

THE TRANSIT

VOL. XI.

UNIVERSITY OF IOWA

1906

EMERGENCY WORK IN THE BRIDGE AND BUILDING DEPARTMENT OF A RAILROAD.

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This subject is of course too broad to be considered in detail in an article of this kind, and what follows may be considered as suggestive merely of the methods which may be used in handling the emergency work which is usually taken care of by the bridge and building department of a railroad. The entire matter will be governed by local conditions and the organization of the various forces adopted by the road in question.

What follows is outlined for a division of 800 to 1000 miles in extent, on a Western road.

On this territory, the Superintendent or Supervisor, as he is often called, may have a general foreman and twenty to twenty-five gangs reporting to him. The number of gangs and their size depends on the amount of work in progress and the character of the lines to be taken care of; i. e., whether or not the various structures are largely of permanent construction or are built of wood and need more frequent repairs and renewals. There will also be various special men in the department, such as the bridge inspector, scale inspector, watchman, etc., and on many roads a sub-department, called the Water Service Department, having a general foreman reporting to the Supervisor, with the necessary pump repairers, pumpers, pipe men, etc. With the proper organization of these various men and gangs, the department becomes a big machine which is able to accomplish almost any desired result in a minimum length of time.

It should be remarked that the organization which will be suitable for carrying on the ordinary routine work with the greatest promptness and economy is really the one best adapted for handling emergencies. The men are thus trained to be prepared for whatever may happen and are ready to act at a moment's notice.

On a large division it may be convenient to divide the territory into five or six districts and place one bridge and building gang in charge of this territory, the foreman of the gang being held responsible for the safety of the bridges on his own territory. The remaining gangs are worked as floating gangs, and are responsible only for the safe and correct handling of the work on which they may be engaged. These floating gangs are moved from point to point on direct orders from the Supervisor.

All bridge and pile-driver gangs will report their whereabouts to the Supervisor by wire and each district foreman will also wire his location to the train dispatcher on his district. The Supervisor, the General Foreman, etc., will also keep some designated office constantly advised by wire of their location on the division.

Each district bridge gang will have a material yard, and the foreman will keep the accounts covering the material in it, reporting same to the Supervisor.

On a division containing several thousand bridges and culverts, it is well for the Supervisor to carry constantly with him a memorandum of all openings, giving the size, length, location, etc., with particular reference to what length of piling would be required to build across any opening in case it is washed out.

The amount of material on hand in the various yards will constantly fluctuate if there is much work in progress, but the Supervisor should keep himself constantly informed as to what he has.

The emergency work with which the Bridge and Building Department is usually concerned is that caused by the destructive action of water and ice, wind and fire, and blockades by snow, and in the Water Service Department by the failure of engines, windmills, pumps, boilers, etc., and the bursting of water mains. The subject of wrecking is not included here, as it is a large subject in itself and the work is often done by another department.

In many sections of the country, probably the most serious emergencies are those arising from the general breaking up of the ice in the rivers and streams, in the spring. To provide for

this trouble a stock of emergency bridge material should have been ordered the year before and stored at the various material yards. These material yards are located at strategic points on the territory to be protected by them. They should, if possible, be located at the district terminals where switching facilities may be had at any time of day or night, so that cars can be quickly set and loaded, and should also be at junction points where practicable, so that the material will be convenient to several lines of road. The emergency material should embrace a good supply of timber for bridges, the piling being selected with special reference to the heights of the openings on the territory in question. There should be a good supply of stringers, caps, sway braces, ties, bolts, track spikes, boat spikes, etc., also sand sacks and miscellaneous building material.

The pile drivers, of which we will assume there are two working on the division, should be worked at such locations if practicable that one will be at one side and the other at the other side of the most threatened territory. This applies, of course, particularly to seasons of general floods, when trouble is momentarily expected. In case of a washout the two pile drivers can then be headed towards each other and may be able to get in a temporary bridge in a few hours. These pile drivers should carry equipment which is absolutely complete. The tools may be painted some bright color and stenciled with the number of the pile driver, so that they will not be readily lost or stolen. The pile drivers should be regarded much as is the fire department of a city, and if kept up to a high state of efficiency the Supervisor may feel reasonably sure that he can get trains over any break that is liable to occur. A couple of 2000 candle power kerosene lights should be carried by each driver in addition to their other equipment, and they should, of course, have an abundant supply of torches and lanterns and rubber boots for the men, the same as the regular bridgemen.

Before the ice begins to move in the spring, but about the time it begins to soften, it is well to send out small gangs of two or three men in a place to all threatened points, and dynamite the ice thoroughly for some distance above and below the bridges. As there is often considerable delay about shipping explosives, it is well to have this dynamite on hand at each bridge where necessary, some time before it is expected to use it. And if there

is no building at hand where it can be safely stored, it is often practicable to make a pit in the ground near the river for it, providing same with a cover and lock.

In order to have the best results, the charges should be fired in the water, *i. e.*, under the ice, through holes cut in same. This is accomplished by tying the charge to the end of a bush or limb and thrusting it into the water underneath the ice. With good water-proof fuse the charge will be exploded in this position, but if, for any reason, there is a failure, a stick of dynamite may be laid on top of the ice over the charge and fired. The concussion from this will explode the charge in the water. When the ice starts to run it may be necessary to stand on the bridge and throw the charges out on the running ice. The fuses have to be quite short to do this successfully, and the operation requires great care.

