DEPARTMENT OF TRANSPORT

RAILWAY ACCIDENT

Report on the Collision that occurred on 30th June 1977 at Newcastle Station

IN THE
EASTERN REGION
BRITISH RAILWAYS

LONDON: HER MAJESTY'S STATIONERY OFFICE

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RAILWAY INSPECTORATE,
DEPARTMENT OF TRANSPORT,
2 MARSHAM STREET,
LONDON, SW1.
26th April 1979.

SIR,

I have the honour to report for the information of the Secretary of State, in accordance with the Order dated 7th July 1977, the result of my Inquiry into the buffer-stop collision which occurred at 10.49 on 30th June 1977 at Newcastle Station in the Eastern Region of British Railways.

The 09.45 Newcastle to Newcastle via Benton passenger train, a two-car diesel multiple unit, which had been correctly signalled, was running into No. 3 Bay Platform line which was unoccupied, when it failed to stop normally and struck the buffer-stop at a speed of approximately 4 mile/h. Most of the passengers were standing in readiness to alight, the impact threw them off balance, and 23 of them and the guard of the train were injured.

The emergency services were summoned promptly and treatment was offered by station staff and British Transport Police trained in first aid. Five ambulances arrived within 11 minutes of the accident and the injured were taken to Newcastle General Hospital where all except one lady, who was detained in hospital for seven days, were discharged after treatment for minor injuries. No damage was caused to the buffer-stop nor to the train which was taken out of service for examination. Slight alterations were necessary to train services and the platform concerned was out of use for about an hour. At the time of the accident the weather was fine and clear.

DESCRIPTION

The Site

1. Newcastle Station is on the East Coast Main Line 268½ miles from King's Cross Station on the north bank of the River Tyne between the King Edward and High Level railway bridges and stands at the junction of the lines to Carlisle, Sunderland and the North Tyne Loop. The station lies to the north of a number of through lines and consists of an island platform connected by a bridge to a single-sided platform to its north aligned approximately east–west. At the east end of the single-sided platform there are seven bay platforms numbered 1–7 from north to south, the single-sided platform being No. 8 and the island platform forming platforms Nos 9 and 10. The approach to the east end of the station is over four tracks; reading from north to south these are the Down and Up North lines, which can be used bi-directionally, and the Down and Up Tynemouth lines. The station is built on the level and is approached from the preceding station to the east, Manors Station, on a rising gradient of 1 in 258 for over a quarter of a mile. From the ramp ends to the buffer-stops all the bay platforms are straight although they are approached from the east round a sharp right-hand curve over a series of viaducts and bridges above the streets of Newcastle, the speed restriction over which is 15 mile/h. The layout of the lines and platforms in the area together with the route of the train are shown on the plan at the back of the report. Trains in the area are signalled on the Track Circuit Block System using multiple-aspect colour-light signals with position-light shunting and subsidiary signals, controlled from a route-relay interlocking in Newcastle Signal Box. Points are electro-pneumatically operated. The buffer-stop concerned is of timber and rail construction secured by bolts to the running rails. The last 375 feet of track alongside Platform No. 3 is beneath the overall station roof which is supported on columns along the centre line of the platform surface although the sides are open to the weather.

The Train

2. The 09.45 Newcastle to Newcastle diesel multiple-unit passenger train (DMU) (out via Benton, return via Wallsend) 2N77, consisted of two vehicles. The leading car was Motor Brake Second 51215 of Class 101/2 built by Metropolitan-Cammell in 1958 and driven by two AEC 6-cylinder horizontal engines of 150 bhp through a standard mechanical transmission, behind which was Driving Trailer Composite (L) 56081 built at the same time by the same builder. The total length of the train was 114 ft and the weight was 57 tons. The unit was equipped with the standard British Railways quick release vacuum brake with two 21-inch cylinders on the leading car and two 18-inch cylinders on the trailing car. The total brake force available to the driver was 76 per cent of the total weight of the DMU i.e. 43·4 tons. The braking system has a normal train pipe, continuous throughout the train, connecting the brake cylinders to the driver's brake valve. On each vehicle there is also a high vacuum release reservoir connected to an exhauster pipe, continuous throughout the train, by an automatic isolating valve which remains open until the vacuum in the release reservoir falls to 19 inches. A feed valve fitted between the release reservoir, the brake valve and the brake pipe ensures that the vacuum in the brake pipe does not exceed 21 inches. This arrangement

