

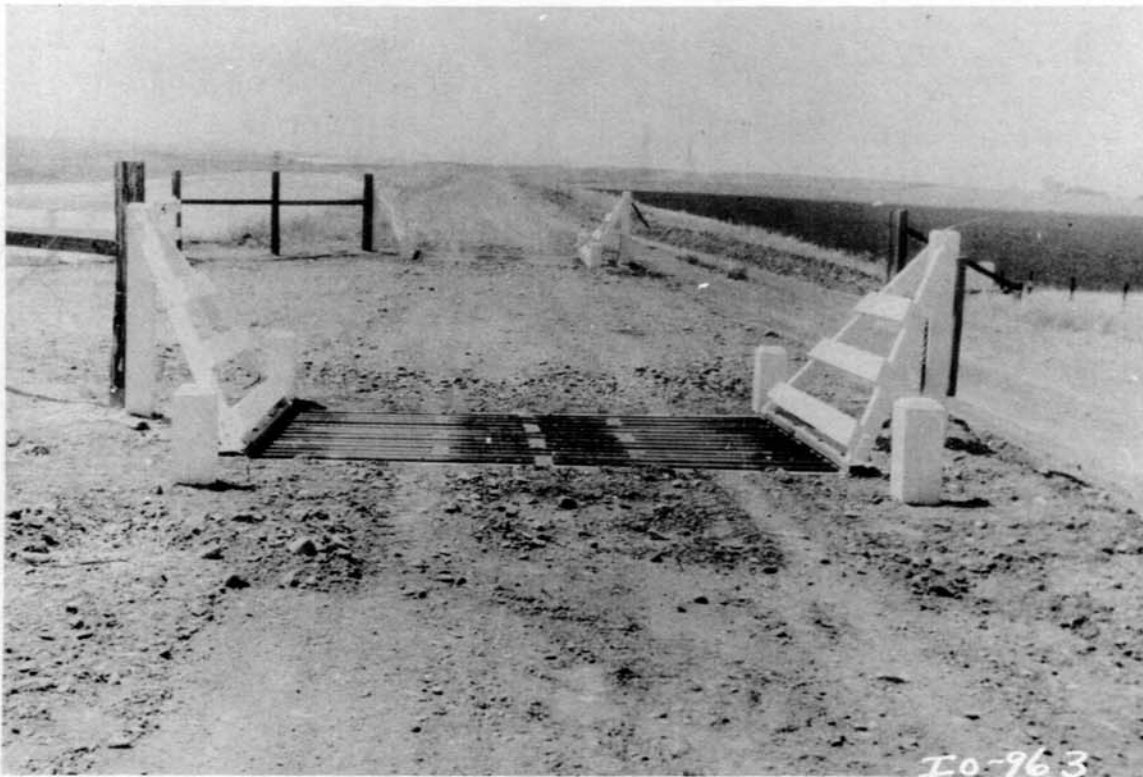
Department of the Interior

Bureau of Reclamation

# OPERATION AND MAINTENANCE EQUIPMENT AND PROCEDURES

RELEASE NO. 13

July, August and September 1955



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Cattle Guards on Canal Operating Roads

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## INTRODUCTION

This is Release No. 13 of the Operation and Maintenance Equipment and Procedures Bulletin. It is being devoted to a study made of cattle guards on operating projects constructed by the Bureau of Reclamation.

The study was made to obtain operating experience for use in improving the design of the Bureau's present standard cattle guards, a photograph of which is shown on the cover, or for use in the development of a new standard design; one that would meet with the approval of all concerned.

The summary of the study presented was prepared over a year ago and was given limited distribution as an office memorandum. Requests for additional copies of the memorandum by those offices that received it and their suggestions that the material contained would be of interest to operating projects, prompted us to release the summary as an O&M Bulletin.

The study was made in the Denver Office of the Assistant Commissioner and Chief Engineer by the Division of Irrigation Operations at the request of the Chief Designing Engineer. No recommendations have been made, but if one conclusion is to be drawn from the information obtained, it would be that it is doubtful if a single standard design will meet all situations or operating conditions to be encountered.

The Operation and Maintenance Equipment and Procedures Bulletin is published quarterly in the Office of the Assistant Commissioner and Chief Engineer, Bureau of Reclamation, Denver Federal Center, Denver, Colorado. It is prepared for publication by the Division of Irrigation Operations from material supplied for the most part by the regional, project and field offices. The Bulletin is circulated for the benefit of project operation and maintenance people, with its principal purpose being to serve as a medium of exchange of operating information. Reference to a trade name does not constitute an endorsement of a particular product, and omission of any commercially available item does not imply discrimination against any manufacturer. It is the hope that labor-saving devices, less costly procedures, and more serviceable equipment developed by the resourceful water users will be a step toward commercial development of equipment and materials for use on our projects in a continued effort to reduce costs and increase operating efficiency.

If additional copies of this issue or other issues of the Bulletin are desired, they may be obtained by writing any of the following offices of the Bureau of Reclamation:

Regional Director, Boise, Idaho  
Regional Director, Sacramento, California  
Regional Director, Boulder City, Nevada

Regional Director, Salt Lake City, Utah  
Regional Director, Amarillo, Texas  
Regional Director, Billings, Montana  
Regional Director, Denver, Colorado  
Assistant Commissioner and Chief En-  
gineer, Denver Federal Center, Denver,  
Colorado

\* \* \* \* \*

## CATTLE GUARDS ON CANAL OPERATING ROADS

There is a considerable difference of opinion among O&M and other project personnel regarding the Bureau's standard design for cattle guards on canal-operating roads. In numerous instances, they have designed and installed cattle guards which they believe are better from a first-cost and maintenance viewpoint. In an effort to reconcile the expressed difference of opinion, the subject was discussed with the Chief Designing Engineer and designers in the Denver Office. In a memorandum to the Division of Irrigation Operations, the Chief Designing Engineer suggested a survey be made of the cattle guards installed on canal-operating roads on Bureau-constructed projects. Results of the survey were to be made available to the designers in their consideration of a new or improved standard design for a more satisfactory cattle guard.

In accordance with the above, a letter was prepared and forwarded to Regional Directors, requesting their assistance and comments on the subject. All responded. In addition, suggestions were received directly from some Bureau and water-user-operated projects. A list of projects from which material on the subject has been contributed is given in Table 1 of the appendix. Our thanks to the regions, projects, and water users for their cooperation.

There are, no doubt, other manufacturers of cattle guards in the proximity of our projects. Just recently, we were informed that a "Powder River" cattle guard is manufactured in Baker, Oregon, by the Commercial Welding Company. The study was made on cattle guards in service on Bureau projects, as reported by the field offices, and only the information received was included in the original study. However, a drawing of the "Powder River" guard has been added as Figure No. 13, and the price list, weight and bill of materials as Figures 14 and 15. The Design Division believes that the 8- by 10-foot extra heavy duty guard can be modified to withstand an H-10 loading by using top rails formed of 1/4-inch plate, 7-inch by 12.25-pound end channels, and six 7-inch by 20-pound intermediate I-beams. This construction would represent a weight increase of approximately 350 pounds over the 1,844 pounds specified by the manufacturer.

Costs of the cattle guards given in the original memorandum and requested herein, except for the "Powder River" guard price list, Figure 14, recently received, reflect the costs of about two years ago (1953). They are subject to correction. However, they will serve for a comparison of costs and should so be used.

## SUMMARY AND CONCLUSIONS

One contributor states, "no cattle guard is an unqualified success," and another that they, "constitute a continual source of maintenance." In the interest of economy, many feel that the number of cattle guards installed on our canal-operating roads can be reduced. Nevertheless, it is agreed by all that cattle guards are a definite need under

certain circumstances and especially serve a vital purpose in expediting travel through stock-raising country.

Most field offices report that where cattle guards have been installed in accordance with the present standard design, they have given generally satisfactory service, except where exceptionally heavy traffic must be accommodated. The principal objection by most field people to the present standard design is the cost of construction. On the other hand, it is pointed out that from an O&M standpoint, the original cost may not be the important cost. The present high cost of lumber and labor and the short life of wooden structures may prove that an even more costly design, one calling for concrete and steel construction, is less expensive over a period of years because of lower maintenance and replacement cost. In this regard, it is interesting to note that although many object to the original cost, there is a tendency in replacement and repair of cattle guards to use steel and concrete construction in an effort to reduce replacement and maintenance costs in the future.

In accordance with the above, a new standard design should embody features that will result in lowest possible cost for materials, labor, and construction, as well as maintenance and replacement. It is generally believed that some changes in the design can be made in the interest of economy in construction and maintenance.

The cost of some guards installed, as reported by the contributors, is summarized in Table II of the appendix.

Some of the more specific suggestions and recommendations for improving the cattle guard designs are listed below:

1. One design standard for cattle guards will not meet the requirements for all projects or operating conditions.
2. "Bed-spring" type cattle guards, wire gates, or "bump-gates" can be used in some locations in lieu of the more costly cattle guards.
3. Commercially available, prefabricated cattle guards should be installed wherever possible. They are manufactured in quantity and, therefore, are less costly.
4. Narrower and less costly cattle guards could be installed on canal-operating roads for passage of light traffic, providing adjacent wire gates for the passage of heavy equipment and traffic.
5. Where the more costly type of cattle guard must be used, specify as many similar guards as possible in one contract to take advantage of mass production and resulting lower cost.
6. Eliminate the 24-inch pit under deck of the cattle guard by using heavy railroad rails, or by setting the stringers of the

cattle guard deck level with the roadway and ramping the roadway over the structure.

7. Provide guard posts adjacent to cattle guards to eliminate damage by the passage of wide equipment over it or to prevent equipment from approaching the cattle guard at an angle.

8. Avoid placing a cattle guard on a sharp curve. It is difficult to approach in a manner that permits traffic to move through it without damage to wing guards.

9. Use lighter material in construction of wing guards, 1-inch instead of 2-inch material.

10. Fabricate wing guards separately and provide for tying them to the guard posts and surface-guard framing by metal strips and bolts or lag screws.

11. Avoid use of mesh-type decking material for cattle guards. Much difficulty has been encountered in breakage of the unsupported mesh.

## GENERAL

### Eliminate Cattle Guards Where Possible

The use of cattle guards on operating roads has been a common and accepted practice where the adjacent land holders were engaged in stock raising before the construction of a canal. As farming operations and ownerships change during development of a project, it frequently happens that neither cattle guards nor fences are required. It is also noticed during construction and operation, that where cattle guards were used in conjunction with wire gates, most of the gates remained open practically throughout the year. This open-gate condition is an indication that the requirement for cattle guards is not as extensive as one may think. In many locations it is believed gates could be installed and maintained more economically.

On many Bureau projects the construction of cattle guards has been limited to the carriage system only. Those located on the distribution systems are installed by the landowners with the location and construction subject to Bureau approval. On other projects cattle guards are provided only in locations where landowners or other interested agencies, such as the railroad, National Park Service, etc., insist.

Cattle guards are not used on many of our projects in the Southwest, particularly in the Lower Colorado River District, and by the Yuma County Water Users' Association or the Coachella Valley County Water District. On the Salt River Valley Project, only a few cattle guards are employed. On other projects in the South and Southwest, cattle guards

have not been constructed on many of the operating roads; however, there is a possibility that they may be needed at some future date. For this reason, they also are interested in the new standard design.

On the Rio Grande Project in Texas, cattle guards on canal-operating roads are not maintained at the present time. During the CCC Program, a few structures were built throughout the project, but these have since been abandoned. However, some of the water users on this project have constructed inexpensive cattle guards, and Photographs 1, 2, 3, and 4 are typical of these installations.

One California project experienced considerable difficulty in various locations by horses crossing on the pipe of cattle guards. In this particular instance, the spacing of the pipes was increased until they were almost impassable for motor vehicles, but the horses continued to pass over the cattle guard. It has been suggested that installation of a pipe grating in which the pipes are loose and can roll has been partially effective for such an instance. It also is suggested that wire gates or bump gates be given consideration in lieu of cattle guards.

Many canal ditch banks are too narrow for both cattle guards and access gates, thus all heavy maintenance equipment must pass over the cattle guard. In these instances, a heavy-duty cattle guard must be constructed.

### General Design of Cattle Guards

There are many types of cattle guards on our projects. Many are very elaborate, such as some of those constructed during the days of the CCC, consisting of heavy reinforced concrete footings and foundations and elaborate wing guards. They were expensive to construct. By contrast, individual landowners on our projects have built many inexpensive cattle guards. Although not entirely suitable for some operating roads, they have been used for this purpose.

The type of cattle guard to be used should depend primarily upon its functional purpose; that is, the type and amount of traffic, the foundation material upon which it is constructed, the narrowness of the ditch banks, etc. In some instances, other factors must be considered. In the South and Southwest, drifting sand that fills the pit under the guard will influence the type of cattle guard which will best serve the purpose.

The Boise Project Board of Control in Region 1 uses some concrete, precast cattle guards which are made and installed in the nonirrigation season. They report satisfactory performance and use the pre-casting operation as a means to economically extend their work season to a yearly basis. A design of this type would result in a less costly installation; one that can be installed as the traffic load develops or location demands.

As previously stated, many projects operate without cattle guards. Some need none other than those provided by the water users themselves. In many instances, it is believed a lower-cost, although less durable, bump gate or wire gate in a farmer's field might suffice, even at a sacrifice of convenience.

Although it is possible that less expensive, light-weight type cattle guards will suffice in some locations, provided a gate is installed for passage of heavy equipment and traffic, there are locations on our canal systems that require a heavy-duty type cattle guard. Design of a single standard to meet the many conditions enumerated will be difficult.

#### STANDARD DESIGN DRAWING NO. 40-D-4383

The standard cattle guard, Drawing No. 40-D-4383, Figure 1, is reported by most projects on which the structure has been installed to be very satisfactory. The principal objection to the present standard is that bids on this design have been very high. However, from an O&M standpoint, as previously stated, the original cost may not be the important cost.

#### Cost of Present Standard Design

A detail study of costs has not been made. However, some information has been submitted, and has been summarized in Table II of the appendix. With reference to this table it is apparent that often the reason for the high bids for construction of cattle guards is that only a few cattle guards are installed under one contract. For example, the low bid for one gate in the Second Section of the Courtland Canal, furnished and installed, was \$500. On another, where seven were required, the low bid per unit was \$400.

In an attempt to reduce the cost of the H5 loading cattle guard shown on the standard drawing and still retain the design standards, one District office reduced the area of the cattle guard built. Instead of providing a structure with a 9 foot, 10 $\frac{1}{2}$ -inch width and 8-foot length, drawings were prepared for an 8-foot width and 4-foot, 11-inch length. Ten of these cattle guards were constructed on the Horsetooth Feeder Canal of the Colorado-Big Thompson Project and two on the Horsetooth Supply conduit of the same project. Bids varied from \$250 to \$800 from low to high, respectively, in both instances. Typical of this redesigned cattle guard is the installation shown in Photograph 5. However, since this canal has been in operation, O&M forces have objected to its narrow width. They all too frequently have had to replace the side guard assembly.

When Willow Creek Canal, another feature of the same project discussed above, was constructed, the standard cattle guard was built with bid prices for four cattle guards being \$1,000 and \$1,150, low to high respectively. On the Flatiron Section of the Horsetooth Feeder Canal, another feature of the same project, the South Platte River District continued to use the standard cattle guard, and for seven cattle guards,



bids were from \$400 to \$1, 100, low to high respectively. One of the cattle guards of standard design is shown in Photograph 6.

### Suggested Design Improvements in Present Standard

Regardless of the surface type of cattle guard made standard, it is believed that a lighter material can be used in construction of the wing guards, thus reducing the cost. 1- by 6-inch lumber is believed sufficient for wing guard construction in place of the 2-inch material shown on our present standard Drawing No. 40-D-4383, Figure 1. It also is suggested that the wing guards be fabricated as separate units and tied to the guard posts and surface-guard framing by metal stripping and bolts or lag screws.

Heavy damage to cattle guards results from the necessary use of the operating road by contractor's equipment, as well as farmer's trucks and equipment. The damage is usually caused by the vehicle not passing properly through the guard, but at an angle or too close to a side. The result is a crushed and destroyed wing guard, Photograph 7. The damage is often the result of carelessness in centering vehicles as they enter the guard or the necessity for making a sharp turn just before entering the cattle guard. In this latter, locating a cattle guard in a sharp curve on a canal bank or too close to a farm bridge, where it is difficult to turn onto the bridge, contributes to a maintenance hazard.

A curb or post of concrete, angle iron, or heavy timber at the base of each side guard, and strong enough to withstand wheel impact, would be especially desirable in some places to protect the side guard. One suggestion in this respect, Photograph 8, consists of 7- by 7-inch redwood posts 18 inches high being installed at either end of each guard, painted white and possibly fitted with red reflecting tape to act as guides for approaching vehicles. The posts are made of surfaced redwood, 4 feet long. The posts are buried  $2\frac{1}{2}$  feet in the ground and extend 18 inches above the surface. Location of the posts is indicated on Figure 1a which is a marked print of Drawing 40-D-4383. It is believed use of these or other types of guard posts will cut the damage to cattle guards to a minimum.

Another suggested improvement in connection with the present standard design is that of providing that the bottom of the stringers be set level with the normal top of the operating road, and the road ramped up to the cattle guard on both sides. Such a procedure would provide adequate drainage, obviate the necessity for the 24-inch deep pit, and reduce costs of construction. This type of design also would be of use on some of our projects in the South and Southwest, where considerable trouble has been experienced with drifting sand filling the cattle guard pit. However, if the pit is eliminated some provision must be made to facilitate periodic cleaning of the space between bars.

