

SOMERSET AND DORSET RAILWAY JOINT COMMITTEE.

Ministry of Transport,
4, Whitehall Gardens,
London, S.W.1,
28th February, 1930.

SIR,

I have the honour to report for the information of the Minister of Transport, in accordance with the Order of the 23rd November, 1929, the result of my Inquiry into the accident which occurred at about 6.35 p.m. on 20th November in Bath Station Yard on the London, Midland and Scottish Railway.

The 3.25 p.m. Somerset and Dorset goods train, Evercreech to Bath, ran away down the steep gradient from Combe Down tunnel to Bath Junction and after being derailed at high speed at the entrance to Bath Yard, collided with and completely wrecked the near end of a building used by Railway Clearing House staff.

I regret to state that engine driver J. H. Jennings was seriously injured and died while being taken to hospital. Inspector Norman who was on duty in the yard, and J. Loder, a clerk in Railway employ who had just arrived at Bath Station by train, and who was making his way home through the yard, were caught by the debris and killed. Fireman Pearce was seriously injured, as also was guard Wagner, who jumped from his van before the accident.

The majority of the wagons on the train were completely wrecked and some damage was done to the permanent way. Considering the violence of the impact, the damage to the engine and to the brake van was surprisingly limited.

The train concerned consisted of 32 wagons laden with coal, one laden goods wagon, three empties, one empty oil tank wagon and a 20-ton brake van. None of the wagons was fitted with a power brake. The total weight is estimated at 493 tons and overall length at 260 yards.

It was drawn by engine No. 89, type 2-8-0, with 6-wheeled tender, running tender leading. This engine weighs 111 tons in working order and is fitted with the steam brake, controlled by the vacuum, on all wheels of engine and tender. The tender is also fitted with a hand brake. The percentage of brake power of engine and tender combined is 71.7 per cent. The boiler pressure is 190 lbs. and tractive power at 85 per cent. boiler pressure is 16 tons.

The weather on the day in question was cloudy and damp, humidity being high and day temperatures ranging between 51.6 and 54.3. There was a very light southerly wind and no rainfall in the 24 hours.

Description.

The Somerset and Dorset Railway runs in a direction generally northerly from Evercreech Junction via Radstock (16 miles) and Midford (22 miles) to Bath Junction (26 miles) where it joins the London, Midland and Scottish line leading to Bath passenger station and goods yard. In the Midford to Bath Junction block section the line is single and from Midford it rises for about 1 mile on a steep gradient to Combe Down tunnel about 1 mile in length, through most of which the rising gradient continues at 1 in 100. From the end of Combe Down tunnel the line falls again at about 1 in 50 for 2 miles to Bath Junction and thereafter is level into Bath.

There is continuous reverse curvature between Midford and the south entrance of the tunnel at 30, 40, 26 and 68 chains radius, the latter curve continuing for a short distance into the tunnel. Thereafter the line is straight until approaching the north exit from the tunnel where curvature recommences and continues down the descent at 29, 38 and 50 chains radius, until the last $\frac{3}{4}$ mile into Bath Junction which is on a right-handed curve at $19\frac{1}{2}$ chains radius, forming almost a complete semi-circle.

About 100 yards before reaching Bath Junction signal box the falling gradient terminates; the line, still curving to the right, bifurcates into up and down tracks, the "up" direction being towards Bath and the up track being

on the left hand. These two running tracks, approaching from the south, join the double track of the L.M.S. line about 100 yards beyond Bath Junction signal box, and at the point of junction there are four tracks, running east (direction to Bath) and west, of which the southernmost is a shunting line leading to Bath Station goods yard. This shunting line was the road over which the goods train was intended to (and actually did) travel, the route from the Somerset and Dorset single line being over the facing points on to the down line of the Somerset and Dorset, and thence over another connection, facing in the direction of travel, on to the shunting line. From the latter connection the shunting line continues straight and level alongside the running lines for a distance of about 330 yards to facing points leading in three directions into the goods yard. The road was set for the right hand one of these three directions, and immediately clear of these points the road again bifurcates; at the latter point the engine was derailed to the left of both tracks, and ran on some 60 yards over the ground between the tracks until it struck the office building which it demolished.