allows both the exhauster and release reservoir to withdraw air from the brake pipe and compensates for the fact that the belt-driven exhauster may be running at low speeds. Measurement of vacuum throughout the report is in inches of mercury.

3. The driver's brake valve has three positions:
Off: High vacuum release reservoir at 29 inches vacuum. Train pipe and brake cylinders at 21 inches. Both maintained by the exhauster through the drivers brake valve and feed valve.
Lap: Maintains the high vacuum side at 29 inches and the train pipe at 21 inches or such lower figure as may have resulted from a brake application.
On: Maintains the high vacuum side at 29 inches but admits air to the train pipe.

At a number of points in each car, including the lavatories, passengers have access to the communication cord which, if pulled in an emergency, operates a valve admitting air to the train pipe and applying the brakes. At the end of the car in which the cord has been pulled an exterior indicator rotates.

The Course of the Collision

4. After making the penultimate stop at Manors Station, 2N77 was driven over the Up North line and along No. 3 Platform line. The driver made what he considered to be a normal series of brake applications to bring the train to a stand a few yards from the buffer-stop but his action did not have the desired effect and the train struck the buffer-stop at the end of the platform line and rebounded about one foot. There was no damage.

Evidence

As to the Running of the Train

5. Sitting facing the buffer-stop of Platform No. 3 as 2N77 arrived and about 15 yards behind it was *Supervisor J. W. Hailes* with two railmen. He told me that he was giving his full attention to the incoming train of which he had a good view. It approached at about 5–7 mile/h and appeared to be making a normal stop except that in the last two seconds before it struck the buffer-stop he realised that it would not stop in time. The braking appeared from the noise to be continuous and normal and the driver was sitting in his seat looking ahead although his hands were out of view. Realising that the train would not stop he rose and went on to the platform to assist the driver and passengers. He told me that passengers regularly opened the doors before trains had come to a stand, that the platform lines were usually empty as DMUs were rarely stabled there during the day, and that after the accident a passenger emergency communication cord in a lavatory was found to have been pulled. This he said happens fairly regularly when children operate the apparatus in the lavatory compartment after the train has stopped. He told me that it was a fine bright day with no rain and that there was nothing unusual about the movement of the train until the last 1½ to 2 seconds. He did not think that there was any oil on the rails approaching the buffer stop although there was some in the six-foot.

6. *Guard W. A. Patten* was in charge of 2N77 and told me that he had been a passenger guard for nearly a year working similar trains in the Newcastle area. He had been in charge of other trains round the same route earlier that morning but joined this train at Platform No. 4 just before it departed at 09.45 and spoke briefly to Driver Forbes with whom he had travelled before. The weather was fine and cloudy and he stayed in the guards' van, which was in the leading vehicle entering the platform on its return to Newcastle, throughout the journey except when his duties required him to leave it. He described the journey round the Loop as completely normal and the same as his journeys round the Loop on previous occasions. The vacuum gauge in his van was working correctly but he did not observe it as the train was entering Newcastle Station. He thought that he was a good judge of speed and said that the train travelled at the usual speed after departure from Manors, slowing down at the Castle Curve. As the train passed the platform ramp travelling at approximately 10 mile/h which was the usual speed at that point, he heard the brakes being applied. They were left rubbing on the wheels and then about half-way along the platform, when the train was just crawling, he heard a second application of the brakes and thought that the final application must have been made when the front of the train was about 20 yards from the buffer-stop. He was standing ready to assist a woman with a pram out of the guard's van when the train struck the buffer-stop and he was knocked over and concussed. He was quite sure that everything had been going normally until the last few seconds before the train hit the buffer-stop.

