

TABLE SHOWING APPLICATION OF LUNDIE FORMULA TO TRAIN RESISTANCE TESTS.

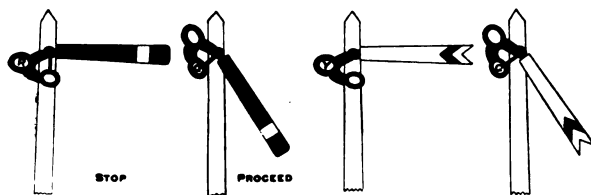
TEST MADE BY	Year	ON	MEM.	Average speed miles per hour.	Train weight, Tons.	TRAIN RESISTANCE.	
						Observed.	Lundie formula.
Wm. Stroudley.	1885	London, Brighton & South Coast.	Single test.	43.3	376	13.2	14.1
			Mean of six tests.	70	270	19.08	21.1
Angus Sinclair.	1892	New York Central.	Single test.	69.6	270	19.8	21.2
			Single test.	51.43	313	16.9	16.25
P. H. Dudley.	1882	Phila. & Reading.	Single test.	80	242.5	18.85	19.0
			Single test.	63.5	242.5	19.5	19.9
			Single test.	63.2	213	19.0	20.2
Clark formula.	1892	C. R. R. N. J.	Single test.	10	100	7.74	7.04
			Single test.	10	200	7.74	6.6
			Single test.	10	300	9.5	9.2
			Single test.	20	100	9.5	10.08
			Single test.	20	200	9.5	9.5
			Single test.	20	300	12.42	13.1
			Single test.	30	100	12.42	11.8
			Single test.	30	200	12.42	11.8
			Single test.	30	300	12.42	11.8

Mr. Lundie himself has made no experiments with heavy passenger trains. The criticism which has been made of previous formulæ is that the results given are too high, and from the above comparison it would appear that an improvement has been made. It is hardly possible to form an opinion from the meager records at hand relative to the merits of the new formula. The standing of its sponsor and the results of comparison so far as possible with obtainable records, however, seem to warrant a trial of the formula in future calculations.

YELLOW LIGHTS FOR DISTANT SIGNALS.

The action of the New York New Haven & Hartford railroad in changing the colors of the lights used for night signals is one of the most interesting events which have recently taken place in railway signaling practice. The change consists in the use of green instead of white lights to denote safety and yellow instead of green lights for caution, the usual red light being retained for a danger signal. The reasons for, and the experiments leading up to, the change are related in a letter to The Railway Age by Mr. W. E. Chamberlain, general manager, who writes us as follows:

In September, 1898, we had an accident at Whittenton Junction, on our Taunton division, caused by a mistake of an engineer, who took a white light on an uplified crossing gate for safety indication of the signal, and investigation showed that the signal was displayed in danger position, but the light of the lantern had gone out. The Massachusetts railroad commissioners, in their investigation and annual report just published, called attention to the matter, and recommended the discontinuance of white for a safety signal, or the establishment of a derailing switch at such danger points. The matter received careful attention, and was the subject of a great many experiments. The



NEW ARRANGEMENT OF SIGNAL COLORS—N. Y. N. H. & H. RD.

prominence of the red light in the Chicago & Northwestern combination distant signal (red and green) was objectionable, as was also the use of two white lights, as had been previously suggested. The experiments with the old-fashioned amber and various other kinds of ready-made yellow gave little satisfaction, but some encouragement; and as a result we had several lots of glass of different shades and finish made, until a satisfactory color was furnished. Several kinds, differing but slightly in their shades, were put into operation on Feb. 26, 1899, on seven divisions, and the other three, completing the eastern district, were equipped on March 5. There is no change or question whatever concerning the positive red danger signal. The lowered position of both home and distant signals is now indicated by a green light, as used on practically all English and many American roads, with the new yellow displayed when the yellow distant signal is in a horizontal position. The change is in every way satisfactory. The engineers feel relieved by increased fa-

cility of recognizing signal lights in the distance, and from being in no further danger of repeating the Whittenton accident, by substituting the ordinary white light for an absent danger signal. The yellow is so much deeper in shade than the ordinary white light as to be instantly recognized from any number of white lights that may be in line, and yet is not dark enough to suggest confusion with red, but of course if so mistaken would be but an error on the side of safety.

