A Study of Railway Accidents in Ireland

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186

A STUDY OF RAILWAY ACCIDENTS IN IRELAND

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CONTENTS

Dublin Destroyed

Our jokes are passed; we've only been employed
To shew how Dublin might soon be destroyed
By railway bridges and by line for train
Till of her boasted beauties none remain
The frightful accounts which must occur
Would keep the Dublin doctors in a stir.

Picture our gallant city Marshal's steed
In terror flying at its utmost speed
Upsetting apple women in a row
And all the dignity of Lord Mayor's Show.

Alarmed Dublin first half dead with fright
Would if this bill were passed be killed outright
And never be received (as in our slaughter)
By e'en the virtues of the Vartry water.

But let us hope her fears shall pass away
Like all the evils of this tragic play
And end, as we now terminate perchance
With your approval, and a jolly dance.

(Dublin Destroyed: The Witches Cauldron of Railway Horrors, Anglo Irish Poetry).

INTRODUCTION

This thesis is basically a study of accidents which occurred on Irish railways since the development of rail transport in Ireland. Information gained concerning the accidents mentioned is from actual enquiries, newspaper cuttings and reference books which I acquired and studied. From such sources I have endeavoured to discover and determine the causes and circumstances involved in the various accidents.

The decision to study Irish rail accidents solely was made for the following reasons: firstly, to tackle a worldwide railway horrors would take a lifetime, and secondly, because Ireland in its short history of railways, has experienced a fair few samples of rail disasters.

Initially, I was interested in writing my thesis on the history of rail transport in Ireland but the more I read the more I realised that the aspect of trains which attracted my attention most was the haunting subject of accidents. It might have been assumed that mine was a morbid interest but when I conveyed my findings and conclusions on the subject to others, I found that a distinct curiosity dwells in us all concerning tragedies.

I was extremely interested in finding out the reasons behind derailments, runaway trains, obstructed lines etc. and then in noting what changes or improvements were made after the crash. I realised that, in many cases, it took such disasters to render faulty systems and designs.

The conclusions to the enquiries I studied seemed to be so obvious that I found myself wondering how people could be so stupid or ignorant. However, when one reads a report of an enquiry, the findings appear to be so precise and clear that it is easy to turn around and comment on the unfortunate person responsible for the accident. I would conclude that no-one has the right to criticize the actions of a fellow human being in a disaster situation.

One must experience the horrific circumstances before one can decide what steps might have been taken to avoid the tragedy.

From my studies I realised that all these accidents could have been easily avoided and the reasons for most of them have been corrected in such a way that they could not possibly occur again. Redesigned parts, new methods and systems provide safeguards against a disaster re-occurring. It is a sad fact of life that we must learn by our mistakes.

The human species is so extremely delicate that it needs to be protected from the environment. It takes so little to main or kill a person: pain and anguish can be caused very easily to this frail creature. The whole aspect of design is to make the world a safer and more comfortable place in which to live. During man's lifespan of 60 to 70 years on the earth, he faces problems which could suddenly terminate his existence, happening in a second of time, or involving years of suffering.

We strive to make the world a better place for living, we seek constantly to perfect or change but we do not seem to be able to prevent man from being the victim of his own inventions.

CHAPTER 1

The Runaway Train, Armagh 1889

Ireland had an excellent record of railway safety. There were very few serious accidents since the railway system consisted of lightly worked single lines.

It was the proud boast of the Northern Counties railway that in its century of independent operation, 1848 - 1949, not a single life of a passenger was lost through any failure on the part of the company or its equipment.

1.1 Description of Accident

The distance from Armagh to Warrenpoint was 27½ miles, perhaps an hours journey. The only portion of the road which is of concern to the reader is that between Armagh and Hamilton's Bawn stations. Leaving the buffer stops in Armagh Station, there was a short level section, giving way to steeper gradients until Hamilton's Bawn Station was reached. The station was 4.91 miles from Armagh. From Table 1 the reader will find it easier to see the curves between the two stations.

Before the description of the accident is detailed, it will be necessary to explain to the reader a system which was then in operation and which was discontinued due to the disaster:

The Time Interval System

This was a system whereby trains were separated from each other on the line by time spaces. For example, on a single line, on which all trains were travelling in one direction, the time spaces were as follows:

Passenger train following passenger train ...	10 min.
Passenger train following goods train	20 min.
Goods train following passenger train	5 min.

The industrious signalman carefully following the rules, could confidently dispatch train after train at top speed at 5, 10 or 20 minute intervals until some panting rustic informed him that the smoke rising behind yonder hill came, not from a bonfire, but from a blazing heap of wreckage on which train after train was immolating itself.

Yet, short of smoke signals there was no other way of doing things at first because there was no other way of knowing whether train 'X' was safely out of the way or whether it was in collision around the corner.

When things began to go wrong, as they did on 12 June, 1889, the time interval system was found to be sadly lacking.

The stations were connected by the Post Office telegraph, the telegraph offices being at the stations. The company was permitted to send its telegrams free in return for the Post Office being allowed to run its lines along the railway formation. The telegraph system was used purely for business purposes not for relaying messages from one station to the next.

Bearing this in mind, the description of the horrific accident continues:

1.2 The Train

The engine allocated for the job was Class H No. 86. It was a handsome little 2-4-0 tender machine built by Beyer Peacock in 1880 for main line expresses. It was calculated that 13 coaches would provide the 800 seats specified. By some means or other the train consisted of 14 coaches and not the 13 as originally intended by William Fenton, running shed foreman. Thomas McGrath was the driver allocated for the job; the fireman was Henry Parkinson.

