Editorial Comment

Flood Damage to Signaling

THE DAMAGE done to railway signaling and interlocking facilities during the floods in March undoubtedly constituted the most extensive disaster of this character in the history of American railroads. From information assembled on this subject, several facts are available which can well be considered in an effort to minimize the damage in the event of future floods of similar proportions.

In the majority of the areas flooded, the water rose to heights never before experienced, because warm rains melted heavy snow on ground that was frozen, promoting unusually rapid run-off. This condition existed over extensive areas so that several tributaries were flooded simultaneously, thus swelling the principal rivers to record stages. For example, the Allegheny and the Monongahela were at flood stage at the same time, thus throwing so much water into the Pittsburgh district that the main stream, the Ohio, could not carry it away. Likewise, for the first time in recent years, both branches of the Potomac were at flood stage simultaneously. The point is that these floods were caused by exceptional conditions, giving rise to the question whether it is worth while to spend much money to prepare for such floods in the future, when the chances are that they may not occur for another 50 or 60 years.

Preparation for Normal Floods

Serious floods do occur, however, every few years at certain locations, and steps can be taken to minimize the damage at these places. For example, the Baltimore & Ohio, based on experience resulting from floods years ago, adopted the practice of attaching the instrument cases at signal-bridge locations to the signal bridges at a height about level with the lower bridge deck. This precaution prevented damage to the instruments at certain locations during the recent floods along the Potomac. During the last decade when no serious floods occurred, many of these instrument cases were moved to lower levels, to overcome the difficulties introduced in maintenance when the boxes were attached to the bridge legs. Now, perhaps, the tendency will be to move the cases to higher levels again.

Likewise, the Lehigh Valley, which experiences floods quite often in the vicinity of Allentown, Pa., has purposely housed the relays and battery in this interlocking at a level above the normal flood stage. The same practice was followed in several interlockings on the Pittsburgh & Lake Erie in the vicinity of Pittsburgh.

In instances where signals, pipe lines, pole lines or even interlocking towers are washed out, the logical step is to replace these facilities. However, a few lessons gathered from recent experience may be helpful in this connection. The Western Maryland lost several signals at points scattered over an entire division. As no supply of equipment was available for immediate replacement, one short section of signaling beyond the flood zone was taken out of service, and the equipment thereon was used to restore the signaling to complete service on the remainder of the railroad. Then, as soon as new materials were received from the manufacturer, the signaling on this short section was returned to service.

Similarly, on the Pittsburgh & Lake Erie, rather than endeavor to bring the signaling on the entire flood territory back to service at one time, efforts were concentrated on units of five-mile sections at each end of the flood zone, so as to connect up with existing signaling on the territory beyond the flood zone, and thereby expedite trains in a uniform manner up to those sections where trains were, of necessity, operated at reduced speeds.

On multiple-track roads where the automatic signaling for one direction of operation had previously been controlled by line circuits, the Baltimore & Ohio lost long sections of its pole line. Rather than leave the signaling out of service until the pole line could be rebuilt, new polar track relays were purchased and the control system for three-position signaling was returned to full service by the use of polarized track control, which required no line circuits.

According to numerous reports, the batteries which were flooded but not otherwise damaged seemed to survive the disaster and to function properly when the remainder of the system was ready. Especially on the Western Maryland, caustic-soda primary batteries were flooded at numerous locations, but these batteries were returned to service when the water was pumped out of the wells or boxes. On the Lackawanna, the primary cells which were flooded were returned to service by dumping out the excess water and replacing the oil. Storage battery, especially the types with sealed covers and vent plugs, seemed to go through the flood with little damage.

Loss of A-C. Power

In many instances, the power houses of commercial utilities were flooded so that the a-c. power sources for sections of signaling and interlockings were cut off for days. On a section of a-c. signaling, the Pennsylvania quickly replaced the a-c. relays with d-c. equipment, and used storage batteries temporarily to operate the signaling.

In some instances, as for example on the Norfolk & Western, the storage cells retained enough charge to continue the signaling in service until power was restored. However, at a large electric interlocking on the Boston & Albany, the a-c. power was cut off for a week. An arrangement of locomotive head-light turbo-generators was set up to charge this battery, thus keeping the plant in service. Likewise, at a large electro-pneumatic interlocking on the Pennsylvania near Pittsburgh, Pa., where the air compressors were flooded, a locomotive, set on a siding, furnished air pressure to operate the switches.