I inclose sketch of semaphore arm and method of application of spectacle.

The sketch referred to is reproduced herewith and shows clearly the arrangement and operation of the signals.

The report of the Massachusetts railroad commissioners, referred to in Mr. Chamberlain's letter, cites the accident at Whittenton Junction and discusses the general question as follows:

The usual colors for railroad signals, which until recently have been almost universally adopted in all civilized countries, are the following: White, to signify safety; red, to signify danger, and green, to signify caution. These colors were agreed upon at a congress of railway men held in Birmingham in 1841. The choice of these colors resulted originally from the experiments of the brothers Chappe, in France, in connection with the establishment of a signal system devised by them. Among other results of these experiments they stated that the visibility of a red light was but one-third that of a white light of the same intensity, that of a green light one-fifth, and that of a blue light one-seventh. White was chosen as the signal for safety, as being the usual light, as well as the most easily visible; while red, as the most easily visible of the colored signals, was chosen for the most important signal, that of danger. So far as visibility was concerned, it would have been desirable for the danger signal to be of the color most easily seen, but it was of course impracticable to use white for a danger signal.

The serious objections to the use of white as a safety signal soon became evident, and have resulted in England in the universal substitution of green as the safety signal at fixed signals, and the abandonment of the cautionary signal (at the home signal post). Green, however, is still used to signify caution in the case of hand or temporary signals. The permissive block system, so widely used in this country, is not used in England, so that a cautionary signal is not there considered necessary, and on English railroads the distant signal is simply a duplication of the home signal.

The objections to white as a safety signal are familiar to all railroad men. They are, first, that if the red lens which forms the danger signal be broken, the light will show safety instead of danger; and, second, that (as in the Whittenton accident) the danger signal may be extinguished, and the engineer may mistake some other white light for the safety signal. The first objection may be, in a measure, and perhaps wholly, obviated by the use of wire glass for the lens; nevertheless, the principle seems sound that the safety signal should be a positive signal.

Notwithstanding the abandonment of white as a safety signal in England, the great majority of American railroads still use this color. The principal arguments urged against giving it up seem to be the following: First, that the engineers are accustomed to its use, and that any change would be dangerous, since a white light not on the railroad might be taken as a safety signal from force of habit; second, that on our railroads, principally because of the extensive use of the permissive block system, it is necessary to have a signal for caution; and it appears difficult to find a suitable color for this purpose. Blue is not suitable, on account of its slight visibility, particularly since the light from the usual lamp flame contains few blue or violet rays. Amber or orange has been suggested, but is objectionable as being so easily confused with red (if the tint is dark) or with white (if the tint is light). This difficulty has been met on some roads, however, by using as a cautionary signal a red and a green light, or by using some combination of green lights.

The report cites the several actions of the American Railway association in the matter and concludes as follows:

The opinion seems to be gaining ground, therefore, that white should be abandoned as a signal color. We conceive this to be probably the better opinion. The matter should, at all events, receive the careful attention of railroad managers:

The alacrity with which the matter has been taken up by one of the principal roads in its jurisdiction should prove decidedly encouraging to the Massachusetts commission.

The Mexican International, Mexican National, Monterey & Mexican Gulf and Monterey & Mineral Belt roads are considering plans for the erection of a union depot at Monterey, Mexico, to cost \$1,000,000.

The Pennsylvania lines have placed a steam motor car on the road between Springfield and Xenia, Ohio, and have established an interurban rapid transit service between those points, a distance of 19 miles, the schedule time being 50 minutes.