McGrath left Dundalk at 6.40 a.m. with 14 coaches. At Portadown, a 12th Third Class coach was added, meaning that the little green engine was pulling 15 vehicles weighing 143¾ tons empty. The weight of the train was already too great, not to mention the fact that 940 tickets had been sold instead of 800. This does not account for the number of passengers who boarded the train without tickets.

Dundalk headquarters had never been notified of the increase in numbers. It was proposed to add a further 3 carriages but McGrath, the driver, declined to add any more.

James Elliot, chief clerk, who was to act as conductor on the train noted that the train was overloaded and remarked that McGrath would be better for assistance. The aid of No. 9 engine was suggested to McGrath but he refused it. On deciding that McGrath was a better judge than himself, Elliot did not push the suggestion.

A tragic story lies behind the refusal of the offer of No. 9's aid. McGrath had gone to John Foster, the Armagh Station Master, and complained about the overloading and neglect to notify Dundalk to provide a stronger engine. Foster, stung by the accusation of neglecting his duties said,

> "Any driver that comes here does not grumble about taking an excursion train with him".

McGrath, upset because his professional expertise had been doubted, subsequently refused any further offers of assistance from anyone.

It should be noted that not one man concerned attempted to notify Dundalk by telegraph.

The trap was laid for practically 1,000 people, due to the stupidity of three men. 600 of the passengers were children.

The Train Sets Off:

When everyone was crammed aboard the train weighed 187 tons. It departed at 10.15 a.m., 15 minutes behind schedule.

After some initial slipping in the yard, no difficulty was experienced and the journey of death got under way. No. 86 had successfully breasted the $\frac{3}{4}$ mile climb of 1 in 82 and entered the $2\frac{1}{2}$ mile climb of 1 in 75. Within 700 or 800 yards she came to a halt and would not stir. All concerned knew there was no way they could re-start the engine. McGrath applied the vacuum brake and the two guards screwed down their handbrakes.

1.3 Course of Action

There were two alternatives:

1) They could send back one of the guards to protect the train by laying detonators on the rails. This would bring the fast approaching 10.35 a.m. train to a halt. This train could then push the excursion train over the hill.

2) The other alternative was to divide the train into two portions, leave the first rake of carriages in the siding of Hamilton's Bawn and come back for the other rake.

The crew had neither the time nore the experience to tackle the latter. Nevertheless Elliot decided to divide the train. Stones were placed under the wheels at the end of the train and the division began. Things were done so quickly that it was not realized once the carriages were separated, the vacuum brakes would no longer function and the train relied solely on a few stones and a handbrake.

Immediately the division was accomplished the rear string of carriages crunched over the stones and began to roll. The handbrake proved useless. If there was any course of action to be taken, panic prevailed over it, and the runaway rolled on.

Passengers realising the danger began to jump from the train and throw children out the windows.

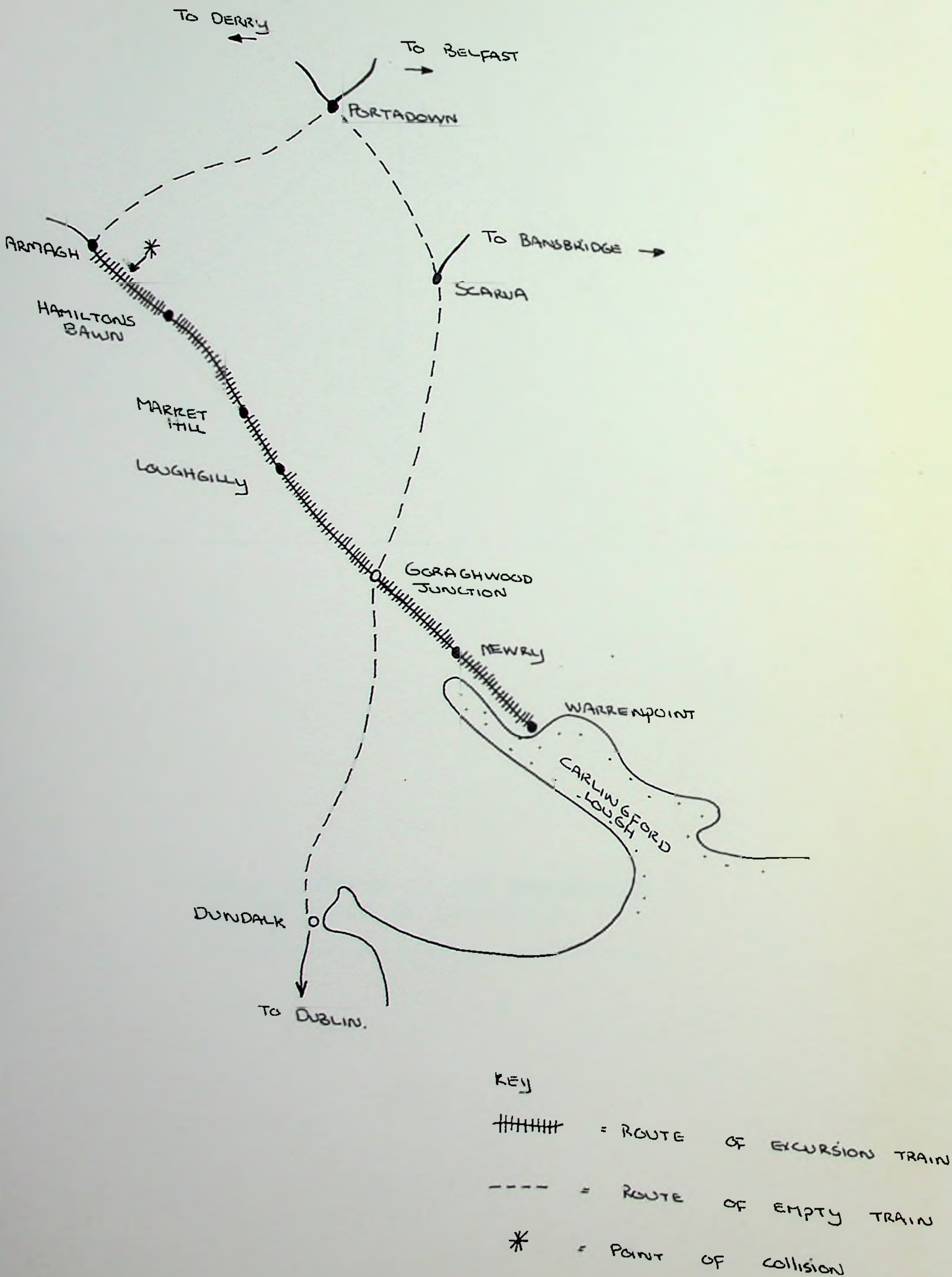
At a speed of 40 m.p.h. the runaway hit the 10.35 a.m. train. The flimsy coaches were pitted against the virtually immovable barrier posed by Engine No. 9.