7. The driver of 2N77 was *Driver G. Forbes* who had been driving DMUs for about 15 years in the Newcastle area and said that he was fully conversant with the routes and the driving and braking techniques for the trains. Prior to the accident he had driven a train for 2 round trips on the North Tyne Loop before taking his break but he could not remember into which platforms he had driven these trains at Newcastle Station although he thought it was most likely that it had been Platform No. 1 or 2; he had however driven trains into all the platforms at Newcastle Station on numerous occasions. After his break he went to Platform

No. 4 and took over the two-car DMU for the 09.45 departure. He told me that he found nothing wrong with the DMU during the journey round the Loop and described the effect of the weather conditions on the rail as "alright".

8. Departing from Manors Station the first signal was displaying a double yellow aspect and he drove at about 15 mile/h until just before reaching the Castle where he shut off power and allowed the train to coast. He was quite certain that he saw the route indicator on the signal indicating Platform No. 3 and was not in any way confused about the platform to which he had been routed. He said that approaching the ramp end of the platform his speed was about 10 mile/h and he applied the brake so as to reduce the vacuum by about 4 inches with the brake blocks "clicking on the wheel" allowing the train to run quietly in with the speed falling all the time. He judged the amount of vacuum destroyed both by watching the gauge and by the feel of the bite of the brake blocks. After making the initial brake application on this occasion he placed the brake handle into the 'Lap' position and said that he was sure he had not placed it into the 'Release' position because it was possible to tell from the feel of the plunger, which clicks into the lap slot, what the position of the brake handle was.

9. He told me that he judged the position at which he should make a further application of the brake by the distance from the buffers rather than by the use of the speedometer or from landmarks on the platform. When he was about 10 yards from the buffer-stop he made a second application with the train travelling at about 4–5 mile/h reducing the vacuum by a further 2 inches in order to come gently to a stop about 5 yards from the buffer-stop. The train then appeared to "pick its wheels up" i.e. began to skid and when he realised that the wheels were sliding he attempted first to release the brake and then to make an emergency application but there was insufficient distance for either action to take effect and before he could do anything else the train had hit the buffer-stop. He was quite sure that the wheels had skidded because of the sound. He thought that he released the Drivers Safety Device (DSD) before the train struck the buffer-stop and said that after the train had stopped he found the throttle closed, the DSD had operated, the gear lever was in neutral, the reverse lever was in full forward gear, and the vacuum brake handle was in the emergency position. He said that he could not remember anything happening on the platform or to his left which could have distracted him.

10. He told me that about 9 months previously, while entering Platform No. 5, the train that he was driving was halfway down the platform when its wheels locked and slid but that gave him sufficient time to release the brakes completely, to make another application, and to stop safely. The sensations that he felt on that occasion in terms of acceleration and deceleration were, he said, the same as on the day of the accident. He had, in the past, reported poor brakes on a DMU because the train was not stopping in the way that it should have done with a brake in proper working order. He could not recall anything having been said recently as a reminder to drivers about the braking technique to use with a DMU. On one occasion he remembered that a brake piston had stuck but he had realised at the time that the brake effect had deteriorated suddenly. He said that he had travelled with a number of other drivers into Newcastle Station in the cab and thought that all of them had the same technique of reducing speed to 10 mile/h at the platform ramp by reducing the vacuum by 4 or 5 inches and then lapping the brake. Irrespective of the size of the train he said that he would always apply the brakes in order to bring the speed down to 10 mile/h at the ramp end of the platforms and that he would always try to travel alongside the platform at that same speed between 5–10 mile/h and would not go further down the longer platforms before making the initial brake application. He said that drivers had been instructed to bring their trains to a stand about 5 yards from the buffer-stops at Newcastle Station.

