The repair job needed varies with the extent to which deterioration or damage by water has progressed. It involves excavating around the abutments and wings down to a good foundation, as determined by the soil conditions. The thickness of the reinforcing wall needed will be determined by the depth of the excavation and the height to which you wish to carry the new wall on the present abutment. I usually use a foot of thickness at the top and taper out toward channel, the width of base being determined by the height of the reinforcing wall. *Be sure to get this subwall deep enough in the earth to prevent any future scouring underneath!* If the present abutment is seriously undermined, for safety's sake it is well to do the underpinning in alternate sections.

The construction procedure depends upon the conditions. Often, in the dry season, it can be done without much interference from water. Usually, however, it will require a cofferdam and the use of water pumps to handle the excavating and proper placement of the concrete. In some cases where the soil in the stream bed was easily eroded, I have paved the channel from abutment to abutment with concrete to prevent further scours. This paved strip should have a cut-off wall at both the upper and lower end to insure that the water will not get out underneath. I have found this type of repair work very helpful in gravelly soil.

As is true in a lot of this repair work, money will be saved if it is done in time. If neglected, the abutment will be so undermined that it will settle out of line. This deformation may require cribbing-up under the bridge and the building of a complete new abutment. After the high water of '37 we had three bridges that required this type of work.

Those of you who are fortunate enough to be near a ready-mix concrete plant will save a lot of time and insure good concrete work by using ready-mix concrete.

When available, I would use reinforcing steel in some of this work, particularly on wing-walls of abutments and on floor work. However, I think that, by making walls thick enough, steel can be eliminated without lessening the value of the job.

This job of reinforcing abutments is just one of the many facing a county road supervisor trying to get by with limited funds, and requires only the liberal use of the common sense given to each of us by our Creator.

CLEANING AND PAINTING STEEL BRIDGES

Leaton Day,
Boone County Road Supervisor

The cleaning, painting, and repair of steel bridges is a big task for any county highway department. It is an obligation that is sadly neglected by most of us.

According to the State Highway Survey of 1936, we have in Boone County 240 bridges ranging from 190-foot spans on down. Approximately 30 per cent of this number are steel structures. It has been our policy to clean, repair, and paint as many of these as possible, from four to six a year; but during the past year we have been unable to accomplish very much in this line of work, because of the shortage of labor. We found it next to impossible to hire men for this type of work.

The equipment we have for repairing, cleaning, and painting bridges is not of the highest type but serves the purpose, and most of it is very inexpensive. We have two cribs, each 15 feet long and 2½ feet wide with a railing 2½ feet high on three sides. These cribs can be swung alongside, overhead, or underneath bridges, making a safe place for men to sit or stand while working. By this method, no ladders need be in the way of traffic.

Hammers, chisels, and wire brushes are used in the cleaning process. This is a slow and tedious task. However, we think this is the most important part of the painting of a bridge. It is a waste of time and material to paint over rust scales and dirt. No painting should be attempted until all repair and cleaning is properly done.

We have an acetylene welding outfit and a portable electric welder, which are used to good advantage in straightening and tightening all braces and tie-rods and repairing any breaks that may be in the structure.

The cost of cleaning, repairing, and painting a bridge depends upon the size, the amount of repairs needed, the condition of the surface to be painted, the equipment used, and the type of labor available. All of our painting has been done with brushes, but a spray-gun can be used to advantage.

We have been using aluminum paint; this is off the market, however, at the present time. We like this paint, as it spreads readily, covers the surface well, and gives the structure good visibility at night. One coat of aluminum paint gives good service for five or six years.

The last large structure we reconditioned was a steel truss, 120-foot span and 16-foot roadway across Eagle Creek. This bridge was in fair condition. Five men worked three weeks moving equipment to the job and cleaning, repairing, and placing a new floor—a total of 825 man-hours. In addition, 7½ days were required for painting and cleaning up afterwards, totaling 375 man-hours. This makes a grand total of 1,200 man-hours.

COST SUMMARY

Labor: 1,200 man-hours @ $0.45	$ 540.00
Paint: 25 gallons @ $2.40	60.00
Lumber	288.00
Total	$ 888.00

At the present price of labor and materials, however, this same job would be 35 or 40 per cent higher. Regardless of cost, it is money well spent. A structure of this size would cost the taxpayers at least $50,000 to replace, and it is impossible to purchase one at any price under the present war conditions.

A desirable plan is to go out each year, after the spring rains, and clean out around the end-posts of all steel structures. Gravel, dirt, vegetation, and moisture will collect at these places, and if not removed will cause serious damage to the structure. A little paint or asphalt applied to these end-post footings will assist materially in lengthening the life of a bridge.

CONSERVING OUR EQUIPMENT

Glen Brown,
Huntington County Road Supervisor

Many of us probably thought we knew quite a lot about maintaining highway equipment before Pearl Harbor, but this war has really put us through school. We feel confident that we can master the course, most of which we will have to lay out for ourselves; but by the time this war is over, we will have an interesting background. I believe our experience will have a profound effect upon the future care and maintenance of highway equipment. A new program will have been born to parallel that now used by operators of large commercial fleets. When, in Road Schools such as this, we pool our experiences, I am sure that repair of highway equipment will reach an efficiency never dreamed of before the Nazi and Jap joined forces against us.

To be more specific, these conditions that often make it impossible for us to get replacement parts have thrown the spotlight on the maintenance man in a dramatic manner. The drama is heightened by the lack of actors (or mechanics) on the maintenance stage. There are simply not enough good men to go around. To my mind the most important factor at this time, in connection with the operation of a County Highway Department and the conservation of highway equipment, is the employment of good mechanics and the maintenance of a well-equipped garage. While our garage is not equipped as well as some, or as well as we would like to have it, we have installed in it the following:

One lathe, one drill press, one electric drill, one mechanical hack saw, three emery wheels of different sizes, one electric welder, one acetylene welder, one forge with electric blower and a full set of blacksmith tools, one pressure grease gun with fittings for proper lubrication, one garage compressor, and numerous small tools.