Total dead....... 80
Total injured.... 260

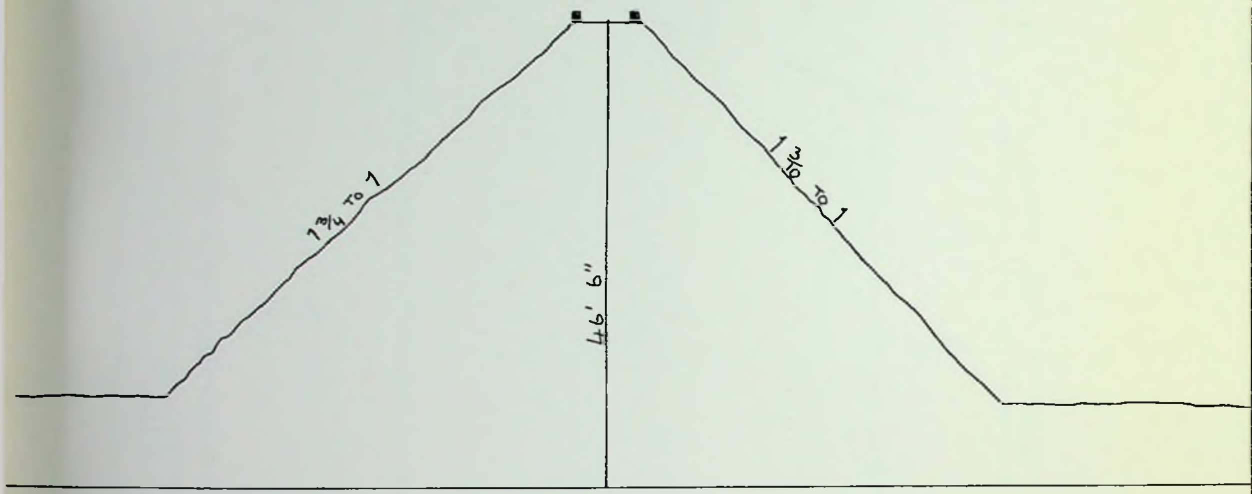
1.4 Conclusion

There were a number of reasons which contributed to the horror. Firstly, the overloading of engine No. 86. The staff knew from the start that it would be a strain for such a small engine. The next problem was the time interval system: The 10.35 train was following behind and could not possibly clear the line when they spotted the runaway. How could a few stones under the wheels stop such a weight from rolling. The braking system was inadequate and was seen to be the primary cause of the disaster.

