REPORTS BY THE INSPECTING OFFICERS OF RAILWAYS UPON CERTAIN ACCIDENTS WHICH HAVE BEEN INQUIRED INTO.

LONDON AND NORTH EASTERN RAILWAY.

Ministry of Transport,
7, Whitehall Gardens,
London, S.W.1.
3rd November, 1928.

SIR,

I have the honour to report, for the information of the Minister of Transport, the result of my Inquiry into the causes of the collision which took place on the 27th June, about 11.8 p.m., between a passenger train and part of a parcels train, at Darlington South, on the London and North Eastern Railway.

In this case a return excursion train, the 8.55 p.m. from Scarborough to Newcastle, whilst approaching Darlington (Bank Top) Station on the down through (avoiding) line with full clear signals, collided head-on with the engine and some vehicles of a parcels train which was engaged shunting.

I much regret to report that the roll of casualties was exceptionally heavy, owing to telescoping of the second and third vehicles of the excursion train, the former of which was fully loaded. Twenty-five passengers were either killed or subsequently died from their injuries. Forty-five others were severely injured and were detained in hospital. Many others suffered from shock effect and minor injuries. The drivers of both trains and the fireman of the excursion train were prevented by severe injury or shock from resuming duty.

The excursion train was drawn by engine No. 2164 (type 4-4-2) with 6-wheeled tender, with a length of 63 feet 5¾ inches, and weighed in working order 123 tons 14 cwts. The following eleven 8-wheeled bogie coaching stock were attached :—

		Length.	Weight. Tons.	Cwts.
No. 21756	3rd class non-vestibule coach... ...	49′	22	1
„ 2886	„ „ „ „	55′ 10″	26	13
„ 1304 (G.C.R.)	„ „ corridor vestibule brake ...	49′ 8″	28	0
„ 5303 (G.C.R.)	„ „ „ „ coach ...	53′ 1½″	30	4
„ 5389	„ „ „ „ „ ...	53′ 1½″	30	4
„ 475C	1st „ „ „ „ ...	53′ 1½″	32	2
„ 51301	Composite „ „ brake ...	48′ 8″	29	9
„ 5227 (G.C.R.)	3rd class „ „ coach ...	53′ 1½″	30	4
„ 51691	„ „ „ „ „ ...	53′ 1½″	30	4
„ 51692	„ „ „ „ „ ...	53′ 1½″	30	4
„ 51303	„ „ „ „ brake ...	49′ 8″	28	15

The overall length of engine and train was about 635 feet and the total weight 441 tons 14 cwts. All the coaching stock, with the exception of the first vehicle, was lit electrically. The seating capacity in the train was 32 first-class and 412 third-class.

The engine was fitted with the Westinghouse air brake, working blocks on the six coupled and two carrying wheels as well as the tender wheels, and the coaching vehicles were dual fitted with Westinghouse and Vacuum brakes (Westinghouse in use), with blocks on all wheels; both brakes being controlled by one lever from the engine footplate, and also from any of the brake compartments.

The portion of the parcels train concerned was drawn by eugine No. 2369 (type 4-6-0) witb 6-wheeled tender, length 62 feet 9 inches, and weighed in working order 124 tons 6 cwts. At the time of the collision the following ten vehicles were attached :—

		Length.	Tare Weight. Tons.	Cwts.
No. 206	4-wheeled covered carriage truck ...	24′ 10″	8	14
„ 334	„ „ „ „ ...	24′ 4½″	8	0
„ 824	„ „ „ „ ...	23′ 9″	7	14¾
„ 1435	„ horse box	19′ 9″	7	18
„ 1008	„ „ „	21′ 2″	9	8
„ 1914	„ „ „	21′ 0″	8	10
„ 104	6-wheeled luggage van	35′ 8″	13	6
„ 2274	„ „ „	35′ 8″	13	6
„ 273	„ „ „	35′ 8″	13	6
„ 270	„ „ „	35′ 8″	13	6

The total length of the engine and vehicles was about 340 feet, and the total weight 227 tons 14¾ cwts.

The engine was fitted with the Vacuum brake working blocks on the six coupled and six tender wheels. All the vehicles were screw coupled, and dual fitted with blocks upon all wheels, except the centre pairs of the 6-wheeled luggage vans.

The result of the collision was that engine No. 2369, which had probably either come to a stand or was nearly at a standstill, was driven backwards over the down through line a distance of about 185 ft. with its front end badly damaged. The first four vehicles in rear of this engine were totally destroyed, the last six were driven backwards on No. 1 platform line, the fifth and sixth being damaged, whilst the last four were practically uninjured.

The leading bogie of the passenger train engine lay in front of engine 2369 across the down through line. The engine itself—2164—after running forward a distance of 195 ft. overturned on to its left side, and lay across No. 4 platform line, with the tender detached behind it. All the coaches of the excursion train kept their general alignment. The first coach had its rear end crushed; the underframe of the third coach overrode that of the second coach, with the result that the rear half of the body and roof of the second coach forced its way inside the third coach, causing telescoping of the rear five and a half compartments of the second, and the front half of the third coach.

It was in the five compartments at the rear of the second coach of the heavily loaded train, that nearly all the cases of fatality and of serious injury occurred. The front half of the third coach was an unoccupied brake compartment. There was little damage to the fourth, fifth, and sixth vehicles, and the last five vehicles were entirely uninjured.

Details of damage to permanent way and to rolling stock will be found in the Appendix.

The night was dark but clear; there was no difficulty, therefore, in observing the signal lights.

Description.

Darlington " Top " Station, and its approach roads, have a general north (Newcastle) and south (York) direction. On Drawing No. 1 will be found plans showing the lay-out of the main approach lines and of platforms Nos. 1 and 2, together with information regarding the signals concerned in this case, and the position occupied by the vehicles of the two trains after the collision.

