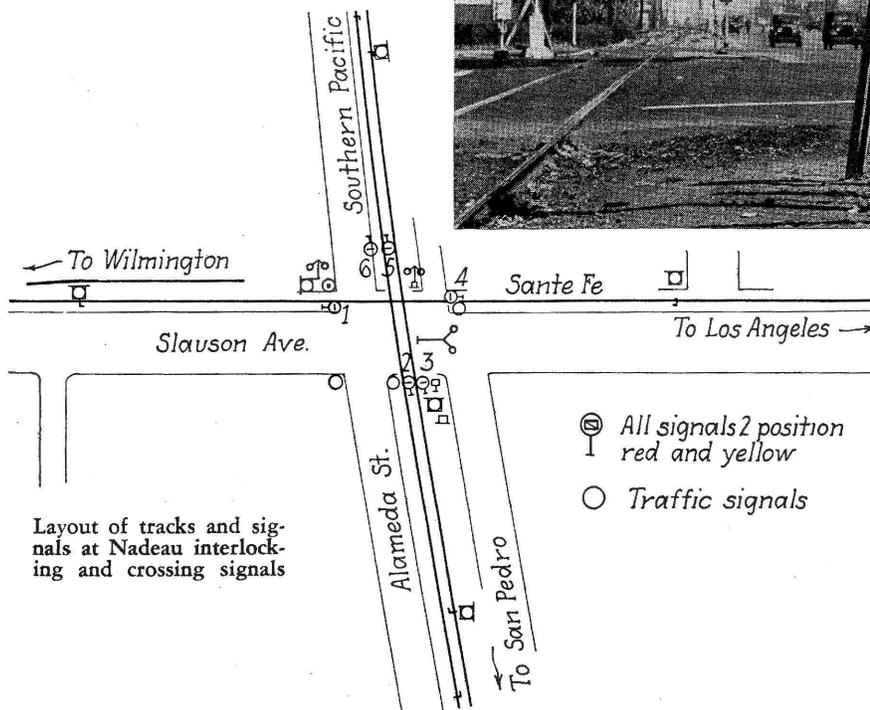


Automatic Interlocking Involves Highway Crossing Signals

Crossing of Santa Fe and Southern Pacific near Los Angeles developed numerous complications

View looking east along Santa Fe track and across Alameda street



Layout of tracks and signals at Nadeau interlocking and crossing signals

AT NADEAU, CAL., a suburb of Los Angeles, an automatic interlocking was installed five years ago at a crossing of a single-track line of the Atchison, Topeka & Santa Fe with a double-track line of the Southern Pacific. The Santa Fe track runs east and west along the north side of Slauson avenue, while the Southern Pacific track runs north and south along the east side of Alameda street. The Santa Fe line extends from Los Angeles to Wilmington, on Los Angeles Harbor, and the Southern Pacific line extends from Los Angeles to San Pedro, also on Los Angeles Harbor.

Traffic on each road averages from 10 to 12 freight runs and switching cuts daily to and from the docks and industries in the harbor district. Both Alameda street and Slauson avenue are main traffic arteries between Los Angeles and the harbor district, and street traffic is extremely heavy.

Originally the railway crossing was protected by a mechanical interlocking plant. The rails, in the pre-automobile day, carried a heavy passenger traffic as there was no other convenient way of reaching the beaches. Then came the automobile and pavements, and highway traffic finally increased to a point warranting the

installation of wigwags. The highway traffic soon became so heavy that the county installed street-traffic signals with time control, but without co-ordinating them with rail traffic. This resulted in even greater traffic confusion at times when there was conflict between indications given by wigwags and the highway traffic signals.

Automatic Plant Installed

A decision was finally reached to replace the mechanical interlocking with an automatic plant and to co-ordinate the traffic signals with train movements. Rail passenger traffic has entirely disappeared and all trains now operated over this crossing are for switching and freight movements. In view of the fact that train speeds are restricted to 8 m.p.h. over the crossings, the home signals are two-aspect searchlight-type dwarfs without distant signals and are located at or very near the curb lines of the streets, so that a train stopped by a signal will not block street traffic.

The railroad signals are normally dark, so that highway traffic will not be confused by the train signals, but the approach of a train on any track causes all signals to be lighted. The circuits are of the ZR stick-relay type,

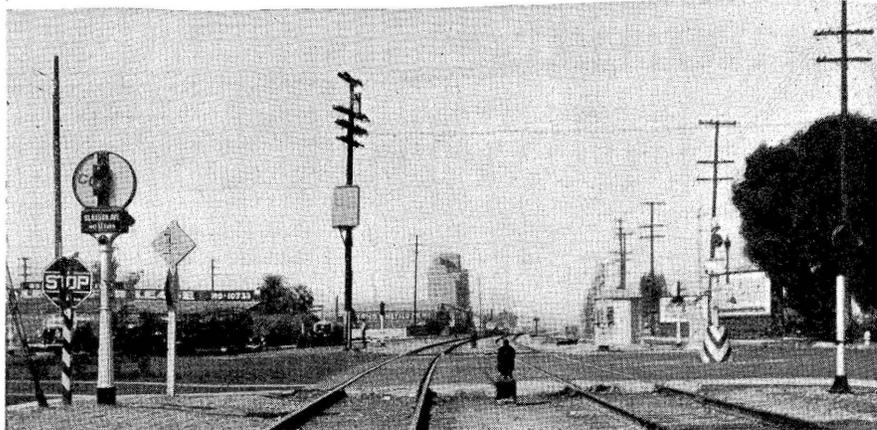
and are arranged for traffic in both directions on all tracks. The approach of any train clears its own signal (conditions permitting) and locks out all other signals.