## Costs of Repairs and Replacements

A total of approximately 225 cattle guards of the present standard design, Figure 1, have been installed on the Madera and Friant-Kern Canals. On the Madera Canal six of the cattle guards had to be replaced in about 6 years, and to date, approximately 30 have had to be replaced on the Friant-Kern Canal; a total of 16 percent. It is estimated that six additional guards should be replaced now on Madera Canal and the remaining 12 within the next 3 to 5 years. On the Friant-Kern Canal, it is estimated that 45 cattle guards should be replaced now, 100 in the next 3 to 5 years, and the remainder within 10 years.

The cost of repairs and replacements varies considerably with the extent to which repairs and replacements are made. Some of the units on the non-operating bank of the canal, which is lightly travelled, are not subjected to excessive damage. It is estimated that these will require about \$15 per year for painting and other maintenance. The costs range upward to \$200 for complete rebuilding and replacing, using such materials as can be salvaged from the old guards, such as the pipe railing, bolts, etc.

From the standpoint of project operation and maintenance, the timber and pipe cattle guard installed in accordance with the present standard on the Madera and Friant-Kern Canal have a maximum useful life of about 10 years. The timber members rot and eventually cause the cattle guard to settle and fail. Treatment of the timber with wood preservatives will prolong the life of the guard, but not to the extent possible by the use of concrete and metal, as has been done in some replaced units on the Central Valley Project, as discussed in a subsequent paragraph.

## OTHER CATTLE GUARD DESIGNS

Several drawings submitted by individual projects or regions are being attached to this memorandum as Figures 2 to 10, inclusive. For permanence and economy, the cattle guards constructed on the Deschutes Project, Figure 2, are considered the best design by O&M personnel in Region 1. The steel grill is made of 1-inch square, reinforcing bars and the pit frame, sills, etc., are constructed of reinforced concrete. Sixty-eight cattle guards constructed under Specifications No. R1-80 (May 9, 1950) cost approximately \$116 each. Prior to the construction contract, however, a large number of these cattle guards were constructed by O&M forces on at least two projects, using reinforcing steel bars from war or construction surplus stock. Costs for many of these earlier installations were considerably less than \$116. Region 1 adds that even if the steel had to be purchased from new stock, this cattle guard would be their No. 1 recommendation because of its economy and simplicity of construction. Also some projects precast concrete, wing guard support posts. These add to the permanence of the installation and are fireproof. Posts and wood structures are often damaged by fire during the weed-burning season.

Figure 3 (Drawing No. 214-219-11008, titled "Madera Canal, cattle guard for operating roads"), is considered by Region 2 as not only a worthy alternate for other cattle guards in the San Joaquin Valley District, but distinctly superior in some respects to many of them. Maintenance has been considerably less. Those installed on the Madera Canal have required no maintenance other than painting of the wooden side guards. The extra width permits the passage of pieces of maintenance equipment, impossible with the narrower cattle guards. The Madera Canal design with concrete and used rail costs an average of \$468 per installation. It is planned that all of the standard design timber and pipe rail guards will eventually be replaced with the Madera design, as the presently installed ones deteriorate and need replacement. To further reduce O&M and replacement costs, a side guard assembly constructed of the deck pipe from the older cattle guards, Figure 4, is suggested.

A more permanent and costlier type of cattle guard is that utilizing railroad rails to support road traffic, at the same time offering minimum tread for stock. This type of installation is used extensively for full highway width, especially on hard-surfaced highways. The Salt River Project, Arizona, uses a cattle guard of this type, patterned after that used by the Arizona State Highway Department, Figure 5 (Drawing B-14-52). In recommending this guard, it is believed most practicable to use rail of at least 90-pound weight. Spacing of the rails of this size, 6 inches on center, affords a space of approximately  $3\frac{1}{2}$  inches between rail heads and is sufficient to carry traffic without wheel or tire damage and enough to discourage stock crossing. The use of rails can obviate the necessity for having a pit under the guard.

The Klamath Project reports that cattle guards constructed using  $2\frac{1}{2}$ -inch standard pipe with a timber pit, as shown on the Standard Design Drawing is quite satisfactory on roads carrying light traffic. During the period that the CCC's were on the Klamath Project, some cattle guards were constructed with precast concrete beams forming the pit. The CCC cattle guards were constructed with timber deck gratings which were not satisfactory. The timber was broken up under the impact of operating equipment. Project forces believe that use of precast concrete beams for construction of the pit was a good idea and has advantages of permanence and simplicity, and that a foundation of concrete instead of wood is almost essential on ditch banks that are too narrow for both a cattle guard and an access gate and at a location where all heavy maintenance equipment must pass over the guard. Supports for movement of draglines or other heavy equipment require sturdy construction.

The "Provo Reservoir Canal cattle guard," Figure 6 (Drawing No. 244-408-288), used on the Provo River Project, has proved to be very successful. The "A" frame wings are of 2-inch, pipe-welded construction. The deck consists of 10 pieces of 2-inch pipe, and the framework for the pit is creosoted timber. Two views of a typical installation are given in Photographs 9 and 10.

Cattle guards installed on the Uncompahgre Project in accordance with Washington, D. C., Standard Drawing No. 29-28 still are

used throughout the Project. No drawing of this guard is available. Constructed entirely of timber, operating personnel have found that it was desirable to modify the standard deck by substituting nine 3-inch by 6-inch planks for the eleven 2-inch by 6-inch planks. With the one modification, the cattle guard has proved to be very satisfactory under operating conditions, and its continued use is planned.

Cattle guards installed by the Bureau on the Tucumcari Project in 1946 have been in continuous service since that time. A number of these structures were built in accordance with Figure 7 (Drawing 257-505-410). In some cases where the foundation material appeared to be unstable, concrete was substituted for the timber sills, bulkheads, and stringers. Most of these structures have proven very satisfactory and have required very little maintenance even while accommodating the travel of heavy equipment.

All cattle guards in use on the San Marcial Division of the Rio Grande Channelization are Type H-15, as shown on Figure 8 (Drawing 163-D-56). These structures were constructed shortly after the first of this calendar year. There has been little opportunity to make any observations. However, it has been noticed that similar type cattle guards in use elsewhere are experiencing some trouble with drifting sand filling the pits. Figure 9 (Drawing No. 23-503-4051), shows the construction details of some cattle guards previously installed on the Rio Grande Project by the CCC organization. Most of these structures now have been abandoned.

Region 6 has also installed cattle guards similar to that shown in Figure 8. One installation of this type in which the deck grill was 23 feet, 3 inches in length was installed for \$494.60.

## LESS COSTLY CATTLE GUARDS

### The "Bed-Spring" Type

In the March 1953 issue of the Reclamation Era, Mr. Theodore Nelson, Chief, O&M Division, Region 1, illustrated and discussed a practical, cheap, portable cattle guard fabricated from light metal strips and small coil springs, mounted upon a tubular frame. A photograph from the Reclamation Era has been reproduced for reference and is included in this memorandum as Photograph 11. Much interest has been shown in this cattle guard.

The Klamath and Vale Projects report installations of the "bed-spring" cattle guard and believe they are satisfactory, but that they have not been in use long enough to determine their permanence or the amount of maintenance that will be required. Several field offices believe the device especially practical and easily made standard with a few improvements. If, under constant use, annual replacement might be necessary, however, its original low cost may offset this.

It appears the "bed-spring" cattle guard would be satisfactory for an installation which accommodates traffic at low speeds and of limited weight. It is hard to visualize the practicability of the device for passing heavy equipment, where the frequency of crossing the guard is high, or where it must be crossed by tractors with or without lugs or pads. Providing gates alongside the cattle guard for passage of the heavier equipment would make the "bed-spring" type cattle guard more feasible.

Suggested changes in design for the "bed-spring" cattle guard include: Need for a greater width than 50 inches--72 inches or more would be a more practical width; metal wickets driven into the ground over the pipe framework to keep the device from moving while being crossed; attachment of the framework pipe to adjacent wooden side posts in order to minimize movement of the guard as well as prevent theft. The Klamath Project also reports that the springs were too short and would not stand up under the strain of many passing vehicles, suggesting that the guard would be more satisfactory if springs of suitable length at the end of the steel straps were provided.

In country where there is fairly heavy winter snow, the performance of the cattle guard would be questionable. On irrigation ditch banks this need not be a problem. The guard is light. It could be lifted out of position and a gate used during the winter time when the ditch banks are subject only to travel in connection with maintenance work.

The Kittitas Reclamation District is using a spring-suspended grill made of surplus steel landing mats for a guard, Photographs 12, 13, and 14. The inexpensive war surplus landing mats are suspended 3 to 4 inches above the ground by use of a single spring on each side of the 90-inch by 120-inch mat. The springs, which are only 10 inches by 1 inch in size, connect a triangularly braced strap iron, welded to the mat, with the top of a side post. A guide is attached at the base of each post. Thus the mat is permitted to move only in an up and down position. Use to date is limited and the Project believes some improvements may be needed. However, the cost of construction and installation is substantially less than the conventional pit-type guards.

### Autogates

There are other low-cost cattle guards available such as "Capital", "C&P", and "Flying L" autogates, manufactured on a commercial basis. All three of these cattle guards are in general use in the Kansas River District; however, no one cattle guard has been chosen as a standard. These guards are manufactured by C and P Autogate Company, North Platte, Nebraska; Capital Bridge Company (Capital cattle guard), Lincoln, Nebraska; and Lincoln Steel Works (Flying L), Lincoln, Nebraska.

The C and P Autogate has been used extensively on the Cambridge and Superior Canal Systems and on the County Road Relocation at Trenton Dam. So far as is known no manufacturers' data or literature is available. Figure 10 is a record drawing submitted by the Kansas River Projects Office.

The C & P Autogate is quite inexpensive. Although used materials are permitted in its manufacture, the C & P Autogate has proven to be highly satisfactory. The purchase price for this guard recently was \$68 each, f. o. b., Indianola, Nebraska, for a lot of 30. The price will vary up to \$100 each, depending upon the quantity purchased. The low bidder for 12 units installed on the Trenton County Road Relocation was \$200 each for furnishing and installing this type of guard. However, there was a lower unit bid of \$100 each.

"Flying L" autogates, manufactured by the Lincoln Steel Works at Lincoln, Nebraska, have been used on canal bank roads in the Pathfinder Irrigation District of the North Platte Project in Nebraska, on the Newlands Project in Nevada, on the Columbia Basin in Washington, and other projects in Region 1 and Region 6. Reports indicate that the cattle guards are proving to be practical, and maintenance is negligible if properly installed. Region 1 prefers a concrete foundation for the guard and finds the autogate more expensive than some other types they are using.

A unique arrangement has been made on the North Platte Project in which the Pathfinder Irrigation District purchases the "Flying L" autogates and sells them to the water users at a total cost of approximately \$200, which includes a cost of \$50 to \$100 for installation. Construction details of the "Flying L" autogate are given in Figures 11 and 12. Some additional information, including a price list, taken from an information circular is given below:

LINCOLN "FLYING L" AUTO-GATE  
PRICE LIST  
Net Prices f. o. b. Lincoln, Nebraska  
(May 21, 1953)

Cattle Guards or Horse Guards

STANDARD GATES			HEAVY-DUTY GATES		
Size	Shipping weight	Price each	Size	Shipping weight	Price each
8' x 6'6"	640 lb	\$ 83.00	8' x 6'6"	845 lb	\$108.50
8' x 7'1½"	700 lb	93.00	8' x 7'9"	1,060 lb	127.50
9' x 7'9"	810 lb	104.00	10' x 6'6"	1,060 lb	132.00
10' x 7'9"	925 lb	118.00	10' x 7'9"	1,340 lb	156.00
12' x 7'9"	1,050 lb	134.00	12' x 7'9"	1,500 lb	174.00

Detachable Steel Wings

Size	Shipping weight per pair	Price per pair
6'6" x 5'6"	100 pounds	\$19.00

Special clamps for clamping two or more gates together, add per set of two. . . . . \$4.00.

### Some Features

Standard gate will carry over 10-ton load.  
Heavy-duty gate will carry over 15-ton load.  
Delivered ready for installation.  
Two or more gates can be clamped together for wider roadways.  
Corral gates, horse guards, and special sizes available on special order.  
Detachable steel end wings available.  
End wings easily attached with only two bolts.  
Special brilliant orange paint for:  
    Protection against rust.  
    Attracting attention of traffic or stock.  
    Attractive pleasing appearance.  
Requires only a simple, flat top, low-cost construction, or can be set on concrete, rock, or timber foundation or base.  
Temporary installations can be set directly on ground.  
Keeps dirt fill out of pit.  
All smooth rounded corners.  
    Reduces injury hazard to livestock.  
    Will not cut or bruise tires.  
Flat top 2 inches wide for smooth ride at all speeds.  
Open on bottom to prevent accumulation of dirt or sand and other debris which collects moisture and causes rusting.  
Center section opens by releasing locking device.  
Gate pit can be cleaned easily and quickly by one man with shovel.  
No tools needed for installation.  
Can be easily moved from place to place without loss or damage to gate.

One commercially-manufactured cattle guard installed on an experimental basis is not satisfactory for the reason that it uses 4-inch, heavy steel mesh over 6-inch by 4-inch I-beams. The beams are spaced in such a manner that small-diameter wheels, such as the front wheels on farm tractors, bear directly on the mesh causing it to fail.

### WIRE GATES OR BUMP GATES IN LIEU OF CATTLE GUARDS

All cattle guards have been eliminated and wire gates substituted on some of our projects because of restricted funds. This substitution has resulted in a substantial saving, with wire gates usually costing from \$15 to \$25.

When design data were being prepared for the St. Vrain and Boulder Supply Canal of the Colorado-Big Thompson Project, the question of cattle guards arose because of the large number of them involved, 30 in the St. Vrain and 45 in the Boulder, 75 in all. It was decided in this case that barbed wire gates could be substituted for the cattle guards.

Many believe that serious consideration might well be given to the use of bump gates in lieu of cattle guards. A gate of this type

will serve both to provide for passage of equipment too wide for a cattle guard and provide a means of keeping stock from straying, without delaying the ditch riders.

Adoption of bump gates would necessitate some education of the farmers. In one experimental installation of this kind some opposition was met, based on the fear that cattle, particularly, could operate the bumper trigger.



APPENDIX

TABLE I

PROJECTS CONTRIBUTING INFORMATION AND COMMENTS

- Region 1:   Boise Project  
              Columbia Basin Project  
              Deschutes Project  
              Kittitas Division - Yakima Project  
              Vale Project
- Region 2:   Central Valley Project  
              Klamath Project
- Region 3:   Coachella Division - All American Canal  
              Salt River Project  
              Yuma Project
- Region 4:   Newlands Project  
              Provo River Project  
              Uncompahgre Project
- Region 5:   Middle Rio Grande Project  
              Rio Grande Project  
              Tucumcari Project  
              Vermejo Project
- Region 6:   Buffalo Rapids Project  
              Missouri River Basin Project  
                  Keyhole Unit - Cheyenne Division  
                  Tiber Unit - Powder Division
- Region 7:   Colorado-Big Thompson Project  
              Missouri-River Basin Project  
                  Cambridge Unit - Frenchman-Cambridge Division  
                  Superior-Courtland Unit - Bostwick Division  
              North Platte Project

TABLE II

SOME COSTS OF CATTLE GUARDS INSTALLED  
(As reported for this summary)

Deck Dimension (Approximate)	Design (See attached Figures)	Construction of			Project and Canal	Number Units Placed	Cost per Unit	Average 3 lowest bids/unit
		Pit Frame	Deck	Side Guards				
9'-10½" x 8'-0"	Figure 1 (Std. Design)	Timber	2½" pipe	Timber	Missouri River Basin: Courtland Canal Courtland Canal Colorado-Big Thompson: Willow Creek Feeder Canal Horse Tooth Feeder Canal Central Valley. Madera and Friant-Kern	1 7 4 7 194	\$ 500 400 1000 400 305	-- -- \$1075 467 (approx)
8'-0" x 4'-11"	Figure 1 (Reduced in size)	Timber	2½" pipe	Timber	Colorado-Big Thompson: Horsetooth Feeder Canal Horsetooth Feeder Canal	10 2	250 250	333 417
8'-8" x 7'-3"	Figure 2	Concrete	1" square steel bars in deck and guards - Welded.		Deschutes	68	116	--
12'-0" x 7'-0"	Figure 3	Concrete	60# rail	Timber	Central Valley: Madera Canal	31	468	--
23'-3" x 8'-0"	Figure 6	Timber	60# rail	Wood posts	Missouri River Basin: Tiber Dam Camp	1	495	733
8'-0" x 7'-0"	Figure 10 (C&P Autogate)	Timber	1½" & 2" pipe	Not given	Missouri River Basin: Trenton Dam Road Relocation	12	200	--
Various	Figure 12 (Flying L Autogate)	Not given	Steel channel and members through-out		North Platte Project: Pathfinder Irr. Dist. Missouri River Basin: Keyhole Dam Camp Keyhole Dam Camp	-- 1 5	200* 420 327	-- 492 439

\*Installed by irrigation district after being purchased by water users.