It will be seen that the up and down through lines pass on the east and clear of the station platforms. Also, that the main line traffic, as well as the approaches to the Station platforms, is controlled from two signal boxes—Darlington North and South Junctions respectively. In addition, the working over No. 1 platform, the up duplicate, and up siding lines, is controlled by signals worked from an intermediate signal-box on No. 1 platform, known as Platform East. This signal-box in respect of the above-named roads is an intermediate block post between the North and South Junction signal-boxes.

The signals Nos. 82 to 85 inclusive at the north end of platform No. 1 are the up starting signals for the North Junction signal-box leading to No. 1 platform, up duplicate, and siding lines—No. 82 being controlled by No. 5 lever from Platform East signal-box. The two groups of signals Nos. 2, 3, and 15 and 6, 9, and 22 are applicable to the up duplicate and No. 1 platform lines respectively, and may be described as the home signals for Platform East signal-box. The two groups Nos. 7 and 8, and 10 and 11, situated towards the south of platform No. 1, are the up starting signals for the up duplicate and platform lines respectively, and are worked from Platform East signal-box. Signals Nos. 18 and 14 and Nos. 19 and 17 are the up home signals for the up duplicate and No. 1 platform lines for the South Junction signal-box.

Signals Nos. 8 and 11, termed " Calling-on " signals, are used instead of Nos. 7 and 10 respectively when a movement on either the up duplicate or No. 1 platform line is accepted under " Caution " by the South Junction signal-box.

Nos. 19 and 18 are running signals leading on to the up main line, whilst Nos. 17 and 14 are shunting signals applicable to movements into the passenger siding, through No. 77 points.

Measured from Platform East signal-box, the approximate distances to the undermentioned signal-boxes, signals, and points, etc. are as follows :—

North Junction signal-box	415	yards North.
North Junction up starting signals, Nos. 82 to 85	257	,, ,,
East signal-box up home duplicate line signals, Nos. 2 and 3	—	
East Box up home No. 1 platform home signals, Nos. 6 and 9	13	yards South.
Centre of scissors crossing between No. 1 platform and duplicate lines	62	,, ,,
East Box up starting signals Nos. 7 and 10 for duplicate and No. 1 platform lines	142	,, ,,
South Junction up duplicate home signals Nos. 14 and 18 (See A on plan)	238	,, ,,
South Junction No. 1 platform up home signals, Nos. 17 and 19	277	,, ,,
No. 52 siding trailing points on up duplicate line	294	,, ,,
No. 53 trailing points from up duplicate line on No. 1 platform line	326	,, ,,
No. 62 trailing points from No. 2 Bay line connection on No. 1 platform line ...	355	,, ,,
No. 66 north end slip points of through crossing leading to down main ...	374	,, ,,
No. 68 south end slip points on down main line	391	,, ,,
Point of collision	419	,, ,,
No. 77 trailing points on down main leading to passenger siding	439	,, ,,
No. 124 down main home signal for South Junction	445	,, ,,
South Junction signal-box	473	,, ,,
Crofts Junction signal-box	1,273	,, ,,
Black Banks Junction signal-box ...	2 miles 232	,, ,,

The north end (No. 66) points of the slip connection normally lie for the down main line; the south end (No. 68) points lie for the down main line.

The fouling point of the down through line with the junction line leading to No. 1 platform and to the up duplicate lines is 120 yards south of Nos. 18 and 14 up home signals for South Junction signal-box for the up duplicate line.

It will be seen from the drawing that the main lines in the vicinity of the accident are practically straight and that the gradients in the down direction rise for a mile preceding the point of collision at inclinations between 1 in 815 and 1 in 426.

Report.

I. The events leading up to this disastrous collision were described at length mainly in the evidence given by signalman J. T. Robson (Platform East signal-box), by signalmen Thomas Walls and James Garratt (Darlington South Junction signal-box), by assistant shunter Michael Morland, and by the enginemen of the two trains.

1. The 9.30 p.m. up parcels train, due to arrive at Darlington at 10.34 p.m., and to depart thence for Northallerton and York at 10.50 p.m., arrived at the south end of No. 1 platform Darlington at 10.45 p.m.—eleven minutes late. This train conveys passengers as far as Darlington, and on arrival comprised 12 vehicles, viz., three 4-wheeled carriage trucks, one 6-wheeled van, one 8-wheeled van, one 8-wheeled 3rd class brake, two 8-wheeled vans, one 6-wheeled van, one 8-wheeled composite coach, one 8-wheeled 3rd class brake, and one 6-wheeled brake van. The first nine of these vehicles, with seven others which had to be picked up at Darlington, were intended to form the parcels train on its departure from Darlington.

Station foreman William Morley had instructed Robson to let the train travel forward beyond the scissors crossing to the south end of platform No. 1, in order to make room for another train which was due to arrive. About 10.47 p.m., therefore, Robson (51 years' signalling service) obtained acceptance under "caution" from the South Junction box, lowered his home signal No. 9, and, in obedience with printed instructions, after the engine had passed this signal, lowered his calling-on arm No. 11 to let the engine move forward to the south end of the platform towards South Junction No. 1 platform up home signals (Nos. 19 and 17). The "calling-on" signal levers Nos. 8 and 11, for the up duplicate and No. 1 platform lines respectively, precede the running signal levers Nos. 7 and 10 for these lines. Unless, therefore, both the running signal as well as the calling-on signal is lowered, a driver on either of these lines should realise that he is accepted under "caution," and not under "clear," as far as the home signals for South Junction signal-box. The driver of the parcels train moved forward accordingly, and stopped his engine a little beyond the south end of No. 1 platform and in rear of Nos. 19 and 17 signals. The additional vehicles, which had to be attached to the parcels train before it left for York, were standing at the north end of the up duplicate line, and shunter Morland had received instructions from the foreman to take charge of the necessary shunting movements.

