

Highway/Railroad Grade Crossings

Identification And Signing

Final Report

Iowa Highway Research Board Project HR-254

January, 1987

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**Iowa Department
of Transportation**

Disclaimer

The contents of this report reflect the views of the author and do not necessarily reflect the official views of the Iowa Department of Transportation. This report does not constitute a standard, specification or regulation.

FINAL REPORT

For An

Engineering Study:

Highway/Railroad Grade Crossings
Identification and Signing

Project HR-254
Iowa Highway Research Board

By

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ABSTRACT

In 1982, Iowa's crossing warning identification system and signage at rail crossings were outdated, inconsistent and inadequate. Iowa's railroad system had been reduced and reorganized during the 1970's and many of the surviving railroad companies were unable to install new signs or devote staff to updating information.

The preliminary engineering part of this project improved the information inventory about each crossing, provided for installation of identification tags and resulted in a comprehensive list of posts and signs eligible for replacement.

The sign installation portion of this project resulted in erection of nearly 10,000 new crossbuck signs and 10,000 advance warning signs with high intensity reflectorization. In addition, new posts and multiple track signs were replaced where appropriate.

Increased visibility of crossings for the motoring public has resulted from proper sign placement and use of high intensity reflectorization. The tagging has provided a consistent correct identification of crossings for accident reporting. The computer inventory of information about the crossings is now correct and provides for informed decision making to administrators of Federal and State crossing safety funds.

OBJECTIVE

The objective of this engineering study was to enhance safety at highway/railroad grade crossings. The passive sign project provided correct identification of railroad/highway crossings and installation of crossing warning signs consistent with industry standards. The four components of the project were:

- ° Inventory Update - A complete and thorough field review was done to update the national grade crossing inventory.
- ° Identification of Crossings - Two metal identification tags with the correct crossing numbers were installed at each crossing.
- ° Identification of Deficient Signs and Posts - A listing was compiled for the signs and posts at each crossing that were eligible for replacement.
- ° Sign and Post Installation - All passive signs at public crossings were replaced with new signs using encapsulated lens sheeting on the front. This high-intensity reflectivity has a longer life and provides the maximum warning protection at unsignalized crossings. The Department also required a 5" strip of the same material on the crossbuck back to provide additional crossing visibility at night.

BACKGROUND

In Iowa there have been many railroad line abandonments since the early 1970's. The Rock Island Railroad liquidation and Milwaukee Road reorganization alone resulted in hundreds of miles of abandonments. Many railroads operating in Iowa were marginal financially and unable to invest in new crossing warning signs. Additionally, eighty percent of Iowa's crossings were rural, and most were not candidates for automatic signal installations.

The typical crossing warning sign had engineering grade reflective sheeting on the front of the crossbuck, multiple track sign and advance warning sign which was old and faded. Some crossing warning signs had no reflectivity at all. Frequently the multiple track sign had an incorrect number of tracks. Many signs showed evidence of damage from farm equipment. Many signs were not at the proper height nor angle to be most visible from the roadway.

In addition to deficient signs, the information available about crossings was incomplete. A national inventory of grade crossing information, created in 1974, was not consistently updated. Selected data from the inventory was used in formulas to make funding decisions for spending Federal Aid 203 Rail/Highway Safety Funds (203 funds) and accuracy of that information was important. Each crossing had been assigned a unique number in 1974 and paper tags were installed. Many paper tags that had been placed at the crossings were missing or damaged.

PRELIMINARY ENGINEERING (PE)

The key to the success of the project was careful, detailed planning of each step and phase. All aspects of the project were identified, organized and addressed to allow for proper installation of signs and posts.

Components of preliminary engineering were:

- ° Identification of deficient signs and posts - Each crossing was inventoried in the field to produce an accurate listing of the required number of new signs and posts for replacement. Any crossbuck sign that did not have high-intensity sheeting on the front and a 5" strip of same on back was eligible for replacement. Multiple track signs and advance warning signs without high intensity sheeting on the face were eligible for replacement. Any posts that were not considered breakaway and consistent with proper height or location in the Manual on Uniform Traffic Control Devices (MUTCD) were eligible for replacement or relocation.
- ° Inventory Update - Each crossing had an inventory form completed with current information. The railroads provided certain information, such as train speeds and number of trains per day.

- Identification of Crossings - Each crossing was properly identified and permanent metal tags were installed. This permanent marking ensured not only correct sign installation but also proper identification for accident reports.

Funding

Federal Aid 203 Rail/Highway Safety Funds provided 90% of the PE cost. A 10% match by non-federal sources was required.

Railroads were responsible for crossbuck installation and highway authorities for advance warning signs. However, distribution of 10% of the PE cost among 15 railroads and 400 cities and counties was deemed to be too difficult and time-consuming to accomplish. Department of Transportation (Department) management suggested the PE portion of the project be established as an engineering study and to approach the Iowa Highway Research Board for the 10% match. The Board agreed to fund the 10% PE cost under an engineering study entitled "Highway/Railroad Grade Crossing Identification and Signing."

The PE cost was estimated at \$175,000. The estimate was sent to the Federal Highway Administration (FHWA) for written approval to begin incurring costs. The following assumptions were used to prepare the estimate:

- A percentage of time for five permanent employees was used; their salary, fringe benefits, expenses and some vehicle expenses. The

employees' time on the project was calculated for three people at 10% of their time, the project coordinator at 100% and the office supervisor at 30% time.

- ° An estimated 63 working days plus fringe benefits, expenses and vehicle charges were calculated for 20 summer people.

The final cost of the PE was \$144,108. The Iowa Highway Research Board paid 10% or \$14,411 and FHWA the remainder.

Railroad Involvement

Several meetings were held with the larger Iowa railroads to discuss this project. The following issues were raised, discussed and resolved in the early planning stages:

- o Will lines to be abandoned be field reviewed? Lines are kept in the inventory until the track is dismantled rather than abandoned. The operating lines were done first, and as time permitted all lines still in the inventory were field reviewed.
- o Can the sign installation be done by a contractor rather than railroad forces? The railroads determined their labor unions would not allow an outside contractor to install warning signs.
- o Who will be responsible for future maintenance of the signs? The railroads were required by agreement to provide future maintenance

of the new signs and posts. If a sign is destroyed in the future, a sign of similar quality will be installed by the railroad.

- o Should standard stop signs be installed on crossbuck posts? In Iowa, many highway jurisdictions saw the installation of a stop sign as a way to decrease potential tort liability. If a highway authority determines stop signs are necessary, they will be installed on their own post.
- o When should a change be made to the inventory regarding train speed or number of trains? These variables are subject to change frequently. A change of plus or minus 10% is sufficient to change the inventory information.
- o Who will move the aluminum tags from old deficient posts to new posts? It is a requirement of the sign installation agreement that each railroad must move the tags.

A letter was sent to each company and written assurance obtained that they would cooperate with both the PE and sign installation. The local railroad representatives, who would be the field people in charge of implementation, met with Department staff to have the project explained. They also answered questions about crossings and helped summer staff with problems in the field.

Tags

Aluminum identification tags with embossed letters and numbers were purchased. The Department let bids for the tags and only one company, Keyes-Davis from Kalamazoo, Michigan, submitted a bid on approximately 18,000 tags at 59¢ a piece. Iowa State Prison Industries was consulted but could not meet the specification for six digits and one letter.

The tags were produced in order, by railroad and branchline within county, from a computer listing made from the crossing inventory. This same listing was used to assign crews and to record sign and post needs. This request increased the cost of the tags slightly, but it was important to have the tags in order for ease of handling in the office. Tags were ordered for all public crossings in Iowa.

Two tags were installed at each crossing on the crossbuck posts or signal masts. The tags were installed as high as possible facing the roadway, to be visible to motor vehicle officers. The tags were banded to the signal mast and nailed to the crossbuck posts. If a post did not need replacement, the tags were permanently installed with 2" galvanized roofing nails. If the post was to be replaced, temporary double-headed nails were used so the railroads could easily transfer the tags from the old post to the new post. Galvanized 3/8" metal banding and hand-held banding tools were used.

Staffing

No additional permanent staff was hired by the Department to carry out this project. Twenty summer employees performed the field review of 8,000 crossings in three months. An additional two temporary staff worked before and after the field review for about six months. One division staff member was assigned to plan and implement the PE during the first year. A Division staff member from the crossing program and an engineer were involved extensively throughout planning and implementation phases of the project.

A request for approval of 20 summer staff was submitted in February, and the required number of state vehicles was reserved. Originally one person per vehicle was planned but it was later decided to use two people to a car. One person read maps and gave directions while the other person drove. The quality of work and employee safety were greatly improved by two person crews.