List of Photographs

- Photo. No. 1 - Water User-constructed cattle guard - Rio Grande Project
- Photo. No. 2 - Water User-constructed cattle guard - Rio Grande Project
- Photo. No. 3 - Water User-constructed cattle guard - Rio Grande Project
- Photo. No. 4 - Water User-constructed cattle guard - Rio Grande Project
- Photo. No. 5 - Typical standard cattle guard with reduced dimensions - Colorado-Big Thompson Project
- Photo. No. 6 - Typical standard cattle guard with full dimensions - Colorado-Big Thompson Project
- Photo. No. 7 - Damaged Wing Guard on Standard Cattle Guard - Delta-Mendota Canal
- Photo. No. 8 - Redwood Posts Protect Cattle Guard - Delta-Mendota Canal
- Photo. No. 9 - Provo Reservoir Canal cattle guard installation
- Photo. No. 10 - Provo Reservoir Canal cattle guard installation
- Photo. No. 11 - "Bed-spring" cattle guard
- Photo. No. 12 - "Floating" cattle guard - Kittitas Division, Yakima Project
- Photo. No. 13 - "Floating" cattle guard - Kittitas Division, Yakima Project
- Photo. No. 14 - "Floating" cattle guard - Kittitas Division, Yakima Project

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- Figure No. 1 - Standard design Drawing No. 40-D-4383
- Figure No. 2 - Deschutes Project Cattle Guard - Drawing No. 112-104-2004
- Figure No. 3 - Madera Canal Cattle Guard - Drawing No. 214-219-11008
- Figure No. 4 - Sketch of Suggested Wing Guard - Madera Canal
- Figure No. 5 - Salt River Valley Cattle Guard - Drawing No. B-14-52
- Figure No. 6 - Provo Reservoir Canal Cattle Guard - Drawing No. 244-408-288
- Figure No. 7 - Tucumcari Project Cattle Guard - Drawing No. 257-505-410
- Figure No. 8 - San Marcial Division, Rio Grande Project Cattle Guard - Drawing No. 163-D-56
- Figure No. 9 - Rio Grande Project, CCC Cattle Guard - Drawing No. 23-503-4051
- Figure No. 10 - C & P Autogate - Drawing No. 328-701-3644
- Figure No. 11 - "Flying L" Autogate - Lincoln Steel Works
- Figure No. 12 - "Flying L" Autogate - Lincoln Steel Works - Drawing
- Figure No. 13 - "Powder River Ranch Guard" - Drawing
- Figure No. 14 - "Powder River Ranch Guard" - Weight and Price List
- Figure No. 15 - "Powder River Ranch Guard" - Bill of Material

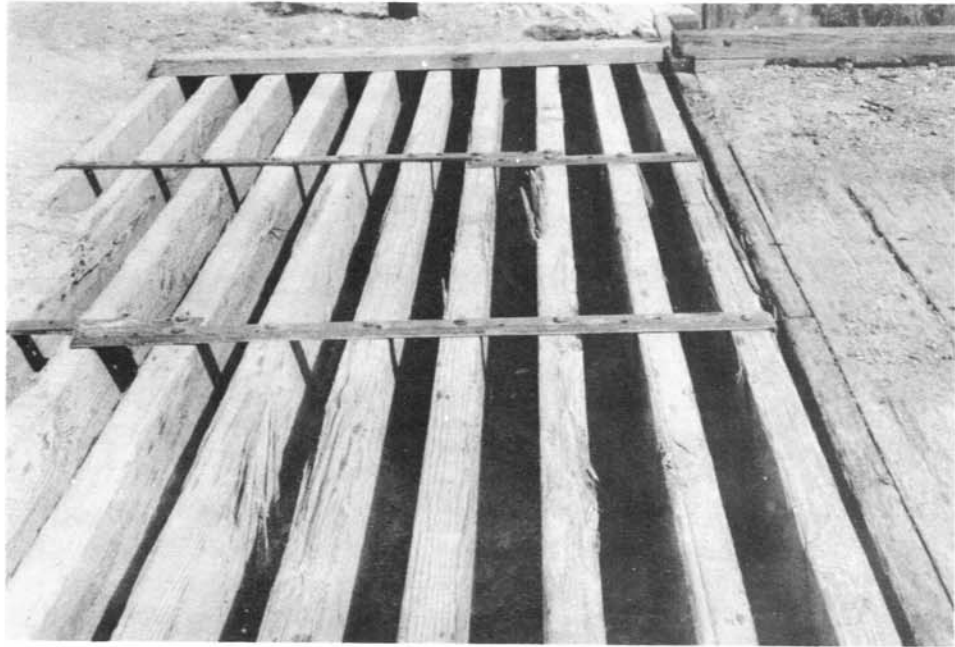


Photo 1 - Wooden deck on cattle guard installed by Water Users on Rio Grande Project, New Mexico-Texas.



Photo 2 - Cattle guard constructed of heavy pipe and installed by Water Users on the Rio Grande Project, New Mexico-Texas.

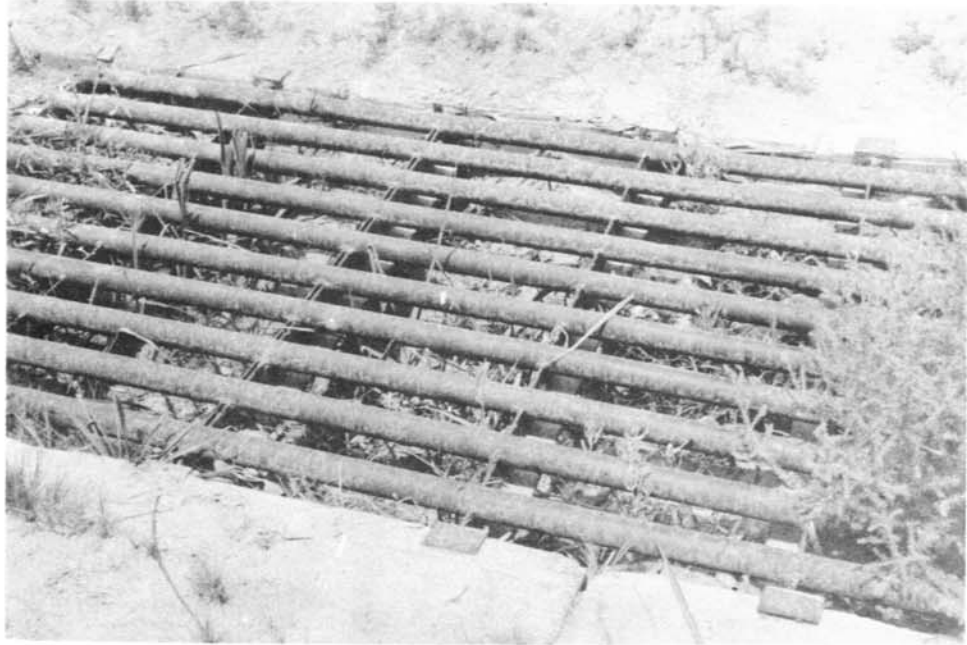


Photo 3 - A deck composed of pipe and angle iron is used by the Water Users for the cattle guard shown on the Rio Grande Project, New Mexico-Texas.

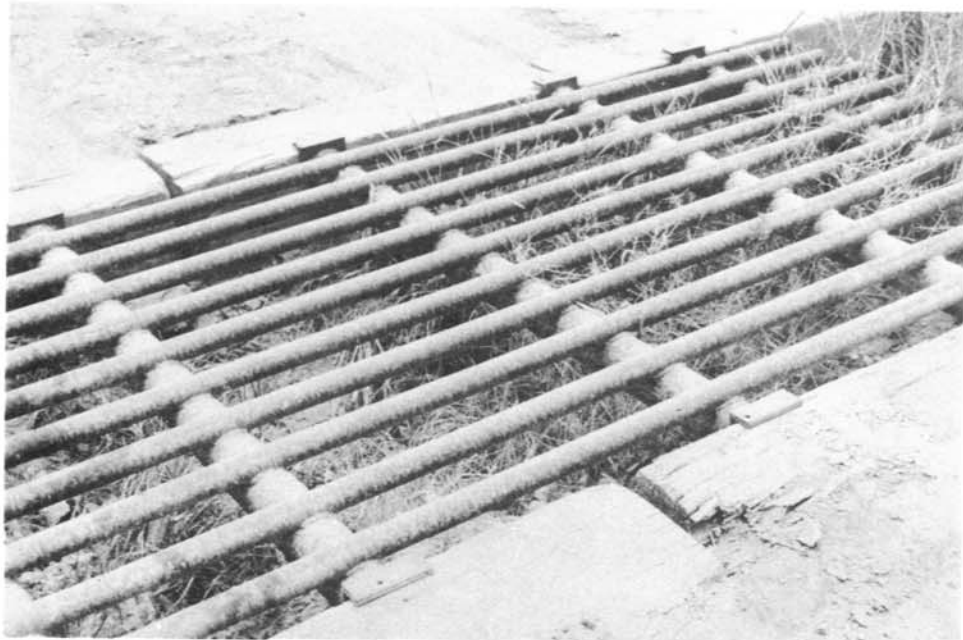


Photo 4 - Another cattle guard deck fabricated from pipe and installed by the Water Users on the Rio Grande Project, New Mexico-Texas.



Photo 5 - A typical cattleguard of standard design but with reduced dimensions, installed on the Colorado-Big Thompson Project.



Photo 6 - A typical cattleguard of standard design and full dimensions, installed on the Colorado-Big Thompson Project.



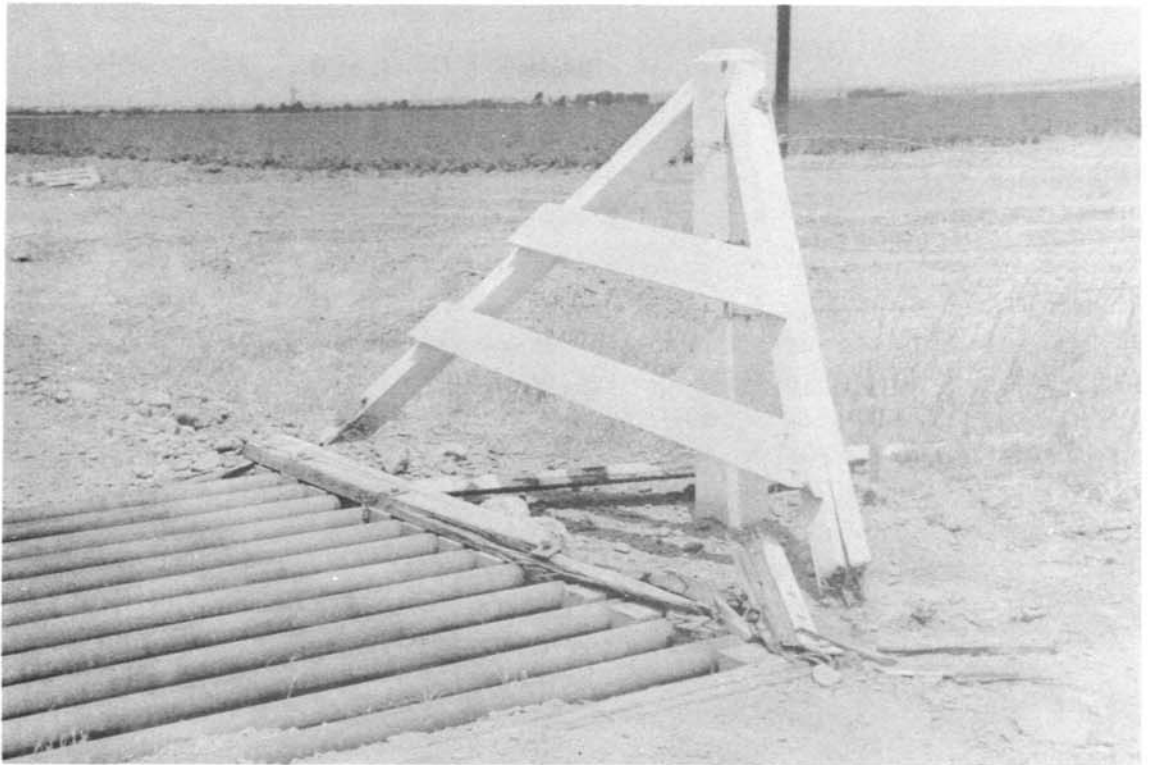


Photo 7 - Damaged wing guard on standard cattle guard on Delta-Mendota Canal.

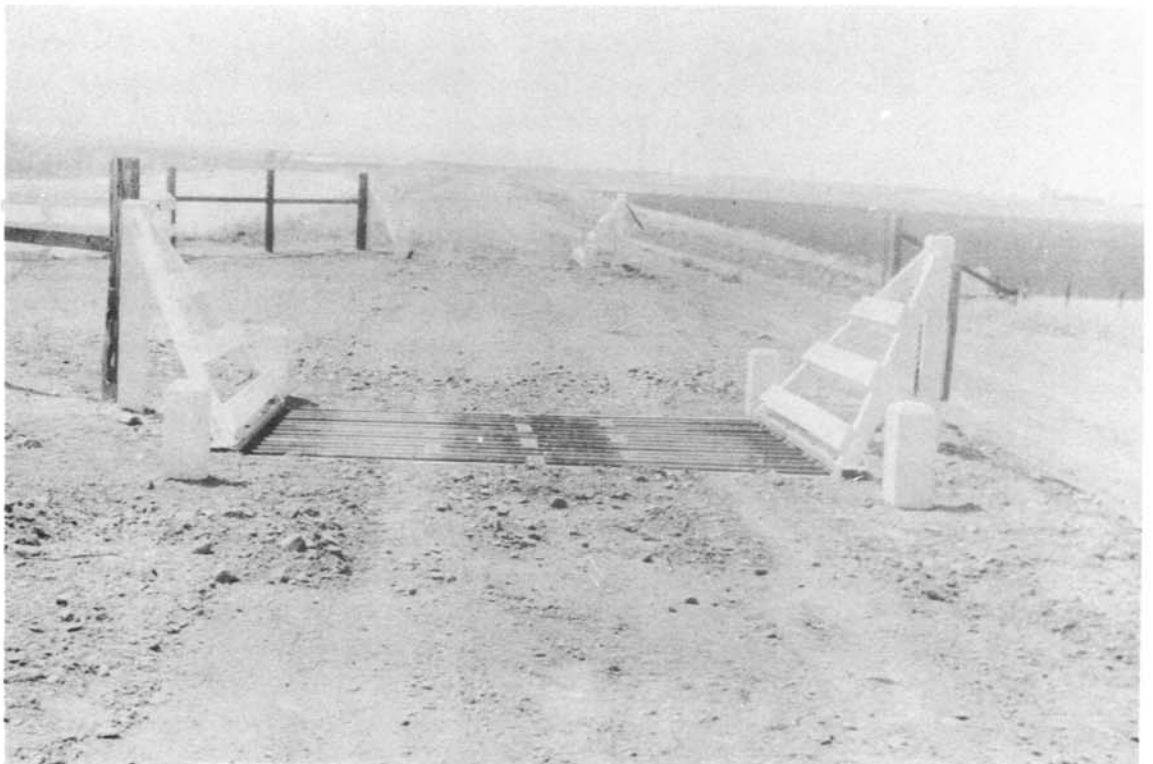


Photo 8 - Redwood posts have been installed to protect the wing guards on standard cattle guards on the Delta-Mendota Canal to prevent type of damage shown in photograph 7, above.



Photo 9 - Typical pit type cattle guard used on the operating road of the Provo Reservoir Canal, Provo River Project, Utah

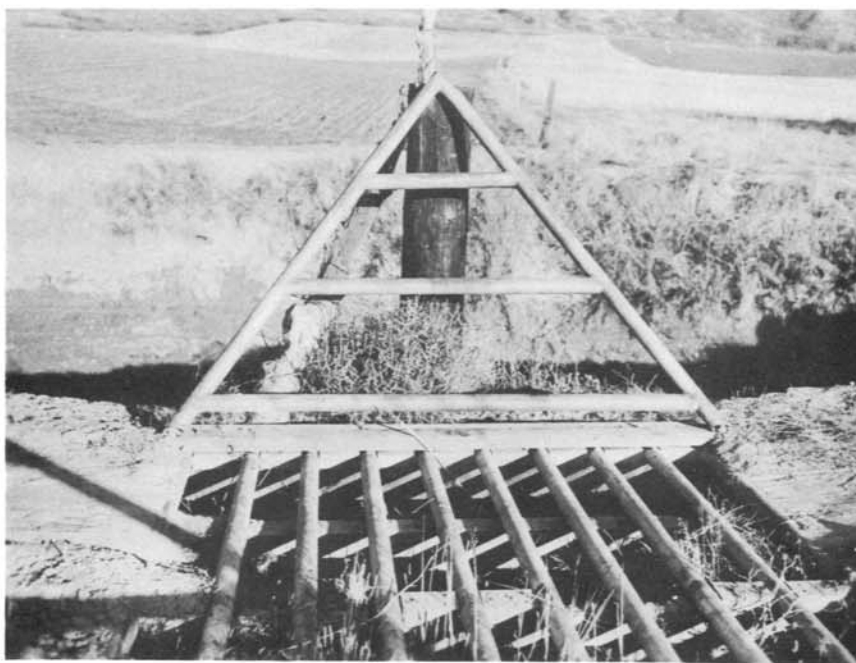


Photo 10 - Close up of typical pit type cattle guard above. Deck and "A" frames are constructed of 2" pipe. "A" frame is all welded construction. Pit frame work is creosoted timber.



Photo 11- "Bed-spring" type cattleguard. Made of  $1\frac{1}{4}$ -inch pipe, 50 inches wide and 120 inches long. Springs 1-inch in diameter and 12 inches in length support a strip of  $1\frac{1}{2}$  by  $1\frac{1}{4}$ -inch strap iron with sufficient tension to carry the strap iron approximately 6 inches above the ground when not in use.



Photo 12 -

Spring-suspended cattle guard constructed from landing mats by O&M forces. Used on a lateral on Kittitas Division--Yakima Project.