Standard brands of insulated wires and cables, even the aerial types, went through the floods without failing, except, of course, where the pole line or trunking was washed away so as to break the wires. Megger tests on wires and cables that had been under water for days showed that, except for a few instances, the wiring was satisfactory for service. However, the wisdom of using aerial cable for main runs of wiring distribution at interlockings was demonstrated on one road. Although the aerial cables at one large plant were submerged, they came out of the flood unharmed, whereas at other plants where the wires were in wood trunking, considerable work was required in opening the trunking, cleaning out the mud and spreading out the wires to dry. In some plants, the wood trunking and wires were so seriously damaged mechanically that the entire outside wiring distribution is to be replaced as soon as possible by new cables.

Muddy Relays a Problem

Aside from the actual loss of apparatus washed away, perhaps the most serious handicap, in returning signaling to service after it has been flooded, is the work required in cleaning the mud and water out of such instruments as relays, circuit controllers, switch machines and rectifiers. The consensus of the men engaged in the rehabilitation work is that an instrument which has been under water for hours or days will not be harmed further by washing out the mud with water. Therefore, the majority of the roads used buckets, streams from a hose and even hot water from a locomotive, to wash mud out of instruments, relay cases, switch fittings and switch machines.

The next problem is to remove the remaining moisture. Air pressure, where available, is effective in this effort. Warm air, as delivered from an ordinary electric hair dryer, acts quickly in drying moisture, and such devices were used extensively, especially on the Eastern Region of the Pennsylvania. In instances where relays are damp but no mud is present, these dryers can be used in the field. The use of alcohol to wash out a relay will remove moisture, this method being used as a temporary measure on one road.

Of course, if a layer of mud has been deposited inside a relay, the only logical procedure is to dismantle it and clean all the parts thoroughly. Several roads set up temporary relay shops in which the relays were given thorough overhauling, insofar as mechanical operation was concerned, on a very fast schedule. Different methods of drying parts and coils were used on the various railroads. The use of ordinary portable sheet-metal cook-stove ovens, especially for baking the coils, seems to have advantages over the use of racks around stoves, for in an oven, the entire coil is subjected to a uniform temperature whereas when hung near a stove, the side toward the stove may get too much heat, which may cause damage.

The signal forces of the railroads are to be commended for their accomplishments in returning the flooded signaling to service so promptly. However, in spite of the fact that the equipment was given the most thorough cleaning possible in the time available, and seemed to be operating satisfactorily when re-installed, it may be that some moisture is still present or some slight defects have been overlooked. Consequently, it will be well to watch all of this apparatus very closely. As a safety measure, some roads are planning to send every flooded relay through their regular repair shops in order that special emphasis may be given to the electrical tests.

Betterments Result from Floods

Although the floods caused extensive damage, they were in some instances a blessing in disguise, for many old relays and signals that should have been discarded years ago, were in service in flooded areas and subjected to mud and water damage. Some of the railroads concluded that it would cost more to rehabilitate this equipment than to charge out the difference for new and modern instruments, while the increased economy in operation and the safety features of the new equipment justify the decision to discard the antiquated apparatus. In at least one instance where a mechanical interlocking was seriously damaged, the entire plant is to be replaced with power equipment controlled remotely from an adjacent interlocking. Likewise, some roads are also taking advantage of the opportunity brought about by the floods to rehabilitate and relocate signaling and to install modern systems of power supply.

CORRECTION: In a Letter to the Editor, published on page 214 of the April issue, N. B. Coley, Toronto, Ont., referred to an article in the New Device section of the March issue entitled "Uniform Time Control for Crossing Signals," and he made the contention that it was not logical for a manufacturer to introduce at this date and claim as their design, a system whose key circuit is a copy of a circuit which has been in use for five years and had been described in published articles.

Since the publication of Mr. Coley's letter, the Union Switch & Signal Company has advised that they own patents which antedate Mr. Coley's published articles in January, 1933, and May, 1934, as well as the articles on similar schemes published in the May, 1929, issue of *Railway Signaling*.

On June 20, 1928, the Union Switch & Signal Company filed a patent application in the United States, on which Patent No. 1,933,690 was issued on November 7, 1933. A corresponding Canadian Patent No. 342,301 was issued on June 12, 1934. These two patents cover the system described by the Union Switch & Signal Company in *Railway Signaling,* and also the system illustrated in Mr. Coley's articles. It will be noted from these filing dates that the United States patent application was filed practically five years before Mr. Coley's first article appeared.

On June 27, 1930, a patent application was filed in the United States by the Union Switch & Signal Company, which was issued as Patent No. 1,933,781, on November 7, 1933, and a corresponding Canadian Patent No. 342,300 was issued on June 12, 1934. These two patents show and claim the checking feature used in the Union Switch & Signal Company system and illustrated in Mr. Coley's published circuits, and they also show and claim the almost identical control of the timing device illustrated in Mr. Coley's articles. This patent was filed almost three years before Mr. Coley's first published article in *Railway Signaling.*—John H. Dunn, Editor.