can only be accomplished by walking over the territory to be inspected. A cable-type bond, except in cases of injury, rarely breaks except close to the plug and the failure at this point is gradual. First, one strand will break and then the remaining strands fail, one by one. I am satisfied that, in practically every instance, the complete failure of a stranded bond, involving the successive breakage of all the individual strands, occupies a period of several months or even a year.

By walking over the territory and inspecting each end of every bond, as outlined above, nearly all the defective bonds will be located. These bonds will be found to have one or several broken strands, and replacement can be made before they have failed. However, if an inspection of bonding is attempted from a motor car, or any other vehicle, the fracture will not be discovered until it is complete, and the end of the bond separated from the plug.

My experience has been that a semi-annual inspection, as above described, will result in the removal of practically every defective bond before a failure has occurred. Of course, under certain conditions such as light steel and fast traffic, the periods of inspection would have to be more frequent.

No electrical test can be relied upon to indicate the presence of defective bonds, as the conductivity of the angle bars varies greatly, due to rust, loose bolts, etc.

Lights Interfere with View of Signals

"What special arrangements have you found necessary at certain locations to prevent street lights, lamps on buildings, or advertising signs from interfering with an engineman's view of signals?"

Local Authorities Co-operate

O. R. Unger
Signal Supervisor, Missouri Pacific
Nevada, Mo.

Complaints arising from interference with signal indications as a result of street lights, signs, etc., usually come from enginemen who happen to be working on a division other than that covered by their regular run. In such instances an engineman will often find many defects that he would not notice on his own territory.

However, we have been very successful in the past in remedying these conditions. In a few instances we have consulted with the local street commissioner or the power company and had the objectionable lights relocated. In most cases they are glad to co-operate.

In other instances we have hooded these lights in order to overcome the objections.

Shields Stop Interference Caused by Street Lights

P. A. Starck
Assistant Signal Supervisor, C. & N.W., Sioux City, Ia.

Newly-installed street lights, lamps on buildings, or advertising signs are often found to interfere with an engineman's view of some signal. We recently encountered a case of this kind involving a street light so situated as to be directly back of and very nearly in line with the home signal light of an interlocking plant as seen by the engineman of an approaching train.

This particular case was corrected by mounting a 3-ft. square sheet-metal shield between the street light and the signal. It so happened that a line pole already in use for other purposes was properly situated with reference to the offending light and this pole was utilized for supporting the shield.

The shield effectively corrected the situation. The same method has been applied at a number of other places effectively. Sometimes it is found necessary to set a new pole or to move a nearby pole to the proper location for the purpose of supporting the shield. Where it is necessary to set a pole, it should be placed as closely to the interferring light as local conditions will permit in order that the shield may be small but yet effectively cover the light.

There have been several instances particularly at flood-lighted properties located in the immediate vicinity of highway crossing signals where the relative alinement of the protective devices and flood lights was such as to render the lights in the signals ineffective. At a number of such places the undesirable condition was corrected by simply refocusing the flood lights and changing their adjustable hoods and reflectors so as to shift their principal focus away from the signals. In all of these cases the proprietors of the establishments co-operated by permitting the readjustments to be made upon being informed of the circumstances.

Less Trouble with Color Lights

A. J. Yarrell
General Signal Inspector, Texas & Pacific, Dallas, Tex.

Only one case of an obstructed signal indication has come to my attention on the Texas & Pacific. This was remedied by adding about 10 ft. to the color-light signal mast; preventing a new train shed over a station platform from obstructing the view.

When we prepare the location plans for a new signal installation all such obstructions as mentioned in the question are carefully considered and the signals are located accordingly. Where it has been necessary to relocate signals in the vicinity of new underpasses, etc., we have experienced very little difficulty.

Of course, most of our signals are of the color-light type. In my opinion they have some advantage over the semaphore type in this respect.

Testing New Interlocking

"In testing a new interlocking prior to placing it in service, which of the following methods do you consider the most reliable: (a) An operating test of each individual function under all normal conditions or (b) detailed checking of each branch of all circuits according to the circuit plan? Why?"

Light Engine Used in Testing

J. H. Butridge
Chief Signal Inspector, Illinois Central
Chicago

In testing a new interlocking plant before placing it in service it is most important to check all circuits against the wiring plan. Such tests can be made by the wireman who handles the work and after completing these tests he reports that the circuits are ready for inspection.

A competent inspector working with the signalman performing the work should check each individual circuit and the tagging against the circuit plan. In my opinion no plant should be put in service until there is absolute assurance that the circuits

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are in accordance with the plans furnished for the work.

