Signal Lighting for the Movement of Traffic in Fog

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● THERE is a distinction between illumination and signal lighting. In the former, of which street lighting is an example, light is directed towards objects to make them visible. In the latter, as in the case of traffic signals, lights are exposed to give information directly.

The utilization of light in fog is principally governed by two basic principles: (1) the attenuation of the light exponentially with the distance it travels, that is, if 9/10 of the original intensity is scattered and absorbed in the first 100 yards, 9/10 of the remaining intensity will be similarly lost in the next 100 yards; (2) the visibility of lights and objects depends generally upon the contrast between their brightness and the brightness of their background, the threshold for the necessary contrast being approximately a constant ratio to the background brightness.

These principles give signal lighting an advantage over illumination as a means of controlling traffic in fog. In the case of illumination produced by lights carried on the vehicle, the light has to travel from the vehicle to the object and back to the driver, twice the distance necessary for light from a signal lamp in the same location as the object. This may readily result in a ratio of 1,000 or more times as much intensity being required to produce visibility by means of illumination as would be required for the visibility of signal lights.

Highway lighting, on the other hand, suffers from the disadvantage of losing some of its intensity in reflection at the object seen and from the dazzling effects of the lights themselves. For indicating the position of a vehicle, the signal light has the advantage that it is possible to have a much-higher contrast between the brightness of the light and its fog background than can be obtained with an object. This fact is recognized in the practice of those drivers who are accustomed to light their head lamps in the daytime when driving during periods of low visibility.

The experience of aviation lighting engineers in guiding air traffic through fog was reviewed. This work started in 1934, and it was soon discovered that far more aid could be given pilots in cases where traffic was limited to narrow channels than in cases where traffic was approaching from all directions. As a result, the lighting of runways and the development of approach lights was emphasized. Tests have now established that where high speeds are involved, two rows of lights parallel to the direction of travel are better than a single row on the left, but that a single row in the center is better than either. Tests are still going forward to determine the optimum configuration for the landing operation.

During the course of the aviation work, three devices have been developed which may be useful in connection with solving the highway traffic problem: (1) the fog simulator, which so controls the intensities of lights that the pilot or driver constantly sees only a few lights ahead of him even when operating in clear weather; (2) the kinorama, which simulates the visual appearance of lights as seen by a pilot during the landing operation, the apparent location of the lights corresponding to the manipulation of controls simulating those of an airplane; (3) the transmissometer, which measures the transmission of light through the atmosphere and gives an indication of the density of fog at a desired location, which may be remote from the measuring instrument.

Applying these principles to the highway problem, it seems logical to test centerlines of retroreflective paint on roadways, but because of the visual cutoff of the automobile hoods which would obscure the lines for some distance ahead of the cars, the prevailing practice of using sidelines may prove superior for the relatively slow speeds at which it would be feasible to move highway traffic in fog. A single line of lights on the left may prove superior to either of these by reason of its having a

longer visual range than is obtainable with retroreflective paint.

A line of "fixed" signal lights on the left may well provide the necessary directional guidance, but the movement of traffic in fog also requires speed control and the proper spacing of vehicles. Speedometers are unsatisfactory for speed control in fog because with the reduced visibility, attention should be concentrated on the roadway. Subjective estimates are unsatisfactory because a driver's judgment will be distorted by his previous driving at high speeds and by the lack of many of his customary visual cues. For spacing, tail lights are unsatisfactory, since the fog increases the apparent distance to them. Block signals might be used, but as carried out by the railroads, they would not provide the speed regulation desirable.

The speaker suggested the investigation of a new system having a continuously moving signal configuration. The system might consist of fixtures at uniform distances, perhaps 100 feet apart, along the left side of the traffic lane. Each fixture would contain red, green, and yellow lights which would be varied in intensity in such a way that each color would seem to be traveling down the highway following the other at a constant speed. The driver would drive so as to keep slightly behind the green signal. This would place the cars a distance apart equal to three times the distance between the fixtures. It would probably be desirable to reserve a traffic lane on the right as a lane of refuge for any driver who found himself incapable of following the lights, vehicles in this relief lane being limited to very slow speeds such as 10 mph. It might also be desirable to utilize some sort of block signal system to produce an emergency signal in case a car stopped in the speed regulated lane.