SB	18	75	3	96
5:00-5:15	SB	16	93	1	110
5:15-5:30	SB	17	79	2	98
5:30-5:45	SB	10	71	1	82
5:45-6:00	SB	14	74	3	91
TOTAL		160	615	18	793

Date: 3/11/97 Time: 4:00-6:00 PM Weather: SUNNY		MANUAL TRAFFIC COUNT SUMMARY IN PASSENGER CAR EQUIVALENTS (PCE'S)		Counted by: BKC Location: Liberty @ Harris	
Time	Approach	Left-Turn	Through	Right-Turn	Total
4:00-4:15	EB	N/A	13	0	13
4:15-4:30	EB	N/A	9	0	9
4:30-4:45	EB	N/A	18	0	18
4:45-5:00	EB	N/A	11	0	11
5:00-5:15	EB	N/A	6	0	6
5:15-5:30	EB	N/A	8	0	8
5:30-5:45	EB	N/A	11	0	11
5:45-6:00	EB	N/A	9	0	9
TOTAL		N/A	85	0	85
4:00-4:15	WB	2	19	N/A	21
4:15-4:30	WB	2	14	N/A	16
4:30-4:45	WB	3	19	N/A	22
4:45-5:00	WB	2	20	N/A	22
5:00-5:15	WB	1	12	N/A	13
5:15-5:30	WB	1	19	N/A	20
5:30-5:45	WB	3	19	N/A	22
5:45-6:00	WB	2	13	N/A	15
TOTAL		16	135	N/A	151

Date: 3/11/97 Time: 4:00-6:00PM Weather: SUNNY		MANUAL TRAFFIC COUNT SUMMARY IN PASSENGER CAR EQUIVALENTS (PCE'S)		Counted by: BKC Location: Harris @ Liberty	
Time	Approach	Left-Turn	Through	Right-Turn	Total
4:00-4:15	NB	2	N/A	0	2
4:15-4:30	NB	0	N/A	0	0
4:30-4:45	NB	1	N/A	0	1
4:45-5:00	NB	1	N/A	1	2
5:00-5:15	NB	1	N/A	1	2
5:15-5:30	NB	0	N/A	0	0
5:30-5:45	NB	0	N/A	2	2
5:45-6:00	NB	1	N/A	0	1
TOTAL		6	N/A	4	10
4:00-4:15	SB	N/A	N/A	N/A	N/A
4:15-4:30	SB	N/A	N/A	N/A	N/A
4:30-4:45	SB	N/A	N/A	N/A	N/A
4:45-5:00	SB	N/A	N/A	N/A	N/A
5:00-5:15	SB	N/A	N/A	N/A	N/A
5:15-5:30	SB	N/A	N/A	N/A	N/A
5:30-5:45	SB	N/A	N/A	N/A	N/A
5:45-6:00	SB	N/A	N/A	N/A	N/A
TOTAL		N/A	N/A	N/A	N/A