The Department personnel office was given a list of qualifying conditions to reduce the huge list of summer applicants. These conditions included; a junior or senior in college, a willingness to travel and previous work experience. Fifty percent females and fifty percent males, including two minorities, were employed to meet the affirmative action goals for the Department. No knowledge of engineering or railroad operation was required. References were checked to determine if past employment had been performed in a responsible manner.

Three weeks before the summer crews started, two full time employees were hired to start in the office preparing for the crews. They planned how many crossings a crew would have to complete each week during the summer. They compiled inventory sheets, tags and code sheets for the crews. This preparation work was essential to the quick start up of the crews in the field. They remained throughout the summer to process completed forms and enter signage needs onto a computer program.

Training for PE Field Work

An instruction manual was developed outlining duties and responsibilities for those employees. Another manual was developed for instruction in updating the inventory, installing tags, and coding signage needs. A one-week training session was held prior to field work. The first two days of the session emphasized safety at railroad crossings and review of the manuals. A Burlington Northern public works engineer spent two days with the group providing valuable education and instruction. Two days were spent in the field demonstrating field work. The final day was spent in the central office getting cars set up, answering questions, making motel reservations for the following week, etc.

Each two-person crew needed some way to easily and accurately measure for post height in a minimum of time and with inexpensive equipment. Wood measuring sticks 1" X 1" X 6', marked with black tape every foot, and a piece of 1/8 inch nylon string about 18 feet long were provided.

A survey chaining pin was attached and a mason's line level was put on the string. This allowed one person to measure the depth of the ditch by holding the string level to the proper distance from the roadway. The measured ditch depth, rounded up to the nearest foot, was added to 15 feet to determine the new post length for that location.

Personnel were trained in pacing so they could determine distances between tracks at a crossing, distances to a nearby parallel road, or other relative distances in the crossing area. These methods, although rather primitive, provided the necessary accuracy needed for the survey at a minimum cost. Equipment costs amounted to less than \$5.00 per crew.

Field Work

The railroads determined that Department employees could install the tags and update the inventory since those were railroad management functions. Only one company requested the Department obtain railroad liability insurance to install tags. The tags for this company's 25 crossings were given to them to install. It was critical that the tags be installed on the posts prior to the signage needs determination. This would ensure that new signs and posts to be installed the following year would be placed at the intended crossing.

Adequate training was very important because these summer employees had no background in railroad operation or engineering. It was sometimes

difficult to determine at which crossing they were, especially when paper tags were gone. They utilized county maps and a listing of crossings in order down the track. Also, local railroad employees were very cooperative in answering questions for the crews.

State track inspectors employed by the Department were valuable in the large cities. They knew which tracks belonged to which railroads and often went with the crews to provide guidance. The crews had large city maps and entered the correct identification numbers on the maps. These maps have been used extensively by Department employees in the last three years.

The determination of whether a crossing was public was especially difficult. Many crossings to factories or housing developments are private although they look public. Railroad companies have responsibility for only public crossing protection. If the road crossing the track is maintained by a public highway jurisdiction then the crossing is public.

The inventory update utilized a preprinted four part form with information existing in the inventory. The field crews crossed out incorrect information and wrote in correct information on the four-part form. Each Friday the field crews and office staff met to discuss questions, so data would be coded consistently.

PROJECT DEVELOPMENT AND ADMINISTRATION

Materials and Manufacturing Specifications

Material and manufacturing specifications were determined by the Department and agreed upon by the railroads and highway authorities. Specifications were established utilizing Department standard specifications for materials and the MUTCD. All specifications met current highway and railroad industry standards. Detailed specifications are shown in Exhibit "B" of the railroad and highway authority agreements attached.

Purchase and Delivery of Sign Materials

In the interest of minimizing cost and maintaining control of the project, the Department, railroads and highway authorities agreed the State would purchase the sign materials and deliver them to pre-determined locations. Lettings were held for crossbucks, posts, multiple track signs, advance warning signs, brackets and hardware. Crossbucks, posts and associated material were delivered to 31 railroad depot sites.

Advance warning signs, posts and associated material were delivered to 25 Department maintenance shops where the highway authorities picked them up. Considerable effort was required to monitor delivery of the exact number of pieces required for each delivery site. The pieces were

counted and receipts delivered to the Rail and Water Division prior to payment for the materials.

In retrospect, the Department should have required the vendors to send all material to one location with Department redelivery to the specific railroads and highway authorities. The Department would have had better control over material delivery and better overall control of project completion.

The post vendor met the delivery time specified in the bid. All other vendors were late, causing a one year delay in starting actual construction. The bracket supplier was one year late in delivery of brackets needed to attach crossbucks and number of track signs to signal systems. This delay affected installation on signalized crossings more than one year.

Installation of Signs

The Department preferred to do all sign installation through a bid-letting process. However, due to railroad labor restrictions, railroads installed their own signs. Highway authorities installed the advance warning signs. The agreement required signs to be installed in accordance with established specifications within twelve months of receipt of material for railroads and within six months of receipt of materials for highway authorities.

The Department was particularly concerned about the ability of the railroad companies to properly install the signs. Past experience had shown railroad personnel were often not familiar with the MUTCD or established installation specifications.

To enhance proper and uniform placement of the crossbucks, preconstruction meetings were held for the railroad people responsible for installation. The railroad preconstruction meetings were scheduled after some of the materials had been delivered and the railroads were ready to begin work. The railroads were encouraged to commit dedicated crews to this work to assure completion of the installation.

Inspection of Signs

Twenty-four Department Maintenance Operation Assistants (MOA's) were designated by the Highway Division as inspectors for the project. They were assigned the duty of inspecting railroad and highway authority sign installations in counties under their maintenance responsibility. MOA's had computer-generated lists of work to be performed for each railroad crossing in their jurisdiction. The following inspection requirements were established for the sign and post installation:

- o 100% inspection of the signs installed on primary roads.
- o Random inspection of work performed by other highway authorities and railroads.

Discrepancies in the installation were brought to the attention of the responsible highway authority or railroad. Corrections were made or a determination was made by the railroad or highway authority that the installation was proper for the specific location.

Billing Procedures for Railroads

The Department and railroads developed a simplified payment process to avoid the excessive accounting burden of the force account billing process. After extensive negotiation, the Department and the railroads agreed to a unit cost procedure for reimbursement. The Department determined the unit cost for installation of the railroad's signs by reviewing the historical cost of installing signs by two State Highway Departments and one railroad. Also, the current cost of railroad labor was considered as well as the rental cost of machines necessary to install signs.

With that information, prices were negotiated for the installation of posts, installation of crossbucks, installation of number of track signs, movement of post only, and travel and distribution per crossing. These costs were:

- o Post: \$29 each post
- o Crossbuck Sign: \$15 each sign
- o Number of Track Signs: \$7 each sign
- o Movement Only: \$29 per movement. Any movement of one post or one post and sign was defined as one movement.

- o Travel and Distribution: \$15 per crossing where work was required under this agreement.

Each railroad was required to pay 10% of the cost of materials and installation for their railroad.

Billing Procedures for Highway Authorities

With over 400 highway authorities participating in the project, the Department wanted to avoid the administrative burden of separate billings and payments. The Department proposed to highway authorities that their 10% participation could be the labor for installation of the signs and posts. The highway authorities agreed their labor costs approximated the 10% participation. This saved the Department extensive administrative costs as no billing or payment was required by either the highway authority or Department.

Future Maintenance of Signs

The railroad companies and highway authorities agreed to accept ownership of the signs once installed. They also agreed to maintain and replace, at their expense, the signs when necessary. It was also agreed the signs would be maintained to the same specification as required in this project.

Railroad and Highway Authority Agreements

Once the field work had been completed and an acceptable project concept established, the Department had to prepare and execute detailed agreements with the railroads and highway authorities. The information gathered on sign and post needs had to be consolidated into a usable form for agreements with each specific railroad and highway authority. This required extensive use of computer data processing. A program on the Department's IBM main frame terminal was used to enter the signage needs from the field review. The field review information was in a temporary file and had to be matched with the crossing inventory in a permanent file. After joining the two files, crossings were sorted by county highway jurisdiction, city highway jurisdiction and by railroad. Computer listings detailing the needs of each railroad and highway authority were attached to an agreement for each.

The agreements, with an explanation cover letter, were sent to all possible railroad and highway authority participants for their review and return if they desired to participate in the program. They were also asked to review the exhibit of sign and post needs and to correct any information which was not accurate.

A standard agreement form for railroads and highway authorities was developed to simplify administration of the project. Eighteen of the 20 railroads in the state participated in the program. Four hundred fifty-one of the 561 highway authorities with crossings participated.

Those not participating were generally located on railroad lines which had been abandoned or were to be abandoned in the near future. The 18 railroad agreements and 451 highway authority agreements called for the installation of 9,854 crossbucks and 9,834 advance warning signs. The total cost of the project was \$1.649 million.

