SOUTHERN REGION TOPICS

O. S. NOCK, B.Sc. M.I.C.E. M.I.Mech.E. M.I.Loco.E.

WHEN news was published in recent months that the long-expected extension of the Southern electrified system had been authorised, one would imagine that most students of modern railway operating practice would have assumed that the entire project would be planned in exactly the same style as in previous Southern electrification schemes. In other words it would be "another Kent Coast", or "another Portsmouth". But the electrified Southern, despite its undoubted power of attracting new traffic, and despite its ability to convey vast numbers of season-ticket holders into and out of London in the rush hours, does inevitably involve the employment of a very large amount of rolling stock in the peak periods, much of which is not heavily used for the greater part of the day. The latest project is complicated further to the extent that electrification was justified financially only as far as Bournemouth.

The operating department was faced with the difficult problem of how to provide for the Weymouth line. It would not be possible, for example, to follow earlier precedents, and run a 12-coach multiple-unit electric train to Bournemouth, and then divide it at Bournemouth Central, running separate sections forward to Bournemouth West and Weymouth—as the Kent Coast trains are now divided at Faversham, or the Hastings trains divided at Eastbourne. To adopt locomotive haulage between Waterloo and Bournemouth would introduce the unwanted complication of light engine working and the occupying of valuable platform space at the terminus.

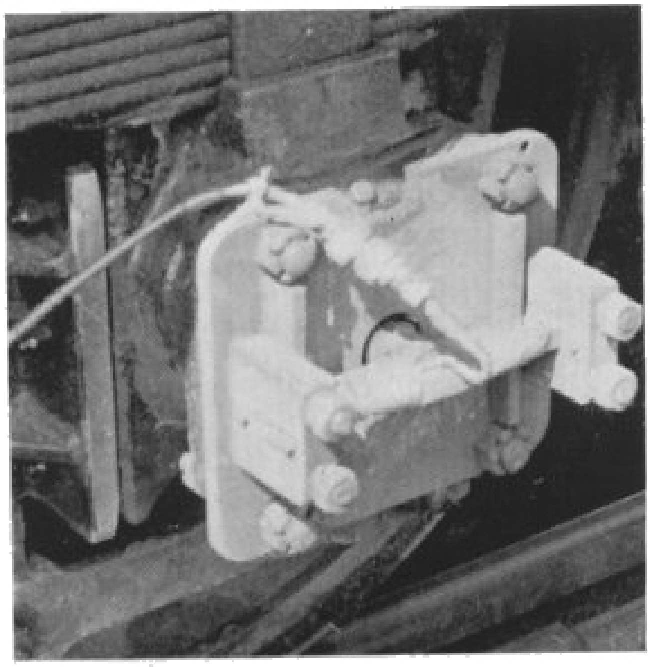
In earlier electrification projects on the Southern, much of the attraction from the operating point of view stems from the fact that the motive power does not have to be separated from its train at journey's end. As a Southern operating man once expressed it to me: "Locomotives are so *untidy*, compared with an m.u. train." It was in considering all aspects of the proposed electrification to Bournemouth that a novel and elegant solution was attained, by the principle of propelling the trains in one direction and hauling them in the other.

The idea of propelling at medium-high speed was not new. It has been used for more than thirty years on the fast residential services of the Eastern and Northern Regions of the French National Railways, with large 2-8-2 steam locomotives working on the push-and-pull principle at speeds up to 75 m.p.h. But on the proposed electric services to Bournemouth it was another matter, because speeds up to 100 m.p.h. were to be involved. How the problem has been investigated, both from the viewpoint of safe riding, and in the remote control of the power units when propelling, was described in a most interesting paper read before the Institution of Locomotive Engineers on April 12, 1965, by Mr. W. J. A. Sykes, Chief Mechanical and Electrical Engineer, British Railways, Southern Region.