Releases are provided at the intersection for use by trainmen in case of track-circuit failure, or to provide a means for taking the signal away from a train performing switching in the clearing section on a conflicting route. The release consists of a time relay set in operation by a pushbutton. The pushing of the button first sets the conflicting signal to "Stop." The movement of the signal to "Stop" is indicated, to the man operating the release, by the lighting of a small red indicating lamp by the side of the pushbutton. After a two-minute interval the desired signal should clear.

Control of Highway Crossing Protection

The wigwag signals are automatically controlled in the usual manner except that they do not operate unless the railway signals have cleared for an approaching train. The wigwag control is so arranged that it is extended to the highway traffic signals, nullifying the cycle control and coordinating the indications of the traffic signals with train movements.

The proper location of the wigwag signals for the protection of these



View looking north along Southern Pacific track across Slauson avenue

crossings was a problem. The wigwag signal for the Southern Pacific is located in the center of the street east of the tracks. On account of the necessity to leave the turning space at the intersection of the streets unobstructed, it was not possible to so locate another wigwag on the west side of the track. The one signal, therefore, serves for the approach of vehicles to the Southern Pacific track from any direction on any of the streets. The slow train speeds were, of course, taken into consideration in this matter. On the Santa Fe, both wigwags are quite visible to north and south traffic in both directions.

The interlocking home signals are of the searchlight type with double filament 13.5 plus 3.5-watt lamps, rated at 8 volts. The two signals located between the tracks on the Southern Pacific are mounted on low concrete foundations to provide adequate clearance. However, the other four signals are mounted on 3-in. pipe masts high enough to bring the center of the lens $7\frac{1}{2}$ ft. above the level of the rail. On this installation all of the wiring is in metal conduit which was jacked across under the pavement.

Control Equipment Centrally Located

With but few exceptions, all of the relays and control batteries are located in a concrete house at the crossing. A double rack, four shelves high, extends through the house, with a passageway on each side. The storage battery is located on the lower shelf with relays on the upper three shelves. An Esterline-Angus automatic time recorder with 17 operating pens is mounted on the end of the rack toward the door. Below the time recorder are two double-pole knife switches so connected in the circuits that the control of the crossing signals and traffic signals can be cut out

when testing the automatic interlocking.

The storage batteries are of the Exide Type-DMGO-9. There are three batteries of four cells each, one of which is used for the home signals on each of the three tracks. One battery of four cells is provided for the Southern Pacific wigwags and one battery of five cells for the Santa Fe wigwags. Each track circuit is operated by a set of four cells of Edison primary battery. This installation was designed and constructed by Santa Fe signal forces, the signals, relays, etc., being furnished by the Union Switch & Signal Company.

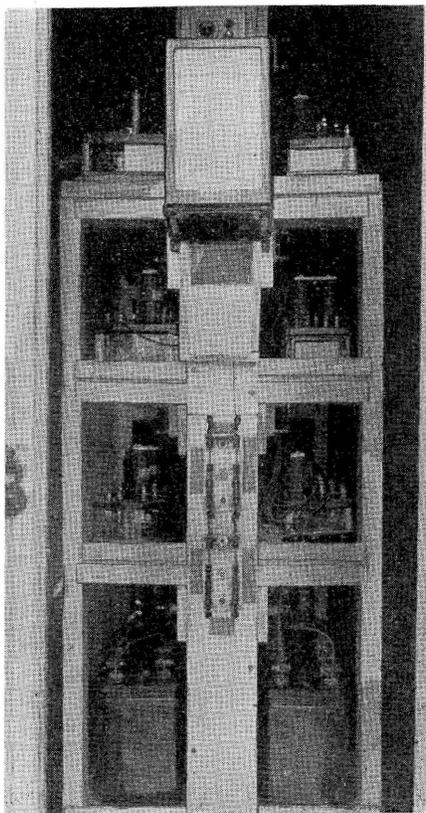
The installation has been in service for five years with no failures to date. The co-ordination of highway traffic signals with train movements at this point was the forerunner of all such installations on the Pacific Coast.

Frisco Track Circuits

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from an average of 0.58 volts to about 0.36 volts increases the shunting sensitivity. Roughly, every 0.1-ohm increase in the limiting resistance improves the train shunt 0.03 ohm. Failure of the relay to shunt occurs when the current through the relay remains above the drop-away value. With the 9-C or Model-13 relays the voltage across the relay is normally 0.53 volts and the current 127 m.a., while with the DN-11 relay the average readings are 0.35 volts and 82 m.a. Therefore, it would seem to be much easier for a train to cause an effective shunt on circuits using the DN-11 relays.

The primary battery used on these installations is the Edison M-500 type with 505-type glass jars, and the relays are of Union Switch & Signal Company manufacture.



Instruments and battery in concrete house