Seven copies of each agreement were necessary. The agreement with the exhibits was about 35 pages in length which meant over 150,000 sheets of paper had to be checked, collated, stapled, labeled and mailed. This was accomplished by utilizing a displaywriter word processor.

The railroad agreement (copy attached) included the statement of purpose, responsibilities of each party, project financing, inspection, maintenance of material, equal opportunity and applicable laws and regulations. The agreement provided a computer-drafted exhibit showing the location of needed crossbucks, posts and length, and number of track signs. It also located crossings where existing crossbucks met current material specifications, but required movement to meet MUTCD location requirements. It also included material specification sheets, location specifications taken from the MUTCD and a specific estimate of cost for the railroad with a billing format page for railroad bills.

The highway authority agreement (copy attached) included the statement of purpose, responsibilities of the parties, project financing, inspection, maintenance of material, equal employment and applicable laws and regulations. The agreement provided a computer-drafted exhibit

showing the railroad location of the crossing including its FRA number, number of warning signs and number of posts. It included material specification sheets and location specifications from the MUTCD. Highway authorities were required to pay 100% of the cost of the material if lost or improperly installed.

Railroad and highway authority agreements were standardized except for two railroads. One Class I railroad had a company standard crossbuck different than the proposed Iowa Standard. That railroad participated in the program using its standard sign. A newly organized small railroad required sign installation before the Department could establish a statewide material letting. That railroad's contract allowed the railroad to purchase and install the signs meeting Iowa specifications.

EVALUATION

The objective of the engineering study was to improve safety at highway/railroad grade crossings in Iowa. There are many factors in addition to this project which have an impact on safety; a decrease in number of crossings, volume of train traffic and highway traffic, public education efforts about crossing safety and the general economy.

From 1983 to 1986 the number of accidents at unsignalized crossings declined. The Department believes this project contributed to that decrease. However, given the number of variables contributing to

accident rates and the short time since project completion, no statistical significance can be attributed to the accident reduction.

SUMMARY

The preliminary engineering phase was completed on time and under budget. The updated inventory allows more informed decision making in allocating 203 funds. The signage needs inventory was instrumental in the successful implementation of the sign installation portion of the project.

The sign installation phase was completed under the estimated budget. An additional year was required to install the signs, largely due to late delivery of materials. However, all signs and posts are installed. The reflectorized signs enhance the nighttime visibility of crossings. Proper placement contributes to longer life of the signs.

This project has gained national attention and is being duplicated in other states. Recently FHWA began a national push to use 203 funds for "low-cost" improvements to crossings not eligible for automatic signals. The installation of passive signs is an excellent example of a statewide low-cost improvement.

Rail and Water Division appreciates the support of the Iowa Highway Research Board on this study.

AGREEMENT

between

ATCHISON, TOPEKA AND SANTA FE RAILWAY COMPANY

and

STATE OF IOWA
Iowa Department of Transportation
Rail and Water Division

for
PASSIVE SIGN PROJECT

Project No. RRP-000S(14)--48-00

Iowa DOT Contact Person Raymond A. Callahan

Address Rail and Water Division, Iowa DOT, Ames, Iowa 50010

Telephone No. 515/239-1678

Railroad Contact Person _____

Address _____

Telephone No. _____

Exhibits

- A - Inventory of Passive Sign Needs
- B - State Specifications for Crossbuck and Post Material
- C - State Specifications for Crossbuck and Post Installation
- D - Company Material Receiving Points Including Material to be Delivered.
- E - Estimate of Costs
- F - Billing Format

AGREEMENT

THIS AGREEMENT is between the Atchison, Topkea and Santa Fe Railway Company, a Delaware Corporation with principal offices at Chicago, Illinois, hereafter called the COMPANY, and the state of Iowa, acting by and through the Iowa Department of Transportation, Rail and Water Division, hereafter called the STATE.

The COMPANY and the STATE agree as follows:

I. CONTRACT PURPOSE

The purpose of this contract is to provide railroad passive warning signs at railroad public at-grade crossings to the material and installation standards defined in Exhibits "B" and "C" attached and made part of this Agreement.

II. RESPONSIBILITY OF THE STATE

- A. The STATE will purchase the railroad passive warning signs and posts as shown in Exhibit "A" attached and made part of this Agreement. STATE will also purchase the necessary hardware to install the signs.
- B. The signs, posts and hardware will conform to the specifications shown in Exhibit "B".
- C. The signs, posts and hardware will be delivered to COMPANY delivery points as specified in Exhibit "D", attached and made a part of this Agreement.

III. RESPONSIBILITY OF THE COMPANY

- A. The COMPANY shall install the signs, posts and hardware at the crossings designated in Exhibit "A".
- B. The COMPANY shall install the signs, posts and hardware in accordance with the installation specifications shown in Exhibit "C", attached and made a part of this Agreement.
- C. The COMPANY shall install all signs, posts and hardware within twelve months of the date the signs are delivered to the COMPANY.
- D. The COMPANY shall inform the STATE two weeks prior to beginning material installation and when the installation is completed.
- E. All old posts shall be removed from the ground or cut within of 4-inches from ground elevation. All material removed shall be cleared from the crossing area.

- F. All temporarily installed 4" x 9" AAR-DOT inventory tags will be removed from the old post before disposal of the post and replaced on the new post in accord with Exhibit "B". The top shall be located midway between the crossbucks facing the street or roadway.
- G. COMPANY agrees to install signs with dedicated forces.

IV. PROJECT FINANCING

A. Funding:

- 1. The estimated cost of this project is \$2,176.04 as shown in Exhibit "E", attached and made a part of this Agreement.
- 2. The FEDERAL HIGHWAY ADMINISTRATION 203 rail highway safety funds shall be utilized to pay 90% of the actual cost of the Project.
- 3. The 10% matching actual costs shall be the responsibility of the COMPANY.
- 4. The STATE shall have no cost associated with this Project other than the cost of administering the federal funds.

B. Computation of Actual Cost:

- 1. The actual cost is composed of the cost of the purchase and delivery of the materials to COMPANY delivery points plus the agreed unit cost of the installation of the material as defined below.
- 2. The agreed unit costs of the installation are as follows:
 - a. Post: \$29 each post.
 - b. Crossbuck Sign: \$15 each sign
 - c. Number of Track Signs: \$7 each sign
 - d. Movement Only: \$29 per movement. Any movement of one post or one post and sign is defined as one movement.
 - e. Travel and Distribution: \$15 per crossing where work is required under this Agreement.
- 3. In the event the COMPANY loses the material or fails to install the material in accord with Exhibit "C", the COMPANY shall reimburse the STATE for the cost of material and its delivery. The COMPANY may elect to reinstall the improperly installed material in accord with Exhibit "C".
- 4. This Project does not require the COMPANY to move active signal warning systems.

5. Removal of 4" x 9" aluminum inventory tags and placement on new posts will be at the expense of the COMPANY and shall not be included as a cost to this Project.

C. Billing Procedure:

1. The STATE will furnish COMPANY the total cost of the material and its transportation cost to COMPANY delivery points.
2. The STATE's letting and payment documents for purchase of material will be on file in the Office of Accounting, Department of Transportation, Ames, Iowa and shall be made available to COMPANY's auditors for their inspection during usual office hours.
3. The COMPANY shall furnish the STATE a copy of the Exhibit "A" showing actual installation plus a billing format document showing actual reimbursement to COMPANY or pay back from COMPANY. The billing format document shall be in a format similar to Exhibit "F", attached to this Agreement.
4. Final payment by STATE or COMPANY, as described in the above paragraph, shall be made after a field inspection of the installed material by STATE and FHWA.

V. INSPECTION

COMPANY authorizes the STATE and FHWA the right to review, inspect and observe, at reasonable times upon reasonable notice, work in progress and completed work as covered by this Agreement. STATE may appoint inspector(s) to represent it in the inspection of all work done under Agreement. The inspector(s) will not act as foreman or perform other duties for the COMPANY, nor improperly interfere with management of the work. COMPANY shall provide the STATE with every reasonable facility for ascertaining whether the work is being performed to conform to Agreement specifications. All such inspection shall be subject to the right of COMPANY to require supervision where appropriate for safety reasons. During such inspections, STATE shall indemnify and save harmless COMPANY against and from liability for all personal injury, damage, claims, cost and expense arising as a result of any injury to a representative of STATE performing such inspections, or their presence on COMPANY property, unless such liability, damage, claim, costs and expenses were caused by COMPANY'S sole negligence.

VI. MAINTENANCE OF MATERIAL

Upon completion of the installation of materials, the COMPANY shall thereafter own, maintain and replace said material as may be necessary, at COMPANY expense. All future maintenance and replacement of COMPANY'S passive signs and posts at Iowa public crossings shall be in accordance with Exhibits "B" and "C". COMPANY shall promptly, at its own expense, remedy any damage to material installed through this Passive Sign Project.