The ideal operating unit, towards the introduction of which the experiments were directed, was a 12-car train between Waterloo and Bournemouth Central, consisting of eight coaches destined for Weymouth propelled from Waterloo by a high-powered four-coach motor unit. From Bournemouth Central the eight non-powered cars would be taken forward to Weymouth by a diesel-electric locomotive.

But the idea of propelling was not confined to the electrified sections. Certain groups of diesel-electric locomotives would also be equipped for push-pull working, and the Weymouth sections of the London trains would be hauled in the down direction, and propelled in the up, thereby avoiding light engine movements, or uncoupling at Weymouth. On the up journey the eight-coach Weymouth portions would be combined with the four-coach electric sets, and hauled to Waterloo. It was envisaged, however, that very few, if any, spare 12-car trains of this type would be available for extra workings at holiday weekends, and so on, and so the investigation recently concluded on the Southern Region also included the propelling of 12-car trains by locomotives, either electric, diesel-electric, or electro-diesel.

The first stage of the investigation was to examine the riding qualities of the standard Southern stock in comparable conditions of running, whether being hauled, or being propelled. The most important aspect of the tests was concerned with the ability of the train to traverse curved sections of the line with no greater possibility of derailment than with hauled trains. Apart from observations of the general riding of the vehicles in such conditions, an apparatus was devised to measure lateral axlebox forces. The lateral component of



Axlebox instrumented to record lateral forces

the tractive effort on the draw-gear would be greatest on the vehicle next to the power-unit, whether locomotive or otherwise, and so arrangements were made to measure these forces on all eight axleboxes of that vehicle. Tests were carried out with both new and worn tyres.

Two series of tests were made. The first was with an eight-coach train, consisting of seven open second-class coaches of steam stock and a motor luggage van, as used on the Continental boat expresses, but with the motors inoperative. This train was alternately hauled and propelled by a pair of electro-diesel locomotives, Nos. E6003 and E6004. The motor luggage van was used at the trailing end, because it formed a convenient vehicle from which to arrange for remote control of the locomotives when propelling.

On the South Eastern main line between Tonbridge and Ashford this test train was propelled at speeds up to 100 m.p.h. Mr. Sykes's paper presented to the Institution of Locomotive Engineers includes a large number of test results, from which the conclusion may definitely be drawn that there are no significant differences between the lateral forces set up when hauling or propelling. To quote Mr. Sykes: ". . . the overall conclusion can be drawn that for curves of radius greater than about ten chains there is no safety problem when the train is propelled."

The second test train consisted of electric express multiple-unit stock, with the motors rendered inoperative. From the locomotive the train was made up as follows: one four-coach set that had one motor coach removed; two four-coach sets; and one motor luggage van. This of course provided a very heavy load for a pair of electro-diesel locomotives—in this instance Nos. E6001 and E6006—and the maximum speed attained was 88 m.p.h.

Train used for second series of propulsion tests by the Southern Region of British Railways, worked by electro-diesel locomotives Nos. E6001 and E6006

TABLE I

SOUTHERN REGION: ASHFORD-WATERLOO

Electric eight-car multiple-unit trains

Run No.	Load, tons full	1		2		3	
		305		305		315	
Dist.		Actual	Speeds	Actual	Speeds	Actual	Speeds
Miles		m. s.	m.p.h.	m. s.	m.p.h.	m. s.	m.p.h.
0.0	ASHFORD	0 00	—	0 00	—	0 00	—
5.7	Pluckley	5 41	60	6 02	56	5 30	62
10.9	Headcorn	9 42	78	10 06	77	9 41	75
14.2	Staplehurst	12 23	77	13 10	71	12 30	73
		—		p.w.s.	25	—	—
16.7	Marden	14 16	80	16 10	51	14 24	79
21.3	Paddock Wood	17 45	78	19 44	77	17 45	81
		sigs.	—	—	—	—	—
26.6	TONBRIDGE	25 19	—	24 26	49*	22 21	41*
29.1	Hildenborough	28 07	60	27 06	56	25 05	55
31.0	*Weald Box*	30 02	61	29 00	62	26 56	63
34.0	SEVENOAKS	33 14	44*	31 58	—	29 51	—
35.5	Dunton Green	34 46	61	33 26	57	31 17	65
39.5	Knockholt	38 32	63½	37 11	64	34 55	65
		—	—	—	—	sigs.	72½
42.3	Orpington	40 48	75	39 46	67½	38 43	20
48.9	Hither Green	48 16	—	46 41	—	44 46	70
		sigs.	—	—	—	—	—
51.2	New Cross	51 20	—	49 46	—	47 56	—
54.2	LONDON BRIDGE	54 52	—	55 23	—	51 57	—
55.4	WATERLOO	57 31	—	57 47	—	54 34	—

