

Penn. R. R. Baggage Car Lighting Tests

It will be recalled that in 1912 an extensive series of tests was made on the illumination of postal cars by the illumination committee of the A. R. E. E. and similarly comprehensive series of tests on the illumination of coaches was made the following year under the auspices of the same committee. The first series of tests on postal car lighting were reported in the March, 1913, issue of the RAILWAY ELECTRICAL ENGINEER and the second series of tests on coach lighting were reported in the October, 1913, issue of the RAILWAY

intensifies the illumination on trunks nearer to the floor of the car than would be obtained where bare lamps are used.

Report of the Tests

The following is the complete report of the baggage car lighting tests made by the Pennsylvania Railroad.



Fig. 1. Present Spacing Using BAD-60 Holophane Reflectors. Note the Heavy Shadow Lines Between the Units on the Upper Walls.



Fig. 2. Showing Illumination with 7 ft. 6 in. Spacing Recommended for PB-70 Cars. Note the Great Improvement in Shadow Lines Over Fig. 1.



Fig. 3. Showing the Illumination with 8 ft. 6 in. Spacing which is Recommended for B-60 Cars. Note the Shadow Lines Are but Slightly More Pronounced than in Fig. 2.

ELECTRICAL ENGINEER, and were later published in book form by the association.

No tests were made at that time on baggage car illumination, and as this class of service involves special requirements peculiar to this service, this series of tests made by the car lighting department of the Pennsylvania R. R. will be very interesting, and may be considered as equally valuable as the previous tests of postal car and day coach lighting. Extreme care was employed to insure that all data be of high accuracy, as was done in the first tests, and some of the same men employed in the earlier testing crew were employed as operators in these tests.

The requirements for baggage car lighting are different from that of any other class of car lighting service. Baggage is piled high along both side walls, leaving a narrow aisle down the center, and illumination is desired on the tags and faces of the trunks piled both near the floor and near the ceiling of the car. Therefore, a deep bowl reflector, which would be suitable for postal car service, is not suitable for baggage car service, on account of the high screening angle of the reflector darkening the upper portion of the pile of trunks. On the other hand, a properly designed reflector of the shallower bowl type does not interfere with the illumination at the upper zone, but

Object of Tests.

It was desired to ascertain whether or not sufficient illumination was being provided in baggage cars and if not, to determine an arrangement that would prove satisfactory. To form a basis for conclusions illumination tests were made in a B-60 and the baggage portion of a PB-70 car with the present arrangement of light units equipped respectively with no reflectors, Holophane aluminized steel reflector No. 18460 and Holophane aluminized steel reflector No. BAD-60, followed by tests in a B-60 car having light units at various spacings and with the different reflector equipment above mentioned.

Conclusions.

From the details of the tests hereinafter presented, the following conclusions are drawn:

1. The present arrangement of light units in PB-70 (passenger—baggage, 70 ft.) and B-60 (baggage, 60 ft.), cars with the reflector equipment now used (Holophane 18460) gives very poor illumination both in intensity and distribution, and this deep bowl type of reflector is not suited to baggage car lighting.

2. An installation of 5 units spaced 7 ft. 6 in. and equipped with Holophane reflector No. BAD-60 at

$1\frac{3}{8}$ " position is recommended for PB-70 cars and 7 units spaced 8 ft. 6 in. and equipped with Holophane reflector No. BAD-60 at $1\frac{3}{8}$ " position for B-60 cars.

3. If, on account of the expense, it is thought inadvisable to change locations of light units in PB-70 and B-60 cars already built, it is recommended that no reflectors be used in these cars, the bare lamps giving better results than a shallow bowl reflector.

Illumination Requirements.