VII. EQUAL EMPLOYMENT OPPORTUNITY

The STATE and the COMPANY agree work covered in this Agreement is subject to all Federal laws and regulations relating to equal employment and opportunity for all persons without regard to race, color, creed, sex, age, religion, and national origin relating to, but not limited to, nonsegregated facilities, minority business enterprise providing equal employment and equal opportunities to veterans including, without limitations, Executive Order 11246 as amended, 41 CFR Section 60-1 et seq., 41 CFR Section 1-1.1310.2, 41 CFR Section 60-741 et seq., Executive Order 11707, 41 CFR Section 60-250.1 et seq., 49 CFR Section 265.1 et seq., to the extent applicable.

VIII. APPLICABLE LAW AND REGULATION

It is understood that the Project herein contemplated will be financed from funds appropriated by the Federal Government and expended under Federal Regulations; that all plans, specifications, estimates, awards of contracts, acceptance of the work and general procedure are subject to all Federal laws and regulations applying to such a Federal project, subject, however, to applicable STATE law. Specific reference is made to Federal Aid Highway Program manual: Volume 6, Chapter 3, Section 2, Sub-Section 7; Volume 6, Chapter 4, Section 1, Sub-Section 1; Volume 6, Chapter 4, Section 2, Sub-Section 1; Volume 6, Chapter 4, Section 1, Sub-Section 14; Volume 1, Chapter 4, Section 3; Volume 6, Chapter 6, Section 2, Sub-Section 1, Volume, Chapter 8, Section 2, Sub-Section 1; and Part VIII to the Manual on Uniform Traffic Control Devices for Streets and Highways, and supplements thereto issued by the Federal Highway Administration. These memoranda are by reference made a part of

this Agreement. In the event that the work herein is non-participating in Federal-Aid, any reference to the Federal Highway Administration in the memoranda referred to herein shall be interpreted as meaning the STATE.

IN WITNESS WHEREOF, the COMPANY and the STATE hereto have caused this Agreement to be executed by their authorized officers as of the dates below indicated.

Executed by the
COMPANY this

ATCHISON, TOPEKA AND SANTA FE RAILWAY COMPANY

____ day of _____, 19____. By _____
Name and Title

State of _____ ss.

County of _____

On this ____ day of _____, 19____, personally appeared _____, to me personally known, who being by me duly sworn did say that he is _____ of said COMPANY and that said instrument was signed and executed by him on behalf of said COMPANY by authority of its Board of Directors as its voluntary act and deed.

Notary Public in and for said County

Executed by the

STATE OF IOWA

STATE this

Iowa Department of Transportation

Rail and Water Division

____ day of _____, 19____. By _____
Neil M. Volmer
Manager, Engineering and Safety

State of Iowa

ss

County of Story

On this _____ day of _____, 19____, personally appeared Neil M. Volmer, to me personally known, who being by me duly sworn did say that he is Manager, Engineering and Safety for the Iowa Department of Transportation, Rail and Water Division, and that he was duly authorized to execute this Agreement as the said Department of Transportation's voluntary act and deed as shown in Staff Action _____.

Notary Public in and for said State

Approved _____

Date _____

Division Administrator
FEDERAL HIGHWAY ADMINISTRATION

PAGE 1
EXHIBIT A

COUNTY # 56 (~~LEE~~) - ATSF
SIGNALIZED CROSSINGS
PROGRAM FOR INSTALLATION OF RAILROAD SIGNS AND POSTS

<u>BRANCH</u>	<u>RRMILEPOST</u>	<u>CROSSINGNO</u>	<u>CROSSBUCK</u>	<u>XBPOST</u>	<u>POSTHT</u>	<u>TRACKS</u>	<u>NUMBER</u>	<u>REMARKS</u>
	00234.12	004954K	4			2	6	
	00236.94	004956Y	2			2	2	
	00238.13	004957F	2			2	2	
	00240.50	004959U	2			2	2	
	00241.39	004961V	2			2	2	
	00248.01	004966E	2			2	3	
	00248.23	004967L	2			2	2	
	00248.85	004968T	2			2	2	
	00251.15	004971B	2			2	2	
*TOTAL AARCCDE ATSF			20			18		

PAGE 1

EXHIBIT A

COUNTY # 56 (LEE) - ATSF
NON-SIGNALIZED CROSSINGS
PROGRAM FOR INSTALLATION OF RAILROAD SIGNS AND POSTS

<u>BRANCH</u>	<u>RMILEPOST</u>	<u>CROSSINGNO</u>	<u>CROSSBUCK</u>	<u>XBPOST</u>	<u>POSTHT</u>	<u>TRACKS</u>	<u>NUMBER</u>	<u>MCVEONLY</u>	<u>REMARKS</u>
ARMOUR CIAL LD	C0000.14	C04560N	2	2	16-16				N-1 S-LEVEL
*TOTAL AARCCDE ATSF			2	2					

2-16'

Railroad Crossbucks
Signing Materials

GENERAL. All materials shall be new and unused. Before incorporation into the work, all materials shall be approved.

Unless otherwise stated, dimensions and tolerances for all bolts, nuts, and washers shall be similar to that specified by ANSI for the size required.

SIGN BLADES. Sign blades shall be extruded aluminum. Aluminum extrusion shall be Alcoa extruded section 84751 and shall meet the requirements of ASTM B 221, Alloy 6063-T6.

SIGN PANELS. Sign panels shall be of sheet aluminum, and shall meet the following requirements:

Sheet Aluminum for signs shall meet requirements of ASTM B 209, Alloy 5052-H38 or 6061-T6, with no specified limit for yield strength or bend test. Sheet aluminum shall have a nominal thickness of 0.080 inch. The thickness shall be subject to tolerances similar to those specified in ASTM B 209 for a sheet having a width equal to the greatest dimension of the sign.

REFLECTIVE SHEETING. Except as otherwise specified on the plans or in these specifications, reflective sheeting shall consist of spherical lens encapsulated in, transparent plastic. The sheeting shall be coated on one side with an adhesive backing protected by a removable liner.

Reflective sheeting shall be uniform in color and reflectivity. In a single sign, variations in color or reflectivity noticeable at a distance of 50 feet or more, under daytime or nighttime lighting conditions, shall be cause for rejection of the sign.

All reflectorized signs shall have silver encapsulated-lens sheeting for the background and black letters, symbols, and borders.

Encapsulated-Lens Sheeting shall meet the following requirements:

- A. Reflectivity. The reflective intensity shall have the following minimum values expressed as average candle-power per foot-candle per square foot of material. Measurements shall be made in accordance with Paragraph 4.3.7 of FSS L-S-300B, "Sheeting and Tape, Reflective: Non-exposed Lens, Adhesive Backing".

Angle, deg.	Silver		
Divergence	.2	.5	1.5
Incidence			
-4	250.	95.	4.0
40	120.	54.	2.0

The reflective intensity of unweathered sheeting, when measured in accordance with the rainfall test specified in FSS L-S-300B, shall not be less than 90 percent of the above values.

- B. Physical Characteristics. The sheeting shall have a strength suitable for handling, processing, and application, according to the manufacturer's recommendations, without appreciable damage. The unapplied sheeting, conditioned for 48 hours and tested at 72 degrees F and 50 percent relative humidity, shall show no cracking when bent around a 1/8-inch mandrel. The reflective surface shall be smooth and flat and shall exhibit an 85 degree specular gloss reading of not less than 50 when tested in accordance with ASTM D 523.

The reflective surface shall be readily processed and compatible with recommended transparent and opaque process inks and shall show no loss of color coat with normal handling, cutting, and application. The sheeting shall permit cutting and color processing at temperatures of 60 to 100 degrees F and relative humidities of 20 to 80 percent and application and curing, as recommended by the manufacturer, without loss of color or staining. The reflective surface shall be resistant to VM&P, naphtha, and mineral spirits.

- C. Color. The color of the sheeting shall be within the limits of the color tolerance charts issued by the U.S. Department of Transportation.
- D. Durability. The sheeting shall be so durable that the manufacturer can recommend that for a minimum outdoor exposure in Iowa of 10 years, deterioration of properly processed and applied sheeting would not be anticipated to the extent that resulting defects, when viewed from a vehicle, would make the sign ineffective for the intended purposes or would reduce the reflective intensity below the following limits:

Reflective Intensity 0.2 degree
divergence -4 degree incidence

Silver 200

- E. Adhesion shall be by a precoated, pressure-sensitive adhesive or a tack-free, heat-activated adhesive, either of which may be applied without additional adhesive coats on the reflective sheeting or application surface. A protective liner shall be attached to the adhesive and shall be removable by peeling without soaking in water or other solvents.