* Speed restrictions

The results were equally satisfactory as with the eight-coach train. The problems of remote controlling the locomotive in rear were, as Mr. Sykes said, "of quite fascinating complexity"; but they were solved up to the point that a prototype six-car trailer set and a type "3" diesel-electric locomotive fully converted for push-pull operation is now in the design stage, and that trials are expected to be run later this year. It is a development that will be watched with the greatest interest.

In the meantime some recent runs with ordinary multiple-unit electric stock on various parts of the Southern Region may be quoted. For these I am indebted to Mr. F. G. Cockman, who is one of the most widely travelled of the correspondents who are kind enough to send me details of their recordings. Table I includes details of three excellent runs on the Folkestone service, in each case with eight-car trains. All these were made in the summer of 1964, and readers may be interested to compare them with the steam and diesel runs on the same service that I published in April, 1961.

The starts were very fast in each case, with "even time" attained before Headcorn, and on the one run of the three to be entirely unchecked on the fast stretch to Tonbridge the quite brilliant time of 22 min. 41 sec. was made for the initial length of 26½ miles. The average speeds on Runs 1 and 3 between Headcorn and Paddock Wood were 78 m.p.h. in each case. All three trains then sustained speeds of around 60 m.p.h. on the 1 in 122 ascent to Sevenoaks Tunnel, but in complete inversion of the characteristics one could previously note on steam runs there was definite restraint through Sevenoaks itself, and downhill to Dunton Green, followed by a hard effort up through Knockholt Tunnel. At this point, despite checks and the slack through Tonbridge, all three trains were inside "even time" at this summit point. With such excellent progress thus far the rest depended on the absence of signal checks for a punctual finish.

The next run, Table II, shows the working of a 12-car multiple-unit boat train from Dover, but routed via Maidstone. At first the going was most leisurely, and up the continuous 1 in 266 gradient through the tunnels and amid the White Cliffs of the Folkestone Warren speed had not much exceeded 40 m.p.h. by the time Folkestone Central was passed, and at Westenhanger summit no more than 52 m.p.h. had been attained. But once the train had been diverted some excellent work was done.

From Ashford throughout to Lenham summit

TABLE II

SOUTHERN REGION: DOVER-VICTORIA

Electric 12-car m.u. Load: 438 tons tare; 460 tons full

Dist.		Actual	Speeds
Miles		m. s.	m.p.h.
0.0	DOVER MARINE	0 00	—
7.0	Folkestone Central	11 15	42
12.7	Westenhanger	18 26	52
16.5	Smeeth	21 39	71
20.8	ASHFORD	26 44	36
26.9	Charing	36 41	56
30.8	Lenham	40 21	71
32.5	Harrietsham	41 34	69
34.9	Hollingbourne	43 17	66
37.2	Bearsted	45 52	61/10
		sigs.	—
40.0	MAIDSTONE EAST	50 52	49/35*
42.4	Barming	54 14	55
45.2	West Malling	56 40	69/36
		sigs.	—
50.3	WROTHAM	63 58	62
52.9	Kemsing	66 15	73
55.8	Otford	69 30	52
57.2	Shoreham	71 19	57
59.5	Eynsford	73 05	72
62.2	SWANLEY JUNC.	76 19	20*
65.1	St. Mary Cray	79 09	68
69.0	BROMLEY SOUTH	82 33	71
72.1	Kent House	85 28	63
74.2	Sydenham Hill	87 26	61
75.9	Herne Hill	89 08	30*
79.9	VICTORIA	96 03	—