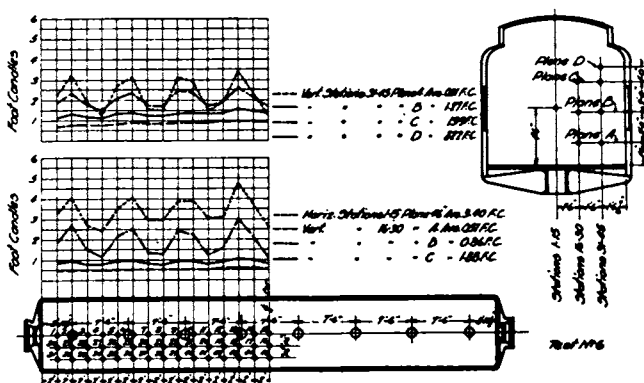
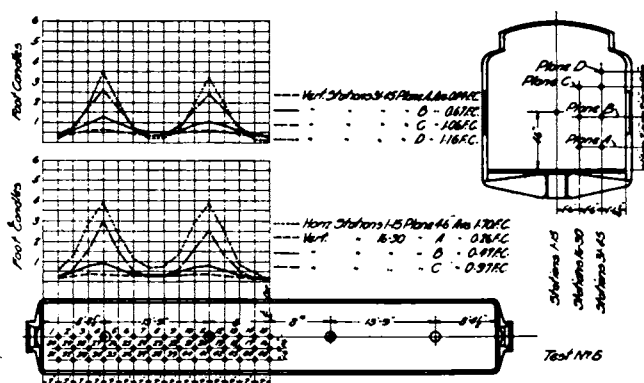
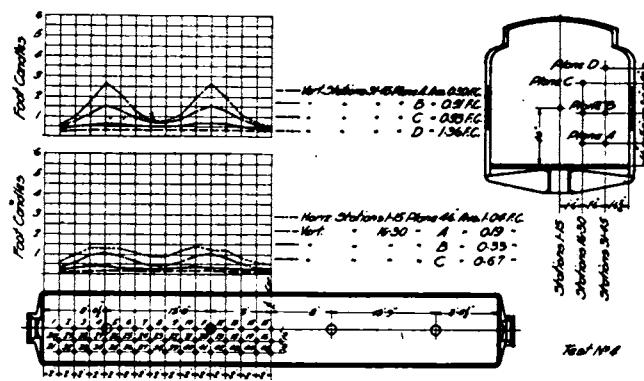
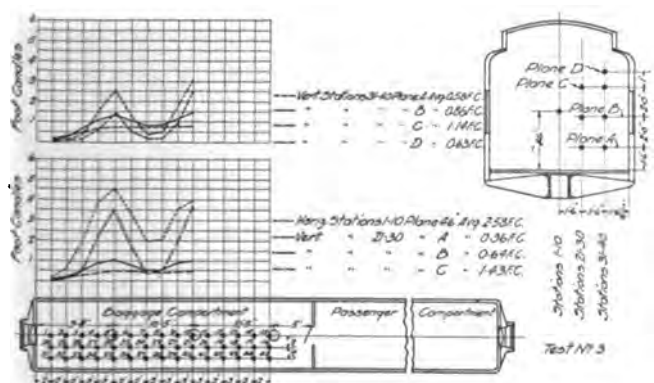
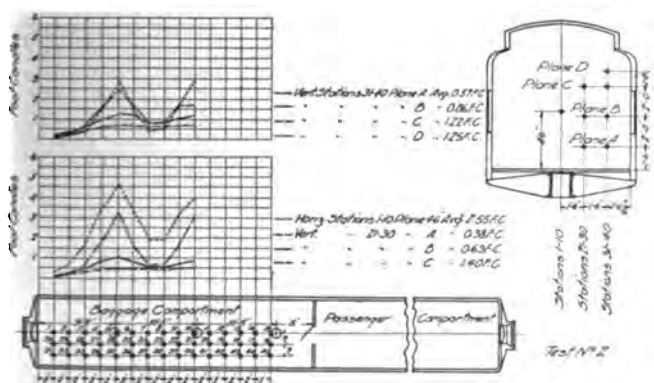
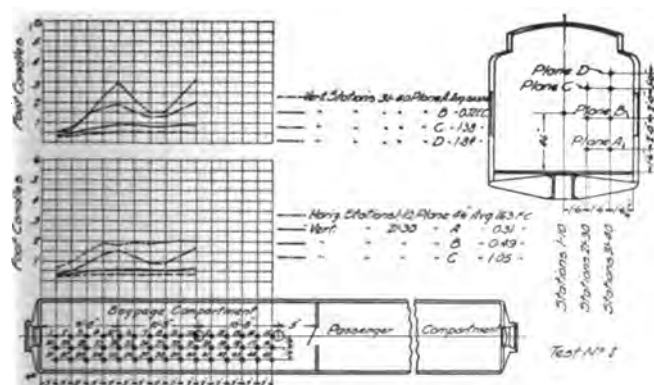
The load in a baggage car, when the latter is well filled, will extend from about $1\frac{1}{2}$ ft. beyond longi-