Combe Down tunnel is about one mile in length with a gradient rising from Midford at 1 in 100 for the first three-quarters of a mile, thereafter being level. It was opened in 1874 when only a short length at each entrance was brick lined, the remainder being in hard sandstone. Since opening, various lengths have been lined with brick where necessary, the total of the brick lined portions amounting now to about half the length of the tunnel. The cross-section of the tunnel varies, an average of the lined portions being approximately circular with a height of about 14ft. above rail level and a horizontal diameter of about 15 ft.

The ground rises steeply from both entrances and the height of ground level above rail level for the greater part of the length varies between 270 ft. and 300 ft.

Distances from Midford signal box :—

South end of Combe Down tunnel	...	...	1,459 yards
North end of Combe Down tunnel	...	...	1 mile 1,525 "
Bath Junction	...	...	3 miles 1,569 "
Point of derailment	...	...	4 " 266 "
Leading end of tender after accident	...	...	4 " 324 "

Gradients from Midford signal box :—

Rising 1 in 330 for 393 yards.

Thence rising 1 in 150 " 366 "

" " 1 in 55 " 440 "

" " 1 in 100 " 100 "

" " 1 in 50 " 221 "

Entrance to Combe Down tunnel about this point.

Thence rising 1 in 100 for 1,368 yards.

" level " 418 "

Exit from Combe Down tunnel about this point.

Thence falling 1 in 50 for 1,537 yards.

" " 1 in 66 " 318 "

" level " 284 "

" falling 1 in 50 " 1,215 "

" level for 188 yards to Bath Junction, and
level for 457 yards to point of derailment.

Report.

On the day on which the accident occurred, driver Jennings and fireman Pearce took engine No. 89 from Bath to Evercreech Junction with a normal full load. Pearce stated that they had no particular difficulty with the engine, that the coal was of the usual quality and that driver Jennings was quite satisfied. There was no necessity to clean the fire at Evercreech while waiting for the return trip.

On the return trip the load over Masbury Summit was up to the maximum permissible and the train lost 13 minutes between Evercreech and Masbury. Guard Wagner had spoken to driver Jennings at Evercreech, when the latter had remarked that the engine was not steaming well, and he spoke to him again

at Radstock while they were dropping some empty wagons and picking up loaded ones. Jennings then said that they were getting along as well as could be expected. Wagner suggested that, if they were stopped at Wellow, Jennings should ask the signalman to hold the train there until they could get a clear run through Midford; it appears that Jennings sent a message by a porter to the signalman at Wellow asking him to ask Midford to give the train a run through as he had a full load on. The train, however, left Wellow before the signalman could get this message, and, leaving at the time they did, it was impossible to avoid a stop at Midford, to allow the passenger train from Bath to cross.

At Midsomer Norton, the station before Radstock, driver Jennings had a few words with driver Bonshor who was driving a train in the opposite direction. Bonshor asked Jennings how he was after his illness, and Jennings said he was all right but that he had had a job getting over Masbury Summit with the load as his engine was steaming very badly.

The train arrived at Midford up outer home signal at 5.2 p.m. and stood there until the 5 p.m. down passenger and 5.15 p.m. down goods trains from Bath had passed Midford. Signalman Larcombe then lowered his calling-on arm, and the train moved forward to Midford and backed on to the down track to allow the 1.20 p.m. up passenger Bournemouth to Bath to pass. This train left Midford at 5.59 p.m. and "Train out of section" was signalled from Bath Junction at 6.8 p.m., immediately after which Larcombe offered the goods train, had it accepted by Bath Junction, and pulled off the signal accordingly. When shunting on to the down track driver Jennings backed a distance of some 300 yards away from the box so as to get on to the end of the falling gradient. After doing this he walked to the box and informed signalman Larcombe that he had a fireman who had not been into Bath often, and that on the previous night he had had a fireman who had found some difficulty in picking up the tablet while passing. Engine 89 is fitted with a tablet catcher but as it was starting in the up direction from the down line this was inoperative. Jennings therefore asked Larcombe if he might remain in the box until his tablet was available for issue, and then take it back himself to his engine so as to avoid any difficulty in picking it up while passing. Driver Jennings told Larcombe that he had a heavy train and was having difficulty with the steaming of his engine, so that he wanted to have a run at the steep gradient beyond Midford; he also said that he thought he would have difficulty in getting through the tunnel owing to the load and the condition of his engine.