The adhesive shall form a durable bond to smooth corrosion- and weather-resistant surfaces and shall permit the reflective sheeting to adhere securely 48 hours after application at temperatures of -10 to 150 degrees F. The adhesive-coated sheeting shall be vandal resistant, and when jabbed with a spatula at -10 degrees F, the adhesive bond shall prevent the reflective sheeting from shocking off. The sheeting shall resist peeling from the applying surface when a 5 pound/inch-width force is applied as outlined in ASTM D903. The precoated adhesive shall have no staining effect on the reflective sheeting and must be mildew resistant.

FASTENING ACCESSORIES. The threads of all fastening accessories shall meet the requirements of ANSI B1.1, National Coarse Thread Series. Sign fasteners shall comply with the following requirements:

- A. Bolts shall be 3/8 inch in diameter with a hexagonal head. Thread fit shall conform to ANSI Class 2A. The length will be as shown on drawings.
- B. Nuts shall be finished, finished thick, regular, or heavy, hexagonal, self-locking nuts for 3/8-inch bolts, but all nuts shall be of the same type. The axial tensile strength at room temperature shall be not less than 4730 pounds. Self-locking nuts shall be approved by the engineer. Thread fit shall be as recommended by the manufacturer.
- C. Washers shall be 7/16" I.D. x 1" O.D. x 0.078" with thickness tolerance of plus or minus 0.006".
- D. Neoprene washers shall be 7/16" I.D. x 3/4" O.D. x 1/8" thickness. (Neoprene washers are required when treated wood posts are used). Durometer hardness shall be 60 to 70 with a tolerance of plus or minus 5.

Hardware shall be furnished in galvanized steel. Galvanizing shall meet requirements of ASTM A 153, Class D, or ASTM A 164, Type LS.

SAWN WOOD POSTS. Sawn wood posts shall conform to the shape and nominal dimensions for rough stock as specified in the contract documents, and shall meet requirements of Dense No. 1 grade for Douglas-fir coast region, or Dense Structural 65 grade for southern pine.

WOOD SIGN POSTS. Wood sign posts shall be either Douglas-fir (coast region) or southern pine and shall be graded as provided in ASTM D 245 according to rules approved by the Board of Review of the American Lumber Standards Committee.

Douglas-fir posts shall be of the following grades and shall be free of heart centers:

4" by 6" - Dense No. 2 Structural Joist and Plank;

Southern pine posts shall be of the following grades:

4" by 6" - Select Structural

Posts shall be furnished in the size and length specified and shall conform to the following for the size designated:

Posts 4 inches by 6 inches shall be furnished S4S and shall be sawn square at both ends. Posts shall be bored with four holes 7/16 inch in diameter through the 4" thickness, with one hole 18" from one end of the post, the second hole 7" from the first, the third hole 16" from the second and the fourth hole 15" from the third. The spacing and alignment of holes shall be within 1/16 inch of true centerline and distance.

All posts shall be kiln-dried or air-dried prior to treatment to a moisture content of not more than 20 percent. When dried, all posts shall be free from bends in more than one plane and free from short or reverse bends, and a straight line from the centers of the ends of a post shall not deviate from the longitudinal axis of the post at any point more than 0.5 percent of the length of the post.

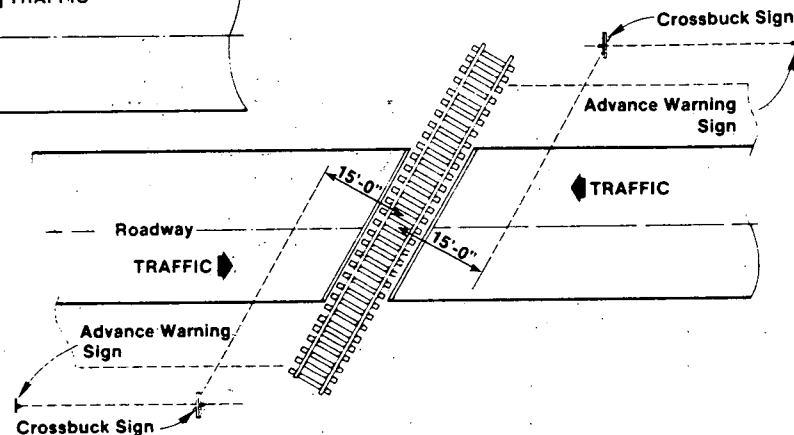
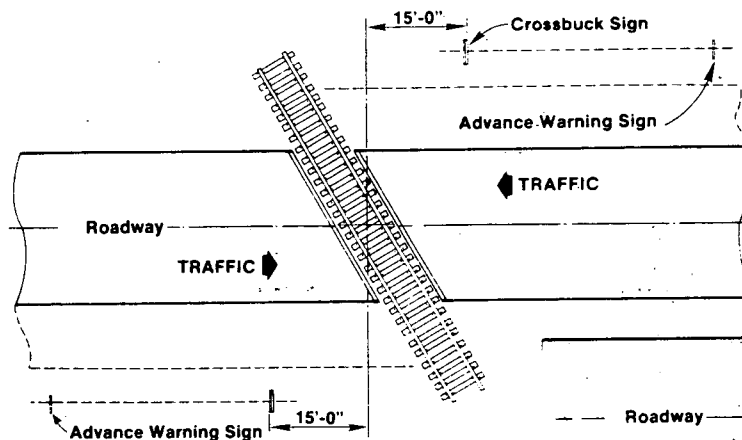
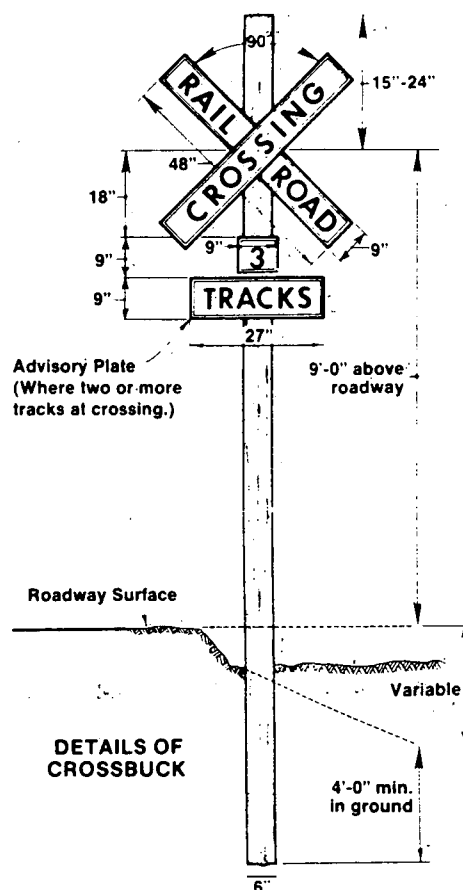
PRESERVATIVE TREATMENT. All boring shall be done before treatment. Unless otherwise provided, posts shall be given pressure preservative treatment with pentachlorophenol in accordance with requirements of AWPA P8.

Railroad Crossbucks
Signing Installation

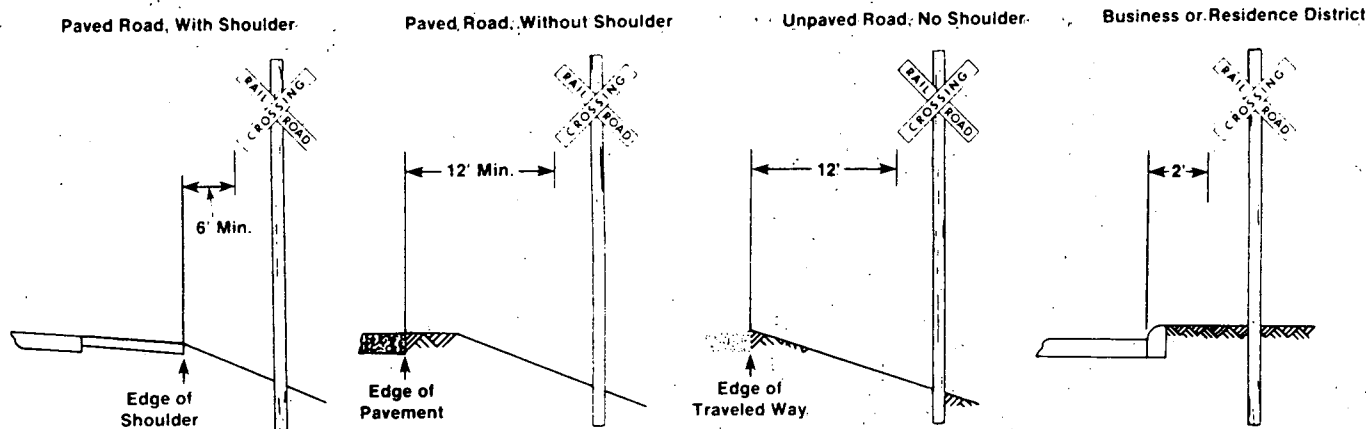
ERECTION OF SIGNS. Signs shall be erected so that they will be at elevations called for, shall be true to line and grade, and shall be truly vertical.