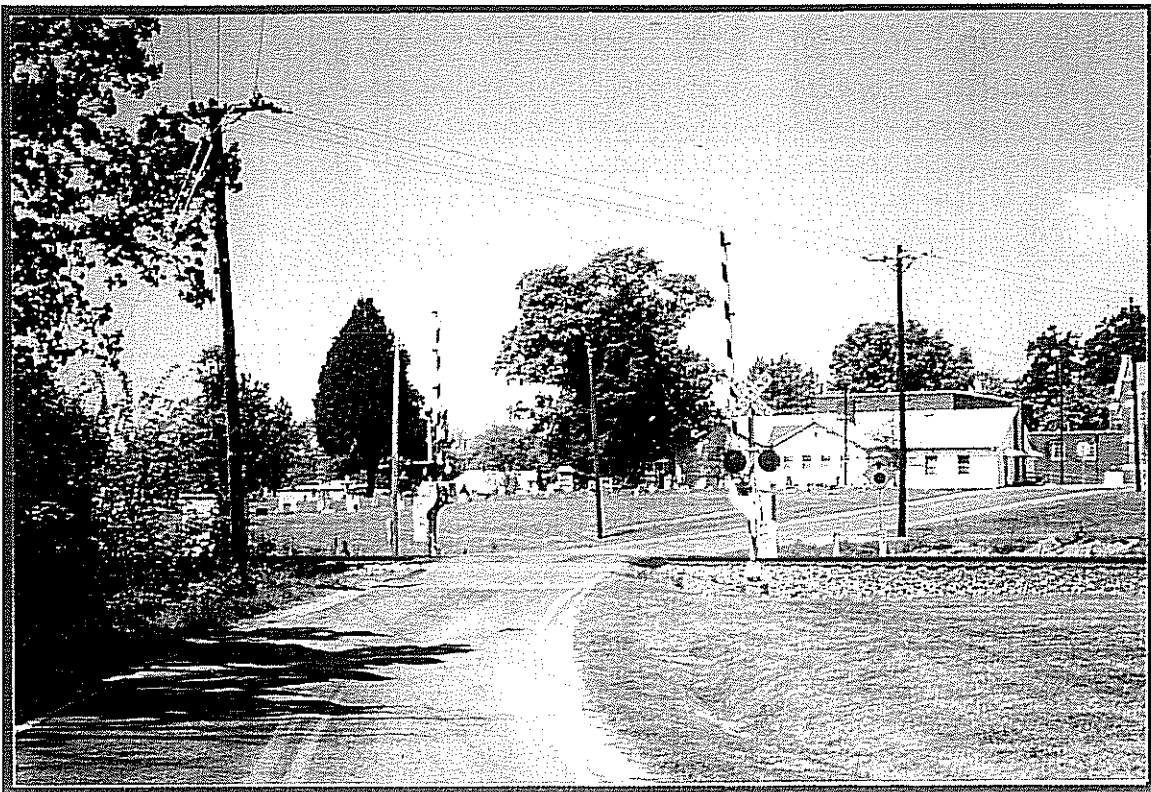
Municipality: Near China Grove

Crossing Number: 724390R

Street Name: Eudy Rd.



Eastbound Approach

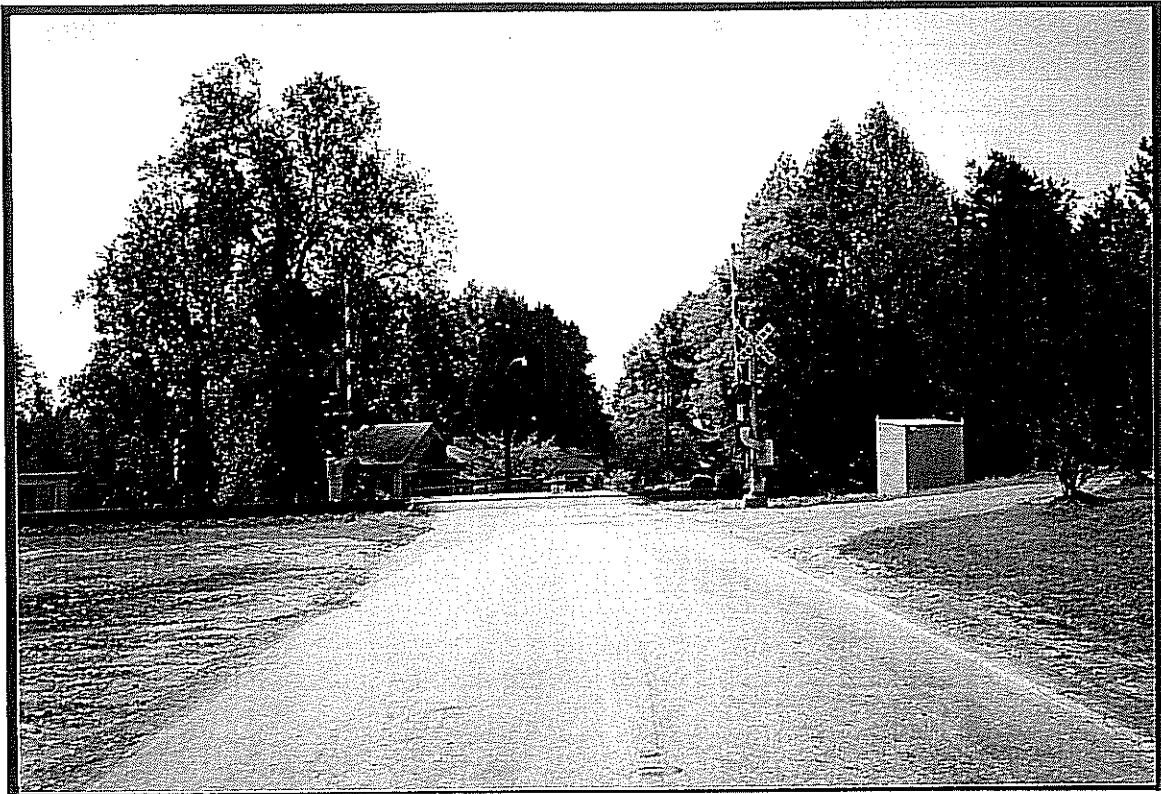


Westbound Approach

Municipality: China Grove

Crossing Number: 724389W

Street Name: Elm St.