Whilst the train stood at the platform, shunter Morland uncoupled between the third and fourth vehicles, and the engine stood for some little time, both the signals 19 and 17 being at danger, until a train had been signalled out of No. 2 up Bay line by the South Junction signal-box and had left. Whilst waiting, Morland mounted the platform and told driver Bell that they were to go down to the South Junction with the three carriage trucks attached, to pick up the vehicles on the duplicate line. Signalman Walls then set the road for the parcels train by pulling Nos. 68 and 77 points and lowering No. 17 signal. He was unable to set the road for the shunting movement on to the up main line, through No. 66 points, as a fish train was travelling on the up main line. As soon as this signal was cleared, Morland signalled the driver to move forward, and rode himself on the last of the three carriage trucks, until the engine and three vehicles had run far enough to clear No. 53 points leading on to the up duplicate line. In order to clear these points (the length of the engine and trucks being 135½ feet) the engine must have at least run forward far enough to foul the down main line, if it did not actually stand on the crossing. Signalman Walls, when he received a hand signal from Morland that 53 points had been cleared, reversed these points, and shouted to Morland that the road was set for the propelling movement into the up duplicate line. Walls then sent the blocking back signal to Platform East signal-box. Morland, after seeing that No. 53 points were set for the movement, signalled the driver to move backwards. Robson received the blocking back signal about 11 p.m., and about 11.2 p.m. the three vehicles and engine arrived opposite his signal-box. He then cleared the blocking back signal to the South Junction signal-box. Morland coupled up the seven vehicles (three horse boxes and four vans), and connected up the Westinghouse air brake. The engine afterwards came to rest under the bridge carrying Nos. 2 and 3 signals applicable to the up duplicate line. At 11.4 p.m. Robson offered the train to the South Junction signal-box, and it was again accepted under "caution" (3-5-5 bell signal) indicating that the main line junction was blocked. Robson then signalled the train "on line" to the South Junction at 11.4 p.m., and lowered No. 2 signal. After the engine had passed this signal, he lowered No. 8, the calling-on signal applicable to the up duplicate line, to show the driver that he had been accepted under caution. So far all the movements were correct, and in accordance with established practice.

The engine moved forward, Morland riding in the third van from the rear. As he approached the group of signals Nos. 14, 18 and 51, worked from the South Junction signal-box, he saw that they were all at danger, and realised that one of the two first-mentioned signals, which were carried on the right-hand post, should have been lowered. At this moment he thought the engine was just passing the signals, and therefore ran to the end of the van and pulled the Westinghouse brake tap. Morland was quite satisfied that the continuous brake was working throughout on the ten vehicles which were then attached to the engine. When the van he was riding in had approached to within about 10 yards of the signal, the speed of the train had been reduced so much that he thought the train was stop-

ping, and put his Westinghouse brake handle back to normal. He then went again to the window to see whether the signals were " off " or still " on," and looking upwards was able to see that both the signals were at danger. He immediately went back to the brake, pulled the handle until the train had almost stopped, before the crash of the collision came. Morland stated that he did not on the first occasion apply the Westinghouse brake fully, as he was afraid it might result in dividing the train. On the second occasion he applied the brake to a greater extent than on the first, but still not fully. He thought the train might have travelled a distance of about 30 yards, after the second brake application, before the crash of the collision came. He thought the speed of the train as it passed the signals, which were at danger, was about as fast as a man could run.

2.—*Evidence of Signalmen at Darlington South Junction.*

This is a very busy block post. The staff employed consists of two signalmen, T. Walls and J. Garrett, and a train booking boy. The signal and point lever frame contains 140 levers. On the night in question Walls (with 39 years signalling experience) was in charge. His duties consisted of signalling up trains, and of working the northern half of the lever frame (1 to 70). Garrett (32 years signalling service) was employed signalling down trains, and worked the southern half of the frame. The signalmen are always notified by the Station Staff of shunting operations. The parcels train has always shunting work to do at Darlington Station, and this is carried out sometimes within Station limits (north of Nos. 7 and 10 signals), and sometimes at the south end of No. 1 platform; in which case the signalmen in the South Junction signal-box are responsible for the movements south of Nos. 7 and 10 signals. On the night in question information was sent to South Junction signal-box that the shunting movements would be carried out at the south end, space being required for a second train at the north end of No. 1 platform line. Walls explained that he did not observe the second movement of the parcels train, after he had accepted it under caution on the up duplicate line. He assumed it would come to a stand at No. 18 up home signal for that line, until he was ready to let it move forward.

Garrett received the offer of the excursion train from Croft Junction at 11.1 p.m., but the train was not accepted until 11.2 p.m. because the clearance of the blocking back signal which had been sent to Platform East signal-box was not received earlier. After acceptance, he lowered the down through inner distant (132), down home (131), and the down starting (124) signals for the excursion train. The train was due to pass at 11.5 p.m., but did not pass the Junction box until 11.8 p.m. The attention of the two signalmen, just before the train passed their post, was attracted by clicking noises in the lever frame. For the moment they did not recognise what caused these noises, but Garrett, realising that something must be wrong, threw all the down through line signal levers to danger, and pulled over the detonator-laying lever before the collision actually took place. It is obvious that the clicking noise heard by the signalmen was caused by the engine of the parcels train running through, first, trailing points No. 53, and afterwards No. 68, which were set and bolted for the down through line. At this moment it is thought that the engine of the excursion train was about midway between the down home and starting signals, i.e., opposite the signal-box.