center line will necessarily be low, even though the horizontal intensity is 3 or 4 foot candles, because of the small angle between such location and the nadir of the nearest unit.

Details of Tests

General.

The tests were made at Altoona Car Shops in PB-70 car No. 4829 after same had been turned out of Paint Shop and in B-60 car No. 5691 which was taken out of service for the purpose, but the interior paint of which was clean. A Sharp-Millar photometer was used to



tudinal center line of car to side of car and as high as about 6 or 7 ft. along the side.

Tags and labels will ordinarily be in a vertical longitudinal plane, hence vertical and not horizontal illumination intensities are important. With any reflector equipment suitable for these requirements, the vertical illumination near floor of car and $1\frac{1}{2}$ ft. from

obtain the foot-candle intensities and all precautions possible were taken to insure accuracy. At all stations the light measured fell directly on test plate of photometer tube, no diffusing plate for indirect readings having been used.

The lamps used in the fixtures were specially made without "getter" properly aged and selected to give

practically equal lumens, of the rating 50 watts, 63 volts, G-30 bulb, and were held at a voltage to give 37.6 H.C.P.

Equipment Tested.

Tests were made in both cars with bare lamps, and with Holophane aluminized steel reflectors No. 18460 (deep bowl) and No. BAD-60 (shallow bowl). In addition to the original spacings of lamp units, tests were made with spacings of 7 ft. 6 in. and 8 ft. 6 in. respectively. The distance between floor and center of lamp filament was in all tests of each car the same,



Fig. 4. Showing the Illumination with Deep Bowl Reflectors. Holophane No. 18460. Notice that Rather Heavy Shadows Are Cast on the Side Walls and Upper Ceiling Due to the Screening Angle of the Reflector.

viz: 8 ft. 6 in. in PB-70 car and 8 ft. 8¼ in. in B-60 car, the latter being obtained by using the shortest fixture of standard design.

Readings Taken.

The location of reading stations is shown on sheets No. 1 and 4 for PB-70 and B-60 cars respectively. Horizontal foot-candles were read on the center line of car on a plane 46 in. above floor, the remaining readings being in vertical foot-candles.

Averages obtained at each station are plotted on curve sheets Nos. 1 to 11 inclusive, which are self explanatory. Sheet No. 12 is a tabulation of average maximum and minimum foot candle values along the same longitudinal line of car and in the same plane, as indicated.

Photographs of the interior of car with various equipment and spacings are shown in Figs. No. 1 to 4 inclusive. These are intended to show only shadow lines and are not comparable with each other to show relative brilliancy.