Eastbound Approach



Westbound Approach

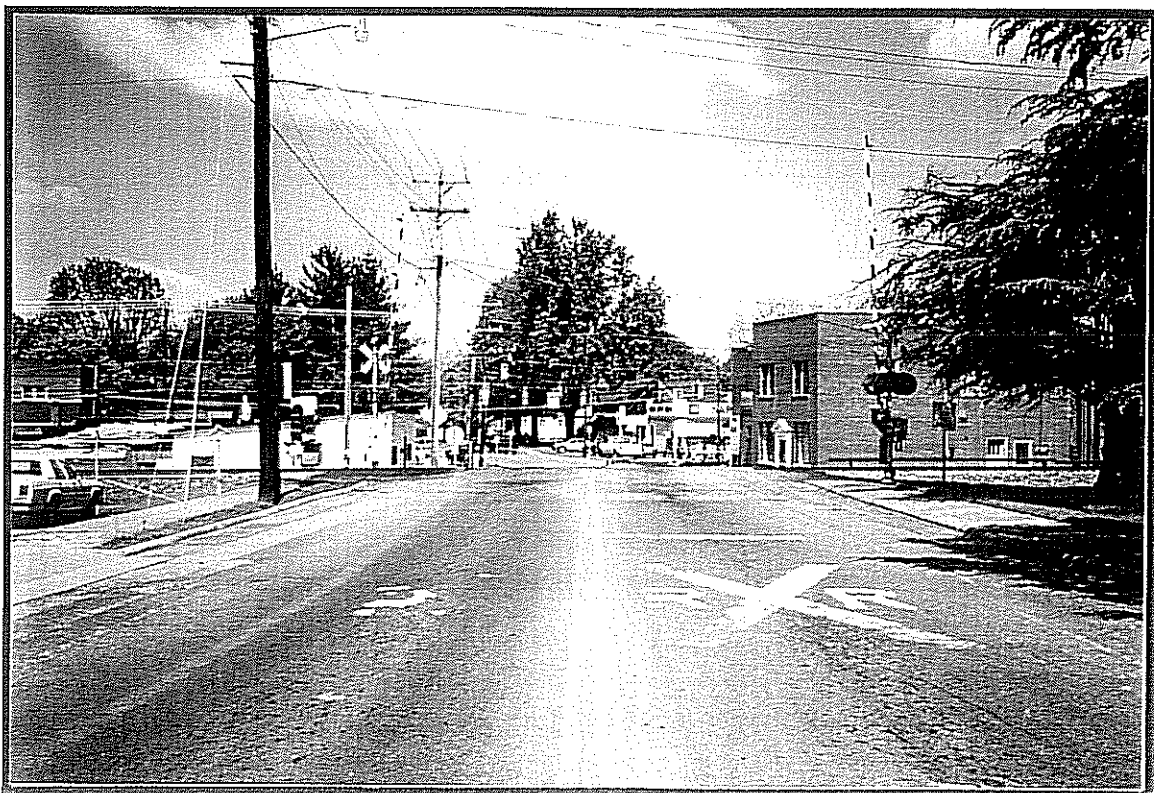
Municipality: China Grove

Crossing Number: 724388P

Street Name: Thom St.