As to Conditions at the Station

11. Also at Newcastle Station on the morning of the accident was *Driver S. McGlashan* who was employed moving DMUs from platform to platform as required by the Supervisor. He said that before the accident he had driven three trains out of and back into the bay platforms, one of which he remembered being a 2-car unit into Platform No. 4 although he could not remember where he had placed the other two trains. He had been a driver since 1958 driving on the North Tyne Loop regularly and had driven into Platform No. 3 the week before the accident. He confirmed a comment by Driver Forbes that Platforms Nos 3 and 7 had the reputation of being more difficult to drive into than the others although he could give no reason for this. He described his technique driving from Manors Station into Platform No. 3 when, travelling at about 15 mile/h or slightly less, he would make the first application approaching the platform ramp end destroying 4–5 inches of vacuum to make sure that the brakes were working correctly; at an unoccupied platform he would make a further 2 or 3 slight applications, trying to hold the brake in 'lap' in between, making the final application about 3 yards from the buffer-stop travelling so slowly that only a slight touch of the brake was necessary to stop normally.

12. On the morning of the accident he had not specially noticed the rail surface but considered that it was not a bad day and he had had no difficulty in driving any of the trains into the station. He said that he

would drive out to the Castle Bridge and then back into the station in the same way as he would bring in a passenger train. He did not think that the rail surface was particularly bad in Newcastle Station. Some time after the collision he was asked to move the train involved but found that he could not release the brakes because the passenger communication cord had been pulled in a lavatory. Once this had been corrected he moved the train just over its own length away from the buffer-stop bringing it to a stand with a normal gentle brake application since it was travelling very slowly. He had noticed nothing abnormal about the DMU.

13. I was informed that as soon as the DMU had been removed, the track leading to the buffer-stop at Platform No. 3 was inspected and, whilst a number of marks were found on the rails, none of them could definitely be identified as the result of the train wheels having skidded along the lines although one rail exhibited a continuous bright line along the gauge edge from the buffer-stop to a point 53 feet away from it. The final 60 feet of track leading to the buffer-stop in Platform No. 3 were dry but the railhead, as with all the other platform lines, was contaminated with oily dirt which tended to produce a greasy surface. This probably arises from DMUs which are left standing at the platforms. There were other short bright scuff marks on both railheads of an intermittent nature over the last 60 feet of track. Similar markings, although less bright because of traffic over them, existed on the tracks into the other bay platforms.

As to the Mechanical Condition of the Train

14. At the beginning of June 1977 *Fitter J. G. Miller*, who had been working on DMUs for 17 years, carried out an inspection of the unit involved in the collision. As part of this inspection he had checked that the train brake system was in order and that the exhausters were producing the correct vacuum. He had checked the pressure gauges and operated the driver's brake valves at both ends of the unit, checked that the DSD was working correctly, that there were no leaks, and that the brake release button was operating correctly. He told me that he had found nothing wrong with the brakes. He had not attempted to carry out the check from memory but referred to his handbook during the inspection.

15. The day before the collision *Carriage and Wagon Examiner T. Hunter*, who had been an examiner for 29 years, inspected with another examiner the brake gear of the DMU involved in the collision. He described how they had carried out the inspection, one of them going along either side of the set, making sure that there were no loose or defective parts, checking the brake adjustments with the brakes applied, seeing that the reserve stroke was not below the minimum laid down, and checking the brake blocks to ensure that none of them needed changing. He described how he was instructed which sets to examine and said that he found this particular DMU in satisfactory running order. He claimed that brake-block flanging was a common fault and that if a block was $\frac{3}{8}$ inch thick or less and flanging badly he would change it. He judged the reserve stroke dimension from experience and did not measure it but had no difficulty in deciding whether it was over the laid down figures of $3\frac{1}{2}$ inches for a power car or 4 inches for a trailer car. He told me that as a result of the inspection he was satisfied that the DMU was fit for service so far as its brakes were concerned.