Fireman Pearce stated that during the wait at Midford he cleared out some clinker, which was no worse than usual, and that driver Jennings looked at the fire, with which he was satisfied. Pearce said that on leaving Midford he had a good clear fire which he reckoned would take them to Bath (the end of the day's trip) without having to fire again.

Driver Jennings was given the tablet about 6.8 p.m., walked back to his engine and started, passing Midford box at 6.13 p.m., speed being probably about 15 miles an hour. By the time the engine reached the tunnel speed had probably fallen to about four miles an hour. During this period Pearce used the pricker once. He is sure that just before entering the tunnel the boiler pressure was about 175 lbs. The engine had not been slipping at all and the sanding gear was in good order.

Shortly after entering the tunnel Pearce found the atmosphere very hot and smoky, causing him to cough violently, and he wrapped his coat round his head and sat down on his side of the tender. At this time, as far as he is aware, driver Jennings was standing on his own side of the footplate, and not showing any special signs of being affected by the smoke or heat. Pearce recollects nothing more after this point.

Guard Wagner considered that the train passed through the tunnel distinctly slower than usual and he thought the atmosphere was thicker than usual. On more than one occasion he looked out and turned his lamp on to the wall to make sure that the train had not stopped.

It is difficult to reconcile the signal box timings at Midford, 6.13, and Bath Junction, 6.33, with guard Wagner's recollection of the time at which he emerged from the tunnel, 6.31, but it is clear that the train must have been in the tunnel

for a period considerably greater than usual, probably 11 to 13 minutes for the one mile of tunnel alone, the normal timing being 13 minutes for the whole four miles, very little of which distance is usually traversed at more than 20 miles an hour.

Just before his van emerged from the tunnel guard Wagner expected to feel the couplings closing up with the application of the tender brake, but he was surprised to find on this occasion that the train was gaining speed more than usual. He applied his brake gently at first, but put it on harder when he realised something was wrong. He listened but could hear no whistle signals from the engine; during the descent he never got a good view of the engine but kept his brake hard on and, after passing Bath Junction, realising he could do nothing more and that a smash was inevitable, he jumped from his van.

A number of witnesses, railwaymen and others, saw the train descending the gradient and running into Bath yard. None of them saw anyone on the footplate nor did they hear any engine whistles. Opinions were divided as to whether the engine and tender brakes were on, judging by sparks, and whether the engine was steaming, but the evidence generally inclines to indicate that the engine was steaming and that the brakes were only applied lightly, if at all. All realised that there was something wrong in view of the excessive speed.

When the train ran into Bath yard, two shunters and a Railway Clearing House number taker were waiting for it on a bridge at the entrance to the yard. Inspector Norman shouted a warning to them and then apparently ran back towards the shed which was struck by the train. The engine, travelling at probably 50–60 miles an hour became derailed at the second set of diverging points inside the yard, and ran on between the tracks for a distance of about 50 yards until it struck the shed, demolishing the west end of it and turning over on its left side. The majority of the wagons piled up in a heap of wreckage, though the brake van remained upright with comparatively little damage, the lamp therein being unbroken.

The rescue of the engine crew was impeded by the fact that the impact had overturned the tender at an angle to the engine, so that access to the footplate was very difficult, added to which volumes of escaping steam and hot water, the engine fire, and the breakage of a gas pipe in the wreck of the shed made this rescue a matter of some risk at first. Despite this a number of railwaymen were on the spot at once, and by their efforts both driver Jennings and fireman Pearce were extricated alive, though, as already noted, Jennings died a few minutes later on the way to hospital.