3.—*Evidence of enginemen and guards of the two trains.*

Driver D. McNulty, with 20 years service as passed driver, and fireman V. R. Bryant with 6½ years service as fireman, were on the footplate of engine No. 2164 with the excursion train. Passenger guard F. Hadwin, who rode in the last vehicle, was in charge. The train left Scarborough on its return journey punctually at 8.55 p.m. It was checked by " permanent way caution " between Scarborough and Seamer, and was stopped by signals at Sunbeck Junction. The continuous brake acted with its usual effect on these occasions. The train was travelling about 60 miles per hour before reaching Black Banks Junction, where the speed was reduced to about 35 miles per hour owing to the danger position of the distant signal. The regulator was also closed between Black Banks and Croft Junction. After passing Croft Junction the distant signal for Darlington South was sighted at " Clear," and speed was increased to about 45 miles per

hour approaching the Junction signal-box. McNulty stated that, as he was passing the bridge carrying the home signals, he saw the headlights of an engine (No. 2369) emerge from the left out of Nos. 1 and 2 platform lines on to the down through line. He applied the continuous brake immediately, and felt the blocks taking hold of the train just as the crash occurred. He had no more than two seconds to act in and was unable to reverse or use sand.

Fireman Bryant generally confirmed McNulty's evidence that the brake was in good order on the journey. After seeing the Darlington South Junction signals were clear, he was engaged firing and, having completed the work, looked up just as the headlights of the engiue appeared in front of them. His driver made a full emergency brake application.

Guard Hadwin tested the continuous brake at Scarborough before the train left, and also vouched for it being in good order, the vacuum gauge registering 20 inches. He estimated the speed of the train at 45 miles per hour just before the collision.

The enginemen of the parcels train were driver R. J. Bell, with 16 years service and 5 years as passed fireman, and fireman J. McCormack, with 9 years experience of firing.

Bell had had considerable experience, as fireman, of the road between Newcastle and York. During the past 5 years he had been driving two or three times a week, his work being mainly limited to working in Greensfield (Gateshead) Shed Yard, or with light engines, empty and goods train traffic between Blaydon and Heaton. He had not signed the Road Book, but he knew the road and signals to Darlington and York. He stated, however, that if he had been asked to sign the book he would have done so, as he knew the road. Moreover, if he had not been satisfied that he knew the road, wheu he was detailed for working the parcels train, he would have asked for the services of a conductor. Though he had previously driven one train which terminated at No. 1 platform, Darlington, and had returned thence to Newcastle, he had never done any shunting work as driver in Darlington Station yard. This was the first occasion on which he had driven the 9.30 p.m. parcels train from Newcastle. On arrival at Darlington, Bell knew there were vehicles to pick up off the middle (duplicate) road. When the train stopped at the south end of No. 1 platform, the engine was standing some little distance from the signals in advance (Nos. 17 and 19) applicable to that road. Bell did not move the engine with the three vehicles attached, on the last of which shunter Morland rode, until the lower and smaller of the two signals (No. 17) was eventually lowered. He then moved forward until his rear vehicle had cleared No. 53 points—his engine at that moment was standing on the down through line. When the shunter shouted, he propelled the train back along the middle (duplicate) road until they came in contact with the vehicles he had to pick up, which were standing north of the scissors crossing. When the additional vehicles were coupled, the shunter signalled to him to go ahead, and the small arm (No. 8) applicable to the middle line was lowered for him to proceed. He thought the lowering of this signal authorised a movement on to the down through line, and that he was justified in moving forward far enough to clear the points, so that he could propel the ten vehicles behind the engine on to the remainder of the train, which was still standing on No. 1 platform road. He knew that in advance of No. 8 signal there was a group of signals on two posts (A on plan), of which the right hand carried two arms. After No. 8 signal was cleared he did not understand that authority to pass this signal post was necessary by the lowering of one of the two arms 18 or 14. Bell could not explain why he thought that authority given by No. 8 signal justified his moving by Nos. 14 and 18 signals at danger, notwithstanding that he was aware that the lowering of No. 11 signal (applicable to No. 1 platform line) did not authorise him to pass Nos. 19 and 17 signals at danger. But he had in some way got this impression. There was nothing wrong with his brake, and he knew that all the ten vehicles behind the engine were fitted, and the brake connections coupled. He thought that if shunter Morland, as was stated, had applied the brake even to a small extent, he would have observed the reduction in the pressure gauge at his end of the train. He noticed that the brake was applied, presumably from the rear of the train, just as the engine was moving on to the down through line. He looked back to see the shunter, but failing, turned to his fireman to ask him if he could see. As

he was turning to speak, with the engine just moving, he saw the excursion train approaching, and released the continuous brake in order to lessen the effect of the collision which was imminent. He stated that the speed of the shunting movement never exceeded 6 or 7 miles per hour, and that, if he had been aware that anyone at the rear of the train was attempting (by brake application) to attract his attention, he could have stopped the train within one or two engine lengths before the main line was fouled.

Fireman McCormack had not worked with driver Bell before, but had on two previous occasions worked as fireman with the 9.30 p.m. parcels train. He stated that he had no knowledge of the signals inside Darlington Station yard, and was ignorant what authority in the way of movement the signals gave to drivers.

Passenger guard J. H. Sharp (with 20 years service as such) was in charge of the 9.30 p.m. parcels train. The train included passenger vehicles as far as Darlington, but carried parcels only between Darlington and York. He rode in the sixth vehicle from the engine, and after arrival at Darlington got out on to the platform, and was engaged in loading parcels into the vans. He did not know what shunting movements the engine carried out whilst the last nine vehicles were standing at the platform—six of these would have been attached to the parcels train when it left Darlington.

4.—*Evidence of Darlington Station Staff.*

Stationmaster Beeby said that it was the normal and almost invariable practice to shunt this parcels train at the north end of No. 1 platform. The only exception was when a second train had to be berthed at the platform. The length of the platform, north and south of the scissors crossing, is sufficient to accommodate eleven and eight bogie vehicles respectively. He thought it was the duty of a shunter who was qualified in the operation of the continuous brake, if he saw the driver of a train of which he was in charge passing a signal at danger, to stop the train as quickly as possible.