Analysis of Results

The present arrangement of light units in the PB-70 cars, as shown on test No. 1, brings the minimum illumination in the vicinity of Stations No. 30 and 31, and this end of the car should therefore receive prime consideration. By inspecting tests No. 1, 2 and 3 it is seen that with reflector 18460 (Sheet No. 3) the intensity is very low in the end of the car (Stations 30

Illumination Tests in Baggage Cars

Average Foot Candle Values Along Longitudinal Lines of Car

	Nature of Val.	Horis. 46" Pl.	VERTICAL						
			16-30A	31-45A	16-30B	31-45B	16-30C	31-45C	31-45D
Test No. 1; PB-70.....	Avg.	1.63	0.31	0.45	0.49	0.72	1.05	1.38	1.84
Bare Lamps.....	Max.	1.95	0.36	0.53	0.59	0.88	1.61	2.01	3.16
Present Spacing.....	Min.	0.61	0.20	0.26	0.25	0.32	0.34	0.43	0.46
Test No. 2; PB-70.....	Avg.	2.55	0.38	0.57	0.63	0.86	1.40	1.22	1.25
Holophane BAD-60.....	Max.	4.73	0.50	0.72	1.07	1.28	3.32	2.53	3.17
Present Spacing.....	Min.	0.32	0.14	0.18	0.13	0.19	0.09	0.10	0.06
Test No. 3; PB-70.....	Avg.	2.58	0.36	0.58	0.64	0.86	1.43	1.14	0.63
Holophane 18460.....	Max.	3.92	0.48	0.74	1.02	1.43	3.63	3.07	2.44
Present Spacing.....	Min.	0.15	0.11	0.15	0.08	0.10	0.05	0.05	0.04
Test No. 4; B-60.....	Avg.	1.04	0.19	0.30	0.33	0.51	0.67	0.93	1.36
Bare Lamps.....	Max.	1.43	0.21	0.33	0.40	0.62	1.12	1.51	2.62
Present Spacing.....	Min.	0.53	0.16	0.21	0.23	0.34	0.29	0.45	0.53
Test No. 5; B-60.....	Avg.	1.70	0.26	0.44	0.47	0.67	0.97	1.06	1.16
Holophane BAD-60.....	Max.	3.84	0.37	0.62	0.91	1.23	3.00	2.57	3.47
Present Spacing.....	Min.	0.35	0.14	0.26	0.18	0.29	0.11	0.17	0.09
Test No. 11; B-60.....	Avg.	1.93	0.29	0.51	0.52	0.80	1.22	1.06	0.68
Holophane 18460.....	Max.	3.86	0.39	0.74	0.99	1.62	4.27	3.22	2.80
Present Spacing.....	Min.	0.22	0.14	0.27	0.12	0.19	0.05	0.07	0.05
Test No. 10; B-60.....	Avg.	3.07	0.85	1.20	0.45	0.71	1.74	1.79	1.97
Holophane BAD-60.....	Max.	4.27	1.03	1.47	0.51	0.77	2.90	2.68	3.56
8'-6" Spacing.....	Min.	1.82	0.66	0.97	0.39	0.58	0.73	1.07	0.70
Test No. 9; B-60.....	Avg.	3.12	0.46	0.80	0.82	1.23	1.96	1.66	1.06
Holophane 18460.....	Max.	3.93	0.50	0.84	0.97	1.47	3.64	3.12	1.94
8'-6" Spacing.....	Min.	2.07	0.42	0.65	0.74	0.93	0.42	0.44	0.20
Test No. 7; B-60.....	Avg.	1.99	0.39	0.59	0.62	1.02	1.27	1.86	2.71
Bare Lamps.....	Max.	2.20	0.43	0.64	0.65	1.27	1.38	2.07	3.24
7'-6" Spacing.....	Min.	1.60	0.32	0.44	0.51	0.77	1.12	1.53	2.26
Test No. 6; B-60.....	Avg.	3.40	0.51	0.81	0.86	1.27	1.88	1.99	2.22
Holophane BAD-60.....	Max.	4.70	0.59	0.93	1.04	1.54	3.00	2.59	3.33
7'-6" Spacing.....	Min.	2.41	0.43	0.66	0.74	1.09	1.14	1.50	1.19
Test No. 8; B-60.....	Avg.	3.67	0.53	0.93	0.99	1.54	2.42	1.99	1.24
Holophane 18460.....	Max.	4.37	0.59	1.00	1.09	1.77	4.13	3.00	2.55
7'-6" Spacing.....	Min.	3.11	0.42	0.69	0.87	1.22	0.98	0.92	0.31