October 28, 1952

Region 1

Photo No. P-33-100-14

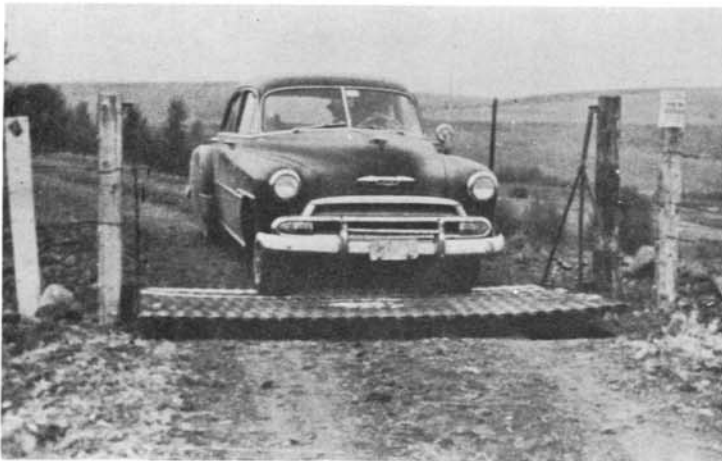


Photo 13 -

Spring-suspended cattle guard-- showing how guides at base of side posts eliminate swing without obstructing the floating action of the mat when car goes over.

October 28, 1952

Region 1

Photo No. P-33-100-15



Photo 14 -

Spring-suspended cattle guard. A pit is not required, but a covering paint should add to its effectiveness.

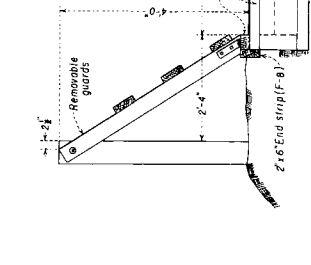
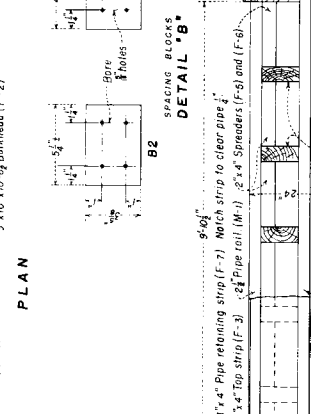
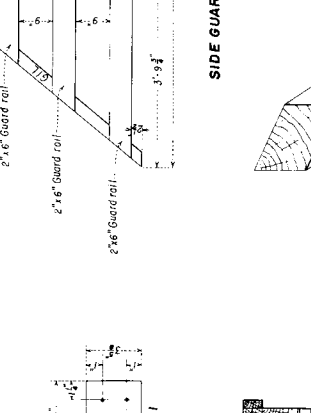
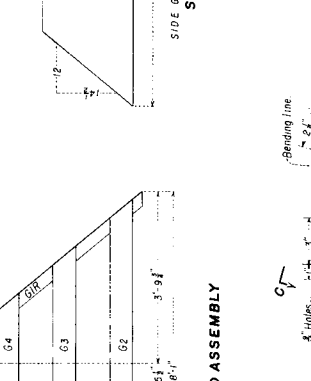
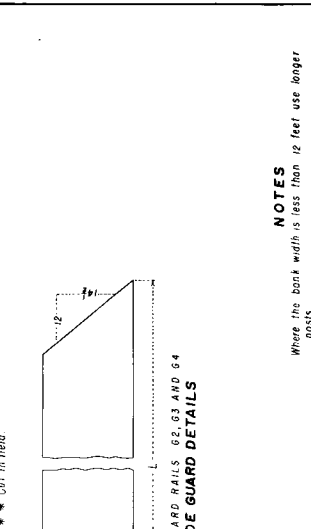
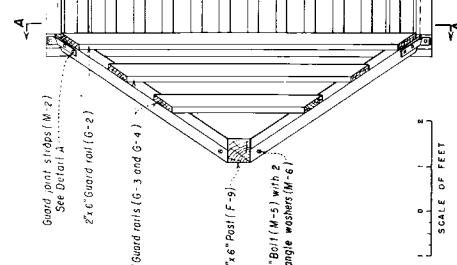
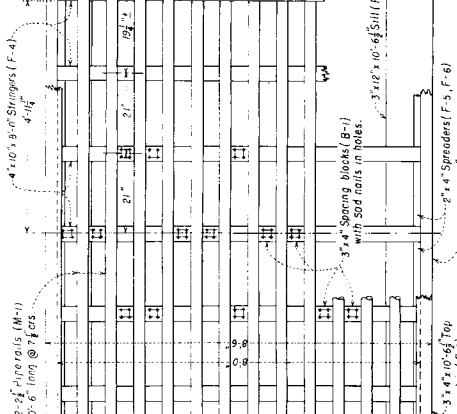
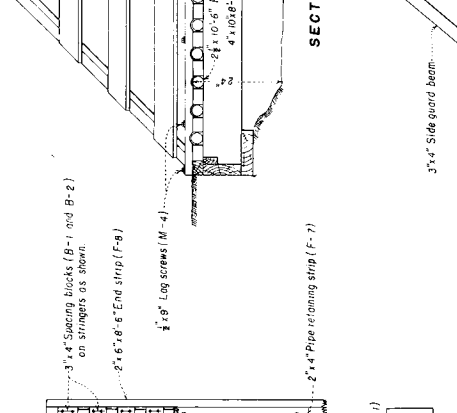
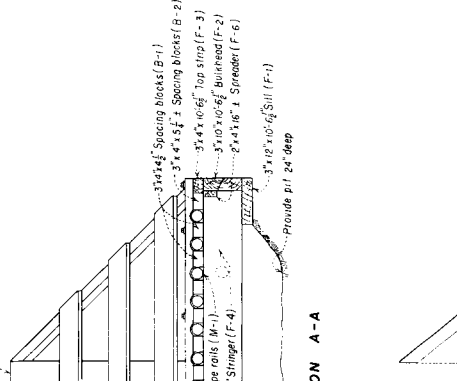
October 28, 1952

Region 1

Photo No. P-33-100-16

**BILL OF MATERIAL FOR ONE CATTLE GUARD**

No.	NUMBER	NAME	DIMENSIONS	SYMBOL	REMARKS
1	4	Side guard beams	3" x 4" x 10'-0" S4S	G-1	See Side Guard Beam Detail A
2	2	Side guard rails	2" x 6" x 10'-0" S4S	G-2	See Detail A
3	2	Side guard rails	2" x 6" x 10'-0" S4S	G-3	See Detail A
4	2	Side guard rails	2" x 6" x 10'-0" S4S	G-4	See Detail A
5	2	Posts	6" x 6" x 10'-0" S4S	P-1	See Detail B
6	2	End strips	2" x 6" x 10'-0" S4S	F-1	See Detail B
7	2	Spacers	3" x 4" x 10'-0" S4S	F-2	See Detail B
8	2	Stringers	4" x 10" x 8'-0" Rough	F-3	See Detail B
9	2	Stringers	4" x 10" x 8'-0" Rough	F-4	See Detail B
10	2	Stringers	4" x 10" x 8'-0" Rough	F-5	See Detail B
11	2	Stringers	4" x 10" x 8'-0" Rough	F-6	See Detail B
12	2	Stringers	4" x 10" x 8'-0" Rough	F-7	See Detail B
13	2	Stringers	4" x 10" x 8'-0" Rough	F-8	See Detail B
14	2	Stringers	4" x 10" x 8'-0" Rough	F-9	See Detail B
15	2	Stringers	4" x 10" x 8'-0" Rough	F-10	See Detail B
16	2	Stringers	4" x 10" x 8'-0" Rough	F-11	See Detail B
17	2	Stringers	4" x 10" x 8'-0" Rough	F-12	See Detail B
18	2	Stringers	4" x 10" x 8'-0" Rough	F-13	See Detail B
19	2	Stringers	4" x 10" x 8'-0" Rough	F-14	See Detail B
20	2	Stringers	4" x 10" x 8'-0" Rough	F-15	See Detail B
21	2	Stringers	4" x 10" x 8'-0" Rough	F-16	See Detail B
22	2	Stringers	4" x 10" x 8'-0" Rough	F-17	See Detail B
23	2	Stringers	4" x 10" x 8'-0" Rough	F-18	See Detail B
24	2	Stringers	4" x 10" x 8'-0" Rough	F-19	See Detail B
25	2	Stringers	4" x 10" x 8'-0" Rough	F-20	See Detail B
26	2	Stringers	4" x 10" x 8'-0" Rough	F-21	See Detail B
27	2	Stringers	4" x 10" x 8'-0" Rough	F-22	See Detail B
28	2	Stringers	4" x 10" x 8'-0" Rough	F-23	See Detail B
29	2	Stringers	4" x 10" x 8'-0" Rough	F-24	See Detail B
30	2	Stringers	4" x 10" x 8'-0" Rough	F-25	See Detail B
31	2	Stringers	4" x 10" x 8'-0" Rough	F-26	See Detail B
32	2	Stringers	4" x 10" x 8'-0" Rough	F-27	See Detail B
33	2	Stringers	4" x 10" x 8'-0" Rough	F-28	See Detail B
34	2	Stringers	4" x 10" x 8'-0" Rough	F-29	See Detail B
35	2	Stringers	4" x 10" x 8'-0" Rough	F-30	See Detail B
36	2	Stringers	4" x 10" x 8'-0" Rough	F-31	See Detail B
37	2	Stringers	4" x 10" x 8'-0" Rough	F-32	See Detail B
38	2	Stringers	4" x 10" x 8'-0" Rough	F-33	See Detail B
39	2	Stringers	4" x 10" x 8'-0" Rough	F-34	See Detail B
40	2	Stringers	4" x 10" x 8'-0" Rough	F-35	See Detail B
41	2	Stringers	4" x 10" x 8'-0" Rough	F-36	See Detail B
42	2	Stringers	4" x 10" x 8'-0" Rough	F-37	See Detail B
43	2	Stringers	4" x 10" x 8'-0" Rough	F-38	See Detail B
44	2	Stringers	4" x 10" x 8'-0" Rough	F-39	See Detail B
45	2	Stringers	4" x 10" x 8'-0" Rough	F-40	See Detail B
46	2	Stringers	4" x 10" x 8'-0" Rough	F-41	See Detail B
47	2	Stringers	4" x 10" x 8'-0" Rough	F-42	See Detail B
48	2	Stringers	4" x 10" x 8'-0" Rough	F-43	See Detail B
49	2	Stringers	4" x 10" x 8'-0" Rough	F-44	See Detail B
50	2	Stringers	4" x 10" x 8'-0" Rough	F-45	See Detail B
51	2	Stringers	4" x 10" x 8'-0" Rough	F-46	See Detail B
52	2	Stringers	4" x 10" x 8'-0" Rough	F-47	See Detail B
53	2	Stringers	4" x 10" x 8'-0" Rough	F-48	See Detail B
54	2	Stringers	4" x 10" x 8'-0" Rough	F-49	See Detail B
55	2	Stringers	4" x 10" x 8'-0" Rough	F-50	See Detail B
56	2	Stringers	4" x 10" x 8'-0" Rough	F-51	See Detail B
57	2	Stringers	4" x 10" x 8'-0" Rough	F-52	See Detail B
58	2	Stringers	4" x 10" x 8'-0" Rough	F-53	See Detail B
59	2	Stringers	4" x 10" x 8'-0" Rough	F-54	See Detail B
60	2	Stringers	4" x 10" x 8'-0" Rough	F-55	See Detail B
61	2	Stringers	4" x 10" x 8'-0" Rough	F-56	See Detail B
62	2	Stringers	4" x 10" x 8'-0" Rough	F-57	See Detail B
63	2	Stringers	4" x 10" x 8'-0" Rough	F-58	See Detail B
64	2	Stringers	4" x 10" x 8'-0" Rough	F-59	See Detail B
65	2	Stringers	4" x 10" x 8'-0" Rough	F-60	See Detail B
66	2	Stringers	4" x 10" x 8'-0" Rough	F-61	See Detail B
67	2	Stringers	4" x 10" x 8'-0" Rough	F-62	See Detail B
68	2	Stringers	4" x 10" x 8'-0" Rough	F-63	See Detail B
69	2	Stringers	4" x 10" x 8'-0" Rough	F-64	See Detail B
70	2	Stringers	4" x 10" x 8'-0" Rough	F-65	See Detail B
71	2	Stringers	4" x 10" x 8'-0" Rough	F-66	See Detail B
72	2	Stringers	4" x 10" x 8'-0" Rough	F-67	See Detail B
73	2	Stringers	4" x 10" x 8'-0" Rough	F-68	See Detail B
74	2	Stringers	4" x 10" x 8'-0" Rough	F-69	See Detail B
75	2	Stringers	4" x 10" x 8'-0" Rough	F-70	See Detail B
76	2	Stringers	4" x 10" x 8'-0" Rough	F-71	See Detail B
77	2	Stringers	4" x 10" x 8'-0" Rough	F-72	See Detail B
78	2	Stringers	4" x 10" x 8'-0" Rough	F-73	See Detail B
79	2	Stringers	4" x 10" x 8'-0" Rough	F-74	See Detail B
80	2	Stringers	4" x 10" x 8'-0" Rough	F-75	See Detail B
81	2	Stringers	4" x 10" x 8'-0" Rough	F-76	See Detail B
82	2	Stringers	4" x 10" x 8'-0" Rough	F-77	See Detail B
83	2	Stringers	4" x 10" x 8'-0" Rough	F-78	See Detail B
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86	2	Stringers	4" x 10" x 8'-0" Rough	F-81	See Detail B
87	2	Stringers	4" x 10" x 8'-0" Rough	F-82	See Detail B
88	2	Stringers	4" x 10" x 8'-0" Rough	F-83	See Detail B
89	2	Stringers	4" x 10" x 8'-0" Rough	F-84	See Detail B
90	2	Stringers	4" x 10" x 8'-0" Rough	F-85	See Detail B
91	2	Stringers	4" x 10" x 8'-0" Rough	F-86	See Detail B
92	2	Stringers	4" x 10" x 8'-0" Rough	F-87	See Detail B
93	2	Stringers	4" x 10" x 8'-0" Rough	F-88	See Detail B
94	2	Stringers	4" x 10" x 8'-0" Rough	F-89	See Detail B
95	2	Stringers	4" x 10" x 8'-0" Rough	F-90	See Detail B
96	2	Stringers	4" x 10" x 8'-0" Rough	F-91	See Detail B
97	2	Stringers	4" x 10" x 8'-0" Rough	F-92	See Detail B
98	2	Stringers	4" x 10" x 8'-0" Rough	F-93	See Detail B
99	2	Stringers	4" x 10" x 8'-0" Rough	F-94	See Detail B
100	2	Stringers	4" x 10" x 8'-0" Rough	F-95	See Detail B



**NOTES**

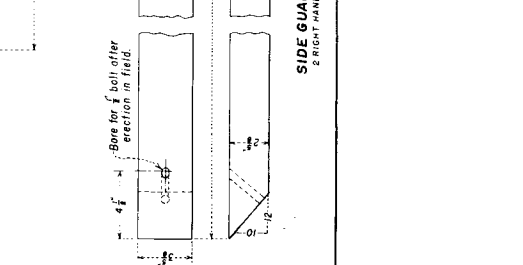
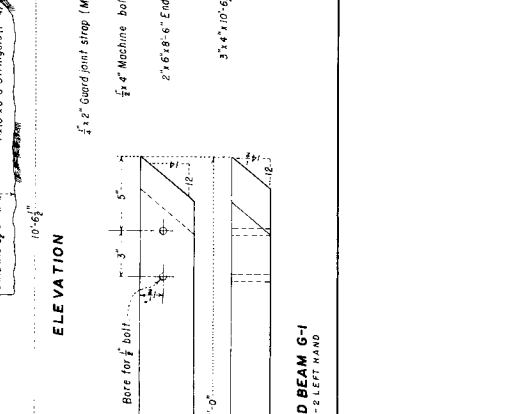
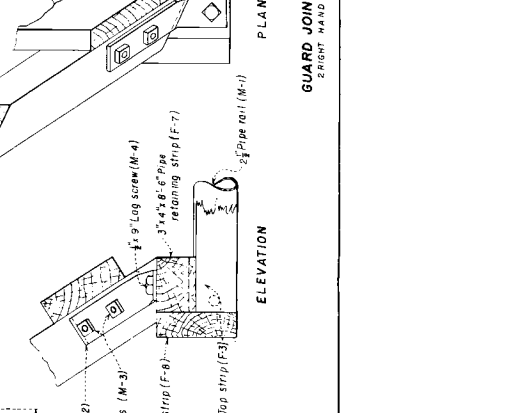
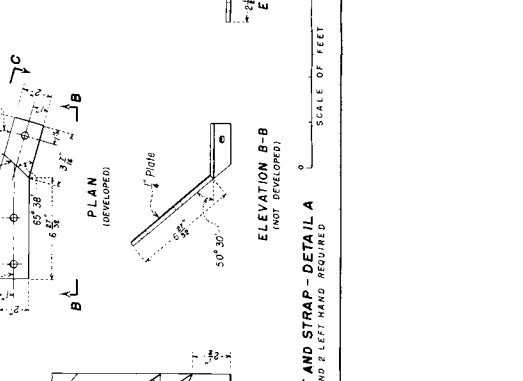
Where the bank width is less than 12 feet use longer posts.

Posts to be cut to dimensions given ± 1/2".

Side guards and portion of posts above ground to be painted white - 2 coats after installation.

Pipe rails and stringers designed for H-3 loading.

Provide for reattachment of pipe rails.