I am informed that the London, Midland and Scottish Railway Company have made awards to porter Parratt and engine driver Lessey, and the Somerset and Dorset Joint Committee are taking similar action in the cases of driver Bowles and fitter Iley, in recognition of their special services in the work of rescue. Credit is also due to shunter Crew, a trained St. John Ambulance man, who was the first to discover that fireman Pearce was still alive, by feeling the pulse in his leg, the only portion of his body accessible immediately after the accident.

When they were found fireman Pearce had a coat wrapped round his head and driver Jennings was lying underneath him; the position of both men was such that I think it is most probable that they had been lying on the footplate at the moment of impact and overturning.

Condition of engine controls after the accident.—Regulator about $\frac{1}{4}$ to $\frac{1}{2}$ open. It is possible, but comparatively unlikely, that it might have been partially opened or closed by shock in overturning. There was no mark of a blow which might have caused such movement.

Reversing wheel in almost full back gear, i.e., practically full gear for the direction of travel (tender first). This is very definite evidence, as a portion of the cab plating was bent in the accident in such a way as to prevent the wheel being moved more than half a turn.

Ashpan dampers full open.

Tender hand brake wheel in full off position. The evidence regarding this is fairly definite.

Brake blocks applied to all wheels of engine and tender, and the pistons of the steam brake were depressed. The brake gear was jammed in this position after the engine overturned, so that it is definite that before the end of the overturning movement of the engine the steam brake was applied. It is not, however, proved by this that the brake was applied before the accident, as the breakage of the tender vacuum connection pipe at the first moment of impact would have applied the steam brake practically instantaneously in the moment of overturning.

Sanding valve open, but sand all used.

Right-hand injector steam valve closed.

Left-hand injector steam valve full open. The water regulator valve of this injector was closed, but this might have been closed by shock in the accident. Fireman Pearce was definitely of the opinion that when they entered the tunnel the right-hand injector was on and that the water level was about halfway up the gauge glass.

Working of engine.—As regards the alleged bad steaming of the engine, it has not been possible to locate any definite cause for this. The condition of boiler, tubes and firebox, etc., was satisfactory, and the coal was a South Wales coal normally in use on the section. Fireman Pearce, who is described by several drivers with whom he has worked as a competent fireman, and well up to his work, was very definite that the condition of the fire was not such as to give trouble, and that driver Jennings was satisfied with it. Pearce could suggest no explanation of bad steaming on this occasion. I was informed by the Company's officers that they had had from time to time complaints of time lost owing to bad steaming by engines of this class, and that they had put Inspectors on to ascertain the cause, but had been unable to find any defect.

Conditions in tunnel.—The last train through the tunnel, some 20 minutes ahead of the goods train, and in the same direction, was the 1.20 p.m. passenger Bournemouth to Bath. Driver Bowles described smoke conditions in the tunnel as about normal, but he had, of course, a considerably lighter train, and was in the tunnel for a much shorter period.

Health of driver Jennings.—Driver Jennings had been absent from duty owing to ill-health from 4th to 16th November, inclusive, suffering from bronchial catarrh and influenza. The doctor who attended him gave it as his opinion that he had recovered for nearly a week before he went back to work, and that his illness in no way made him more susceptible to asphyxiation by smoke fumes.

Conclusion.

Certain points regarding this case may be disposed of very briefly. There are no questions of defective condition or operation of points, signals or permanent way. There is no doubt that the speed of the train at the moment of passing Bath Junction was much in excess of what was normal or safe, and various witnesses expressed surprise that the train kept to the rails when negotiating the facing points and curvature at this point. The final derailment was the natural and almost inevitable result of this excessive speed.

The investigation must therefore be directed to the determination of the cause of the excessive speed.

Possible causes of excessive speed are :—

(a) Carelessness or reckless driving on the part of the driver at the top of the down gradient, with subsequent inability to stop.

This, I think, may be dismissed at once. Driver Jennings was a man of 57 years of age, with 39 years' railway service, passed driver in 1915 and made driver in 1919. He was intimately acquainted with the line, the engine, and the working of similarly laden trains, and he had a very good record. It is inconceivable that he could wittingly have allowed his train to attain such an excessive speed on this steep gradient, having regard also to the points mentioned under (b) below.