Eastbound Approach



Westbound Approach

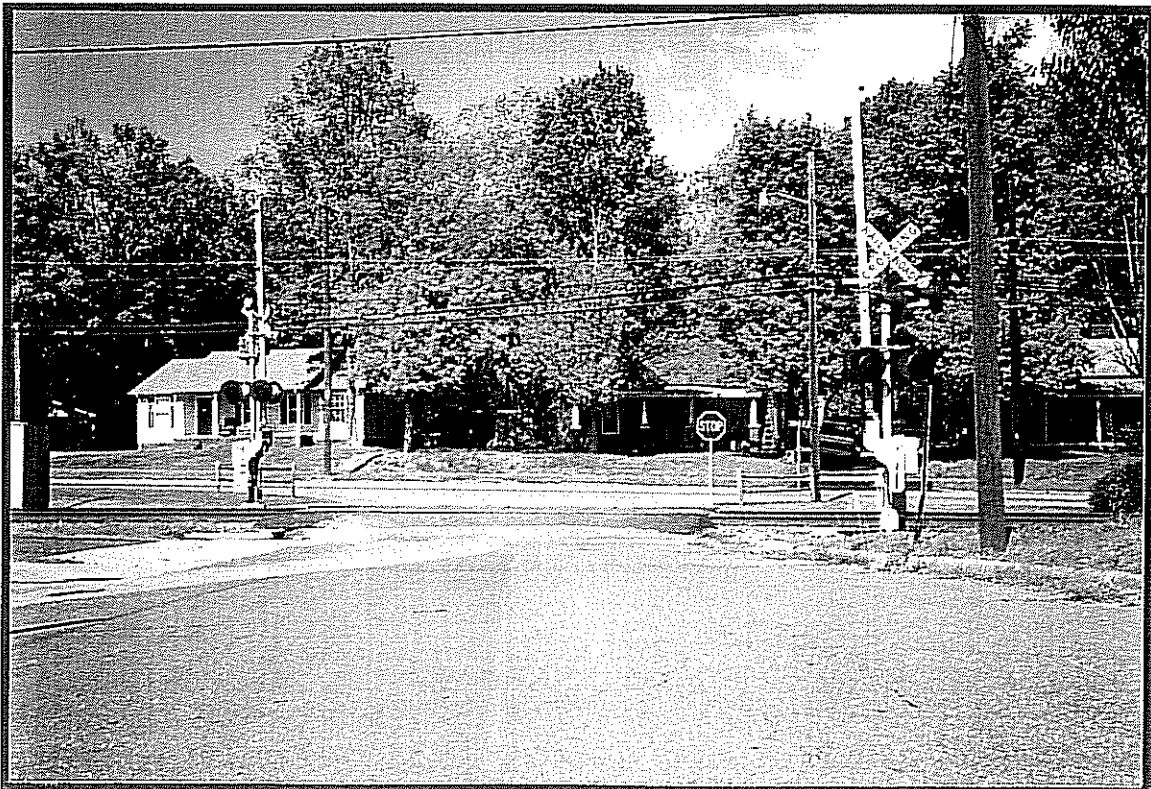
Municipality: China Grove

Crossing Number: 724386B

Street Name: Chapel St.



Eastbound Approach



Westbound Approach

Municipality: China Grove

Crossing Number: 724384M

Street Name: E. Centerview St.



Eastbound Approach



Westbound Approach

Municipality: China Grove

Crossing Number: 324382Y

Street Name: E. Church St.