**CATTLE GUARD FOR OPERATING ROADS**

STANDARD DESIGNS

UNITED STATES DEPARTMENT OF AGRICULTURE  
BUREAU OF RECLAMATION

DESIGNED BY: *[Signature]*  
DRAWN: *[Signature]*  
CHECKED: *[Signature]*  
APPROVED: *[Signature]*

DATE: *[Date]*

PROJECT: *[Project Name]*

SCALE: *[Scale]*

140-0-4383

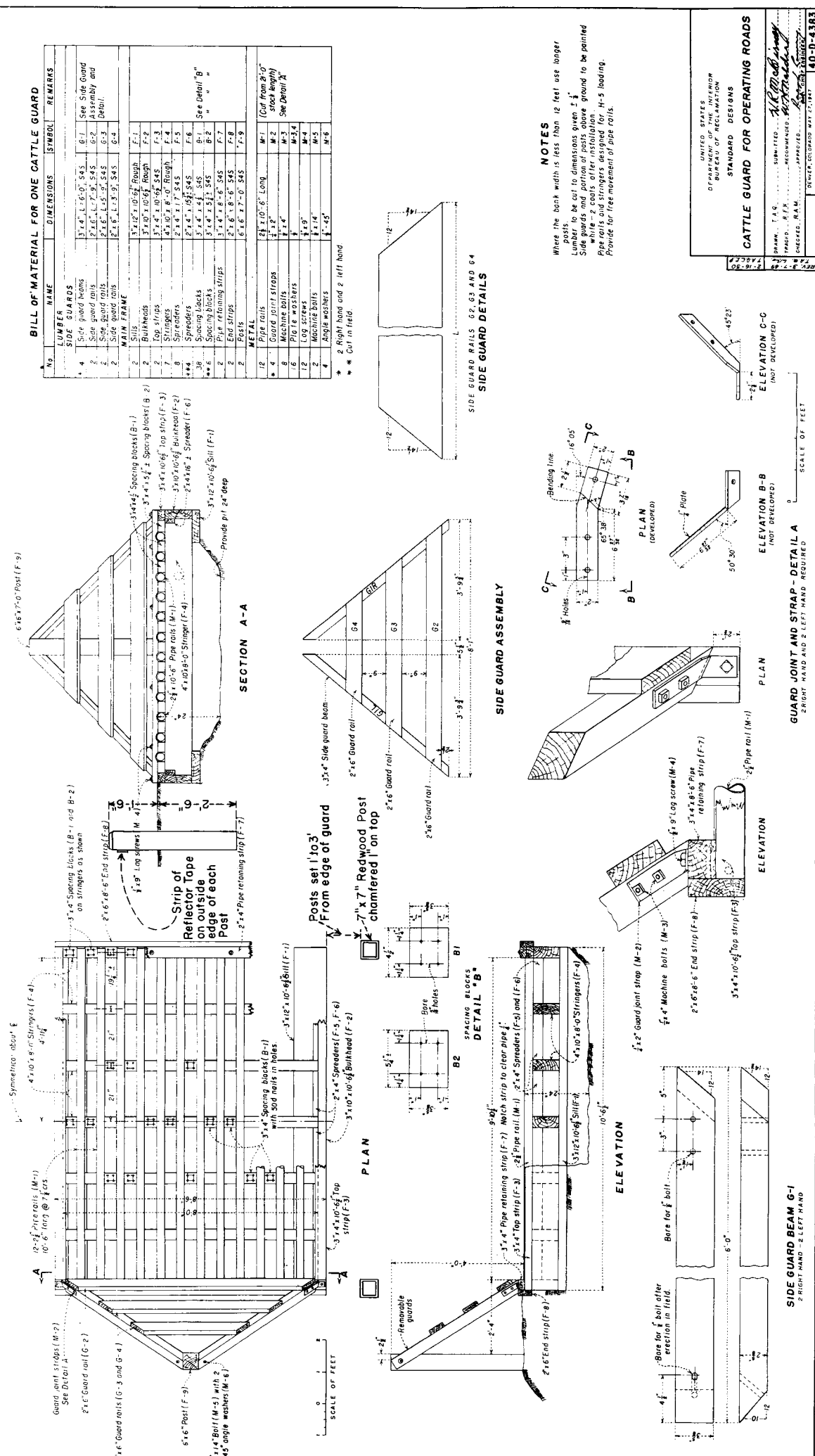


Figure 2

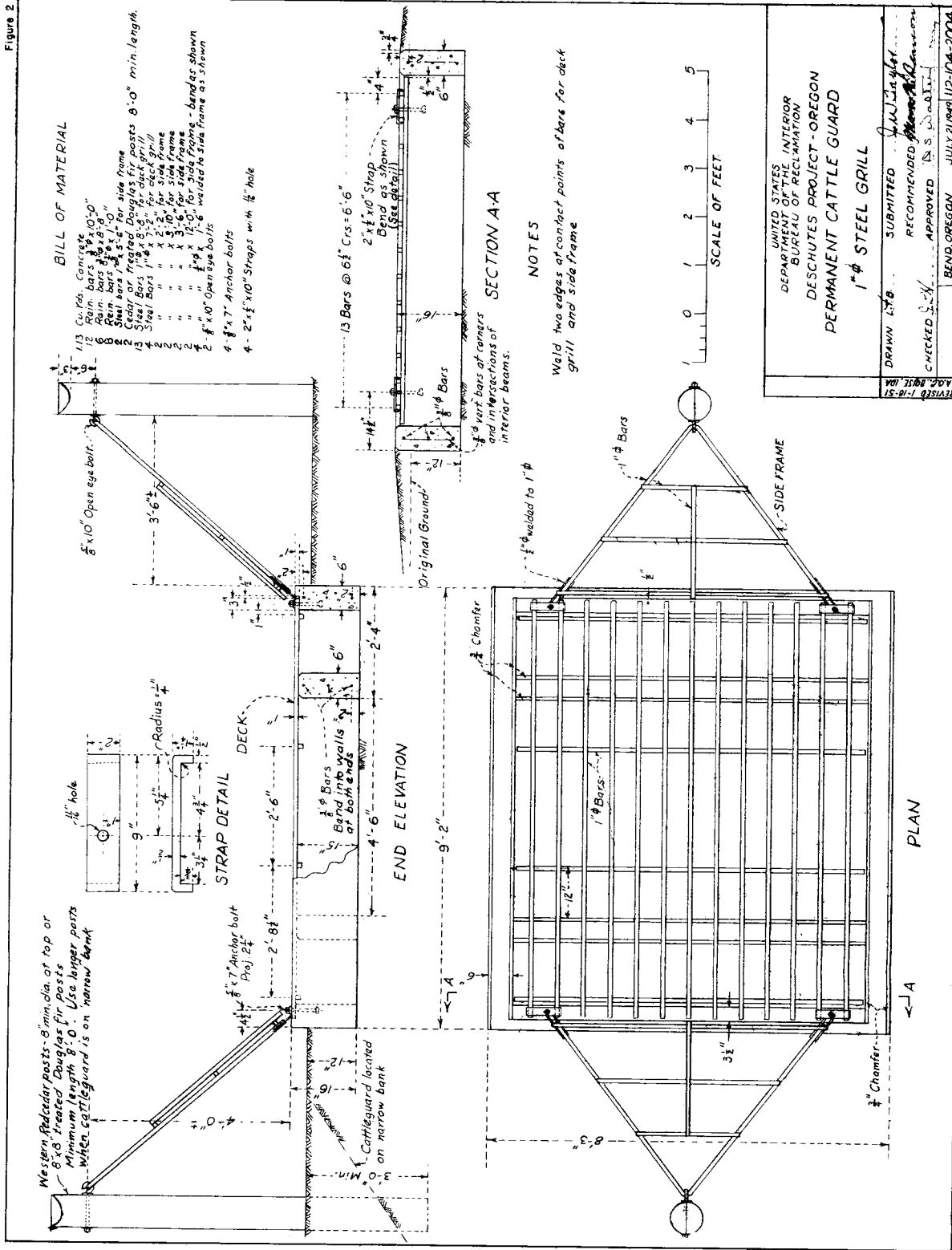


FIGURE 1

BILL OF MATERIAL		DIMENSIONS	
200	Rebar	Post	6"x6"x7'-0" x 4x
4	Side guard beam	Side guard beam	3"x4", L=6'-0" x 4x
2	Side guard rail	Side guard rail	2"x6", L=7'-9" x 4x
2	Side guard rail	Side guard rail	2"x6", L=5'-0" x 4x
12	Rails	Rails	60 lb ASCE, L=12'-0"
20	Spacer bars, inter.	Spacer bar, inter.	3"x4", L=1'-18"
4	Machine bolt & nut	Machine bolt & nut	3/4"x1/4"
8	Machine bolt & nut	Machine bolt & nut	1/2"x1/4"
8	Plate washer	Plate washer	1/2"
32	Anchor bolt & nut	Anchor bolt & nut	3/8"x12" Galvanized
4	Guard joint strap	Guard joint strap	2"x4", L=9'-18"
7	Nails	Nails	20d common
32	Anchor plate	Anchor plate	4"x4", L=4"
6	Rails	Rails	60 lb ASCE, L=6'-0"
6	Rail splice bars	Rail splice bars	2" long for 60" rails
12	Splice bolts, nut & washers	Splice bolts, nut & washers	3/4" for 60" rails
32	Lock washers	Lock washers	1/2"

ESTIMATED QUANTITIES  
(for one catleguard)

Concrete 3 CY  
Structural steel (Used rails) 3600 lbs  
Rebar 220 lbs  
Miscellaneous Metal 220 lbs  
Timber 100 FBM

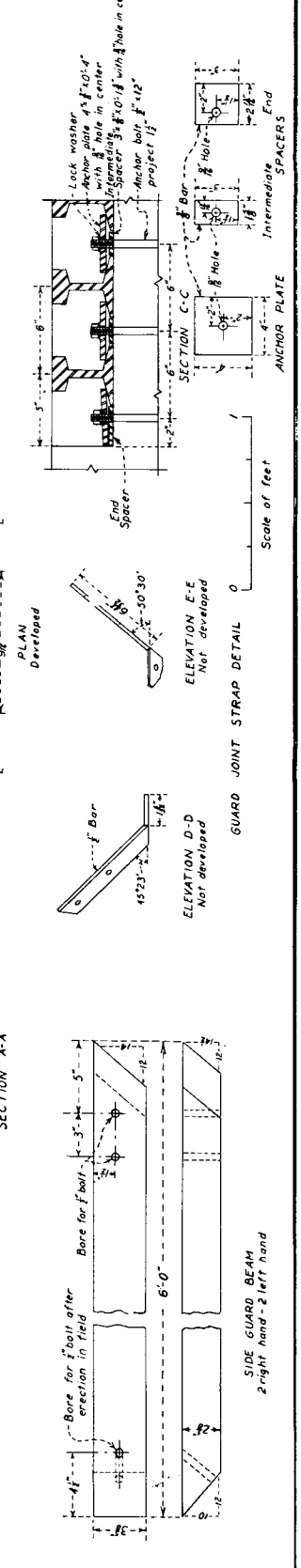
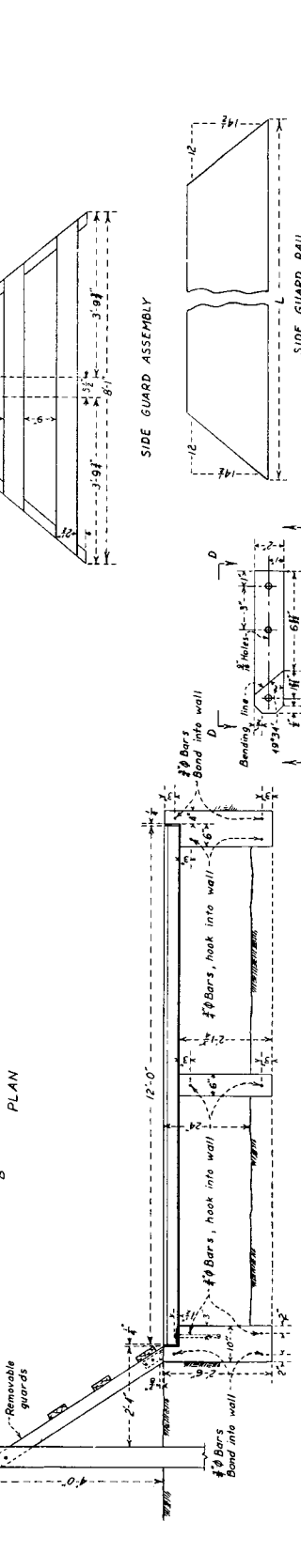
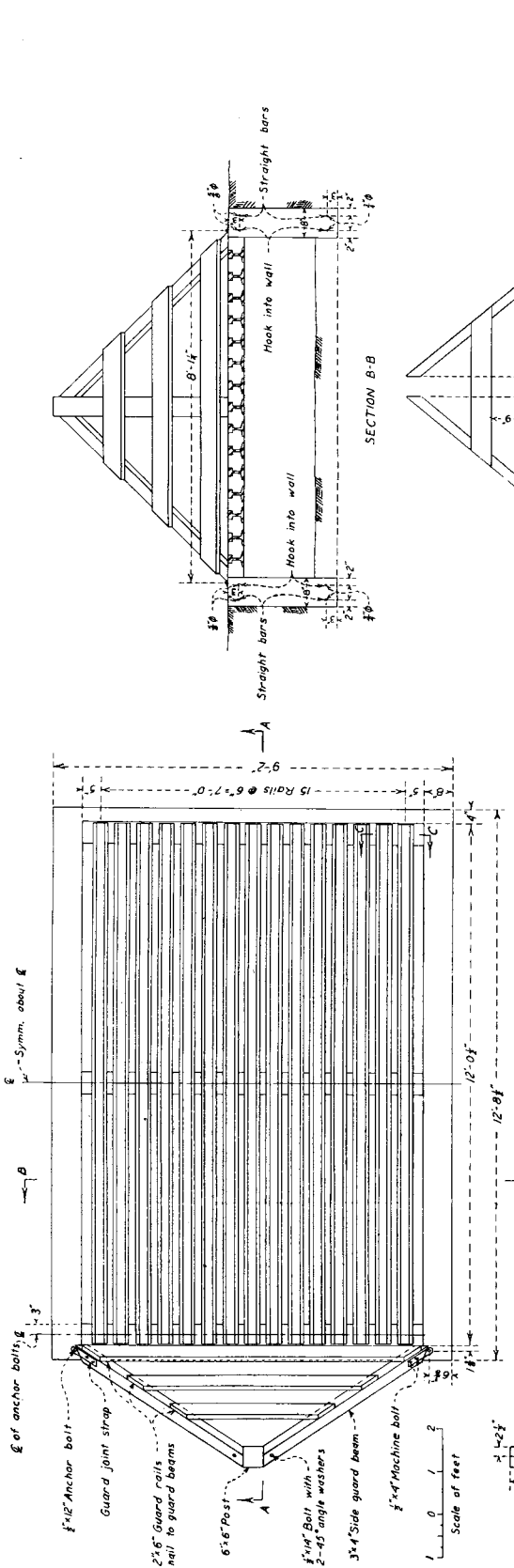
NOTES

Where the bank width is less than 14 feet use longer posts.  
Lumber to be cut to dimensions given ± 1/8".  
Splice bolts, nut & washers to be galvanized.  
Concrete to be placed while 2 coats of water repellent are applied.  
Concrete to be placed on undisturbed earth or compacted fill.  
Short lengths of rails to be spliced over center support with standard rail splice.  
Rails to be cut from 30 ft - 60 lb ASCE used rails.  
Side guard posts to be either redwood or treated.

UNITED STATES DEPARTMENT OF AGRICULTURE  
BUREAU OF RECLAMATION  
CENTRAL VALLEY PROJECT - CALIFORNIA  
MADERA CANAL

DRAWN: F.H.L.  
CHECKED: J.H.L.  
APPROVED: J.H.L.  
DATE: JAN 5, 1930

PROJECT: 214-219-1005



SIDE GUARD BEAM  
Right hand - 2 left hand

GUARD JOINT STRAP DETAIL

SECTION C-C

SECTION A-A

PLAN DEVELOPED

ELEVATION E-E

ELEVATION D-D

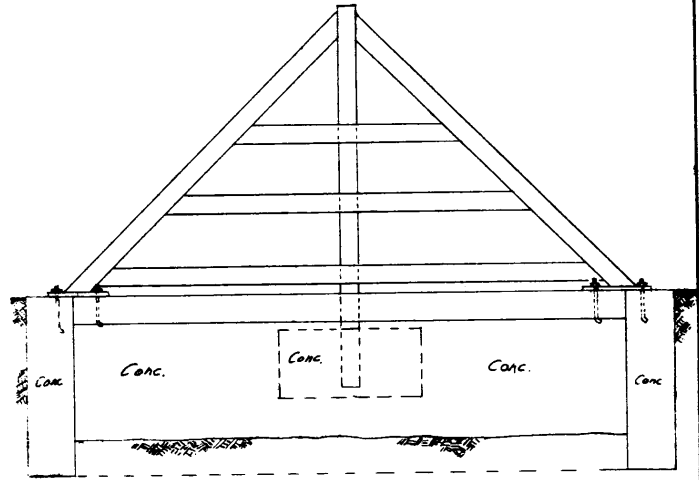
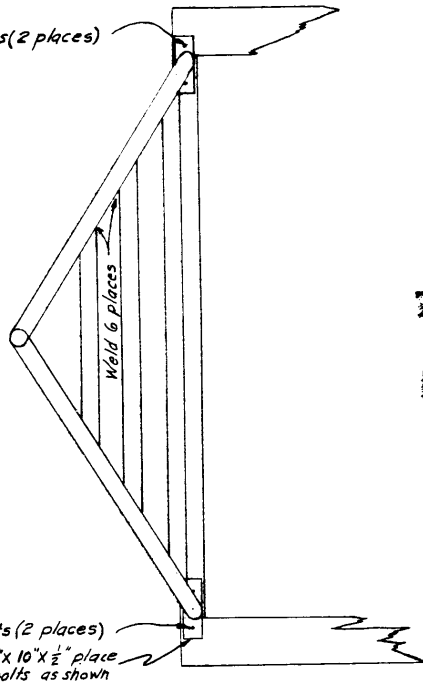
Scale of feet