(b) Overpowering of engine by weight of train and/or brake failure. The weight of the train was within the authorised limit for this class of engine, being 169 "quarters" as against 172 "quarters" maximum permissible. (This

system of reckoning is based on an 8-ton loaded mineral wagon counting as four "quarters," and heavier vehicles in proportion, according to a fixed scale.) The brake equipment was found to be in good order after the accident, with the exception of a breakage on the Bissel truck, evidently due to derailment. The brake blocks had been reported by a driver on the previous day as requiring taking up, and they had accordingly been adjusted on the morning of the accident. They were in good condition and had required nothing more than normal attention. The rail was dry and the sanding gear of the engine was in good order, but after the accident it was found that all sand had been used.

The evidence of several drivers with experience of this type of engine and similar loads on this line was unanimous in that they had never had any trouble with braking.

The most definite objection to the theory of overpowering is, however, the fact that no attempt had been made to reverse the engine nor to apply the hand brake on the tender; the question of when the steam brake was applied on the engine and tender is discussed further below, but it was certainly not applied for most of the descent. In addition it is quite clear that there was no whistling, as would certainly be expected from the driver of a runaway train.

(c) Possibilities (a) and (b) above being thus ruled out, the only reasonable alternative is that during the descent from Combe Down tunnel neither of the men on the footplate was in a condition capable of taking any action to control the train, and this is supported by the following evidence as well as by a number of the preceding items.

The evidence of fireman Pearce and guard Wagner that the tunnel was on this occasion exceptionally hot and smoky, and that after a short distance Pearce had to wrap a coat round his head and sit down, after which he remembered no more.

The fact that after the accident the position of the bodies of driver Jennings and fireman Pearce was such that it seems probable they must have been lying on the footplate at the moment of derailment.

The fact that none of the nine or ten witnesses who saw the train pass in more or less close proximity saw anyone on the footplate.

The evidence that the train was an unusually long time in the tunnel and the inference that the engine was probably labouring heavily for most of the time.

I am therefore led to the conclusion that both driver and fireman were overcome by smoke and fumes while passing through Combe Down tunnel, and that the engine emerged from the tunnel uncontrolled. Having regard to the falling gradient, it can be shown by calculation that, even assuming the engine was only just moving at the exit from the tunnel, it might well have attained a speed of 50 miles an hour or more at the foot of the gradient, in spite of the guard's brake application.

The above conclusion has been confirmed by medical evidence at the adjourned inquest on 17th February, when the medical officer, who had been asked by the Coroner to make a post-mortem examination of driver Jennings, stated that he had found there was at least 75 per cent. saturation of the blood with carbon monoxide, and that as a result driver Jennings must have been either unconscious, or on the borderline of unconsciousness, in such condition as to be helpless to perform his duties.

The fact that the engine and tender brake blocks were found applied after the accident can be explained in two ways, either that the fracture of the tender vacuum connection applied the brakes while turning over, or that the engine descending the gradient at high speed in full gear, with regulator partly open, drained the boiler of steam to such an extent that the vacuum ejector failed to maintain the vacuum and thus applied the steam brakes. It was found by experiment that when boiler pressure had fallen to 74 lbs. the vacuum failed to the degree necessary to apply the steam brakes. Such application would, of course, be gradual, and the retarding effect of the steam brake with such low steam pressure would be trifling.

The point is not, however, very material, as, whether the brakes were not applied until the derailment or only lightly applied near the end of the run, in neither case would they have had any appreciable retarding effect.

Recommendations.

This tunnel has been in use for over 50 years without any similar case of the engine crew being overcome by fumes, and for the last 15 years this class of goods engine, with practically the same maximum loading, has been traversing the line; from the evidence of a number of drivers and others it is fairly clear that under normal circumstances the atmospheric conditions are not such as to involve any risk or anything more than a degree of discomfort.

All witnesses agreed, however, that occasionally conditions were very bad, and it seems probable that such conditions are produced by a combination of adverse factors, such as smoke from trains immediately preceding, an engine labouring heavily and, possibly, slipping, and unfavourable weather conditions, with high humidity and absence of wind. All these factors were present to a marked degree on the occasion of this accident.