This opinion was supported by station foreman Morley and guard Sharp.

II. Signalling arrangements at Darlington. It will be seen from the drawing attached, and from the " Description," that the Darlington North and South Junction signal-boxes, which control through traffic over the main and goods loop lines, are situated half a mile apart. For up traffic which has to stop at Darlington Station there are three additional lines in use, viz., No. 1 platform, the up duplicate, and an up siding. Control over traffic using these lines is exercised from Platform East signal-box, which is situated on No. 1 platform 415 yards from the North and 473 yards from the South Junction signal boxes. Movements from north to south are made under the usual block telegraph signals between the three boxes.

It is necessary to provide for the occupation of No. 1 platform by two trains at the same time, and home signals Nos. 6 and 9 and Nos. 2 and 3 are therefore required to define the stopping points so that movements over the scissors crossing and slips connecting the three lines may not be interfered with. These signals are about 260 yards from Darlington North up starting signals. It will be seen that up starting signals for the East signal-box are provided for the up platform and duplicate lines, and are situated only 129 yards and 142 yards in advance of their respective home signals, and not, as might be expected, at the extreme south end of No. 1 platform. These signals define the southern limit of the section for the two running lines controlled from the East signal-box—the section thus having a total length of about 400 yards.

All movements beyond these starting signals on either the up platform or duplicate lines are therefore signalled on the block to the South Junction signal-box. The home signals for South Junction signal-box for these lines are situated 96 yards and 135 yards in advance of the East box starting signals for the up duplicate and platform lines respectively. Similarly, shunting movements in the down facing direction on either of these lines from the south are made under the blocking back signal.

Under the East box up home and up starting semaphore signal arms are carried small arms, which are lowered independently of the upper arms to warn drivers that the signal in advance is at danger, and that they have been accepted under caution by the South Junction. These small signals are incorrectly termed " calling on " arms. In reality, having regard to the fact that they authorise movements up to the next signal, they are actually " shunt ahead " signals.

These arrangements have been in use for many years, and must therefore be well-known to drivers who have any acquaintance with the working arrangements inside Darlington Station yard. From the point of view of present day methods of signalling, however, they are open to criticism.

III. Effects of collision, description of stock, etc. The speed of the excursion train at the moment of collision was about 45 miles per hour and the parcels train engine with its vehicles was probably at rest when the impact took place—the wheels being free from brake effect. This engine had run through No. 68 facing points (bolted) in the trailing direction, and the switches do not appear to have been thereby seriously damaged, for the engine after the collision was found on the rails of the down through line. The four vehicles behind the engine were standing on the crossing, and the last six vehicles on No. 1 platform line. The first and heaviest effect of the momentum of the excursion train on impact was absorbed in driving the parcels train engine and tender backward a distance of about 60 yards, in destroying the four vehicles behind it, and in driving backwards the remaining six vehicles along No. 1 platform line. There followed the derailment and overturning of the engine (No. 2164) which finally came to rest on its side about 65 yards from the point of collision. The final surge forward of the coaches was absorbed in the three front vehicles, and resulted in the telescoping which took place between the second and third.

It will be seen from Appendix II that the two leading vehicles were non-vestibule coaches, and the remainder vestibule-fitted, that the age of the coaching stock varied from 17 to 29 years, and that all except the first were electrically lit. In respect of construction all had wood bodies fitted to underframes built either entirely of steel (Nos. 5227, 51691 and 51692), or of steel with wood headstocks (Nos. 21756, 2886, 5303 and 475 C), or entirely of wood (Nos. 1304, 51301 and 51303). The solebars in the case of No. 1304 had outside angle iron plating. All the coaches were fitted with side buffers and central drawbar hooks with screw couplings. The buffers and buffer casings extended (when coupled) 1 foot 10 inches beyond the headstocks, the interval between the headstocks when coupled being about 3 feet 6 inches. The centre of the axes of the buffers (with unloaded vehicles) was 3 feet 6 inches above rail level, coinciding with the centre line of the headstocks. The faces of the buffers were either circular or oval in shape as shown in Appendix II.

On the two vehicles which telescoped, the buffer stroke provided on No. 2886 was 6 inches, and 5 inches on No. 1304. The buffer rods on No. 1304 inside the headstock (6 inches by $11\frac{1}{2}$ inches) were attached to a laminated spring with 12 steel plates (3 inches by $1\frac{1}{2}$ inches) kept in position by a buckle through which the drawbar passed, the camber in the centre of the spring being 7 inches. On No. 2886, with wood headstock $5\frac{1}{2}$ inches by 12 inches, the buffing provided (Spencer Moulton (No. 287) rubber springs) was much stiffer, and the spring container more securely bolted to the steel channel solebar and angle iron diagonal framing. The centres of the buffers were 5 feet $8\frac{1}{2}$ inches apart in each case.

When impact occurred, though the buffers between Nos. 21756 and 2886 and draw and truss bars were bent, and the rear end of No. 21756 was crushed, there was no actual telescoping, perhaps owing to the adjoining ends of the two coaches at the moment of impact being on the same level. The force of momentum must have been absorbed by compression and destruction of buffers and damage to steel underframing (with vestibule attached but unextended). Between the second and third vehicles it appears that the leading end of No. 1304 lifted, the buffers and steel solebars of No. 2886 broke through the wood headstock of No. 1304, so that the underframe of No. 1304 was driven by the momentum of the rear nine coaches over the steel underframe of No. 2886, with the result that telescoping to the extent described took place, and the leading bogie of No. 1304 was driven back against its trailing bogie by the underframe of No. 2886.