0 1 2 3 4 5 6 7 8 9 10 11 12



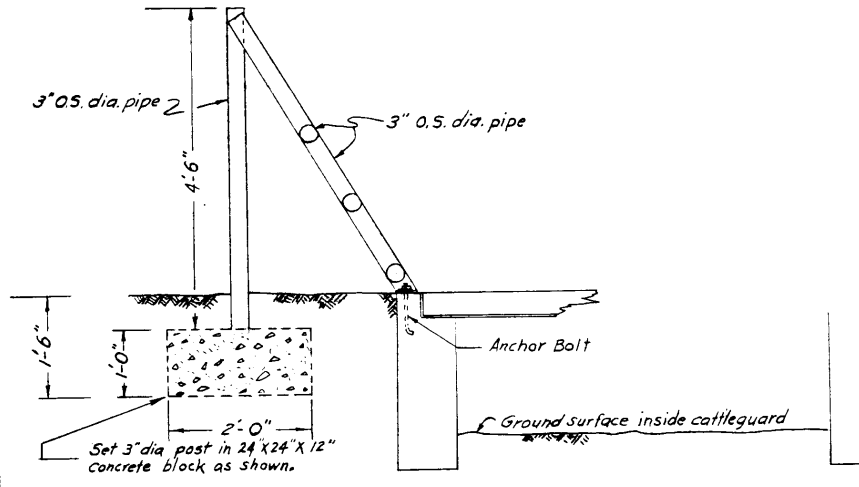
Figure 4

$\frac{1}{2}$ " X 12" Anchor bolts (2 places)



$\frac{1}{2}$ " X 12" Anchor bolts (2 places)

Weld  $2\frac{1}{2}$ " dia to  $3$ " X  $10$ " X  $\frac{1}{2}$ " plate and anchor with bolts as shown



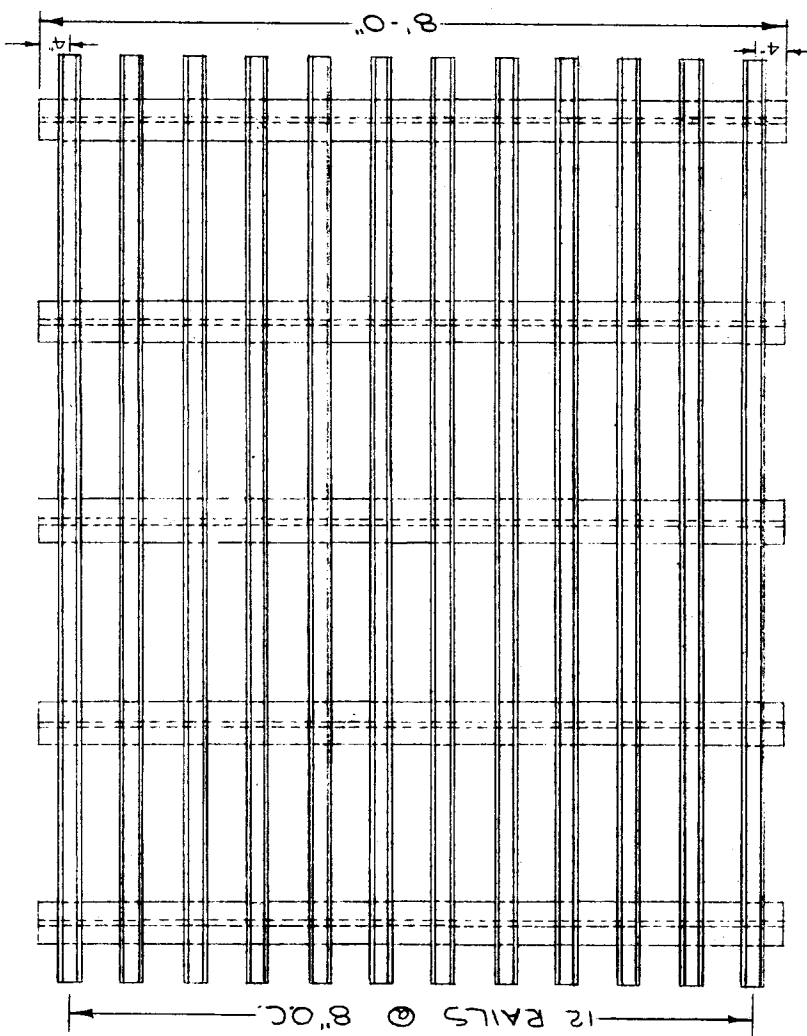
4-8-54	214-219-11008

Figure 5

**BILL OF MATERIALS**

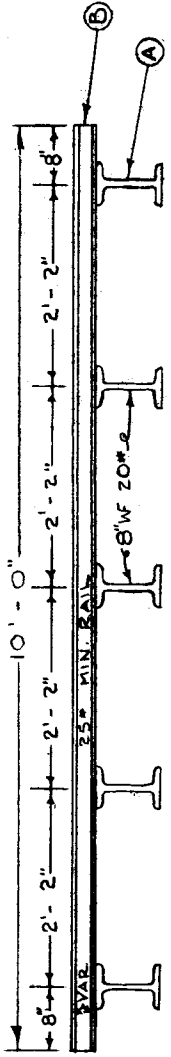
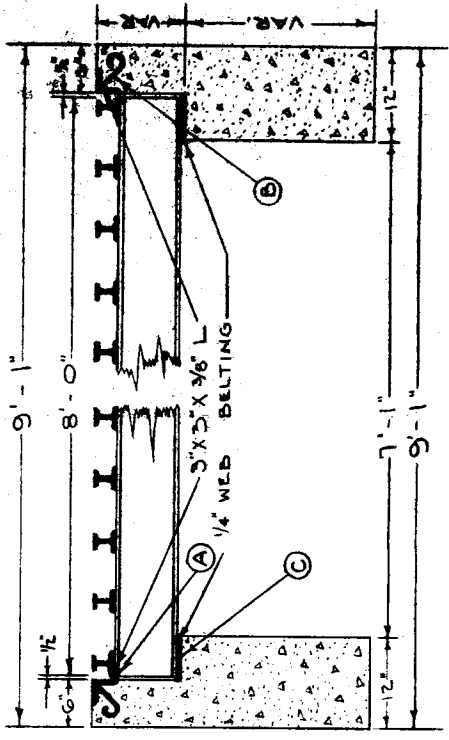
ITEM	SUB	REQD	DESCRIPTION	UNIT
1		1	GRILL	
A	5		8" W 20 LB BEAMS 6'-0" LONG	
B	12		25 LB (MIN) RAIL 10'-0" LONG	
2		2	CONCRETE SILL	
A	2		3" X 3 3/8" X 10'-0" ANGLES	
B	7		1/2" P ANCHORS (WELDED TO ANGLE)	
C	2		1/4" X 6" X 10'-0" WEB BELTING	
D			CONCRETE AS REQUIRED	
E			REINF. STEEL AS REQUIRED	

ITEM # 1



NOTE: 1. ALL WELDED CONSTRUCTION.

ITEM # 2



REVISED	BY	CHK'D	D. G. D. NO. 1	REV.
SALT RIVER VALLEY WATER USERS' ASSN PHOENIX, ARIZONA				
<b>STANDARD OF DESIGN</b>				
<b>10'-0" CATTLE GUARD</b>				
DESIGNED	BY	CHK'D	M. A. T.	
DRAWN	BY	REC'D	S. S.	
TRACED	BY	APPROV'D	S. S.	
SCALE	3/4" = 1'-0"			
MAY 10, 1950 10-14-52				

Figure 6

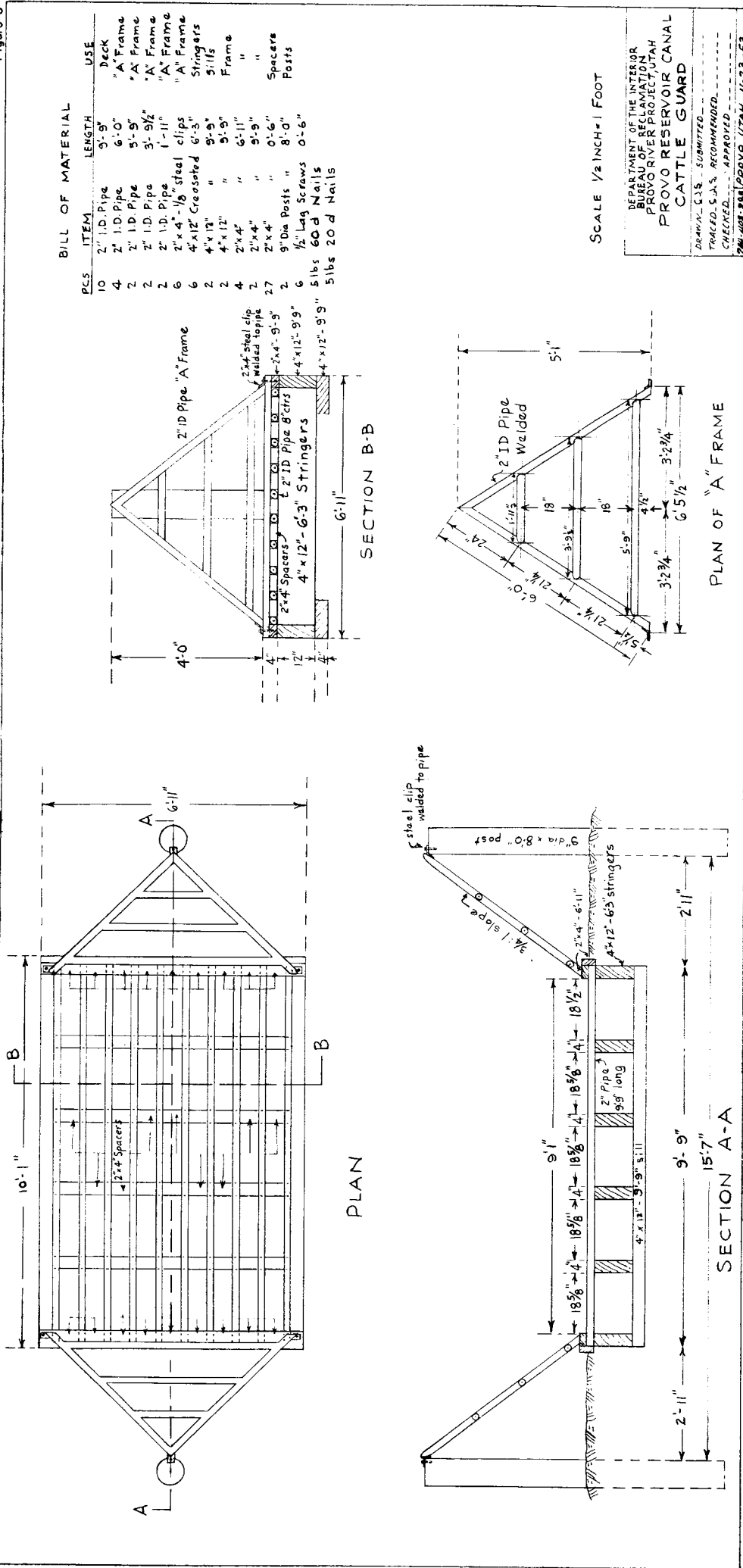
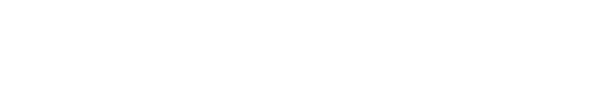
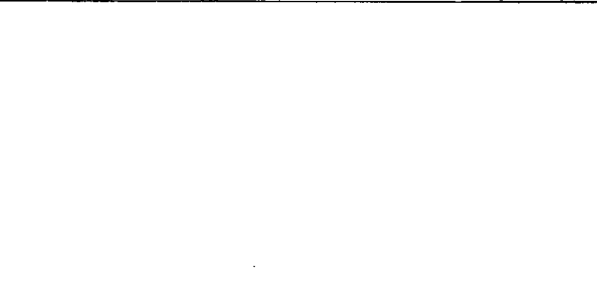
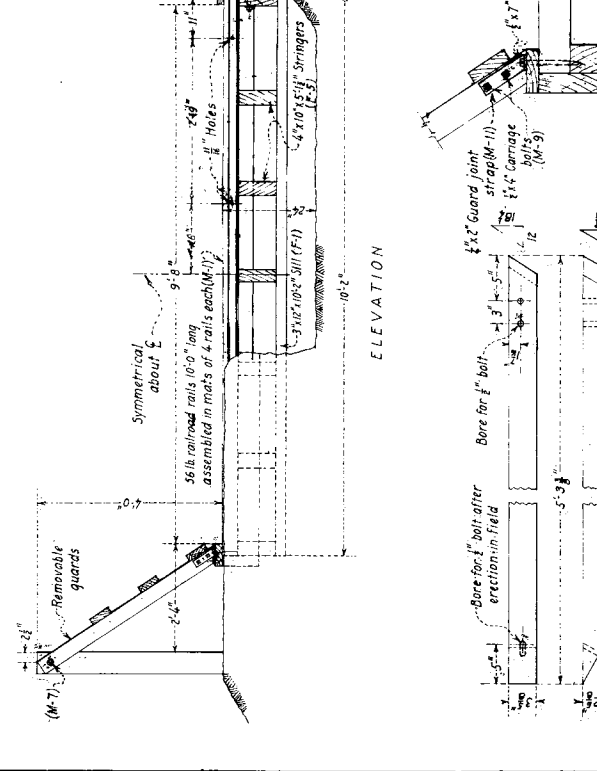
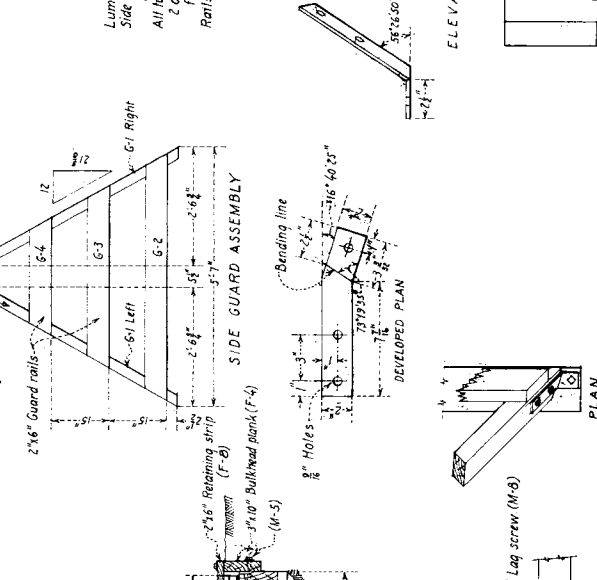
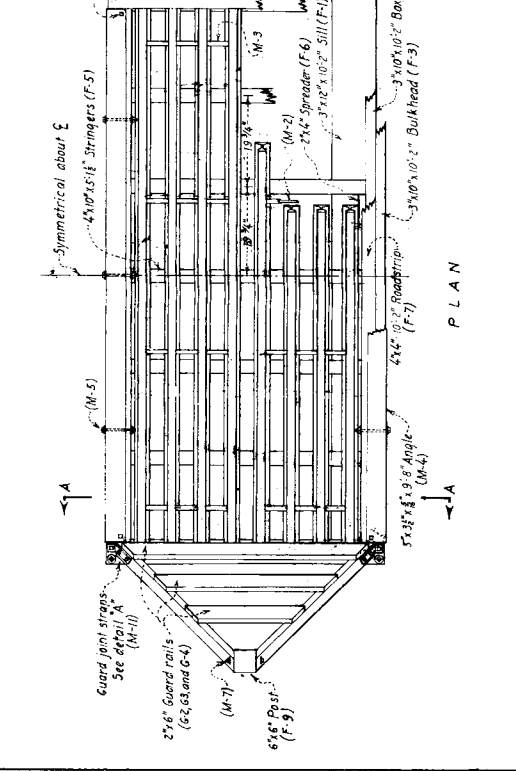
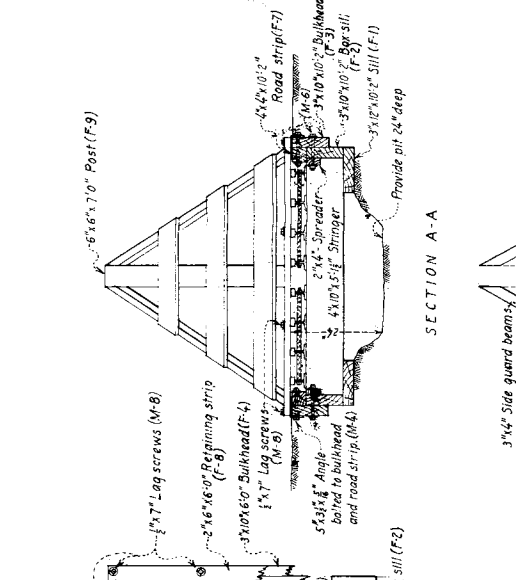
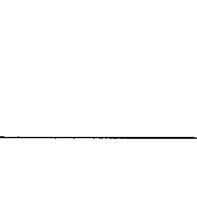
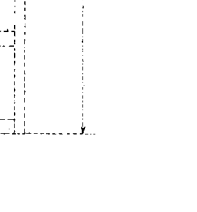
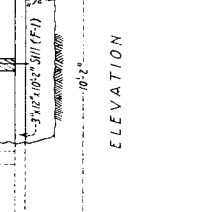
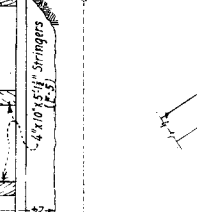
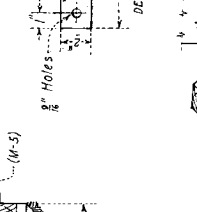
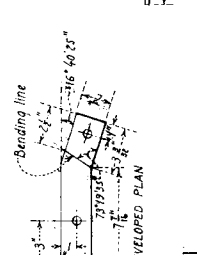
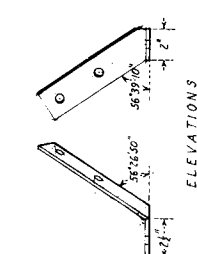


Figure 7

BILL OF MATERIAL		
NO.	NAME	DIMENSIONS
1	LUMBER	
1	Side guard beams	3 1/2 x 6 x 3 1/2
2	Side guard rails	2 x 6 x 3 1/2
3	Side guard rails	2 x 6 x 3 1/2
4	Side guard rails	2 x 6 x 3 1/2
5	WALNUT FRAME	
6	Posts	6 x 6 x 7'-0"
7	Stringers	4 x 10 x 15 1/2
8	Spreader	2 x 4 x 16'-0"
9	Retaining strip	2 x 4 x 16'-0"
10	Remainig strip	2 x 4 x 16'-0"
11	Post	6 x 6 x 7'-0"
12	Post	6 x 6 x 7'-0"
13	Post	6 x 6 x 7'-0"
14	Post	6 x 6 x 7'-0"
15	Post	6 x 6 x 7'-0"
16	Post	6 x 6 x 7'-0"
17	Post	6 x 6 x 7'-0"
18	Post	6 x 6 x 7'-0"
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94	Post	6 x 6 x 7'-0"
95	Post	6 x 6 x 7'-0"
96	Post	6 x 6 x 7'-0"
97	Post	6 x 6 x 7'-0"
98	Post	6 x 6 x 7'-0"
99	Post	6 x 6 x 7'-0"
100	Post	6 x 6 x 7'-0"



**NOTES**  
 Lumber to be cut to dimensions given ± 1/4"  
 Side guards and portion of posts above ground to be painted white - 2 coats after installation  
 All lumber below ground line shall be treated with a 2 coat application of crude Creosote before fabrication.  
 Rails and stringers designed for H-S loading.