* Speed restrictions

the line has a pronounced rising tendency, though the actual gradients change incessantly. As far as Charing the rate of ascent would average about 1 in 160, though just before that station there is three-quarters of a mile at 1 in 100. Here the speed was 56 m.p.h., but the easier ascent that follows saw a rapid acceleration to no less than 71 m.p.h. and the last mile at 1 in 100 up to Lenham was cleared with no perceptible fall in speed. Once over the summit, as so frequently happens nowadays with the Southern electric trains, the speed fell, and the steep descent into Maidstone was taken without power. A severe signal check to 10 m.p.h. delayed the approach to the East station, but the time of 24 min. 8 sec. was nevertheless an excellent one over so hilly a road.

Passing Maidstone East at 35 m.p.h. there next came a good acceleration up the 1 in 102-165 to Barming, and on the slightly falling stretch towards West Malling speed had risen to 69 m.p.h. before there came a slight signal check. This was unfortunate from the viewpoint of spectacular performance, because it spoiled the attack on the bank up to Wrotham. Here the gradient is 1 in 101½ for 2¾ miles, and 1 in 132 for a further mile. Despite the check, however, speed had risen to 62 m.p.h. at Wrotham, and the steeply-graded switchback onwards to Swanley was taken with variations in speed from 73-52-72 m.p.h. until there came the severe slowing to 20 m.p.h. to take the Chatham main line at Swanley Junction. There was some fast and undelayed running through the London suburban area with the last 19¾ miles from Swanley covered in the same number of minutes, and Victoria was reached in the very quick time of 96 min. 3 sec. for this difficult alternative route.

Next come, in Tables III and IV, some good examples of the smart intermediate running involved on the standard schedules of the Kent Coast and Portsmouth lines respectively. On the 16.48 hr. from Whitstable some characteristically brisk work was done along the coast; and then, after the load had been made up to 12 cars, from Gillingham there was a fine example of modern

TABLE III

SOUTHERN REGION: WHITSTABLE-BROMLEY SOUTH

Load: 8 coaches, 330 tons tare, 350 tons full

Dist.		Actual		Speeds
Miles		m.	s.	m.p.h.
0.0	WHITSTABLE	0	00	—
4.0	*Graveney Crossing*	4	50	68
7.1	FAVERSHAM	8	22	61/30
11.2	Teynham	12	23	61
14.4	Sittingbourne	15	11	69
17.5	Newington	18	21	59
20.2	Rainham	21	25	58/24
		p.w.r.		—
23.2	GILLINGHAM	25	44	—
	Load: 12 coaches, 496 tons tare, 520 tons full			
0.0	GILLINGHAM	0	00	—
1.6	CHATHAM	2	37	—
0.6	ROCHESTER	1	18	28
3.4	*Cuxton Road Box*	5	34	40
7.4	Sole Street	9	49	58/56
8.4	Meopham	10	44	62
10.9	Fawkham	12	52	70
13.8	Farningham Road	15	05	79
16.9	SWANLEY JUNC.	17	44	70
19.8	St. Mary Cray	20	00	70
23.7	BROMLEY SOUTH	23	43	—