IV. First Aid Requisites and Emergency Tools. There were available in the excursion train in each of the brake compartments of Nos. 1304 and 51303 an ambulance box and a case of salvage tools (see detail in Appendix III). There was also a ladder for rescue purposes in 1304. The ambulance and rescue equipment in No. 51303 were available after the collision, but those in No. 1304 were not available owing to the destruction of the vehicle.

At Darlington passenger station 26 of the staff are trained in ambulance work, of whom six were on duty at the time of the accident. Thirty more of the staff employed at Croft Junction and Bank Top Goods Warehouses and Yards were similarly qualified. In addition, there were more than 200 ambulance men employed in the Company's various works at Darlington whose services might have been called for, if required, in this emergency. At these centres there were seven stretchers available, six of which were actually brought into use, and eight other ambulance boxes containing splints, bandages, etc.

Qualified medical assistance arrived on the site within twenty-five minutes, and Greenbank Hospital was asked by telephone for the attendance of the ambulance van. Before 11.35 p.m. this van, with other motor cars and vans, was standing ready to move the injured to the hospital, and the Fire Brigade men were in attendance. Within twenty minutes of the collision there were available on the site more men, ambulance material, etc., than could actually be brought to bear upon the work of rescuing the injured from the telescoped carriages.

Conclusion.

I. All the evidence in this case, including his own, leaves no doubt that driver Bell passed both signals, Nos. 18 and 14 applicable to the up duplicate line, at danger, on his second shunting movement in the direction of Darlington South Junction. He explained that he thought that " Calling-on " signal No. 8 authorised movement towards the South Junction, presumably because there was no visible obstruction on the line ahead, as far as was necessary for all the vehicles behind his engine to clear No. 53 points, in order that when the points were reversed he might propel them back on to No. 1 platform line. Seeing that he realised that an identical signal (No. 11) on No. 1 up platform line did not authorise him to move past Nos. 19 and 17 signals in the danger position, when he had to draw forward with the same object, i.e., to clear No. 53 points, it is difficult to understand how he gained so false an impression. In support of his explanation, he instanced a similar case of signalling at Newcastle. But examination of the signalling plans proved that the conditions at Newcastle were dissimilar, and his conclusion therefore not warranted. He stated that he had only once before driven a train into No. 1 platform at Darlington and had never previously been in charge of an engine during shunting work in Darlington Station yard. He should have asked for assistance, or applied for information to shunter Morland, if he was unacquainted with the signalling.

It is clear that his general knowledge of signalling was insufficient to enable him to read correctly any complication of signals in a yard with which he was not acquainted.

With regard to shunter Morland, he had had a long experience of the signalling in the station yard, and saw Bell's engine pass the signals at danger, and without authorisation. It was his duty, I consider, in the circumstances, to have applied the brake powerfully, and to have stopped the train; this he could have done before the engine reached the junction with the down main line. The train was travelling at a speed of about 7 miles per hour, and an interval of not less than 117 yards intervened between Nos. 18 and 14 signals and No. 62 points. He ought to have realised that his train was running into danger in moving towards a main line junction with signals against it. I do not therefore find his explanation, that he thought the train might be divided, if he made a powerful brake application, acceptable.

II. My conclusions on the cause of this collision are :—

(*a*) That responsibility rests upon driver R. J. Bell, who passed Nos. 18 and 14 home signals for Darlington South Junction at danger. His general knowledge of signalling and his previous lack of experience at Darlington Station yard can alone account for his erroneous reading of

the authority afforded for No. 8 signal. When, however, he saw the collision was imminent, he acted with good judgment in releasing the continuous brake, and thereby possibly reduced the serious effects of the collision.

He is a young man (32 years) and has a clear record as driver. I am glad to record that he gave his evidence in a thoroughly straightforward manner.

(*b*) I do not consider that his fireman, J. J. McCormack, is responsible. But his statement that he knew nothing about signals, or the authority they gave to a driver, is unsatisfactory in view of the fact that he was promoted fireman in 1921, and passed his examination for driving in January, 1928.

(*c*) That porter shunter Morland might have prevented the collision had he taken the initiative, and acted with decision. I cannot, therefore, free him from some responsibility in the case.

(*d*) That the enginemen of the excursion train, driver D. McNulty and fireman V. R. Bryant, as well as the signalmen, are entirely free from blame.

III. From the report it will be noted that on two brake vans of the excursion train there were sets of first-aid requisites and emergency tools, that a sufficiency of stretchers and additional ambulance boxes were available in the station, and that a large number of the Company's staff were trained in ambulance work. The arrangements made by the Company for dealing with the emergency and affording assistance to those injured appear to have been adequate in every direction.

IV. The following points in connection with this case call for the attention of the Company :—

(*a*) *Drivers' knowledge of signalling.*

Driver Bell had not been called upon to sign the Road Book as an acknowledgment that he knew the road and the signalling. On the other hand he stated that if he had been asked to sign the book he would have done so readily, as he was conversant with the road and signals between Newcastle and York. It appears, therefore, that something more than a mere signature in the Road Book is required to establish the fact that a driver is conversant, first, with the general principles of signalling and, secondly, with the position and details of signalling inside all large station yards, within which he may be called upon to carry out shunting work. The attention of Railway Companies has been drawn on other occasions to the desirability of a better proof of a driver's knowledge of signalling than his signature in the Road Book. This is essential in the case of young drivers with comparatively little experience.