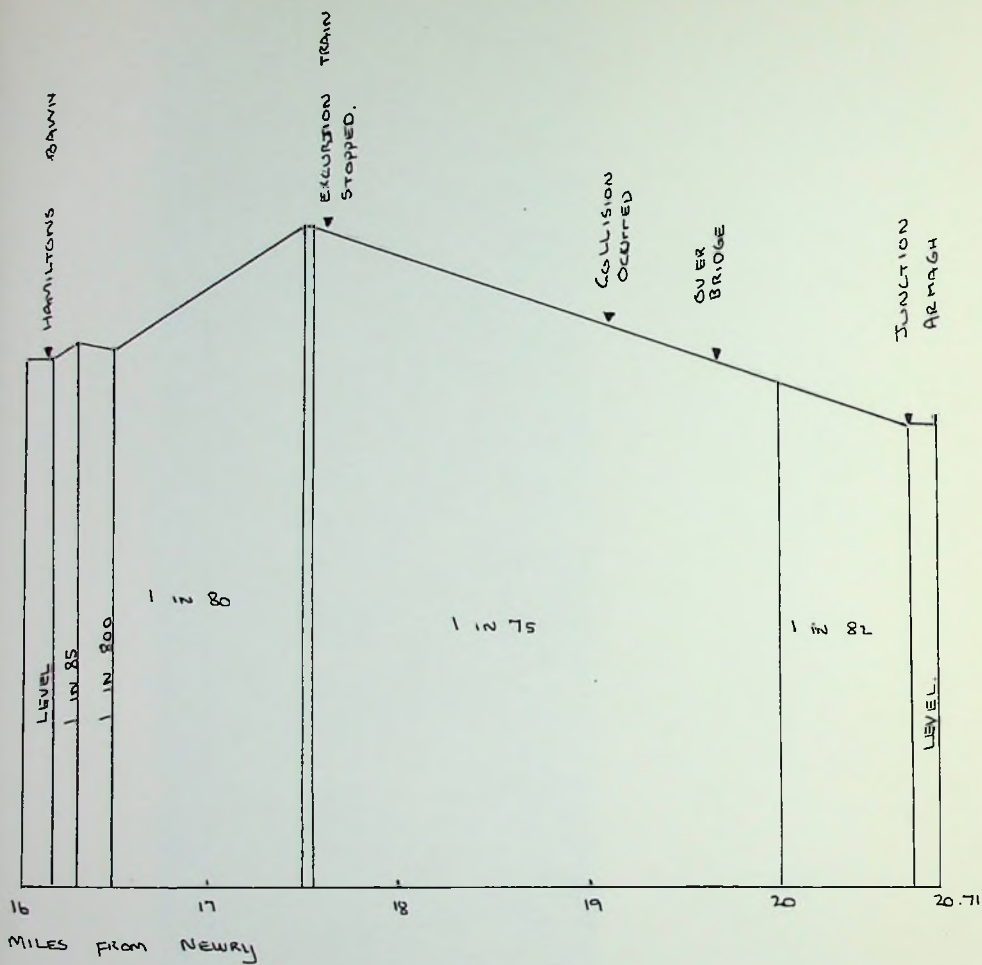
Following the accident the Smith Vacuum Brake fell into compulsory desuetude and was soon forgotten. One of the last but equally contributory factor to the crash was the negligence on the part of the railway staff to either add an engine or alternatively split the train at Armagh.



MAP OF AREA WHERE THE ACCIDENT TOOK PLACE.



CROSS SECTION OF THE EMBANKMENT
AT THE PLACE OF COLLISION.



GRADIENT PROFILE
ARMAGH H.B. SECTION.

TERRIBLE RAILWAY ACCIDENT.

ARMAGH, JUNE 12.

A terrible railway accident occurred to-day on the Great Northern line, within about two miles of the Armagh Station. The annual excursion of the Sunday school children connected with the city was arranged to take place at 9 30 this morning. Many of the parents and teachers accompanied the children, and the occupants of the train, which left the station shortly after the appointed hour, numbered from 1,000 to 1,200 persons of all ages, but mostly children. Warrenpoint was the place where the annual *fête* was to be given. There is rather a steep incline on the railway, with an embankment near Killooney, and the heavy-freighted train was watched by a number of spectators with much interest as it struggled up the ascent. The engine appeared to be unequal to the work it had to do. As the train approached Killooney it parted in two, and the hind portion ran back down the steep gradient at a rapid and ever-increasing pace. The actual cause of the separation does not clearly appear. Some accounts say that, the engine being of insufficient power, a portion of the train was intentionally detached, while others, with more probable accuracy, represent that the couplings gave way under the heavy strain, that the brakes were not on, or were unable to check the headlong course of the carriages. What rendered the accident more terrible is the fact that the ordinary passenger train which leaves the Armagh Station at 10 20 a.m. started at the usual time, the railway officials being ignorant of the delay which had taken place in the progress of the excursionists. The result was that the detached section of the children's train came dashing down the incline and ran into the passenger train, smashing its own rear-end carriages into splinters, and causing a tremendous crash and chaos in both trains. The engine and carriages were thrown off the line down the embankment.

The extent of the disaster is not yet fully ascertained, but between 60 and 70 persons, chiefly children, and including the guard of the excursion train, are reported to have been killed. and the number who have received terrible injuries is still larger. The news was rapidly conveyed to Armagh, and, of course, spread the greatest consternation in the city. Parents and friends who were unable to bear the agony of suspense as to the fate of their children and other relations hastened to the scene, and vehicles of every kind were sent to assist in bringing home the mangled remains of the victims and those whose condition needed medical help. The doctors of the city and clergymen of various denominations were zealous and indefatigable in their efforts to assist the sufferers, and the people of all classes manifested the deepest sympathy for the bereaved families. Since the accident at Straffan, county Kildare, many years ago, no disaster so terrible has happened on an Irish railway. A staff of surgeons left Belfast this evening by special train for Armagh, and every medical assistance has been offered from the surrounding towns.

Irish Times, June 13, 1889

CHAPTER 2

Description of the Smith Vacuum Brake

The Smith Vacuum Brake was an American invention, the work of John Smith of Pittsburgh, Pennyslyvania. A company was formed in the U.K. to manufacture the brake under licence.

The invention relates to the class of brakes for railway carriages in which the power activating the brakes is derived from the pressure of the atmosphere, acting on the heads of the flexible cylinders of chambers on the interior of which a partial vacuum had been created.

The basic idea was to have a continuous brake capable of being applied simultaneously to the entire train by the action of the engine driver. The nature of the system did not permit application by the guard nor was it adapted for passenger communication, as is the case with the automatic vacuum brake.