Wood posts shall be set in holes which are 12 inches in diameter and of the proper depth, and posts shall not be cut after treatment.

Posts shall be set to full depth and accurately aligned both vertically and horizontally. Post holes shall be backfilled in layers not more than six inches in depth. Each layer shall be thoroughly compacted, care being taken to preserve the alignment of the posts.



TYPICAL INSTALLATIONS



RAILROAD CROSSING SIGNING (CROSSBUCK PLACEMENT RRP-1)

COUNTY	PROJECT NUMBER	STATE	FED. ROAD DIST. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
		IOWA	1			

Iowa Passive Sign Project

RRP-000S(14)--48-00

Company Material Receiving Points Including Material
To Be Delivered

Exhibit "D"

ESTIMATE OF COSTS
Iowa Passive Sign Project
RRP-000S(14)--48-00

1. Material Costs

- a. 22 Crossbuck signs at \$49.66 each \$ 1,092.52
b. 2 Posts at \$32.19 each \$ 64.38
c. 18 Number of track signs at \$19.73 each \$ 355.14

Total Estimated Material Cost

\$ 1,512.04

2. Installation Costs

- a. 2 Posts at \$29 each \$ ~~XXX~~ 58.00
b. 22 Crossbuck signs at \$15 each \$ 330.00
c. 18 Number of track signs at \$7 each \$ 126.00
d. 0 Movement only at \$29 each \$ 0
e. 10 Travel and distribution at \$15 each crossing \$ 150.00

Total Installation Cost

\$ 664.00

3. Total Estimated Project Cost

\$ 2,176.04

NOTE: Estimated material costs were secured by STATE purchasing office.

(Railroad Company)

1. Material Costs (including transportation to COMPANY)

- a. _____ Crossbuck signs @ \$ 39.95 * each \$ _____
- b. _____ 16' Posts @ \$ 25.00 * each \$ _____
- _____ 18' Posts @ \$ 28.20 * each \$ _____
- _____ 20' Posts @ \$ 31.67 * each \$ _____
- c. _____ Number of track signs @ \$ 10.67 * each \$ _____
- d. Hardware
- _____ 1/2"x6 1/2" bolts w/nuts @ \$ 0.3556 * each \$ _____
- _____ 1/2"x 5" bolts w/nuts @ \$ 0.2415 * each \$ _____
- _____ 1/2" steel washers @ \$ 0.0684 * each \$ _____
- _____ 1/2" neoprene washers @ \$ 0.0590 * each \$ _____
- _____ 4" sign brackets @ \$ 3.98 * each \$ _____
- _____ 5" sign brackets @ \$ 5.43 * each \$ _____
- _____ 8" sign brackets @ \$ 5.54 * each \$ _____

Total Material Cost \$ _____

*Information will be furnished by STATE after material letting

2. Installation Costs

- a. _____ Posts @ \$29 each \$ _____
- b. _____ Crossbuck signs @ \$15 each \$ _____
- c. _____ Number of track signs @ \$7 each \$ _____
- d. _____ Movement only @ \$29 each \$ _____
- e. _____ Travel and distribution @ \$15 each crossing \$ _____

Total Installation Cost \$ _____

3. Total Project Costs \$ _____

4. Total Project Costs times 10 percent \$ _____

5. Total Installation Cost minus 10 percent Total Project Costs
equals amount due COMPANY \$ _____

COMPANY shall reimburse STATE for 100 percent of the costs of all material delivered to COMPANY but not installed.

AGREEMENT

between

CITY OF ACKLEY, IOWA

and

STATE OF IOWA
Iowa Department of Transportation
Rail and Water Division

for

INSTALLATION OF ADVANCE WARNING SIGNS AT RAILROAD CROSSINGS

Project No. RRP-000S(14)--48-00

STATE OF IOWA:

Contact Person Neil M. Volmer

Address Rail and Water Division, Iowa DOT, Ames, Iowa 50010

Telephone No. 515/239-1497

HIGHWAY AUTHORITY (City or County):

Contact Person Frank Boheman, councilman

Address c/o City Hall, Ackley IA 50601

Telephone No. 515-847-3332

Exhibits Attached to This Agreement

- A - Inventory of Sign Needs
- B - Specifications for Material
- C - Specifications for Installation

RECEIVED

FEB 10 1984

RAIL & WATER DIV.

IOWA DEPARTMENT OF TRANSPORTATION
AGREEMENT FOR INSTALLATION
RAILROAD CROSSING ADVANCE WARNING SIGNS

THIS AGREEMENT is between CITY OF ACKLEY, IOWA hereinafter called the HIGHWAY AUTHORITY, and the STATE OF IOWA, acting by and through the Iowa Department of Transportation, Rail and Water Division, hereinafter called the STATE.

The HIGHWAY AUTHORITY and the STATE agree as follows:

I. CONTRACT PURPOSE

The purpose of this contract is to provide advance warning signs at railroad public at-grade crossings to the material and installation standards defined in Exhibits "B" and "C" attached and made part of this Agreement.

II. RESPONSIBILITY OF THE STATE

- A. The STATE will purchase the necessary advance warning signs, posts and hardware as shown in Exhibit "A" attached and made part of this Agreement.
- B. The signs, posts and hardware will be delivered to a distribution point located within 50 miles of the HIGHWAY AUTHORITY for receipt by the HIGHWAY AUTHORITY.
- C. The signs, posts and hardware will conform to the specifications shown in Exhibit "B".
- D. The STATE will inform the HIGHWAY AUTHORITY of the designated location and the date signs will be available.

III. RESPONSIBILITY OF THE HIGHWAY AUTHORITY

- A. The HIGHWAY AUTHORITY shall obtain the signs, posts and hardware at the distribution point designated by the STATE.
- B. The HIGHWAY AUTHORITY shall install the signs, posts and hardware at the crossings designated in Exhibit "A".
- C. The HIGHWAY AUTHORITY shall install the signs, posts and hardware in accordance with the installation specifications shown in Exhibit "C" and in Part VIII to the Manual on Uniform Traffic Control Devices for Streets and Highways.

- D. The HIGHWAY AUTHORITY shall install all signs, posts and hardware within six (6) months of the date the STATE advises the HIGHWAY AUTHORITY the signs are available at the distribution point.
- E. The HIGHWAY AUTHORITY shall inform the STATE two (2) weeks prior to beginning material installation and when the installation is completed.

IV. PROJECT FINANCING

A. Funding:

1. The FEDERAL HIGHWAY ADMINISTRATION 203 rail highway safety funds shall be utilized to pay 90% of the cost of the Project.
2. The 10% matching costs shall be the responsibility of the HIGHWAY AUTHORITY.
3. The STATE shall have no cost associated with this Project other than the cost of administering the federal funds.

B. Project Costs:

It is agreed between the HIGHWAY AUTHORITY and the STATE that 90% of the total cost of the project shall be the cost of purchasing and delivery of the materials to the distribution point. It is also agreed that 10% of the total cost of the project shall be the cost to obtain material from distribution point plus the cost to install the materials minus the salvage value of the existing deficient material.

C. Financial Participation by Each Party:

1. The STATE'S use of 203 rail highway safety funds shall pay all costs associated with purchase and delivery of materials to designated distribution points as defined in paragraph B above.
2. The HIGHWAY AUTHORITY shall be responsible for all costs associated with obtaining the signs from the designated distribution point and installation of the materials. The ownership of all existing signs remains with the HIGHWAY AUTHORITY. If the HIGHWAY AUTHORITY loses or fails to properly install the materials in accordance with Exhibit "C", the HIGHWAY AUTHORITY shall correct the failure or make immediate repayment to the STATE for all associated costs of the materials.

V. INSPECTION

The STATE and FEDERAL HIGHWAY ADMINISTRATION have the right to review, inspect and observe, at reasonable times upon reasonable notice to the HIGHWAY AUTHORITY, materials, work in progress and completed work as covered by this Agreement. The STATE and the HIGHWAY AUTHORITY agree the HIGHWAY AUTHORITY is responsible for sign location at specific crossings.

VI. MAINTENANCE OF MATERIAL

Upon completion of the installation of materials, the HIGHWAY AUTHORITY shall assume all ownership and all maintenance responsibility of the advance warning signs. The HIGHWAY AUTHORITY agrees to replace any sign installed by this Project which is destroyed or missing. All maintenance and replacement of HIGHWAY AUTHORITY'S material at the crossings improved under this Agreement shall be in accord with Exhibits "B" and "C".

VII. EQUAL EMPLOYMENT OPPORTUNITY

The HIGHWAY AUTHORITY and the STATE agree work covered in this Agreement is subject to all Federal laws and regulations relating to equal employment and opportunity for all persons without regard to race, color, creed, sex, age, religion, disadvantaged, handicapped and national origin relating to, but not limited to, nonsegregated facilities, minority business enterprise providing equal employment and equal opportunities to veterans.