(*b*) *Signalling at Darlington Platform East.*

Unless the term " Calling-on " is confined to signals which signify, in accordance with General Rule No. 43, that a driver may expect to find an obstruction on his road, or be required to stop at a signal-box before he reaches the next signal, there is, I think, some liability that the term may be misunderstood by enginemen. Platform East signals Nos. 8 and 11, termed " Calling-on " signals, are of the same type, only with smaller arms and lights, as the up starting signals Nos. 7 and 10. They actually have the same value as ordinary shunt ahead signals. I understand that the Company prefer to retain the present arrangements for de-limiting the extent of the sections controlled by Platform East and South Junction signal-boxes respectively, and consider the retention of all the existing signals necessary. Even so, a better definition of the meaning which it is intended the signals should convey to enginemen can be obtained by the use of a single 3-aspect light signal on each line. The yellow being displayed when the signal in advance is at danger, and the green when the signal in advance is clear. I recommend that some alteration in this direction should be considered by the Company.

V. This accident is clearly one which would have been prevented, despite the failure of driver Bell to understand the signalling, and of shunter Morland to act with good judgment, by a method of automatic train control.

VI. No fire occurred as a result of this collision. The first coach alone was lighted by gas, and no breakage took place of high pressure gas piping, or perforation of the gas cylinders carried on the coach.

VII. The telescoping of the rear five compartments of No. 2886 into the front brake compartment of No. 1304 was the direct cause of the great majority of deaths and serious injuries in this collision. It is difficult to lay down any certain preventive action to obviate telescoping. So much depends upon factors of which we have little knowledge, upon irregularity of rail surface, and upon chance. I have discussed the general question with the Company's Chief Mechanical Engineer, and offer the following remarks, many of them truisms, on the conditions which it is desirable should prevail in the make-up of a train, and in the construction of the coaching vehicles, which will tend to prevent telescoping :—

(*a*) Telescoping is generally due to one end of the coach rising or falling, and underframes consequently over or under-riding. Out of level of coaches, and therefore of buffer faces due to variations in the main springing of coaches under load may, in the event of severe impact, cause bending of the buffer faces and sometimes of the buffer rodding. This may in itself ultimately lead to over-riding of one frame, as a very recent case has proved.

(*b*) Impact shock effect should be taken up by buffer springs, and by distortion, if momentum is sufficiently great, of the underframes, and lifting prevented. Homogeneous strength of springing of buffering and of design of solid steel underframing is therefore necessary throughout a train. If vehicles of lighter weight or with less solidly constructed frames have to be used, it is desirable they should be marshalled with stronger built and more up to date vehicles both in front and rear.

(*c*) The interval between headstocks of coaches should be as small, and the couplings as short, as practicable for necessary freedom of movement, so that any tendency of the underframe of one coach to lift will bring its headstock into contact with the headstock of the coach adjoining and possibly prevent over-riding.

(*d*) In the case of non-vestibule stock, the existing clearance of 3 feet 6 inches between headstocks, and the use of side buffering with screw couplings, allows greater freedom of vertical movement between the ends of adjoining headstocks than is desirable, and the arrangement cannot be described as anti-telescopic. There may, however, be danger to men employed in coupling work (with buffers plunged) if this interval between headstocks is reduced, and the screw coupling retained. But if reduction in the interval be for this reason not found practicable with the use of screw couplings, either automatic couplers, which do not necessitate men going between the coaches for coupling or uncoupling, and permit of closing the interval between the headstocks, should be adopted instead of the screw coupling; or heavy steel fenders, corrugated in type, should be used to ensure interlocking of the headstocks as a means of prevention of telescoping.

(*e*) As regards vestibule stock, recent accidents have proved :—

(1) The buck-eye coupling and latest pattern (steel faced) Pullman vestibule, and

(2) Articulated stock

are the best known types for prevention of telescoping.

(*f*) It is not clear that " all-steel " coaching stock, unless perhaps it is of the very heavy type adopted in the U.S.A., which has specially strengthened steel collision compartments at each end of the coach, is likely to prove successful. Unfortunately this heavy type of stock—with similar passenger accommodation—has more than twice the weight of well designed bogie stock now in use on British Railways.

A number of coaching vehicles constructed entirely of steel, but without heavy anti-collision compartments in front and rear have been built by Railway Companies, and are under trial. It remains to be seen whether the effect of damp at the joints will result in deterioration of this stock. It is also doubtful how such all-steel coaches will behave under very violent shock effect, in cases where the force of momentum has to be entirely absorbed by the vehicles. There is also the difficulty which will exist in effecting the rescue of passengers enclosed in such vehicles.

I understand that a recent method of all steel tubular welded construction, which is being tried in France, may prove to be both effective in prevention of deterioration, and is likely to provide greater strength.

VIII. The question of the best method of preventing telescoping of coaching stock, as the result of collision, is one for serious consideration by Railway Companies. But it is necessary to remember that there exists a large amount of coaching stock in good condition and fit for service, which it would be impossible to scrap for a number of years.

I have the honour to be,

Sir,

Your obedient Servant,

J. W. PRINGLE,

Colonel.

The Secretary,
Ministry of Transport.

APPENDIX 1.

PARTICULARS OF DAMAGE.

1.—Rolling Stock—Engines.

Engine No. 2164.

Buffer beam knocked off.
Bogie knocked out and bogie frame badly broken.
One bogie axlebox broken.
Both main frames badly bent at the front end.
Right backway eccentric rod badly bent, fouling the other gear.
Cylinder casting badly damaged underneath.
Exhaust injector grease separator smashed off the motion support plate.
Engine cab badly damaged and knocked out of place.

Tender.

All brake gear damaged and the right middle axlebox broken.

Engine No. 2369.

Bogie all twisted up and badly damaged, leading wheels locking against bogie frame.
Middle cylinder and middle piston valve covers knocked out and both trail rods badly bent.
Buffer beam knocked off.
Both main engine frames at front end doubled up.
Engine brake gear damaged.
Centre drawbar and side bars between engine and tender smashed.

Tender.

Fall plate and intermediate buffers damaged.

2.—Coaching Stock—Excursion Train.