Kent Coast line eight-car electric train near Whitstable

TABLE IV

SOUTHERN REGION: PORTSMOUTH-WATERLOO

Electric 12-car multiple-unit train: 484 tons tare, 510 tons full

Dist.		Sch.	Actual	Speeds
Miles		min.	m. s.	m.p.h.
0.0	PORTSMOUTH ...	0	0 00	—
0.8	Fratton		1 53	—
3.6	*Portcreek Junc.*		5 21	—
7.2	HAVANT	9	9 38	—
3.1	Rowlands Castle ...		4 21	52
9.1	*Buriton Siding*		11 04	53
11.5	PETERSFIELD		13 34	58
14.9	Liss		16 31	70
19.5	Liphook		21 27	56
23.4	HASLEMERE	27	25 38	—
4.5	Whitley		5 22	62
8.5	Godalming		9 02	75½ (max.
9.5	Farncombe		10 05	—
12.7	GUILDFORD	16	13 53	—
3.5	Worplesdon		6 05	—
5.9	WOKING	9	10 06	—
2.7	West Byfleet		3 25	62
5.3	Weybridge		5 41	67½
10.0	Esher		9 34	76
12.4	Surbiton		11 34	70
			sigs.	37
17.1	Wimbledon		17 26	—
20.5	CLAPHAM JUNC. ...		21 46	—
			sigs.	—
24.4	WATERLOO	31	30 16	—

performance up Sole Street bank, with an attained speed of 58 m.p.h., and a minimum of 56 m.p.h. on the long 1 in 100 ascent. With a swift acceleration down to Farningham Road, touching 79 m.p.h., and a rapid continuation the driver all but achieved an "even time" start-to-stop run from Chatham to Bromley South. I have not tabulated the conclusion of this run. There were several checks inwards from Dulwich, but Victoria was reached 6 sec. inside of the allowance of 16 min. from Bromley South.

The Portsmouth run on the 16.20 hr. up was made in December, 1964, with a 12-car train having a gross load of 510 tons. But of course with multiple-unit trains the working of such a load involves nothing more from the driver, nor in performance of the motors, than a four-car or an eight-car train. Nothing in the way of high speed can be made in the short and level initial run to Havant; but the capacity of these electric trains was shown splendidly in the ascent to Buriton Tunnel, most of it, from Rowlands Castle, on 1 in 80. Then, where the "Schools" class 4-4-0s used to dash away in such thrilling style down through Petersfield, it seems from the speeds that this electric train was coasting. There is some stiff climbing from Liss; but from the initial speed of 70 m.p.h. this 12-car train cleared it quite easily. Nevertheless the start-to-stop time of 27 min from Havant to Haslemere is one of the sharpest on the run.

The downhill run to Guildford was smartly made, with appropriate reductions of speed round the Godalming curves, but a full minute was lost between Guildford and Woking. My correspondent quotes only one speed on this section, namely that of passing Worplesdon at 49 m.p.h., so that beyond that I cannot suggest why this small loss of time occurred. Some fine work was done on the main line, with a fast downhill start from Woking, and after taking the rise from Weybridge without any fall in speed, there came a good sprint from Hersham to Esher at 75-76 m.p.h. Some signal checks hindered the run-in from Surbiton; but none of them caused any really serious delay, and Waterloo was reached ¾ min. inside schedule.

In recent years most of the work of the Bulleid Pacifics, whether rebuilt or otherwise, has been with no more than moderate loads; and although their running continues to be very smart it does not involve any exceptional effort. By the kindness of Mr. Cockman, and also of another correspondent, Mr. D. W. Winkworth, I am able to publish two very fine heavy-load performances on the up "Bournemouth Belle" which have a particular interest in view of the developments now foreshadowed on that route. Very full details of these two runs are set out in Table V, and it will be seen that both engines were hauling gross loads of 500 tons.

As regards the engines themselves, Mr. Winkworth comments that No. 35002 was in what he calls "vile external condition, for no indication of its livery could be seen and the coat of arms of the nameplate was completely coated with grime." My

TABLE V

SOUTHERN REGION: SOUTHAMPTON-WATERLOO

"The Bournemouth Belle"