No steam was required when the brake was not actually in use. The automatic vacuum system uses steam continuously to create a vacuum, to maintain it and to prevent the brake being applied. If air is admitted to the brake pipes for any reason, an immediate application of the brakes takes place through the train. With the Smith Brake however, steam was only applied to create a vacuum when it was desired to apply the brakes.

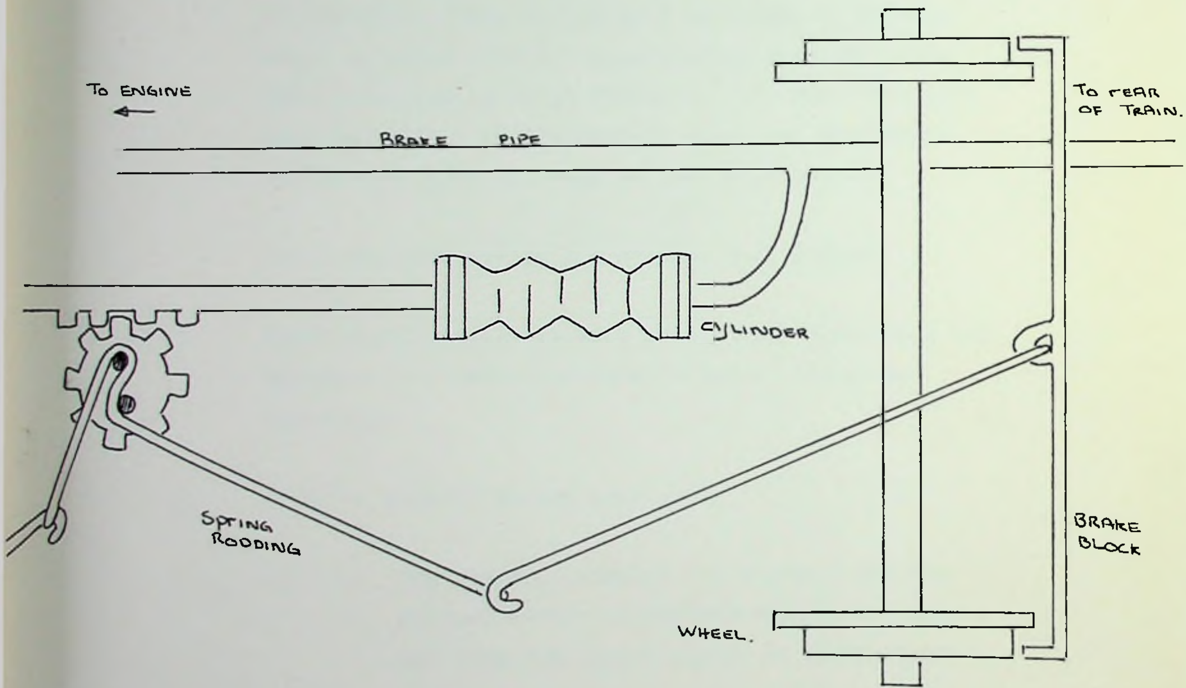
Below each carriage or other vehicle was a collapsible cylinder or chamber known as a 'diaphragm' which might be of india rubber or leather, and, arranged similarly to a concertina. Generally, one end of this sac was anchored but when a vacuum was created, the other end collapsed or contracted and, by a system of rudding applied the brakes.

In the event of a failure in continuity of the brake pipes, air was allowed to enter the system and this caused a slight reinflation of the 'sac'. This coupled with the spring action fitted to restore the brakes to normal, and the weight of the brake hangings, ensured that the brakes were released.

The engine might be fitted with one or two ejectors. The large one was for normal creation of vacuum rapidly, and the small one for giving greater intensity to the draught and used for producing and maintaining a more perfect vacuum.

To apply the brakes steam was driven into a chamber of the ejector, the amount of steam being proportional to the degree of brake application required. To release the brakes air was simply admitted to the pipes by a valve on the engine and this, aided by the spring, performed this action.

The drawing of the cylinder and rudding relates to a six-wheeled carriage (as involved in the accident at Armagh); for bogie stock, separate arrangements were needed for each bogie.



THE SMITH VACUME BRAKE
(NOT TO SCALE.)

CHAPTER 3

A Short History of Telegraphs and Signals

3.1 Accident on Great Southern Railways system at Straboe near Portlaoghise.

The accident occured at 11.25 p.m. on the night of 20 December, 1944, at the 40 ¾ mile post at Straboe about 5¼ miles beyond Portarlington, when the night mail scheduled to leave Dublin at 7.45 p.m. from Cork collided with a cattle special which was stationary, having been held up owing to fuel difficulties.

One person was killed and several were injured.

Eight wagons of cattle were practically demolished and approximately 50 cattle were killed or had to be destroyed.

After an enquiry it was concluded:

1) The primary cause of the accident was the failure of the driver and fireman to observe and obey the danger signal at Portarlington.

2) The second cause was the failure of the guard of the cattle special to protect his train in accordance with the Company's regulations when it had stopped owing to fuel difficulties.

Arising out of the evidence submitted it was recommended that the Company's regulations regarding rear lighting of goods be strictly enforced or, if it is found that a reduction in the number of side lights is necessary owing to shortage of paraffin oil, a suitable amendment of the regulations should be made by the Company.

What is the best way to signal a train and how can one assure oneself that the driver is not going to run into the back of another train?