No. 21756—Buffer, drawbar and truss bars bent and one end of coach smashed.
No. 2886—Totally wrecked (telescoped).
No. 1304—Totally wrecked (telescoped).
No. 5303—2 corridor lights, 2 top quarter lights and 1 top door light broken.
No. 5389—1 large side light, 1 top door light broken and 2 buffer sockets broken.
No. 475 C—2 buffer sockets broken.

Fitted Stock—Parcels train.

No. 206—Totally wrecked.
No. 334—Totally wrecked.
No. 824—Totally wrecked.
No. 1435—Totally wrecked.
No. 1008—One solebar, one headstock, two buffer castings and one end pillar broken.
No. 1914—One end entirely smashed.
No. 270—Vacuum pipe dislodged.

APPENDIX II.

INFORMATION REGARDING STOCK COMPOSING 8.55 RETURN EXCURSION TRAIN.

No of Vehicle.	Description.	Constructed.	Lighting.	Headstock.	Underframe.	Type of Buffer.
Engine 2164 and Tender.	—	1914	—	—	—	—
21,756 ...	Non-vestibule Bogie Third.	1911	Gas.	Wood.	Steel.	14" diameter convex vertical. Ditto horizontal.
2,886 ...	Ditto.	1908	Electric.	Wood.	Steel.	Oval, 16" by 12" convex vertical. Ditto horizontal.
1,304 ..	Vestibule Bogie Brake Third.	1899	Electric.	Wood.	Wood with angle iron stiffening.	15" round convex vertical. Ditto horizontal.
5,303 ...	Vestibule Bogie Third.	1906	Electric.	Wood.	Steel.	Ditto.
5,389 ...	Ditto.	1907	Electric.	Wood.	Steel.	Ditto.
475c ...	Vestibule Bogie First.	1907	Electric.	Wood.	Steel.	Ditto.
51,301 ...	Vestibule Bogie Compo.	1899	Electric.	Wood.	Wood.	Ditto.
5,227 ...	Vestibule Bogie Third.	1906	Electric.	Steel.	Steel.	Ditto.
51,691 ...	Ditto.	1904	Electric.	Steel.	Steel.	Ditto.
51,692 ...	Ditto.	1904	Electric.	Steel.	Steel.	Ditto.
51,303 ...	Vestibule Bogie Brake Third.	1899	Electric.	Wood.	Wood.	Ditto.

APPENDIX III.

Contents of ambulance boxes, and emergency tools, contained in brake compartments of both Nos. 1304 and 51303.

First-Aid Requisites.

1 tourniquet.
½ lb. Boric lint.
Cotton wool.
8 triangular bandages.
4 roller bandages (narrow and wide).
5 yards ½ inch adhesive plaster.
5 yards 1 inch adhesive plaster.
1 pair of scissors.
Safety pins.
2 2-oz. bottles of sal-volatile.
2 2-oz. bottles of iodine.

Emergency Tools.

1 Fire extinguisher.
1 Fire bucket.
1 large crowbar.
1 small crowbar.
1 axe.
1 double-edged saw.

(3103—29) Wt. 14852—1369/1173 910 12/28 P. St. G. S/ 13

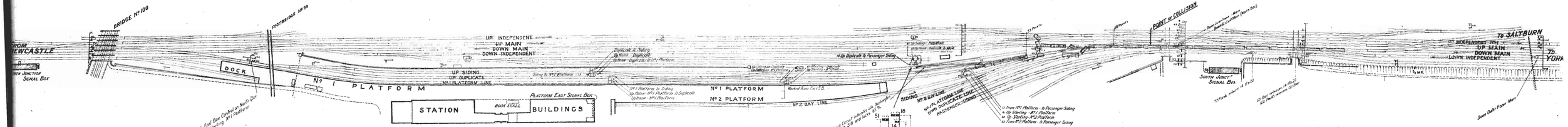
L. & N. E. RAILWAY

COLLISION AT DARLINGTON SOUTH JUNCTION

ON 27TH JUNE 1928

To accompany Col. Sir J.W. Pringle's report dated 3rd November 1928.

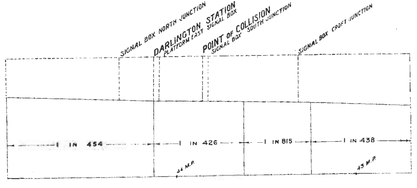
Drawing No 1



SITE PLAN

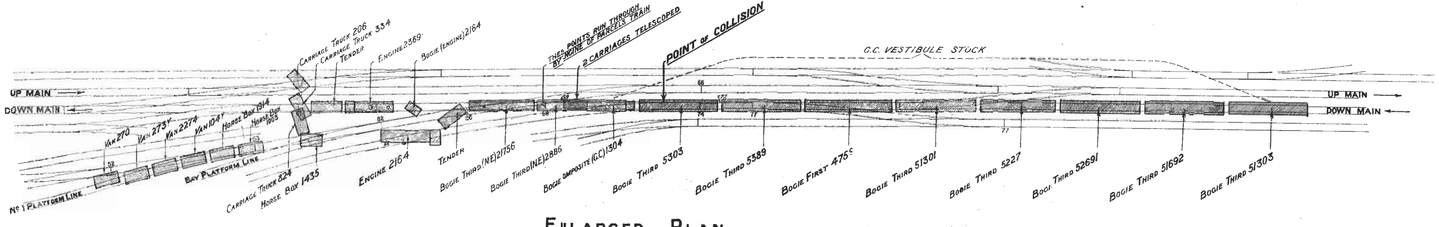
SCALE: 1/1000

DETAILS OF SIGNAL A



LONGITUDINAL SECTION

HORIZONTAL SCALE: 3 INCHES TO 1 MILE
VERTICAL SCALE: 100 FEET TO 1 INCH



ENLARGED PLAN