16. On duty at South Gosforth Depot on the afternoon of the accident was *Senior Maintenance Supervisor L. Phillipson* who said that he had worked on DMUs since 1960 and had been a Maintenance Supervisor for 6 years. When he came on duty he was told that he had to carry out a special brake test on the DMU involved in the accident which he did with an assistant, a fitter, and a carriage and wagon examiner. He explained that the test was to Standing Order CD227 and described how each individual part of the test was carried out and the result. Because he was called away at one stage, his assistant carried out two of the tests and recorded the results incorrectly. As a result a further complete test was carried out which confirmed the results found by Mr. Phillipson with the exception that there were slight alterations to the amounts of flanging found and changes in the piston rod reserve strokes recorded because the wrong measurements had initially been taken. Presented with the revised brake test pro-forma he said that he did not consider the amount of brake-block flanging excessive although it was time that something was done to adjust it, the piston rod reserve strokes were below normal maintenance tolerances but they would still provide adequate brake force, and, in the piston sticking check and the slow application test, the piston of No. 2 brake cylinder on the power car (the trailing end) was sticking and it did not operate until almost all the vacuum had been destroyed. Mr. Phillipson said that he had repeated the two latter tests three times with the same result on each occasion.

17. I then asked the Railway Officers to comment on the results of this special brake test and they said that although the amount of brake force would have been affected, the brakes would have been most unlikely to have deteriorated to this extent during a single journey. Having driven round the North Tyne Loop with them in this condition the driver should, from the numerous brake applications which he would have made in the course of the journey, have been well aware of the slightly reduced amount of brake force at his command that might have resulted from the brake-block flanging and the reserve stroke deficiencies. They considered that the rate of brake application in the slow application and slow leakage tests was rather lower than that of the brake applications described by Driver Forbes in his evidence as those which he made

at the platform end and shortly before hitting the buffer-stop although there was no way of telling at what rate of application the brake piston might have stuck and at what rate it might have been free.

Tests

18. Shortly after the accident I visited Newcastle and with the Railway Officers repeated parts of the CD227 brake test on the DMU. The results were similar to those recorded by Mr. Phillipson. Because one cylinder had failed to operate in two tests I asked the Railway Officers to arrange the full testing of all four brake cylinders from the DMU. This showed that three of the cylinders were completely in order but that the piston rod of the trailing end cylinder of the leading power car was bent; this confirmed the results of the previous tests and could have been the cause of its failure to operate in them. However it is not clear how and when the piston rod was bent; if before the accident I would have expected it to have been detected during a previous brake examination unless the loss of reserve stroke had brought the bend into the gland. I was assured that it could not have been bent in the accident and that it had probably been bent in transit for the test; nevertheless this cylinder failed two tests immediately after the accident and the possibility remains that the loss of reserve stroke and the gentle application made by Driver Forbes could have resulted in the failure of this cylinder to operate as the train ran alongside Platform No. 3.

19. I made a number of journeys in the driving compartments of DMUs making normal passenger journeys from Manors Station to Newcastle Station. In nearly every case the drivers permitted the train to approach the platform ramp end at a speed of between 10 and 15 mile/h and appeared to make rather firmer initial brake applications further down the platforms than described by Driver Forbes in his evidence. A series of braking tests carried out under circumstances similar to those of the accident but with different drivers produced the following results from 10 mile/h with a consistent braking point 496 feet from the buffer-stop.

Vacuum Inches	*Reduction Inches*	*Stopping Distance Feet*	*Remarks*
21–15–12	6–9	111	Lap position not maintained. Vacuum drops slowly from 15 in. to 12 in.
21–15	6	126	Brake maintained in Lap position. Vacuum constant until the train came to a stand.
20–16	4	234	Brake maintained in Lap position.
20–15	5	165	Brake maintained in Lap position.