Although the chance of the recurrence of this combination of the adverse factors may be remote, I cannot think that the risk is one that should be taken, having regard to the evidence given to me by various drivers and others, and I discussed with the Company's officers the various means of avoiding such risk in future.

The most obvious method of doing this is by improvement of ventilation, either by a vertical shaft or by some arrangement of a fan and forced draught. Unfortunately, either of these schemes would be very costly and can hardly be justified at any rate until simpler schemes have been tried.

The general consensus of opinion of drivers appeared to indicate that if they enter the tunnel (from the Midford end) at a fair speed, they are not in the tunnel long enough for conditions to become serious, and that trouble is liable to arise only when they are stopped at Midford and have to re-start with a heavy load up the severe gradient leading to the tunnel. There appears to be no question of any difficulty in traversing the tunnel in the south-bound direction.

The simplest remedy would be, therefore, to make a substantial reduction in the permissible loading (north-bound) over this section of the line, or, if necessary to provide a banking engine from Midford to the southern entrance to the tunnel. In addition to this it would be desirable to arrange, as far as possible, that north-bound goods trains, which have to be detained on the south side of the tunnel, should be detained at Wellow rather than at Midford, so that they can run through Midford and not have to start against the severe gradient. Owing to the limitations of single line working I recognise that this may not always be convenient.

I understand that the question of the reduction of permissible loads is now under consideration by the Company. I would recommend that a close watch be kept on the results attained by any such reduction, with a view to confirming the adequacy thereof, or, if necessary, the consideration of further measures of amelioration such as arrangements for ventilation.

A further point which arose in the course of my Inquiry is the fact that, owing to these engines being too large for the turntables available, they have to work through the tunnel tender leading when travelling towards Bath.

Some of the evidence inclined to a theory that operation with tender leading accentuates the discomfort of the smoke and fumes, by reason of the engine cab forming a cup which fills the tunnel, and tends to collect and intensify them. On the other hand, it is evident that with this arrangement, the chimney being in rear of the cab, there must be a tendency to leave behind the smoke from the engine itself, and, except perhaps when the engine is moving at an unusually low speed, one would expect that the tender leading arrangement might be preferable. The evidence of drivers on this point was neither unanimous nor convincing and I doubt whether the fact of working tender leading had any direct bearing on this regrettable accident.

It may be noted that the first five of this class of engine, constructed in 1914, were fitted originally with tender cabs, but in 1921 the cabs were removed from the tenders in view of complaints that they were inconvenient and uncomfortable.

It should be possible to form a fairly conclusive opinion on tunnel conditions, tender leading compared with chimney leading, from the results of a few practical experiments, and, before it is decided to continue indefinitely a regular practice of working these large engines tender leading, I consider that such investigations would be very desirable. If the results were such as to support the argument that working tender first is seriously objectionable, the provision of adequate turning arrangements should receive further consideration by the Company.

I have the honour to be,

Sir,

Your obedient Servant,

A. C. TRENCH,

Colonel.

The Secretary,
Ministry of Transport.

APPENDIX.

Main items of Damage to Engine and Tender.

Front safety valve (Ross type) broken off—clean break.

One inspection cover on top right hand corner of firebox detached and pushed inside the boiler.

Cab and platform plates bent and twisted.

Front and rear brake stretchers of Bissel truck fractured.

This was evidently due to the derailment, a wagon having been pushed into this portion of the engine as she lay on her side.

Tender axleboxes damaged.

(Examination of the boiler shows that the firebox stays, tubes, superheater elements, seams, and smokebox fittings appeared to be in good condition.)

Damage to Rolling Stock.

30 wagons either completely destroyed or damaged beyond repair.

4 wagons seriously damaged.

Most of these 34 were 8 and 10-ton wagons, laden with coal, and belonging to various Private Owners.

1 oil tank wagon (empty), a good deal of minor damage.

1 20-ton brake van—leading end of body smashed and various minor breakages and distortion.