Run No. Engine 4-6-2 No. " Name Load tons (e/f)			1 35028 *Clan Line* 473/500		2 35002 *Union Castle* 473/500	
Dist.		Sch.	Actual	Speeds	Actual	Speeds
Miles		min.	m. s.	m.p.h.	m. s.	m.p.h.
0.0	SOUTHAMPTON ...	0	0 00	—	0 00	—
1.1	*Northam Junc.* ...	3½	3 28	—	4 19	—
5.6	EASTLEIGH ...	10	9 57	58	11 22	56
9.5	Shawford		13 41	61	15 15	60
12.6	WINCHESTER ...		16 46	62	18 19	64
14.7	*Winchester Junc.* ...	20½	18 52	63	20 19	63
21.1	Micheldever ...		25 05	60	26 21	63
23.0	*Roundwood*		26 57	58	28 05	62
28.9	*Worting Junc.* ...	37	32 32	69/50*	33 31	slack
31.4	BASINGSTOKE ...		35 00	70	35 56	70
37.0	Hook		39 20	81	40 26	74
39.5	Winchfield ...		41 09	76/81	42 22	73
42.7	Fleet		43 39	79½	44 56	78
46.0	Farnborough ...		46 08	78	47 36	74
48.2	*Milepost 31* ...		47 52	75½	49 27	70
51.2	Brookwood ...		50 07	81	51 51	73/65
54.8	WOKING	58	52 45	84	54 59	74
			sigs.	—	—	—
57.5	West Byfleet ...		55 53	40	57 08	74
			—	—	p.w.s.	20
60.1	Weybridge ...		58 45	—	60 51	—
			sigs.	—	—	—
65.9	*Hampton Court Junc.*	67½	64 21	68	67 57	64
71.9	Wimbledon .		69 50	66	73 22	68
75.3	CLAPHAM JUNC.	77	72 58	—	77 04	—
79.2	WATERLOO ...	84	79 37	—	83 48	—
Net times, min.			76		80	

* Speed restriction

Photo: Brian Stephenson

"Merchant Navy" class Pacific No. 35022, "Holland-America Line", passing Woking with the down "Bournemouth Belle" Pullman train from Waterloo to Bournemouth West

friend suggests that there was something amiss with the brake gear. He says that the driver made unusual heavy applications at Northam Junction, at Worting, and before Clapham Junction, thus losing time considerably against the times made on the companion run.

But coming to the actual runs themselves, on the first of these, recorded by Mr. Cockman, engine No. 35028, *Clan Line*, made an excellent start, reaching 60 m.p.h. at the foot of the long 1 in 250 climb to Roundwood box, and steadily accelerating on the grade to 63 m.p.h. at Winchester Junction. There was some falling off after this, to a minimum speed of 58 m.p.h. at the summit. This rather suggests some falling off in boiler pressure. But nevertheless the train passed Worting Junction 4½ min. inside schedule, and the time of exactly 35 min. through Basingstoke makes an interesting comparison with the 42 min. scheduled for so many years to this point in the days of the old 2¼-hr. service between Bournemouth and Waterloo.

On the companion run engine No. 35002 suffered at first from the exceedingly slow running at Northam, which put the train 1 min. 23 sec. behind the other one at Eastleigh. But by this time the engine was going in first-class style, and whatever she may have looked like externally she could certainly put forth the power. Her time from Eastleigh to Roundwood was 16 min. 43 sec. against 17 min. exactly by No. 35028, and the speed was held at 63 m.p.h. for mile after mile. This would have involved an output of 1,720 equivalent drawbar horsepower.

East of Basingstoke considerably the faster work was done on the first run. The 23.5 miles from Basingstoke to Woking were covered in 17¾ min., at an average speed of 79.5 m.p.h., whereas the shabby 35002 took 19 min. 3 sec., which gives an average speed of 74 m.p.h. Both trains began to experience delays from Woking inwards. From the nature of the checks, however, it would seem that No. 35028 was on the tail of a train that was travelling fairly fast, because after the first check the others were no more than slight. From Hampton Court Junction onwards the driver would be able to regulate his speed by the successive aspects of the colour-light signals so as to match that of the train in front, and this he seems to have done very successfully. On the second run a bad permanent-way check at Weybridge rather took the wind out of the sails of No. 35002, and accounted for 3¾ min. in running. Nevertheless these were both fine runs—that of No. 35002 evidently made in conditions of some difficulty.