20. I am advised that the calculated braking distance for a two-car Class 101 DMU at 5 mile/h with 6 inches of vacuum destroyed is 6·7 yards increasing to 9·2 yards with one brake cylinder on the power car inoperative. The use of a leak disc with an 11/64 inch diameter hole in the slow application test permits 21 inches of vacuum to be destroyed in about 100 seconds.

Discussion

21. Any one or a combination of four factors could have led to the collision. The state of the rails was described as no worse than usual and must have been similar to that of the other platform lines over which Driver Forbes had driven trains earlier that morning. Evidence about the existence of skid marks was inconclusive; what marks there were extended from a point some 50 feet away from the buffer-stop and up to it. Although the operation of the communication cord during a brake application would have increased its severity and might have caused skidding, Forbes made no comment about an unexpected reduction in vacuum which I feel sure he would have noticed from his gauge. On previous occasions its misuse has been confined to stationary trains and I have assumed that on this occasion too it was pulled after the train had stopped. The brake defects found as a result of the very stringent CD227 tests would not have resulted in any sudden change of characteristics except that a slight initial application, rather than a firm one, could have led to one cylinder failing to operate. The fourth factor is the drivers handling of the brake and there is some evidence to indicate that this was not as it should have been since, according to the tests, the brake application described by Driver Forbes should have brought the train to a stand about half way along the platform. Even allowing for one brake cylinder being inoperative, unknown to the driver, his initial brake application was very slight. Traction bulletins issued in October 1974 and April 1976 made reference to the necessity of making a firm initial brake application in order to ensure that all cylinders are working.

Conclusion

22. I conclude that the accident occurred primarily through the use by Driver Forbes of an incorrect braking technique; this led to the train approaching the buffer-stop at too high a speed and his subsequent emergency brake application caused the train to skid and resulted in the collision. I also consider that the brake defects revealed by the CD227 test could have been a secondary cause when combined with the slight initial brake application.

Remarks

23. As a result of a single-car DMU colliding with the buffer-stop at Stourbridge Town on 2nd April 1977 and a number of other buffer-stop collisions involving two-car DMUs I decided to discuss with the Officers of the British Railways Board the maintenance standards applied to the brake equipment of DMUs. Out of 15 cases of trains passing signals at Danger or over-running stopping points where brake failure had been alleged, examination showed that four cases involved units with one or more defective cylinders and a further four involved units where one or more cylinders subsequently failed the slow application test. This test, which has already been referred to in the CD227 test, was introduced in 1974 to detect faulty rolling ring operation in the brake cylinders and is carried out at the No. 4 Depot Examination (5/6,000 miles or roughly every month). In 14 recent buffer-stop collisions involving DMUs one resulted from faulty brake equipment and two more, although attributed to a misjudgement by the driver, involved DMUs which were subsequently found to have brake faults.

24. I found the slow application test had been introduced and the initial Traction Bulletin to Drivers issued, as a result of some minor brake irregularity incidents. The potential of the buffer-stop collision to cause large numbers of casualties (because passengers are standing ready to alight) is considerable and it was clear that brake defects could result in insufficient brake effort when drivers fail to use the correct braking technique. The latest issue of the drivers manual makes it clear that a smart first application is essential reducing the vacuum to 15 inches or below. The fact that drivers need to be reminded of the vacuum brake technique can probably be ascribed to the rapid spread of electro-pneumatic and air brake equipment.

25. Other aspects of maintenance that have received special attention are described below.

a. *Free Lift.* There must be movement of the piston before the load of the brake rigging is taken up, to allow the rolling ring to seat properly in the cylinder. A modification is being carried out to produce this feature on several classes where it was omitted in the original design and a stop is being added to ensure that the correct amount is obtained.

b. *Flanging.* Lateral slackness in the brake rigging can lead to the brake blocks not being centred over the tread of the tyre; thus the full area of the block is not in contact with the tread and the block wears unevenly. Modifications are being carried out to reduce flanging and attention is being given to the brake rigging.

c. *The Fitting of Pistons, Rolling Rings and Cylinders.* An air-tight seal between piston and cylinder must be maintained for the brake to work. All British Railways Engineering Limited works responsible for the overhaul of cylinders have been visited and the importance of dimensional accuracy has been stressed. Tolerances have been reviewed and made more stringent and an oversized rolling ring has been introduced to compensate for a wider variation in tolerances than intended, arising partly from the mixing of components during overhaul rather than keeping them in matched sets.

d. *Examination Schedules.* I was told that the Officers of the Board were satisfied that the content and frequency of use of these schedules was adequate to detect any brake defect before it became dangerous.