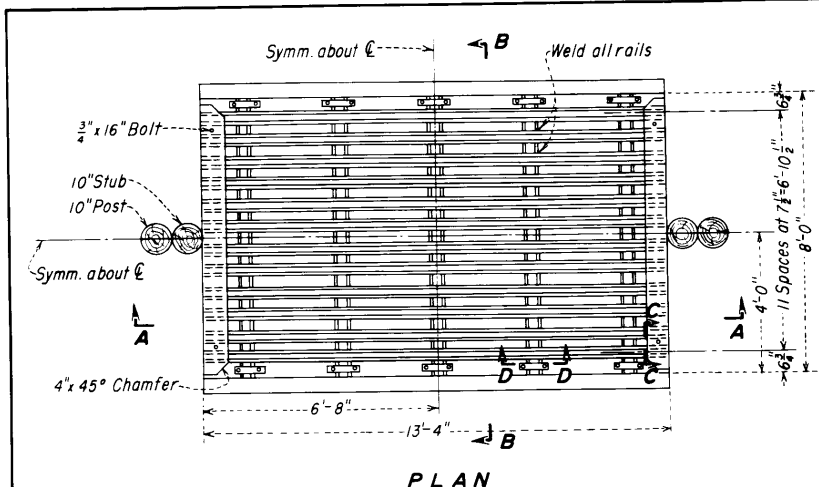


UNITED STATES DEPARTMENT OF AGRICULTURE  
 BUREAU OF RECLAMATION  
 TUCUMCARI PROJECT - NEW MEXICO  
 CONCHAS CANAL  
 CATTLE GUARD FOR OPERATING ROAD

DESIGNED BY: J. H. ...  
 DRAWN BY: M. W. ...  
 CHECKED BY: ...  
 APPROVED BY: ...  
 SUBMITTED: ...  
 RECOMMENDED: ...  
 2.1-E-337  
 TUCUMCARI, N.M., MARCH 17, 1941  
 87-808-410

GUARD JOINT AND STRAP - DETAIL A  
 2 RIGHT HAND AND 2 LEFT HAND REQUIRED.

SIDE GUARD BEAM G-1  
 2 RIGHT HAND - 2 LEFT HAND

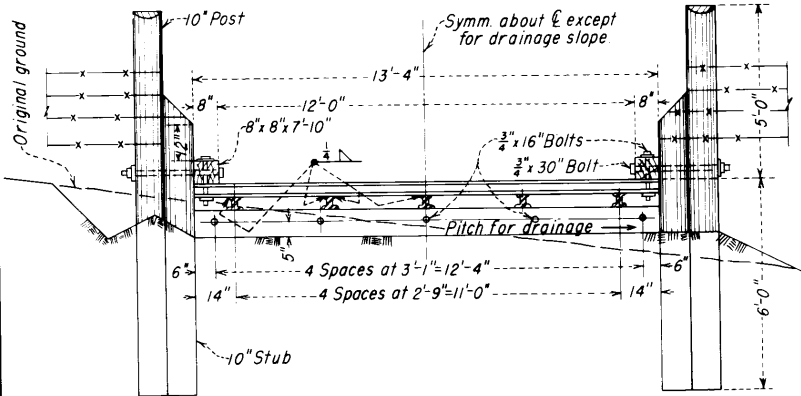


PLAN

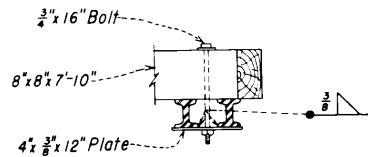
**BILL OF MATERIAL**  
(FOR ONE CATTLE GUARD H-15)

ITEM	No.	DIMENSIONS
RAILS	12	60" or 70" x 13'-4"
RAILS	5	80" x 8'-0"
TIMBER	2	8" x 10" x 13'-4"
TIMBER	2	6" x 18" x 13'-4"
TIMBER	2	8" x 8" x 7'-10"
POST	2	10" x 11'-0"
STUB	2	10" x 8'-6"
BOLT	2	3/4" x 30" Carriage
BOLT	34	3/4" x 16" Machine
WASHER	70	Malleable Iron - 3/4" bolt
PLATE	4	4" x 3/8" x 12"
PLATE	10	4" x 3/8" x 9"

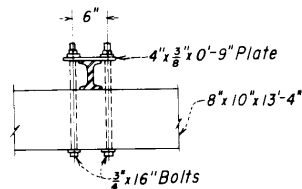
23 REQUIRED



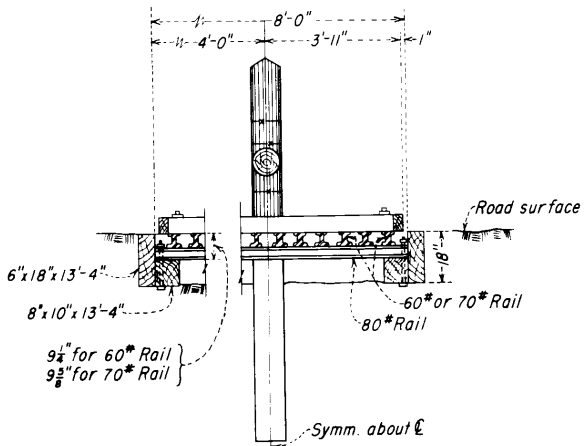
SECTION A-A



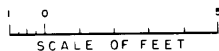
SEC. C-C



SECTION D-D



SECTION B-B



**NOTES**

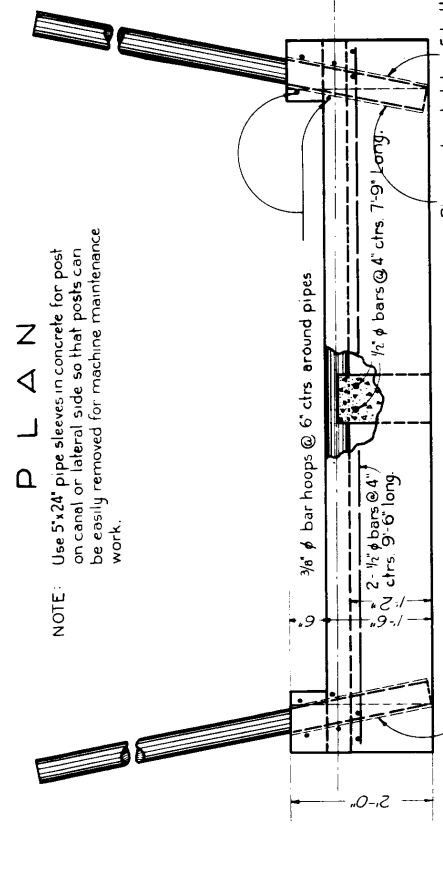
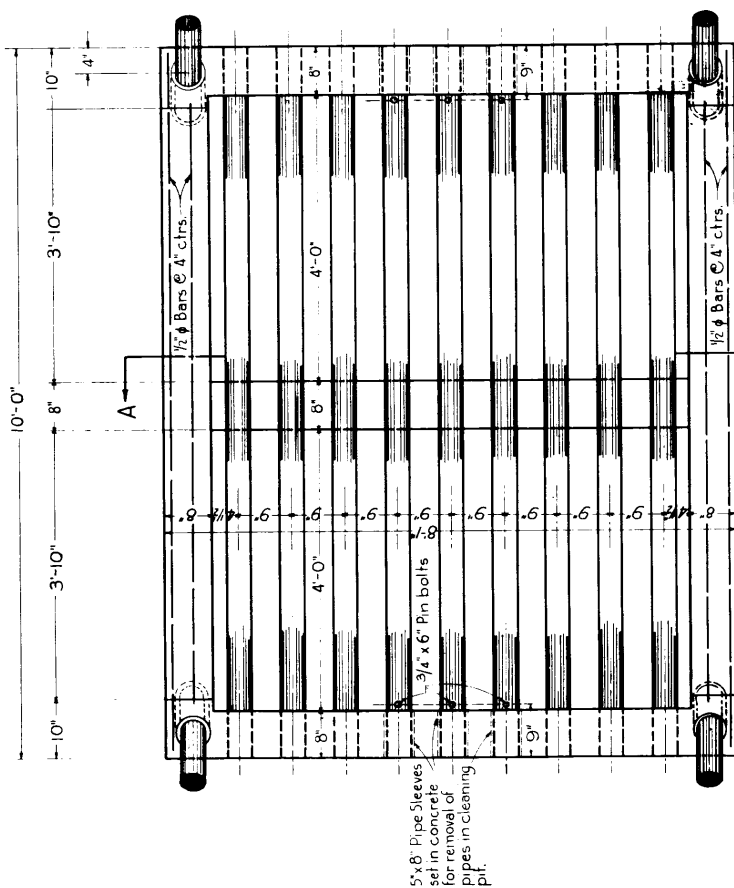
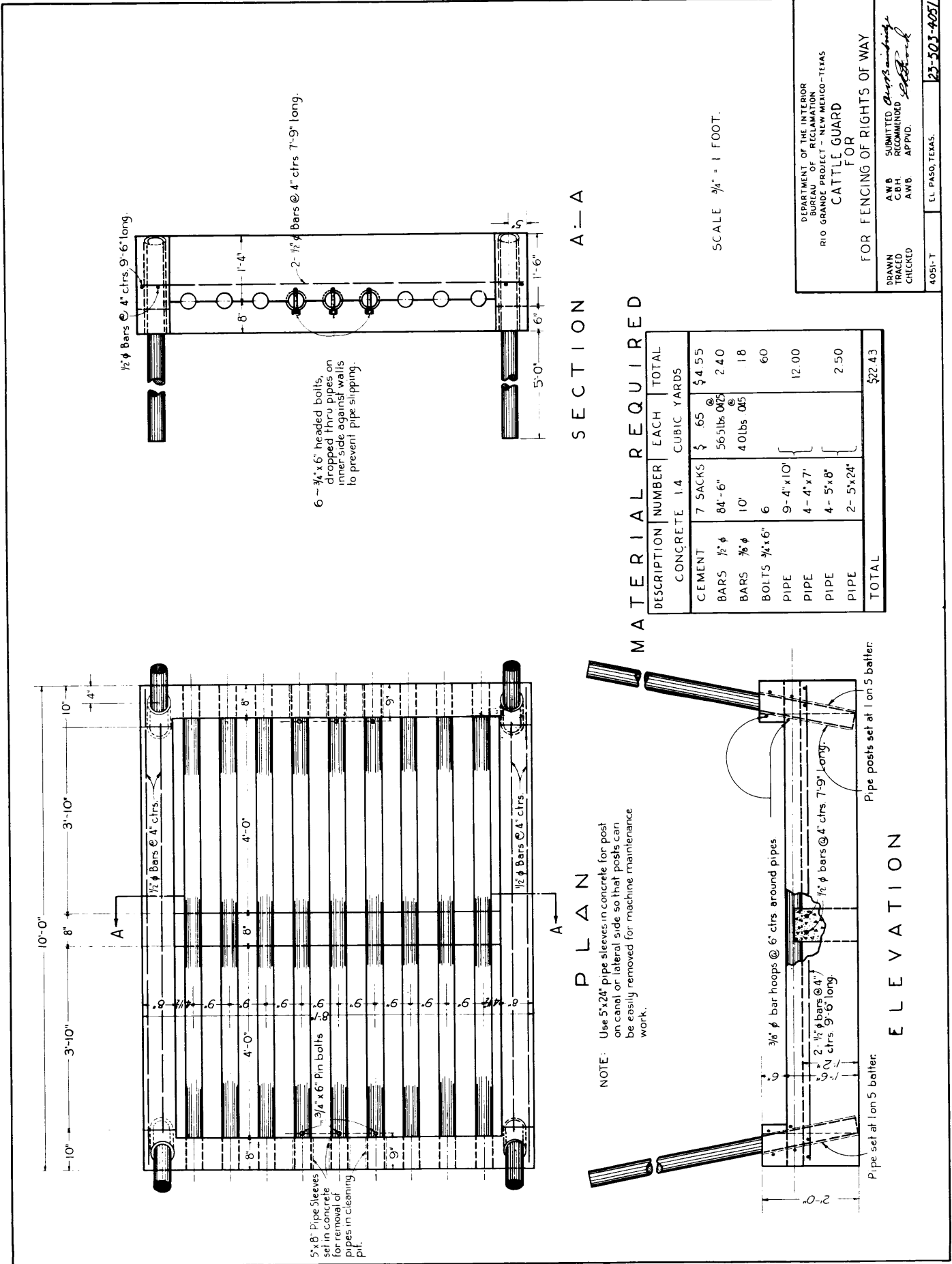
Lumber to be cut to dimensions given  $\pm \frac{1}{8}$ "  
 All lumber for cattle guards shall be treated southern yellow pine, or treated west coast douglas fir.  
 With carriage bolts use one malleable washer.  
 With machine bolts, use two malleable washers.  
 Transverse rails may be furnished in random lengths, and spliced and welded at the supports as directed by the contracting officer.  
 For approximate location of cattle guards, see Dwg. 163-D-41

UNITED STATES  
 DEPARTMENT OF THE INTERIOR  
 BUREAU OF RECLAMATION  
 MIDDLE RIO GRANDE PROJECT-NEW MEXICO  
**CHANNELIZATION**  
**H-15 CATTLE GUARD DETAILS**

REV 1-13-55  
 G.A.P.

DRAWN: G.A.P. SUBMITTED: *A.W. Kuhn*  
 TRACED: H.M.G. RECOMMENDED: *A.W. Kuhn*  
 CHECKED: *W.C. 427* APPROVED: *A.W. Kuhn*  
 CHIEF DESIGNING ENGINEER

DENVER, COLORADO - SEPT. 14, 1951 **163-D-56**



NOTE: Use 5"x24" pipe sleeves in concrete for post on canal on lateral side so that posts can be easily removed for machine maintenance work.

**MATERIAL REQUIRED**

DESCRIPTION	NUMBER	EACH	TOTAL
CONCRETE	1.4	CUBIC YARDS	
CEMENT	7 SACKS	\$ .65 @	\$ 4.55
BAR 1/2" $\phi$	84'-6"	56.5 lbs @	2.40
BAR 3/8" $\phi$	10'	40 lbs @	1.8
BOLTS 3/4" x 6"	6		60
PIPE	9-4" x 10'		12.00
PIPE	4-4" x 7'		
PIPE	4-5" x 8'		
PIPE	2-5" x 24"		2.50
<b>TOTAL</b>			<b>\$22.43</b>

SCALE 3/4" = 1 FOOT.