Eastbound Approach

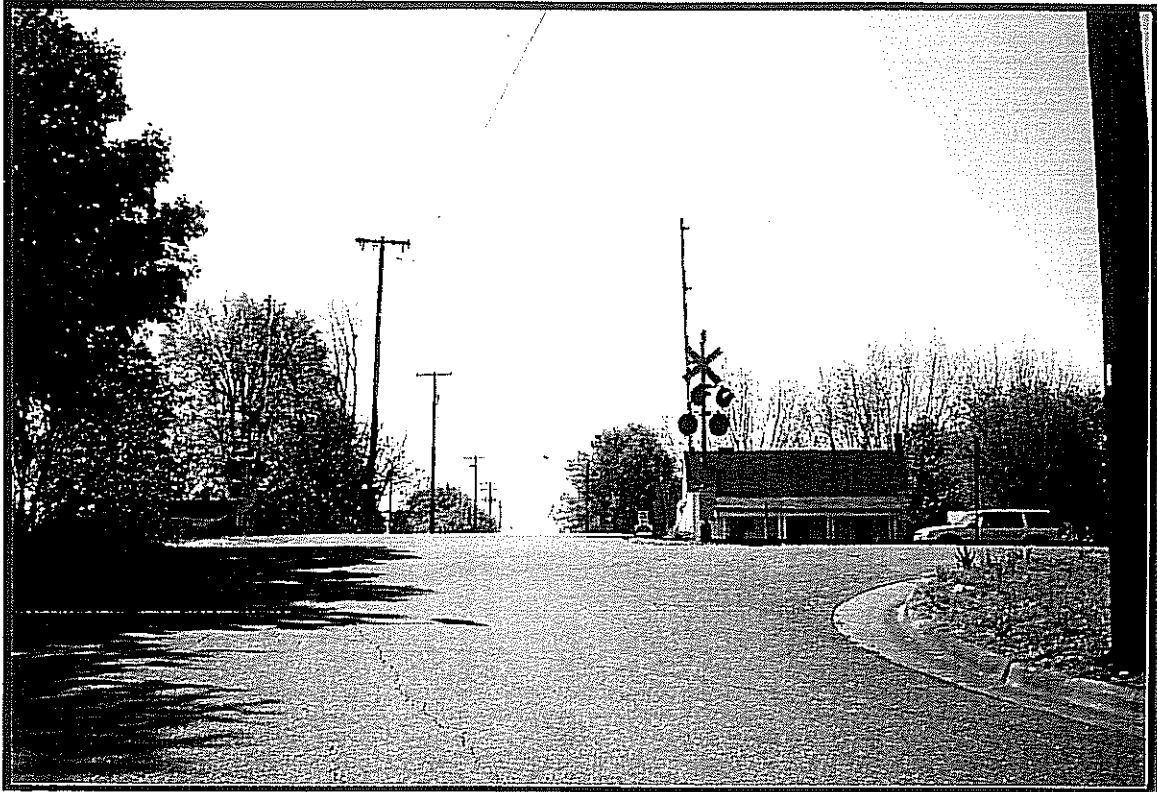


Westbound Approach

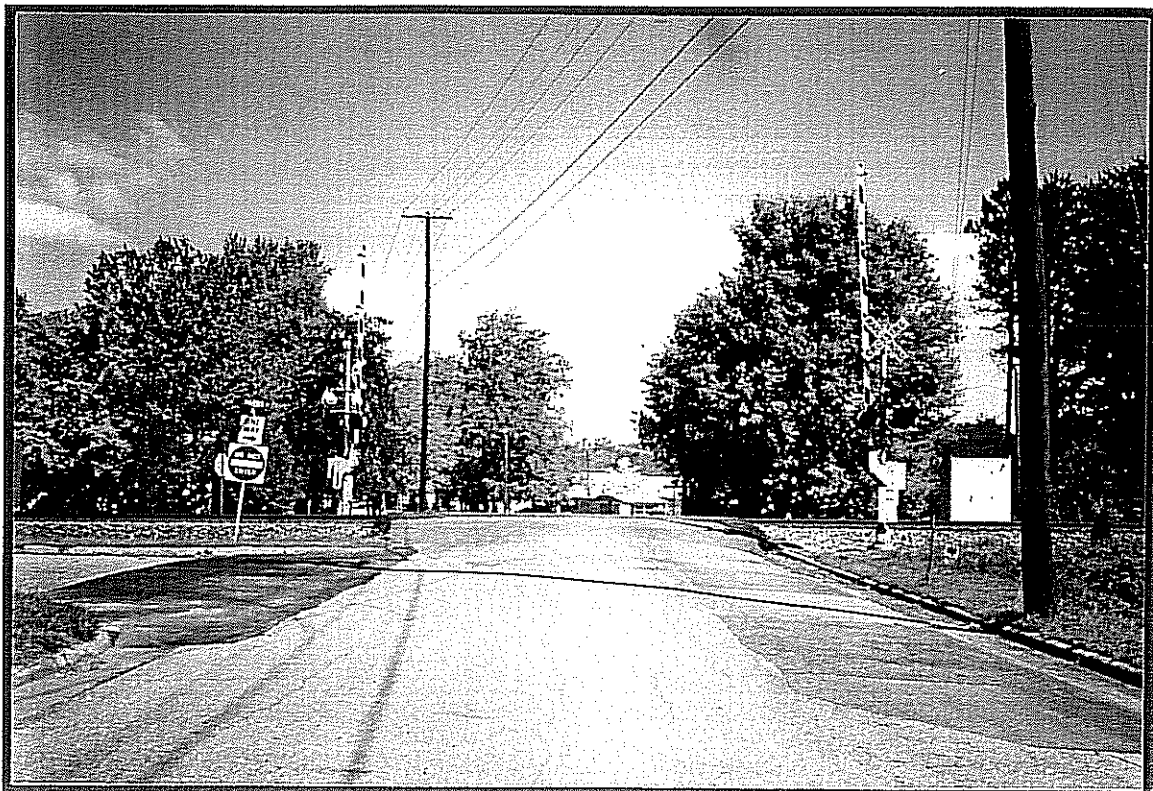
Municipality: China Grove

Crossing Number: 724381S

Street Name: E. Liberty St.