26. I have been assured that the necessary action has been taken to improve standards after a thorough review of the examination, maintenance, and overhaul of DMU vacuum brake equipment. Instructions to drivers concerning braking technique have been issued and are reinforced when Inspectors travel in the cabs of locomotives or multiple-units to assess drivers. Accordingly I have no recommendations to make.

I have the honour to be,

Sir,

Your obedient Servant,

A. G. B. King

Major

The Permanent Secretary,
Department of Transport.

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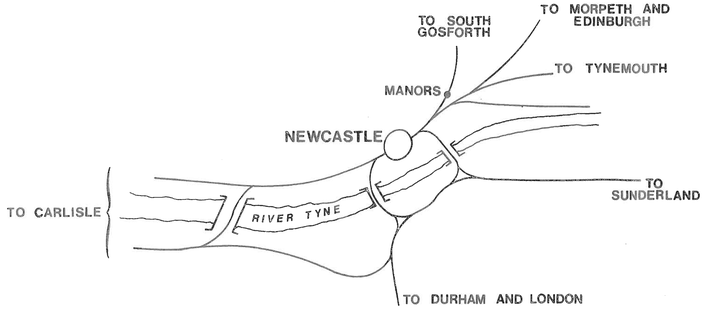
BUFFER-STOP COLLISION AT NEWCASTLE EASTERN REGION BRITISH RAILWAYS 30th JUNE 1977



LOCATION DIAGRAM

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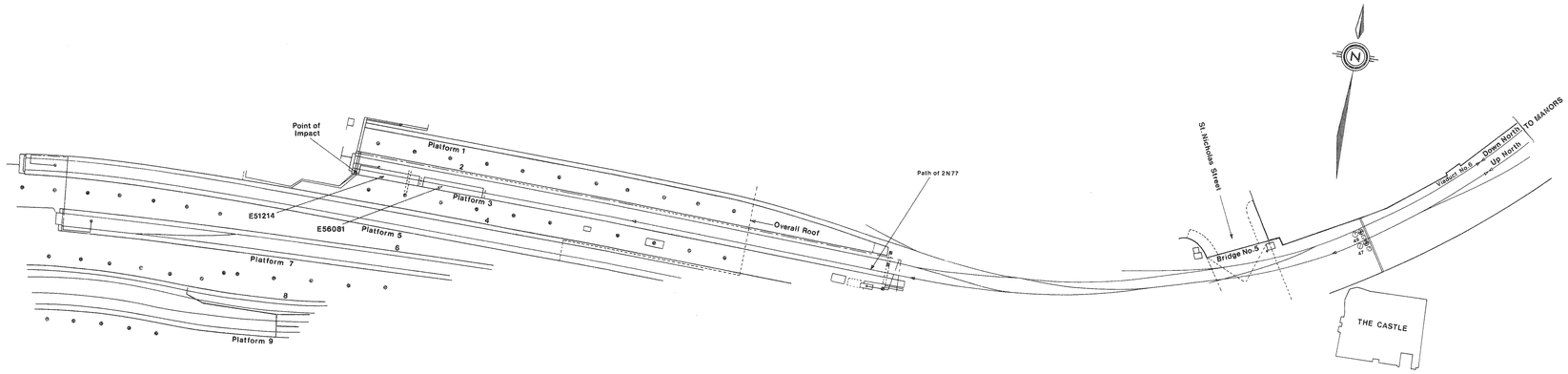

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