**SECTION A-A**

DEPARTMENT OF THE INTERIOR  
 BUREAU OF RECLAMATION  
 RIO GRANDE PROJECT - NEW MEXICO - TEXAS

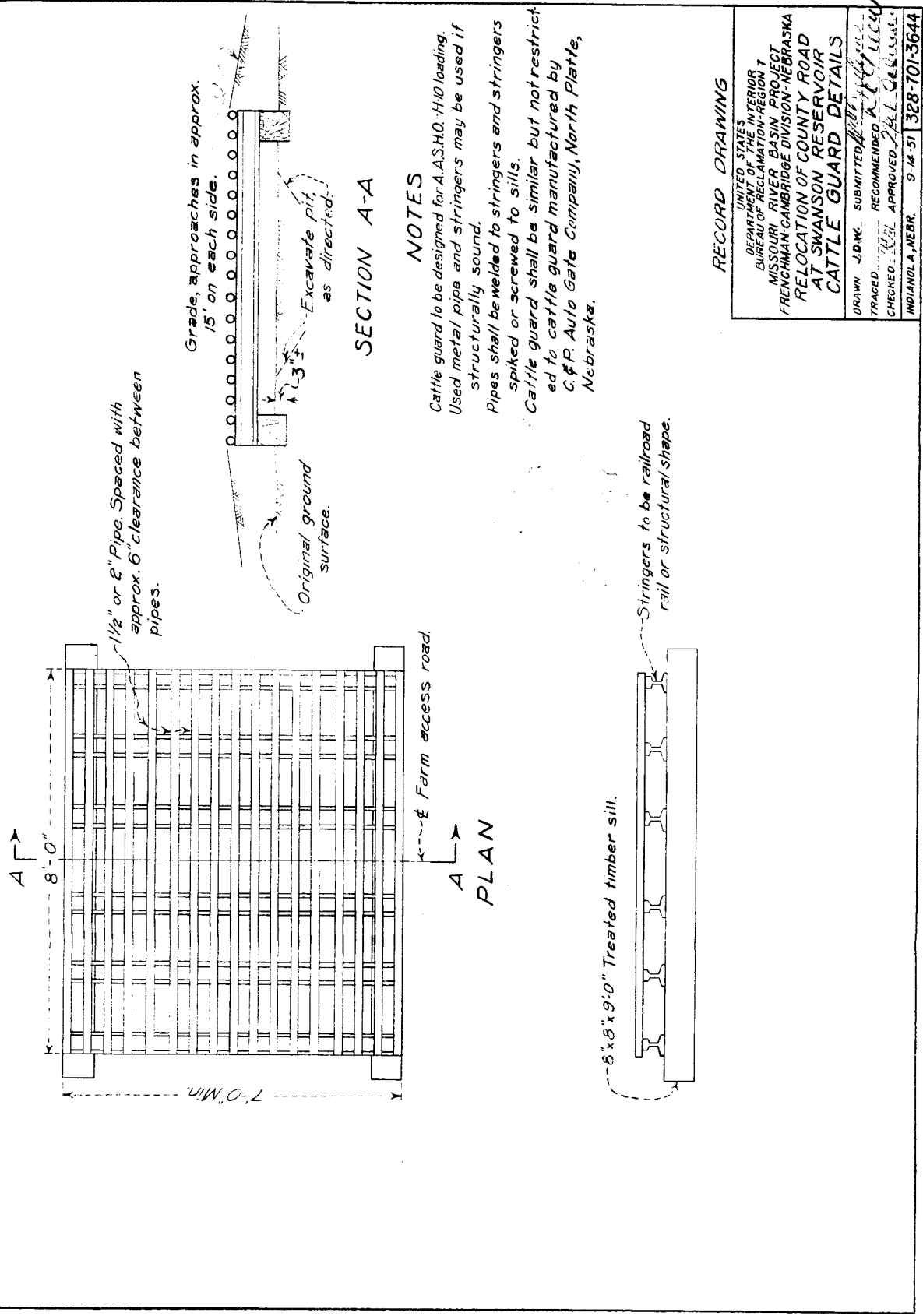
**CATTLE GUARD**  
 FOR FENCING OF RIGHTS OF WAY

DRAWN: [Signature]  
 TRACED: [Signature]  
 CHECKED: [Signature]

AWB SUBMITTED  
 AWB RECOMMENDED  
 AWB APP'D.

4051-T  
 EL PASO, TEXAS.  
 23-503-4051

Figure 10



Built To The Specifications Of

# FARMERS AND RANCHERS

## 'Flying L' Autogate Features

### PLATEAU TOP

"Plateau Top" cross bars—beveled for extra strength—hold up to 15 tons. The flat top provides a smooth ride at all speeds. Rounded corners protect both auto tires and livestock from injury. All joints — except special locking device that secures the center cleaning section — are electrically welded to prevent them from working loose. Cross bars made of special high strength steel—won't collect moisture and rust out. Proper spacing keeps livestock from crossing.

### FIRM CHANNEL BEAMS

Four channel beams give heavy duty support to the Plateau Top cross bars. (Five beams insure "no-give" support in larger sizes.) The beams are sufficiently below the cross bars to prevent livestock from crossing on them. Beams are deep for strength, and are sufficiently wide to insure lasting welds to the cross bars.

### SOLID ENDS AND SIDES

This "closed" construction keeps dirt from sifting into pit. Installation is easy; dirt or concrete can be banked up against ends without special forms.

A SIZE FOR EVERY NEED  
TO HOLD BACK CATTLE,  
HORSES, SHEEP AND HOGS

For an especially wide gate,  
two or more Autogates are used.

#### STANDARD SIZES

6 ft., 6 in. long—8 ft. wide  
7 ft., 1½ in. long—8 ft. wide  
7 ft., 9 in. long—9 ft. wide  
7 ft., 9 in. long—10 ft. wide  
7 ft., 9 in. long—12 ft. wide

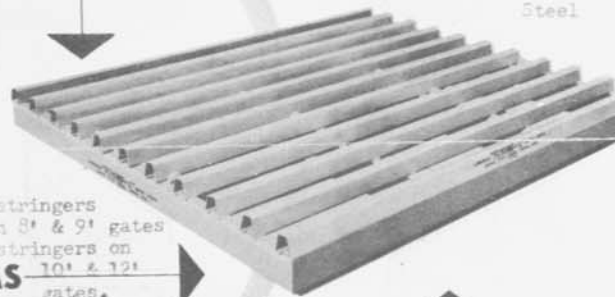
#### HEAVY DUTY SIZES

6 ft., 6 in. long—8 ft. wide  
7 ft., 9 in. long—8 ft. wide  
6 ft., 6 in. long—10 ft. wide  
7 ft., 9 in. long—10 ft. wide  
7 ft., 9 in. long—12 ft. wide

Lighter Duty Gates:-  
Outside stringers . 5" Channel  
Inside stringers . 5" I-beams  
Bars . . . . . 9 gauge  
Yoloy Steel

4 stringers  
on 8' & 9' gates  
5 stringers on  
10' & 12'  
gates.

Heavy Duty Gates:-  
Outside stringers . . . 7" channel  
Inside stringers . . . 7" I-beams  
Bars . . . . . 3/16" Yoloy steel



### 'FLYING L' CORRAL GATE

A new gate designed for use with corrals, small feed lots, etc., where stock is rather closely confined. It is designed so as to practically eliminate all possibility of injury should animal be crowded into the gate. Sharp cornered bars placed between the Plateau Top cross bars increase the gate's effectiveness.

### 'FLYING L' HORSEGUARD

An Autogate especially designed for confining horses. The edges of the Plateau Top cross bars are flanged outward to reduce the space between them, so that a horse's hoof will not slip through.

The Corral Gate and the Horseguard are available in all sizes in both standard and heavy duty types.



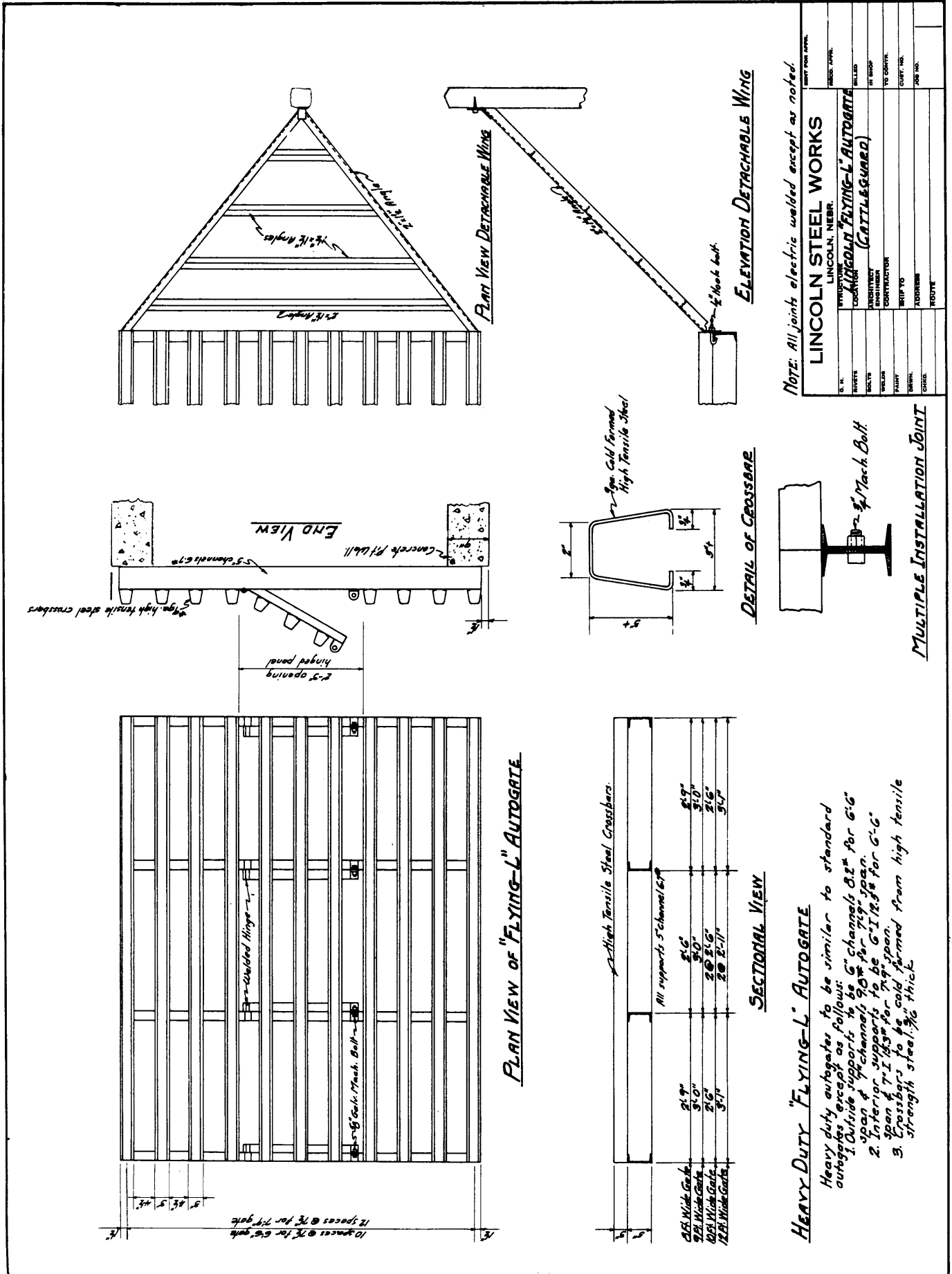
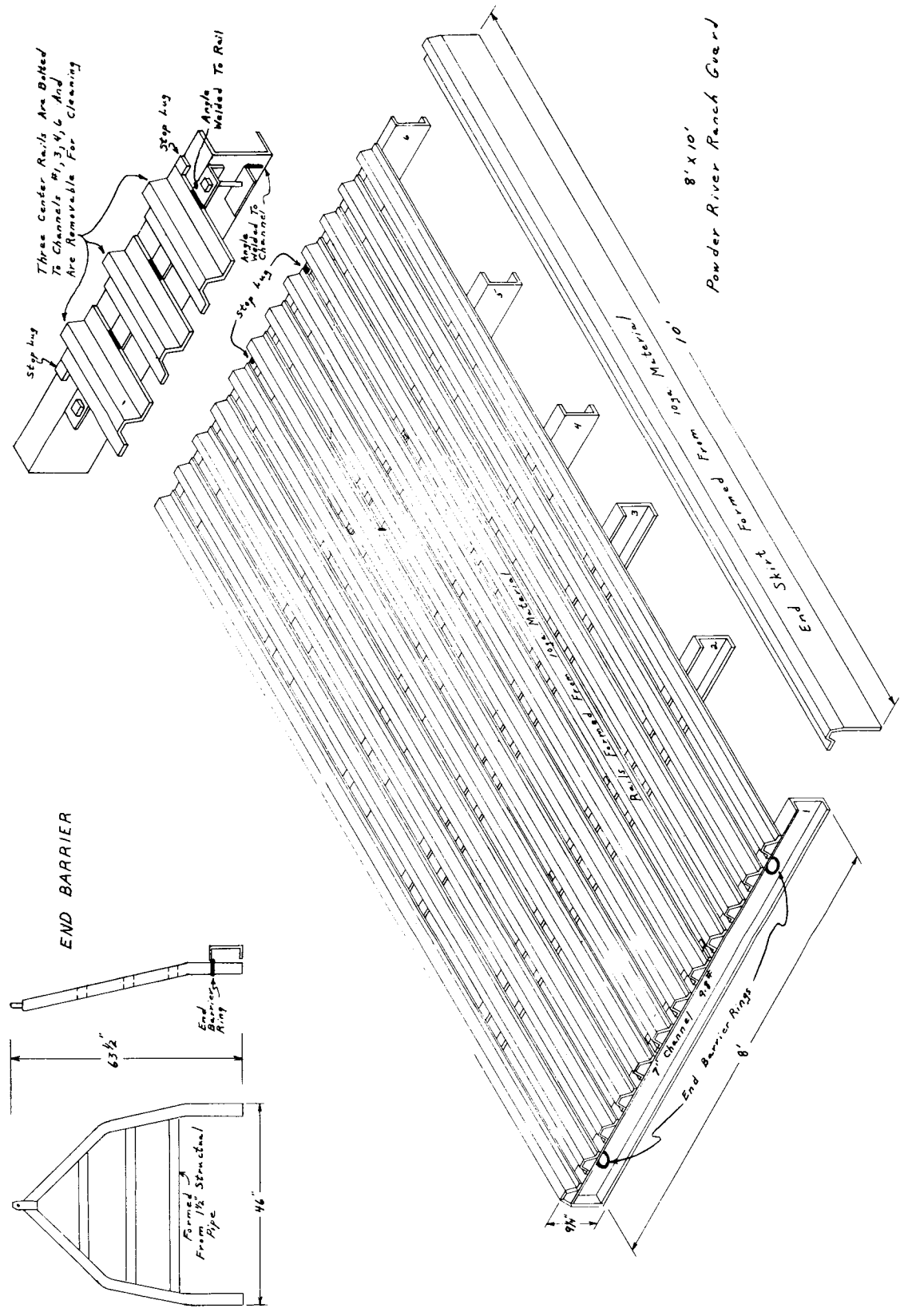


Figure 13



**COMMERCIAL WELDING COMPANY  
TENTH & WASHINGTON STREETS  
BAKER, OREGON**

Manufacturers of "Powder River" Ranch Equipment  
Distribution points in the western states Telephone: Jackson  
3-3654  
3-3655

**THE "POWDER RIVER" CATTLE GUARDS**  
A guard for every job

The following prices f. o. b. distribution points.

"Powder River" Ranch Guards			"Powder River" Heavy Duty		
<u>Size</u>	<u>Weight</u>	<u>Price</u>	<u>Size</u>	<u>Weight</u>	<u>Price</u>
6 x 8	560	80.00	6 x 10	1088	154.00
6 x 10	711	103.00	6 x 12	1212	170.00
6 x 12	906	132.00	7'5" x 8	1063	150.00
7'5" x 8	720	105.00	7'5" x 10	1239	175.00
7'5" x 10	979	142.00	7'5" x 12	1474	205.00
7'5" x 12	1082	157.00	8 x 8	1095	154.00
8 x 8	771	112.00	8 x 10	1330	188.50
8 x 10	1017	148.00	8 x 12	1568	220.00
8 x 12	1158	168.00	8 x 14	1817	256.50

**"Powder River" Extra Heavy Duty Guards**

<u>Size</u>	<u>Weight</u>	<u>Weight</u>	<u>Price</u>	<u>Price</u>
	3/16 formed rail	1/4 formed	3/16 formed rail	1/4 formed
7'5" x 10	1475	1704	205.00	240.00
7'5" x 12	1711	1988	239.50	278.50
7'5" x 14	1933	2257	272.50	315.50
8 x 10	1573	1844	222.50	259.50
8 x 12	1820	2144	257.50	299.50
8 x 14	2066	2444	287.50	329.50

All above guards are formed having a plateau top. Clean out sections in every guard. Detachable end wings available @ \$16.50 per set.

Special sizes built on request.

Prices subject to change without notice.

The following list shows the weights of steel used in the manufacture of the "Powder River" cattle guard

"Powder River" Ranch Guard

<u>Size</u>	<u>Understructure</u>	<u>Decking</u>
6 x 8	4--6" standard channels	10 ga. formed rails
6 x 10	5--6" standard channels	10 ga. formed rails
6 x 12	6--6" standard channels	10 ga. formed rails
7'5" x 8	4--7" standard channels	10 ga. formed rails
7'5" x 10	5--7" standard channels	10 ga. formed rails
7'5" x 12	6--7" standard channels	10 ga. formed rails
8 x 8	4--7" standard channels	10 ga. formed rails
8 x 10	5--7" standard channels	10 ga. formed rails
8 x 12	6--7" standard channels	10 ga. formed rails

"Powder River" Heavy Duty Guard

<u>Size</u>	<u>Understructure</u>	<u>Decking</u>
6 x 10	7--7" 9.8 channels	3/16 formed rails
6 x 12	8--7" 9.8 channels	3/16 formed rails
7'5" x 8	6--7" 9.8 channels	3/16 formed rails
7'5" x 10	7--7" 9.8 channels	3/16 formed rails
7'5" x 12	8--7" 9.8 channels	3/16 formed rails
8 x 8	6--7" 9.8 channels	3/16 formed rails
8 x 10	7--7" 9.8 channels	3/16 formed rails
8 x 12	8--7" 9.8 channels	3/16 formed rails
8 x 14	9--7" 9.8 channels	3/16 formed rails

"Powder River" Extra Heavy Duty Guard

<u>Size</u>	<u>Understructure</u>	<u>Decking (Rails)</u>
7'5" x 10	8--7" 12.25 channels	3/16 or 1/4 formed
7'5" x 12	9--7" 12.25 channels	3/16 or 1/4 formed
7'5" x 14	10--7" 12.25 channels	3/16 or 1/4 formed
8 x 10	8--7" 12.25 channels	3/16 or 1/4 formed
8 x 12	9--7" 12.25 channels	3/16 or 1/4 formed
8 x 14	10--7" 12.25 channels	3/16 or 1/4 formed