Eastbound Approach



Westbound Approach

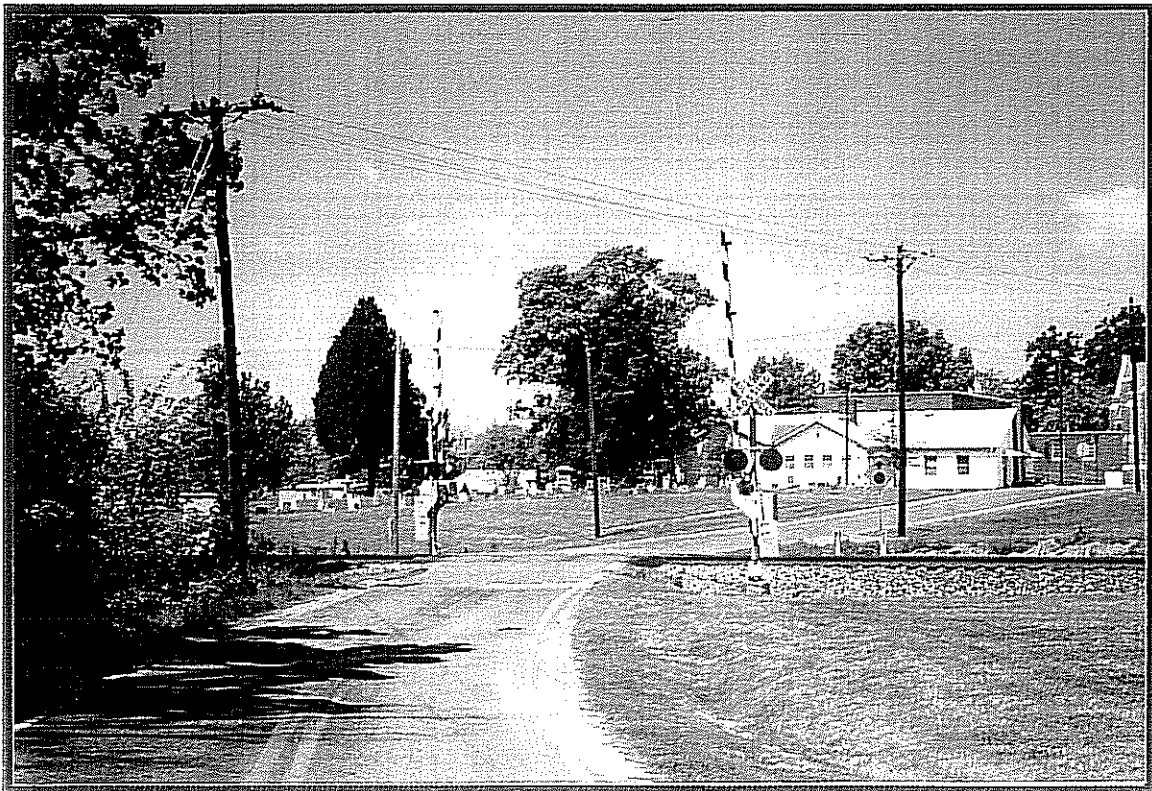
Municipality: Near China Grove

Crossing Number: 724390R

Street Name: Eudy Rd.



Eastbound Approach

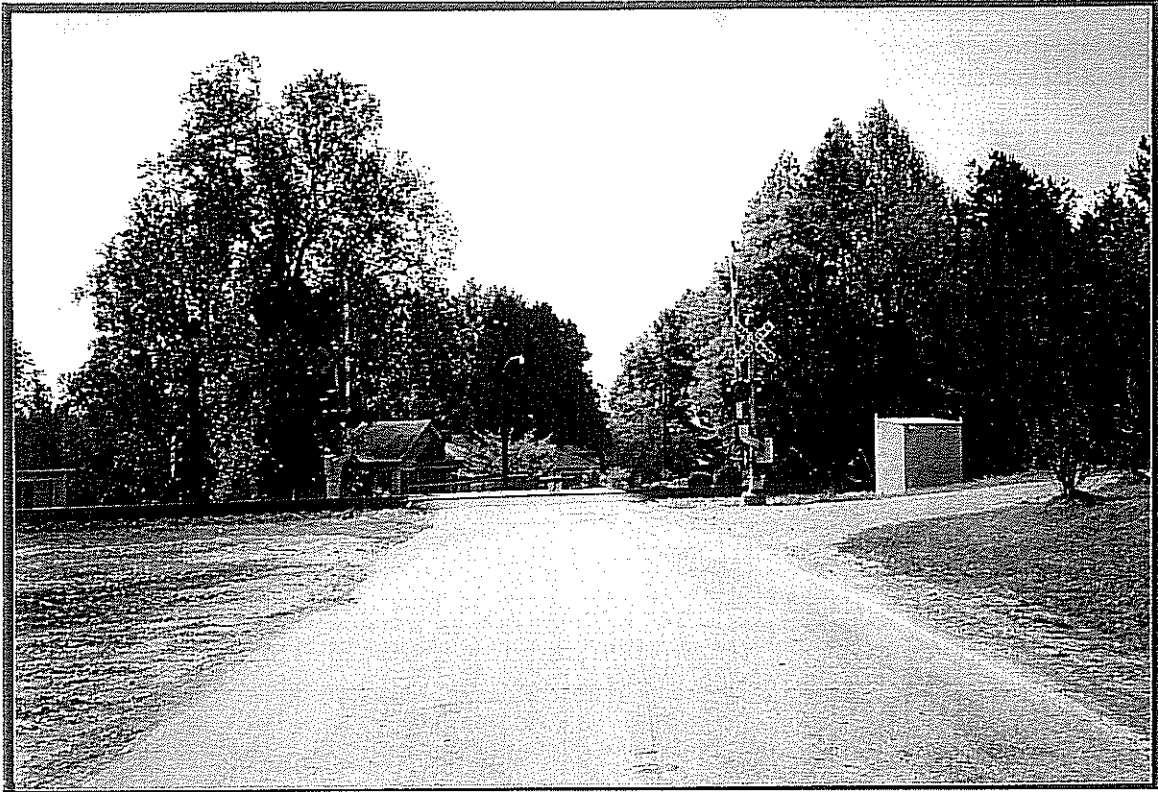


Westbound Approach

Municipality: China Grove

Crossing Number: 724389W

Street Name: Elm St.



Eastbound Approach



Westbound Approach

Municipality: China Grove

Crossing Number: 724388P

Street Name: Thom St.