When the season of the spring breakup is about to start the Supervisor will station watchmen at all threatened points and they will wire the condition of the river, the ice, and the weather daily. With these reports coming in it is possible for the Supervisor to get a bird's-eye view of the conditions on all the various streams and branches of same on his territory and anticipate where the points of danger will be. If for instance, a bad gorge starts on a stream, its rate of travel will be reported and he can have men, pile drivers and material already on hand to commence the work of repairs. A good system of reports and a knowledge of the peculiarities of the various streams will enable one to accomplish some surprisingly good results.

The destruction caused by summer rains can not be so well foreseen, but on the other hand the trouble is seldom so widespread. The only safety lies in eternal vigilance and being amply prepared for trouble. The Supervisor can avail himself of the daily weather reports usually received by the Superintendent's office, and in case of general and heavy rains, warn the bridge gangs not to tie up at night at inaccessible stations, and not to send their men away on scattering jobs, but to work on some job where they can be quickly communicated with. On Sundays or holidays, it will often be necessary to see to it that the men keep within call, if they do not work. In times of washouts the roadmaster of the district will also be present with his forces, and if the trouble is with the track or roadbed and not with a bridge, should take charge. The bridge and building men should all

have track tools, however, and be prepared to do any kind of track work when necessary. In case of a large amount of track being washed out from the roadbed the bridge mechanics can often greatly assist in getting it back by rigging blocks and tackle, or with other devices which are not carried in the regular trackmen's equipment. They can frequently crib up washed-out track much faster than it can be filled in by track men, and in case of high cribs will make a more reliable job.

As soon as trains are gotten over, the crib work should be removed as soon as practicable and the openings filled in or regular bridges constructed, as it is difficult to keep timber cribs safe any great length of time. A bridge gang should be left in charge of these cribs if they have to be maintained long on a line of heavy traffic.

In case of wooden bridges destroyed by fire, it is often practicable to crib the entire opening or set up a bridge on frame bents without driving piles, if there is no pile driver at hand, as these fires most frequently occur, of course, in dry weather, when there is no water running through the opening.

The safety of bridges is seldom endangered by the action of the wind, but important buildings, such as shops, roundhouses, etc., are unroofed or otherwise damaged by the wind action. One of the most serious effects of a severe windstorm is the destruction of windmills and towers. It sometimes happens that half a dozen or more water stations which are supplied by wind power may be put out of commission in a single day. This ties trains up as effectively as does a wreck or a washout. A supply of windmill parts should be kept constantly on hand, and also several reserve steam pumps and boilers of small capacity. These can be quickly set up to take the place of the windmills. To provide for boiler failures, etc., in the large pumping stations, a convenient arrangement is to have a large boiler permanently mounted in a box car, with an equipment of pipe, fittings, pipe tools, etc., and also a steam pump. This can be shipped on first train to any point of failure, and a temporary pumping plant set up in a few hours. As the car contains a complete assortment of pipe tools and material, it will be very convenient for use in connection with repairs to broken water mains, etc.

Emergencies caused by snow blockades, are frequently taken care of by other departments, but the Bridge and Building De-

partment should be prepared to accompany the snow plow or rotary when necessary, taking charge of same or assisting the roadmaster or other official in charge. In case of a bad snow season, a string of outfit cars with suitable bedding equipment, commissary supplies, etc., may be kept in constant readiness, so as to take care of extra laborers, which may be put on in addition to regular gangs, who are equipped with outfit cars.

When telegraphic reports come of an emergency requiring the Bridge and Building Department, the Supervisor will at once call out the various gangs, whom he desires to have go to the scene of trouble, wiring them full instructions in regard to material needed, etc. He will arrange with the Assistant Superintendent or Dispatcher in regard to what work train service is needed, wire yardmasters to have necessary cars set for loading, and then repair to the scene of the trouble by the quickest available means.

It should be borne in mind in handling any emergency work where the men must work in water, ice, snow or in other exposed or dangerous localities, frequently without sufficient sleep, it is of prime importance to furnish them with good food at as nearly regular intervals as possible, and have a place provided for them where they can be comfortable when the work is completed. If the men feel sure that their superior officer is constantly watching out for them in regard to these matters, there is seldom any difficulty in getting them to do any kind of disagreeable or dangerous work. If the company is not provided with regular boarding outfits which can go with them to the scene of trouble, the Supervisor should arrange with local hotels or restaurants to feed the men promptly. A lunch for men at one or two o'clock in the morning when necessary to work all night will accomplish wonders.

From the above observations on emergency work, I trust it will be apparent that the secret of success is ample preparation and organization. As to the actual details of the work, having arrived at the scene of the trouble, the conditions vary too much to attempt to describe details in this article. The best method of procedure will be determined by the Supervisor or his foreman in charge. In regard to train movements, if there is no representative of the train department at hand, the Supervisor will wire the dispatcher what he wants done, and a good dispatcher will comply with the wishes of the man, who is on the spot and in charge of the work.