VIII. APPLICABLE LAW AND REGULATION

It is understood that the Project herein contemplated will be financed from funds appropriated by the Federal Government and expended under Federal Regulations; that all plans, specifications, estimates, awards of contracts, acceptance of the work and general procedure are subject to all Federal laws and regulations applying to such a Federal project, subject, however, to applicable STATE law.

IN WITNESS WHEREOF, the HIGHWAY AUTHORITY and the STATE hereto have caused this Agreement to be executed by their authorized officers as of the dates below indicated.

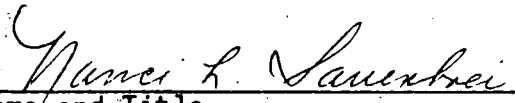
Executed by the
HIGHWAY AUTHORITY this

7th day of February, 19 84. By


Name and Title
Dale Brass, Mayor Pro Tem

Attest:

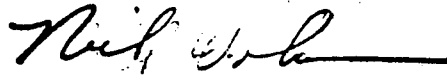
By


Name and Title
Nanci L. Sauerbrei, City Clerk

Executed by the
STATE this

STATE OF IOWA
Iowa Department of Transportation
Rail and Water Division

16th day of May, 1984. By


Name and Title

Approved _____
Date

Division Administrator
FEDERAL HIGHWAY ADMINISTRATION

PAGE 1

ACKLEY PROGRAM FOR INSTALLATION OF ADVANCED WARNING SIGNS

INSP. INIT.

AARCODE	BRANCH	RRMILEPOST	HWYNO	STRNAME	CROSSINGNO	WARNSN	ADVPST
CNW	MARSHALLTOWN	00200.60		DOUGLAS AVENUE	201258X	2	2
		00200.70		LINCOLN AVENUE	201259E	2	2
		00201.50	0	10TH AVE.	201261F	2	2
ICG	MAIN LINE	00315.48		CERRO-GORDO ST	307258U	2	2
		00315.59		FRANKLIN STREET	307259B	4	4
		00315.68		WORTH	307260V	2	2
*TOTAL CITY CCLS						14	14

A-1

Railroad Advance Warning Signing Materials

GENERAL. All materials shall be new and unused. Before incorporation into the work, all materials shall be approved.

Unless otherwise stated, dimensions and tolerances for all bolts, nuts, and washers shall be similar to that specified by ANSI for the size required.

SIGN PANELS. Sign panels shall be of sheet aluminum, and shall meet the following requirements:

Sheet Aluminum for signs shall meet requirements of ASTM B 209, Alloy 5052-H38 or 6061-T6, with no specified limit for yield strength or bend test. Sheet aluminum shall have a nominal thickness of 0.125 inch. The thickness shall be subject to tolerances similar to those specified in ASTM B 209 for a sheet having a width equal to the greatest dimension of the sign.

REFLECTIVE SHEETING. Except as otherwise specified on the plans or in these specifications, reflective sheeting shall consist of spherical lens encapsulated in, transparent plastic. The sheeting shall be coated on one side with an adhesive backing protected by a removable liner.

Reflective sheeting shall be uniform in color and reflectivity. In a single sign, variations in color or reflectivity noticeable at a distance of 50 feet or more, under daytime or nighttime lighting conditions, shall be cause for rejection of the sign.

All reflectorized signs shall have yellow encapsulated-lens sheeting for the background and black letters, symbols, and borders.

Encapsulated-Lens Sheeting shall meet the following requirements:

A. Reflectivity. The reflective intensity shall have the following minimum values expressed as average candle-power per foot-candle per square foot of material. Measurements shall be made in accordance with Paragraph 4.3.7 of FSS L-S-300B, "Sheeting and Tape, Reflective: Non-exposed Lens, Adhesive Backing".

Angle, deg.	Yellow		
Divergence	.2	.5	1.5
Incidence			
-4	170.	62.	3.0
40	80.	35.	1.5

The reflective intensity of unweathered sheeting, when measured in accordance with the rainfall test specified in FSS L-S-300B, shall not be less than 90 percent of the above values.

- B. Physical Characteristics. The sheeting shall have a strength suitable for handling, processing, and application, according to the manufacturer's recommendations, without appreciable damage. The unapplied sheeting, conditioned for 48 hours and tested at 72 degrees F and 50 percent relative humidity, shall show no cracking when bent around a 1/8-inch mandrel. The reflective surface shall be smooth and flat and shall exhibit an 85 degree specular gloss reading of not less than 50 when tested in accordance with ASTM D 523.

The reflective surface shall be readily processed and compatible with recommended transparent and opaque process inks and shall show no loss of color coat with normal handling, cutting, and application. The sheeting shall permit cutting and color processing at temperatures of 60 to 100 degrees F and relative humidities of 20 to 80 percent and application and curing, as recommended by the manufacturer, without loss of color or staining. The reflective surface shall be resistant to VM&P, naphtha, and mineral spirits.

- C. Color. The color of the sheeting shall be within the limits of the color tolerance charts issued by the U.S. Department of Transportation.
- D. Durability. The sheeting shall be so durable that the manufacturer can recommend that for a minimum outdoor exposure in Iowa of 10 years, deterioration of properly processed and applied sheeting would not be anticipated to the extent that resulting defects, when viewed from a vehicle, would make the sign ineffective for the intended purposes or would reduce the reflective intensity below the following limits:

Reflective Intensity 0.2 degree
divergence -4 degree incidence

Yellow

136

- E. Adhesion shall be by a precoated, pressure-sensitive adhesive or a tack-free, heat-activated adhesive, either of which may be applied without additional adhesive coats on the reflective sheeting or application surface. A protective liner shall be attached to the adhesive and shall be removable by peeling without soaking in water or other solvents.

The adhesive shall form a durable bond to smooth corrosion- and weather-resistant surfaces and shall permit the reflective sheeting to adhere securely 48 hours after application at temperatures of -10 to 150 degrees F. The adhesive-coated sheeting shall be vandal resistant, and when jabbed with a spatula at -10 degrees F, the adhesive

bond shall prevent the reflective sheeting from shocking off. The sheeting shall resist peeling from the applying surface when a 5 pound/inch-width force is applied as outlined in ASTM D903. The precoated adhesive shall have no staining effect on the reflective sheeting and must be mildew resistant.

FASTENING ACCESSORIES. The threads of all fastening accessories shall meet the requirements of ANSI B1.1, National Coarse Thread Series. Sign fasteners shall comply with the following requirements:

- A. Bolts shall be 3/8 inch in diameter with a hexagonal head. Thread fit shall conform to ANSI Class 2A. The length will be as shown on drawings.
- B. Nuts shall be finished, finished thick, regular, or heavy, hexagonal, self-locking nuts for 3/8-inch bolts, but all nuts shall be of the same type. The axial tensile strength at room temperature shall be not less than 4730 pounds. Self-locking nuts shall be approved by the engineer. Thread fit shall be as recommended by the manufacturer.
- C. Washers shall be 7/16" I.D. x 1" O.D. x 0.078" with thickness tolerance of plus or minus 0.006".
- D. Neoprene washers shall be 7/16" I.D. x 3/4" O.D. x 1/8" thickness. (Neoprene washers are required when treated wood posts are used). Durometer hardness shall be 60 to 70 with a tolerance of plus or minus 5.

Hardware shall be furnished in galvanized steel. Galvanizing shall meet requirements of ASTM A 153, Class D, or ASTM A 164, Type LS.

SAWN WOOD POSTS. Sawn wood posts shall conform to the shape and nominal dimensions for rough stock as specified in the contract documents, and shall meet requirements of Dense No. 1 grade for Douglas-fir coast region, or Dense Structural 65 grade for southern pine.

WOOD SIGN POSTS. Wood sign posts shall be either Douglas-fir (coast region) or southern pine and shall be graded as provided in ASTM D 245 according to rules approved by the Board of Review of the American Lumber Standards Committee.

Douglas-fir posts shall be of the following grades and shall be free of heart centers:

4" by 4" - "No. 2" - Structural Light Framing;

Southern pine posts shall be of the following grades:

4" by 4" - No. 1 Dense;

Posts shall be furnished in the size and length specified and shall conform to the following for the size designated:

Posts 4 inches by 4 inches shall be furnished S4S and shall be sawn square at both ends. Posts shall be bored with two holes $7/16$ inch in diameter with one hole 3" from one end of the post, and the other 30" from the first. The spacing and alignment of holes shall be within $1/16$ inch of true centerline and distance.

All posts shall be kiln-dried or air-dried prior to treatment to a moisture content of not more than 20 percent. When dried, all posts shall be free from bends in more than one plane and free from short or reverse bends, and a straight line from the centers of the ends of a post shall not deviate from the longitudinal axis of the post at any point more than 0.5 percent of the length of the post.