Eastbound Approach



Westbound Approach

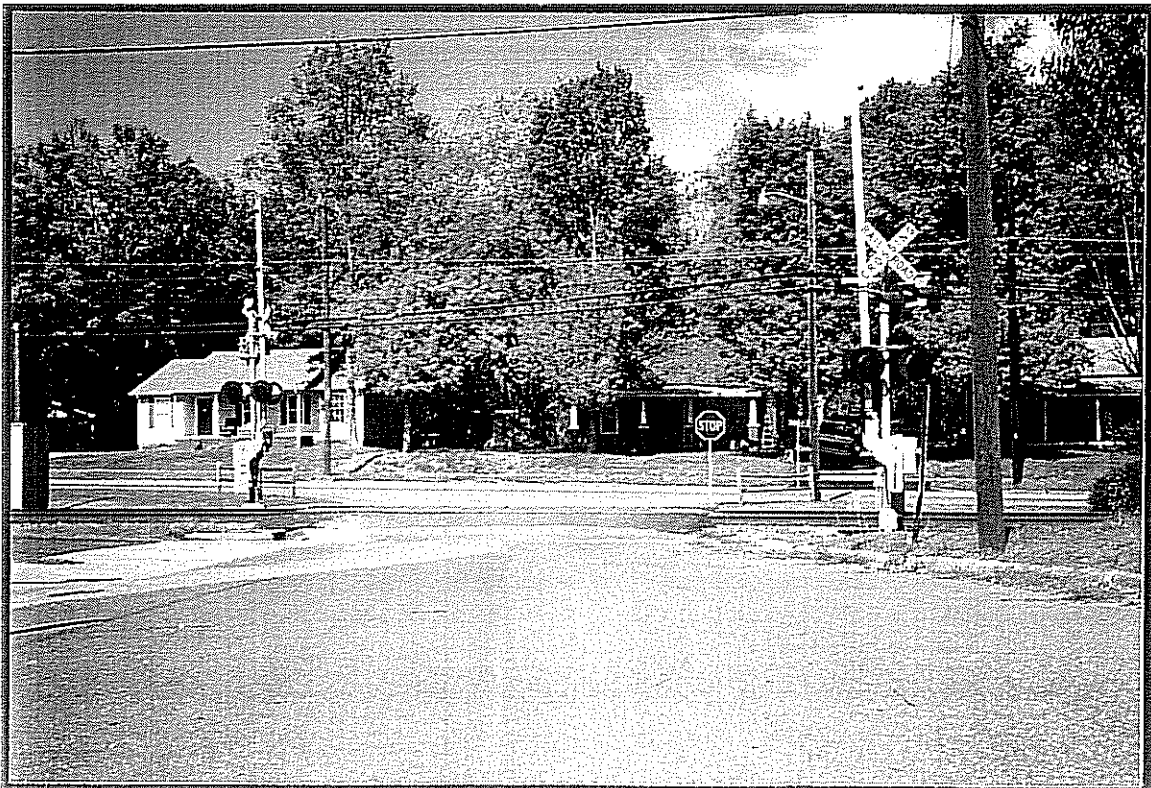
Municipality: China Grove

Crossing Number: 724386B

Street Name: Chapel St.



Eastbound Approach



Westbound Approach

Municipality: China Grove

Crossing Number: 724384M

Street Name: E. Centerview St.