Not only were trains faster than any other means of transport known before, they were slow to bring to a halt and were unable to take action to evade obstruction in their path. Therefore, it was realised from the start that careful precautions would be needed to ensure their safety. As G.D. Dempsey wrote in"The Practical Railway Engineer" in 1855:

> "Without a system of well arranged, well understood, and faithfully worked signals, it would be utterly impossible to conduct the traffic of any railway with safety and regularity.
>
> "The 'all right' and 'hold hard' of the stage coach, the 'go on', 'ease her', 'stop her' and 'half turn astern' of the steamboat, are sufficient for the proper progress of those conveyances; but against the puff, whirr, the chatter of the 'Vulcan', the 'Rocket', the 'Ajax', the 'Thunderer' or the 'Hurricane', what human voice, even if pitched in the key of a stentor could possibly prevail?"

However, there are several kinds of information that signals have to convey to the driver of a train. First of all there is the question of whether the line is clear ahead or whether there is another train on it. Secondly, there is another question when approaching stations and junctions: are the points set for a diverging route for which speed must be reduced. Thirdly, particularly relevant at night and low visibility weather, it is important to give advance warning of any need to stop or slow down at a following signal that cannot yet be seen, so that the driver may start to pull up. Finally, there is also the question of how the guard (or passengers) may attract the driver's attention to the need to stop because of some misadventure on the train.

3.2 The Interval System

This system was previously mentioned in the description of the accident at Armagh, which showed its tragic effect on an excursion train.

As far as the maintenance of an interval between trains proceeding in the same direction was concerned, this was originally the responsibility of specially appointed railway personnel, who had the duty of keeping a check on passing trains and giving a hand signal to the driver, either to slow down or to stop, or else to carry on unchecked, according to the time elapsed since a previous train had passed.

In general an interval of 10 minutes was imposed varying somewhat according to circumstances. The signalman had many other duties too, such as, to keep an eye on porters and others loading wagons, to prevent pilferage, to apprehend trespassers, etc. It was not surprising that his hand signals were soon found to be inadequate, if only because drivers could never be sure where to look for him.

Eventually a man was assigned to signals only and was given the responsibility of operating a series of fixed signals, which begal to be installed in the mid 1830's.

3.3 Signal Development

A. <u>Lanterns</u>

There were different kinds of signals developed. In the first instance, there was the simple lantern hung on top of a post by night, showing either a red or white light (for DANGER or CLEAR)

By day hand signals continued and in order to change the colour displayed, someone had to climb a ladder to adjust the lantern.

B. The Disc Signal

In 1838, Sir John Hawkshaw invented the disc signal, a flat plate at the top of a pole capable of being turned through 90° so that it either presented its full face or its invisible edge to a driver, with a lantern with two coloured lenses similarly attached for night use.

This signal gave two readily visible aspects by night but one by day and was not very widely used in its original form.

C. Flags

Another method of displaying signals invented in 1841 was by use of flags. The flags were hoisted up a flag pole. This worked well depending on the wind direction but when there was no wind was not very effective.

D. Coloured Boards

Other lines used coloured boards placed on stands. There was, at any rate, some uniformity about the colours used:

WHITE	=	ALL CLEAR
GREEN	=	CAUTION
RED	=	DANGER

A white light at night was less confusing than it would be now, with few if any, streetlamps and most houses lit only by candlelight

No matter how clear or adequate the signal system might have been there was always the danger of misunderstandings on the driver's part or as a result of division of responsibilities at stations.

To quote F.S. Williams in "Our Iron Road" 1883,

> "A station master, or porter, might put signals at safety or danger, while someone else worked the points. Or it might be that the pointsman ran from his point to the signal lever, or back again. Or it might be, and too often it was the case, that the signals were not properly worked at all; the pointsman, perhaps, was fully occupied in pulling the one lever, and could not get at the other; or the signal-man might vainly trust to the pointsman doing his duty and give the signal of safety when danger was imminent".

Points and signals might thus be, and too often were, in direct contradiction and the driver, relying on the safety which the lowered arm or white light falsely bespoke, rushed confidently on his headlong way, to wake up, if he ever woke at all, amid the crash of shattered carriages and the shreiks of the wounded and dying.

Signal Box: Sydney Parade Station, Dublin 1982.
Residents living in this area protested against the installation of automatic ba-riers so man-powered gates are still in use.

Inside the signal box.

Ship-like wheel to open and close gates.

E. Semaphores

The first railway semaphores (post with moveable arms) seem to have been used in about 1839 in Britain. It soon became much the most common form of signal.

In the shape standard from the mid 1840's until 1870, a railway semaphore consisted of one or more wooden arms hinged at one end and hanging in a slot at the top of the signal post. Three aspects were shown, based on the three standard hand signals originally given by the signalman:

Arm horizontal	=	STOP
Arm down 45^{o}	=	CAUTION
Arm vertical	=	CLEAR

Very often the same post held signal arms for each direction: the driver could always distinguish the one applying to him since it protruded from the left hand side of the post. The signal post also carried a lantern which either turned through 90^{o} to display coloured lenses or was fitted with moving spectacles of coloured glasses, in conformity with the position of the semaphore arms.

Both the disc-and-crossbar and the slotted-post semaphore were tolerably sound signals and remained in service on a large scale into the 1890's.

With the increasing speed of trains, distant signals came to be needed almost universally. In Britain the slotted-post semaphore was given its quietus after an accident in 1876 when an arm was frozen into its slot during bad weather and gave a false 'CLEAR' indication.