After being placed in service the plant should be tested under actual operation. In testing large interlocking plants on this road we have used a light engine running backward and forward over all possible routes in the plant. One signalman is placed on the engine, who makes inspection of the signal indications and instructs the engineman in regard to the speed of the engine through the plant. Inspectors are placed in the tower to make a complete check as the engine moves over the track circuits and if any bad shunting conditions exist they are taken care of and the test repeated. A test under actual operating conditions is essential as there may be some mistakes in the circuit plan which can be discovered with this test.

Portable Telephone Useful in Testing

B. F. Oler
Assistant Engineer, Pennsylvania New York, N. Y.

In testing a new interlocking prior to placing it in service, I would not consider the test complete nor reliable unless detailed checking of each branch of all circuits, according to the circuit plan, had been completely carried out, and an operating test of each individual switch and signal function had been made.

Usually the tests are made under traffic. With sufficient help and the use of portable telephones so constructed that they can be used on the interlocking circuit wires, the tests can be made without loss of time and without interference with traffic.

Both Operating and Circuit Tests Essential

H. A. Appleby
Assistant Signal Engineer, A. T. & S. F. Amarillo, Tex.

An interlocking plant should never be placed in service until a complete set of operating tests for all possible combinations of conditions has been made. This test not only checks construction but also checks errors in design. All construction errors cannot, however, be found by the operating tests and a detailed check of each circuit should be made before it is placed in service, for the same reasons that these circuit tests are repeated periodically after the plant has been placed in service.

My experience has been that the operating tests and circuit checks are equally important, and neither is complete without the other. We insist that both operating tests and circuit checks be made before new or repaired installations are placed in operation.

Complete Operation Test Often Impracticable

W. N. Hartman
Assistant Signal Engineer, Chesapeake & Ohio, Richmond, Va.

The question pre-supposes that complete tests of the interlocking can be made prior to placing it in service, which in actual practice is seldom possible. The majority of new interlocking installations consist of conversions from mechanical to power-operated switches in remote-control or C.T.C. projects where complete operating tests of each individual function before it is placed in service are impracticable.

Even though an entirely new group of switches and crossovers is to be interlocked, the layout is almost invariably located in existing main tracks requiring placing in service under traffic. With this condition, automatic signals or other existing signal facilities are so involved as to necessitate deferring some of the operating tests until the circuit changes incident to the interlocking installation have actually been completed and the facilities, in their entirety, placed in service.

Both methods of testing are essential. The check designated as method (b) detailed checking of all circuits, should be made prior to placing in service, so as to correct all irregularities in the wiring which might result in failure of any of the functions to operate as intended.

The check designated as method (a) operation tests, is necessary in order to detect possible errors in circuit design as well as defects in equipment or auxiliary apparatus which, even though wired in accordance with the circuit plan, would result in interruptions adversely affecting the movement of trains. As many of these checks as operating conditions will permit should be made prior to placing the facilities in service, and the balance completed as soon as practicable thereafter.

Operating tests of each individual function under all abnormal as well as normal operating conditions, are also essential in order to simulate conditions which might be rarely encountered in normal service. This should consist of conducting complete break checks of each individual circuit, having observations made of the various functions affected, to insure that proper protection is provided.

Phantom Indications

"What improvements have been or can be made to reduce the phantom indication on flashing-light type highway crossing signals?"

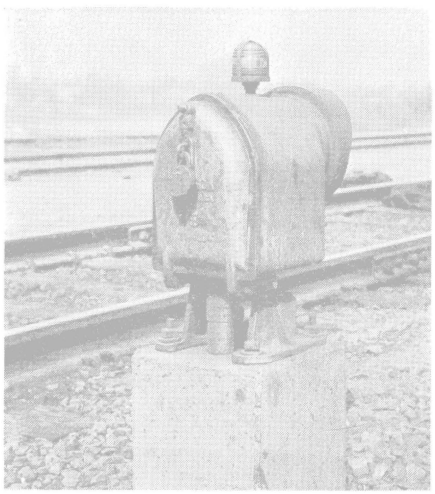
Relatively Unimportant with Flashing-Light Signals

O. S. Field
Engineering Department, General Railway Signal Company, Rochester, N.Y.

It is our belief that the objections to phantom indications from this type of signal are not of great moment. The normal alternately-flashing indication is inherently distinctive from the two stationary lights caused by reflection and from the single fixed light displayed when the signal is operative with the flashing relay not working. From the writer's limited observation, practically every motorist is fully aware of these differences.

It would seem of much greater importance to educate the public to the meaning of the bright alternately flashing lights, than to spend effort on trying to reduce a weak stationary phantom.

We recognize that a small percentage of signals are so located that phantom from the sun occurs during the early morning or late afternoon on clear days. In such instances almost complete elimination of phantom may be secured by the use of doublet lenses in place of the more efficient roundel and reflector.



On the Southern Pacific a small marker lamp on top of each dwarf signal assists in preventing accidents to trainmen