Eastbound Approach



Westbound Approach

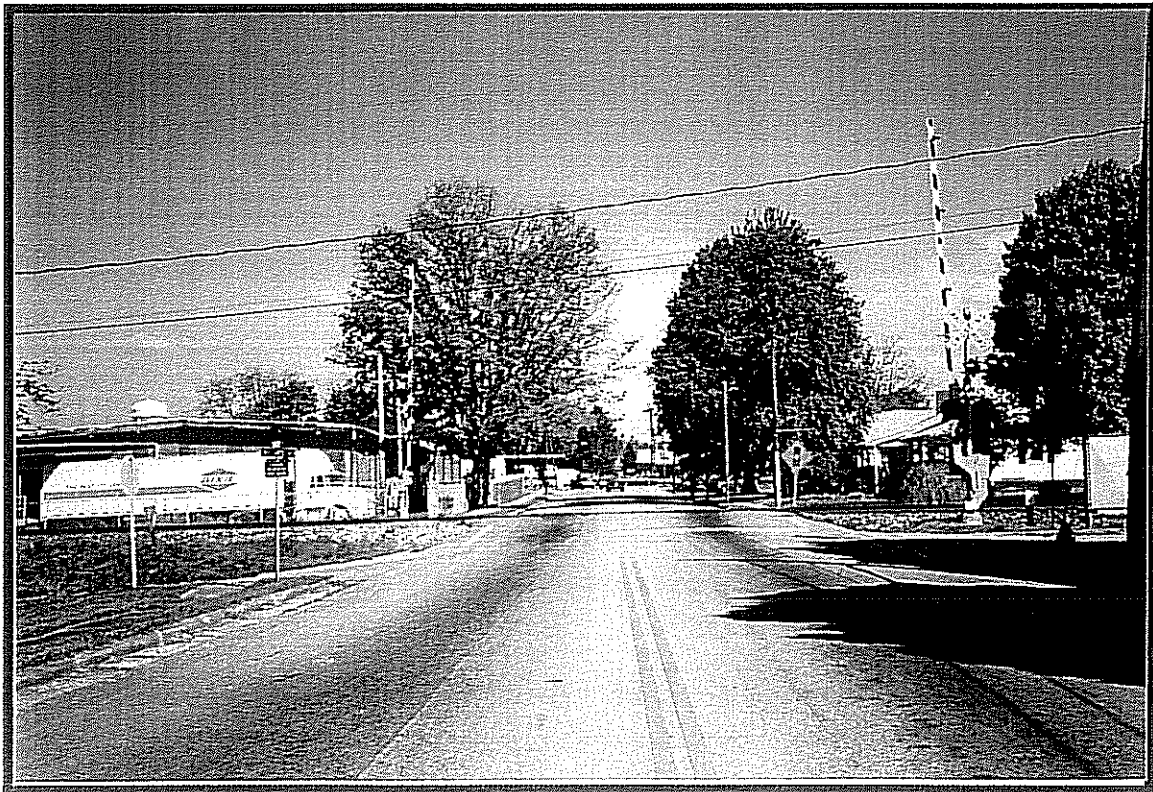
Municipality: China Grove

Crossing Number: 324382Y

Street Name: E. Church St.



Eastbound Approach



Westbound Approach

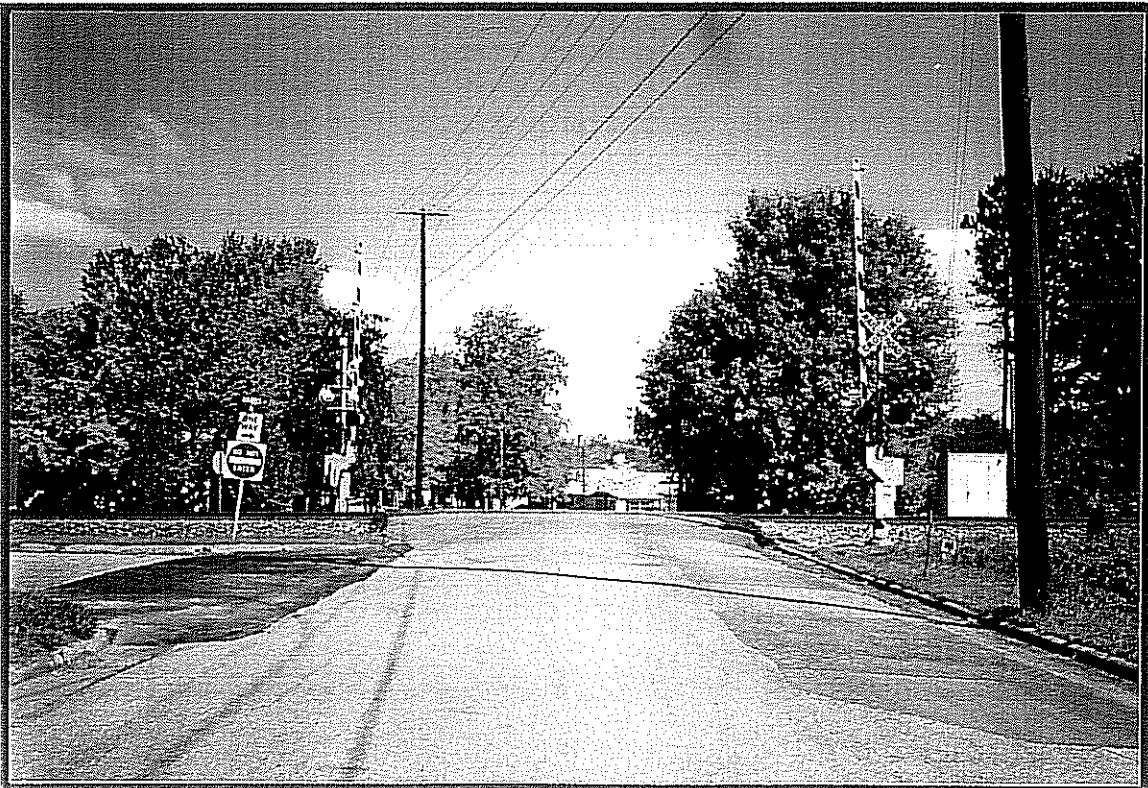
Municipality: China Grove

Crossing Number: 724381S

Street Name: E. Liberty St.



Eastbound Approach



Westbound Approach