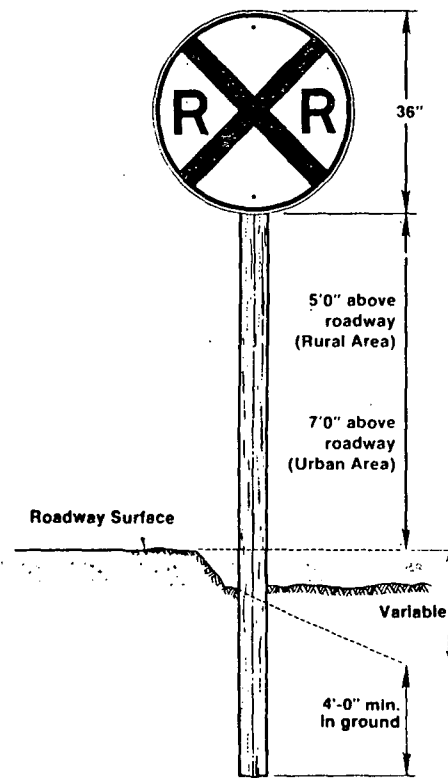
PRESERVATIVE TREATMENT. All boring shall be done before treatment. Unless otherwise provided, posts shall be given pressure preservative treatment with pentachlorophenol in accordance with requirements of AWPA P8.

Railroad Advance Warning
Signing Installation

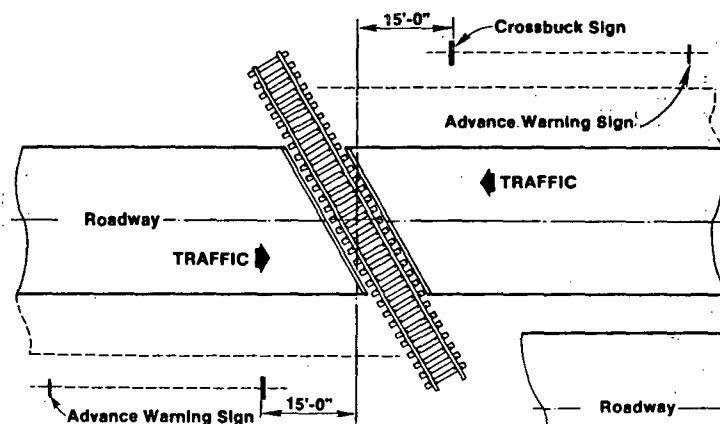
ERECTION OF SIGNS. Signs shall be erected so that they will be at elevations called for, shall be true to line and grade, and shall be truly vertical.

Wood posts shall be set in holes which are 12 inches in diameter and of the proper depth, and posts shall not be cut after treatment.

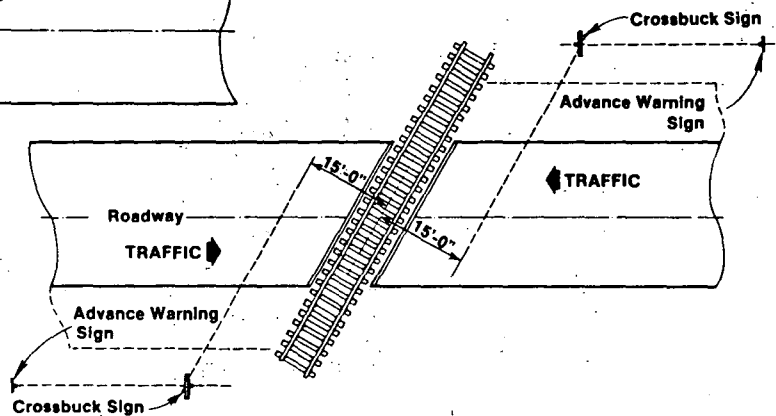
Posts shall be set to full depth and accurately aligned both vertically and horizontally. Post holes shall be backfilled in layers not more than six inches in depth. Each layer shall be thoroughly compacted, care being taken to preserve the alignment of the posts.



DETAILS OF RAILROAD
ADVANCE WARNING SIGN



TYPICAL INSTALLATIONS

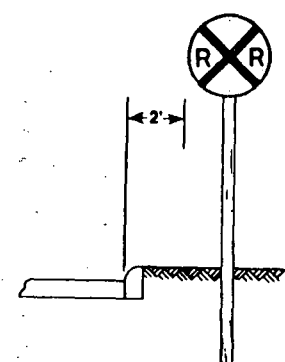
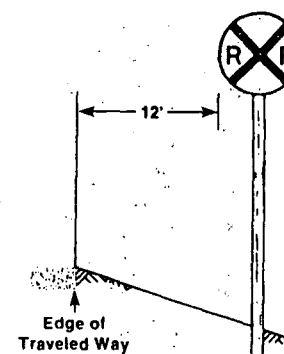
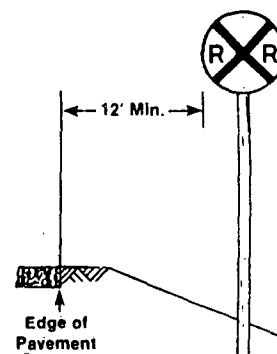
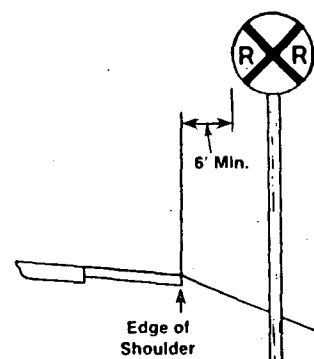


Paved Road, With Shoulder

Paved Road, Without Shoulder

Unpaved Road, No Shoulder

Business or Residence District



GENERAL NOTES:
Details indicated hereon for the Railroad-Highway Advance Warning signs are typical for a normal installation of this type.
Placement of the sign shall be in accordance with MUTCD and as shown on Advance Warning Sign Placement RRP-3.



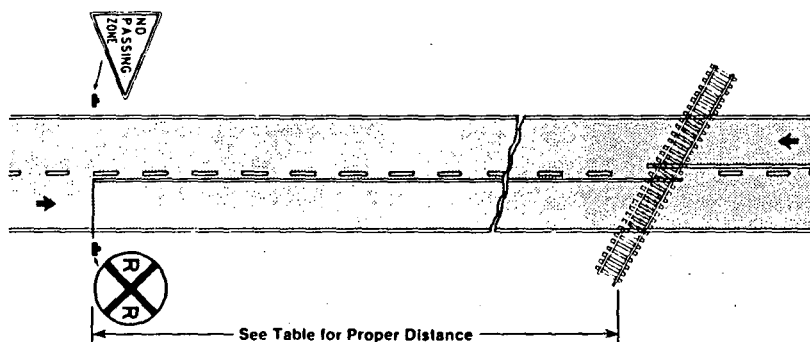
Iowa Department
of Transportation

RAILROAD CROSSING SIGNING
(ADVANCE WARNING SIGN PLACEMENT RRP-2)

COUNTY

SHEET NUMBER

DATE
BY
CHECKED
APPROVED



ADVANCE WARNING SIGN PLACEMENT Table

Suggested Minimum Warning Sign Placement Distance—Feet ¹

Posted or 85 percentile speed mph (use higher speed)	Condition A high judgment needed (10 Secs PIEV)	GENERAL WARNING SIGNS ¹					
		Condition B STOP condition		Condition C Deceleration conditions to listed advisory speed—MPH (or desired speed at condition)			
		0	10	20	30	40	50
20	175	(¹)	(¹)				
25	250	(¹)	100				
30	325	100	150	100			
35	400	150	200	175			
40	475	225	275	250	175		
45	550	300	350	325	250		
50	625	375	425	400	325	225	
55	700	450	500	475	400	300	
60	775	550	575	550	500	400	300

¹ Distances shown are for level roadways. Corrections should be made for grades. Distances based in 36-inch signs. If 48-inch signs are used, the legibility distance may be increased to 200 feet. This would allow reducing the distance by 75 feet.

² In urban areas, a supplementary plate underneath the warning sign should be used specifying the distance to the condition if there is an in-between intersection which might confuse the motorist.

³ Distance provides for 3-second PIEV, 125 feet Sign Legibility Distance, Braking Distance for Condition B and Comfortable Braking Distance for Condition C as indicated in A Policy on Geometric Design of Rural Highways, 1965, AASHTO, Figure VIII-15B.

⁴ No suggested minimum distance provided. At these speeds, sign location depends on physical conditions at site.

Iowa Department
of TransportationRAILROAD CROSSING SIGNING
(ADVANCE WARNING SIGN PLACEMENT RRP-3)

COUNTY

PROJECT NUMBER

DATE

1/2" = 1'

1" = 2'

3" = 6'

6" = 12'

12" = 24'

24" = 48'