and 31) and midway between units (Stations 23 and 38). Reflector BAD-60 (Sheet No. 2) slightly improves conditions around the latter named stations but does not improve the low readings at end of car. The best results are obtained by using no reflector at all as in Sheet No. 1.

Therefore, if this location of units is maintained in cars already constructed, it is advisable to remove reflectors. If practicable to change fixture locations, the results of the tests on B-60 car will apply equally to PB-70 in determining best spacing.

Present Spacing.

60-Foot Baggage Cars.

Tests made	Sheet No. Plots	Photographs
Bare lamps	4	..
BAD-60 reflector	5	13
18460 reflector.....	6	14

By referring to tests No. 4, 5 and 11, it is seen that, with present spacing of light units, the intensity values fall so low at a considerable number of points as to make these minimum values the determining factor in

selecting equipment. Table No. 1 shows the minimum values to be as follows:

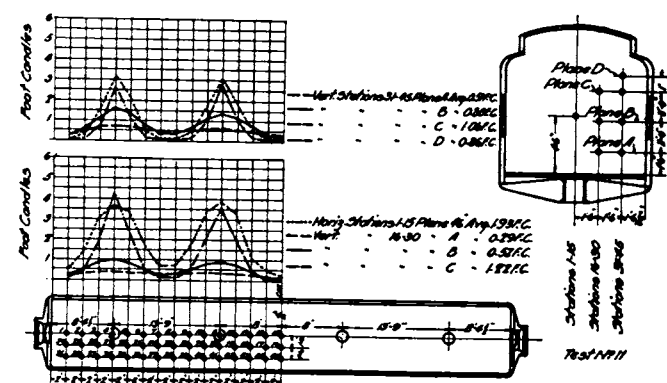
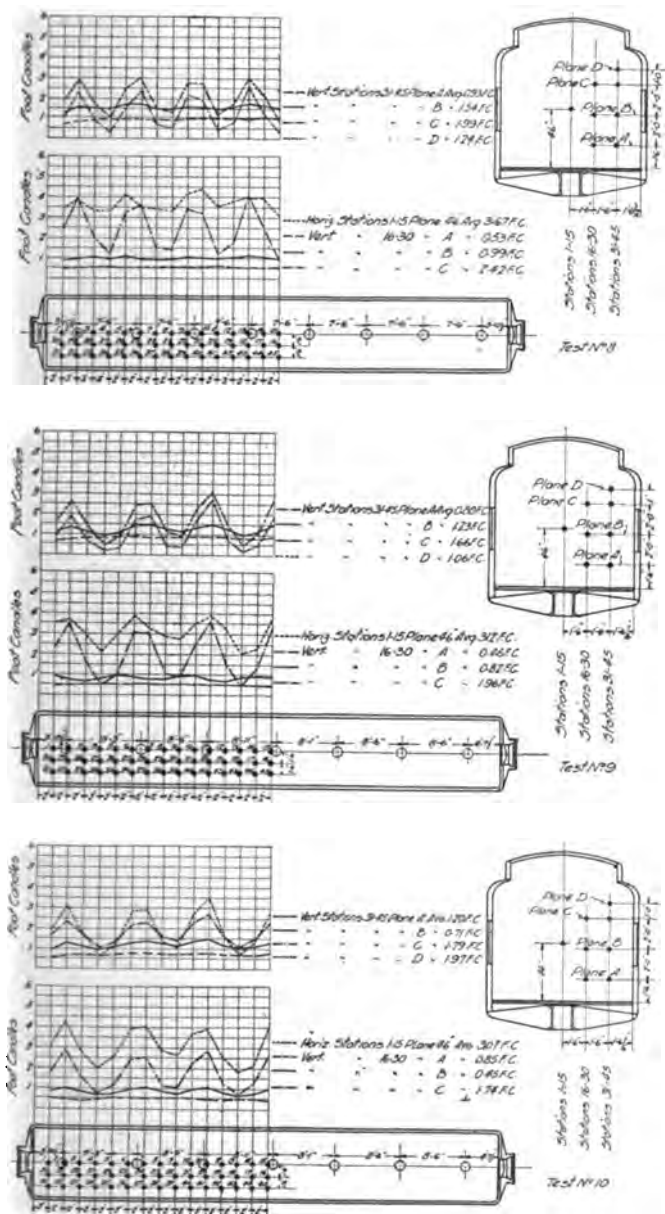
Stations	Bare Lamps	BAD-60	18460
Horizontal	0.53	0.35	0.22
16-30 A.....	0.16	0.14	0.14
31-45 A.....	0.21	0.26	0.27
16-30 B.....	0.23	0.18	0.12
31-45 B.....	0.34	0.29	0.19
16-30 C.....	0.29	0.11	0.05
31-45 C.....	0.45	0.17	0.07
31-45 D.....	0.53	0.09	0.05