3.4 A Strange Type of Signalling

In Co. Down a very peculiar automatic signalling system was employed. The basic principles of the system were that a driver, after standing at a stop signal at DANGER for 2 minutes might proceed with great care to the next STOP signal, wait another 2 minutes there if it was against him and then proceed again, and so on.

During fog or snow the waiting period was extended to 4 minutes. The significant point was that the driver was not required to telephone to the signalman after 2 or 4 minutes was up before he restarted his train, and this must be regarded as a somewhat dangerous practice. It had come about chiefly owing to the Co. Down's straitened financial circumstances, one signalman having to do the work of a number and as the sections of line equipped with these signals were track-circuited it was felt that the system was foolproof so long as the safeguards incorporated in it were observed.

For 20 years it worked well enough but those who considered the system effective were thoroughly disillusioned on a January morning at Ballymacarret. A serious collision occurred which changed many minds about the specified 2 and 4 minute intervals of signals.

The driver waited for the 2 minutes and then as there was virtually no fog moved slowly along to Victoria Park, the last stop before Ballymacarrett. Some passengers alighted. The distant signal at Ballymacarrett was on, the driver could see it and so he continued along the route. However, the fog was getting thick so he moved cautiously. Soon it was so dense he had to open the window to see the signal. Suddenly a red light appeared about 30 yards ahead and with barely enough time to apply the brakes the engine went ploughing into the rear of the stationary Bangor train.

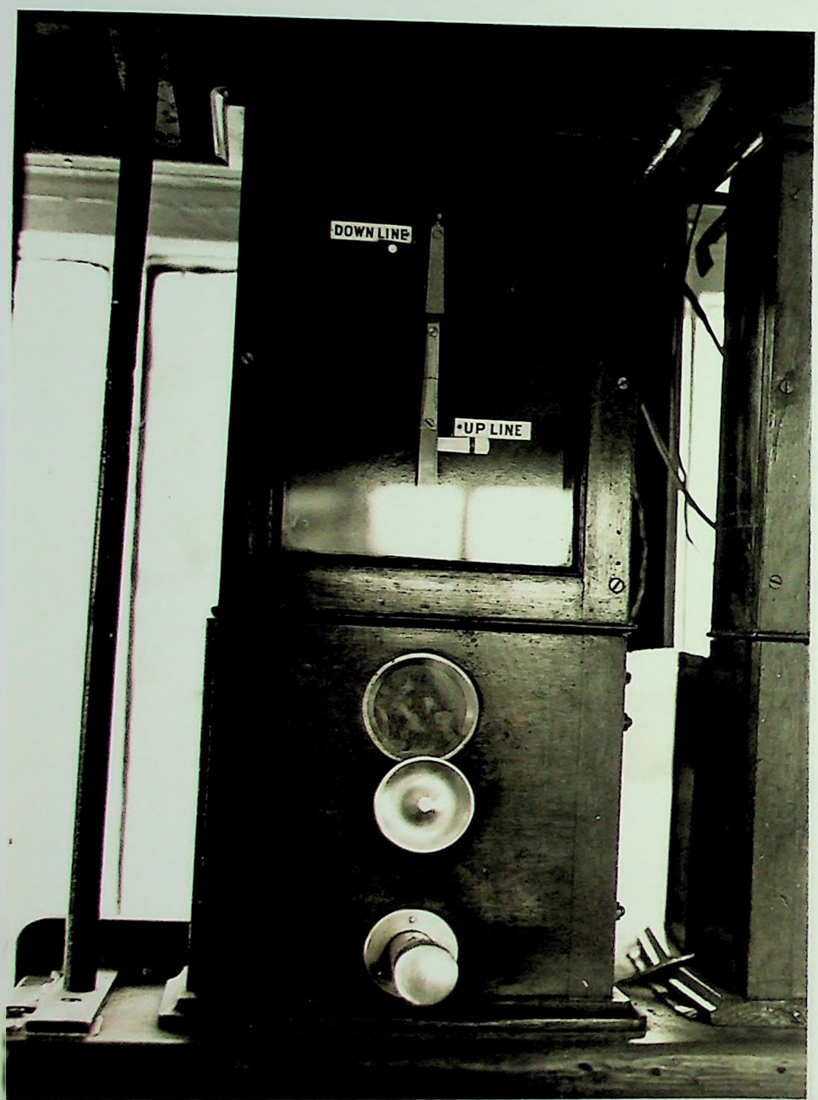
It swept through the 13-ton six wheeler as if it hardly existed, coming to rest 10 feet into the next carriage. Altogether 18 people were killed, 22 were injured, 4 of whom later died of their injuries.

After a full inquiry the conclusion was written,

"the failure of a faulty signal".

The signal had become stuck due to ice and thus the tragedy had occured.

After this disaster the 2 minutes and 4 minutes waiting periods were abolished and the driver had to telephone ahead for permission to proceed.



This block instrument is used in the average signal box today.
When the needle faces upwards it means "LINE CLEAR"

CHAPTER 4

Junctions

On the earliest lines there were few junctions and it was possible to depend on hand signals or individually worked fixed signals to control them, particularly in conjunction with severe speed restrictions. Working of this kind at junctions in mid country away from stations lasted a surprisingly long time.