On all reading planes, except stations 31 to 45, plane A, the bare lamps show better results and the rank

an 8 ft. 6 in. spacing of light units to be considerably lower midway between units with 18460 than with BAD-60 reflector, on the two upper planes C and D. In other words, 18460 reflector cuts off the light in such a manner that there is a dense shadow cast on the side of car which shadow is longest midway between units as may be seen by referring to the photograph, Fig. 4. This shadow is much shortened and less dense with BAD-60 reflector, as shown in photograph, Fig. 3.

The BAD-60 equipment at this spacing gives ample illumination throughout the car with sufficient uniformity and is therefore recommended for B-60 cars.

If this spacing is used in PB-70 cars, the distance between the ends of car and first unit would be 5 ft.,



which is too great to give sufficient illumination in ends of car. It is therefore recommended that 5 units equipped with BAD-60 reflectors be used in PB-70 at a spacing of 7 ft. 6 in.

7 Ft. 6 In. Spacing.

Tests made	Sheet No.	
	Plots	Photographs
Bare lamps	9	..
BAD-60	10	17
18460	11	18

The results of the tests at a 7 ft. 6 in. spacing show, with all equipment, slightly more uniformity and somewhat higher intensities on certain stations than with the 8 ft. 6 in. spacing but hardly enough better in these respects to warrant the extra unit, considering the desirability of keeping the total wattage as low as possible consistent with sufficiently good results.

Test No. 8 shows the foot-candle plots by use of 18460 at this spacing and shows that, even at so close a spacing, the 18460 has too low an angular cut-off to meet the requirements, the illumination on plane D falling too low between units. Altoona, Pa., May 1, 1915.

Train Dispatching by Wireless.

It is now possible to communicate from a moving train to a fixed station a distance of 130 miles. The train radio service has been used for a variety of purposes, such as reporting the number of passengers on board for connecting lines, for ambulance service and commercial telegrams. The cost is not prohibitory considering the advantages to be gained. One year the pole lines in New Jersey and New York and Pennsylvania were almost completely wrecked by sleet storms, and wireless was about the only communication for about 10 days.

of equipment is: 1st, bare lamps; 2nd, BAD-60; 3rd, 18460.

If it is inadvisable to change the spacing in B-60 cars already built, it is recommended that no reflectors be used.

8 Ft. 6 In. Spacing.

Tests made	Sheet No.	
	Plots	Photographs
BAD-60	7	15
18460	8	16

Tests 9 and 10 show the illumination resulting from