Nevertheless, there was a source of danger in the possibility that signals might indicate one thing but points perform another. The only solution to the problem was to bring the levers controlling all the signals and points for the whole of each layout, to one place. All the controls had to be placed in one frame and interlocked mechanically in such a way that each had to correspond with all the others, while conflicting movements were made impossible.

4.1 Method Designed

The actual locking method was basically simple, involving the use of a locking bar moved by the rod attached to other levers: the complexity of a mechanical locking frame is simple due to the large number of permutations of movements that must be catered for, and hence, the frame itself was a fairly expensive piece of apparatus that needed to be kept well maintained and under cover.

Thus, the signalbox, into which the signal man moved also, turning his well lit upper floor above the machinery into a highly polished comfortable heated home away from home, came into being.

During the period before about 1860, effectively the safeguard from collisions due to conflicting movements at junctions or accidents due to trains being diverted into the wrong line at speed, in cases where there was no driver error, was the reliability of the signal man.

The signal men were in general a very competent body of men, recruited for good money at a time when the railways could afford to pick and choose their employees. In fact their mistakes were relatively rare: disasters at this period tended to show up shortcomings in the system or equipment more often than failures of the human element, bearing in mind that the system should itself contain safeguards against error.

CHAPTER 5

The Development of the Electric Telegraph System

The maintenance of an interval between trains moving in the same direction on the same line was the most important problem of the early days of the railways. The time interval system, already explained, was not safe or adequate as the number of trains grew and speed increased. The system was the cause of many rear collisions.

The only answer which came up and was adopted very slowly was the electric telegraph. The idea of the system was that there would be several telegraph stations along the line and the arrival, passing or departure of every train would be noted. The instructions were that a second train should not be allowed to leave until the arrival of the first at the following station had been duly communicated.

5.1 The Block System

The idea of the block system was strongly opposed by many railway companies, probably because of the expense involved. However, gradually the system was introduced.

Edwin Clark's apparatus was one of the first systems on the market. Unlike the modern block instrument, which is normally at rest with no current passing, a current flowed continuously through the Clark instrument whose normal indication with the needle inclined one way was "LINE CLEAR".

As a train passed one box the signal man reversed the direction of the current and the needle swung the other way to read "TRAIN ON LINE". It could not be restored to its first position except by the signalman at the next box, as the train passed him.

The telegraph wire was carried in a loop halfway down every post along the line, and the train crews were instructed, in the case of breakdown or accident to cut the line thus a vertical needle was observed by the signalman and an emergency was shown.

In principle, it was a good idea but in practice it gave rise to too many false alarms, so the principle of cutting the wires was, after some years, abandoned.

5.2 The Staff and Ticket System

On single lines it was customary for every section to have a picketman who either rode on or gave a ticket to the driver and thus despatched every train personally.

It was then realised that it was not necessary to have a man employed for this job, a piece of wood would do and this was the origin of the staff and ticket system. Each staff was clearly labelled with the length of line it covered and a driver could not enter that length unless either he had the staff or had been shown it and given written permission to proceed.

Interlocking the various telegraphs and staff systems guarded against most types of signalman's error but there was still one considerable loophole, in that there was no check against the driver who misread or disobeyed a signal indication. The difficulty was to find some means of either attracting his attention or somehow stopping the train without him.

In 1850, a communication cord consisting of a line run on hangers outside each window was invented. The line when pulled would ring a gong on the tender. As you may well imagine this proved to be unsuccessful.

It was realised that the guard should have a reliable source of communication with the driver. One suggestion was that he had a code of whistle. There was also the problem of passenger to driver communication, a universal continuous brake system was designed and introduced.

5.3 A Tribute to the Men Who Ran the Trains on Whom so much Depended

Written by Mark Huish and delivered before the Institution of Civil Engineers in London, April 1952, the following tribute to railwaymen was delivered:

> "There is probably no class of men, to whom such serious duties are entrusted, and who repay with such fidelity, attention and skill, the confidence reposed in them. Kind and considerate treatment and good wages, combined with the utmost strictness of discipline, a readiness to reward merit, and a rigid determination to punish severely every dereliction of duty, are the best means of forming good and attentive servants...... Experience very clearly shows that in general better results have been obtained by rewarding obedience than by the greatest severity in punishing misconduct".

So much depended on men being able to trust each other to follow a fixed routine precisely, that there was no room for the undependable among his fellow workers: they did not wish to follow alongside him. It was more a fair code than a harsh one.

CHAPTER 6

Signalling Today

Colour light signalling is gradually becoming more common on both C.I.E. and the N.I.R., and single line working has been speeded up by the introduction of mechanical exchange apparatus for E.T. staffs. Automatic barriers are in operation at a number of level crossings on C.I.E. and N.I.R. lines, although the public understandably is still somewhat wary of them, and their installation has not gone ahead at the pace originally intended.

Indeed at Sidney Parade on the Dun Laoghaire line, the wiring was installed, all ready for the barriers, only to be removed after vociferous protests from local residents, and a demonstration of the system to Dublin County Council, which then decided it did not like the idea.

Nevertheless great changes in signalling are in the air and will result in a large degree of remote control. C.I.E. would like to introduce continuous track circuiting which would result in perhaps no more than 5 or 6 signal boxes in normal use, 2 or 3 on the Southern section, and one each on the Midland, South Eastern and Northern sections. The only real obstacle in the way of this progress is a financial one. However, this might well be overcome by the great saving in labour costs which would result.

Colour light signalling

CHAPTER 7

Accident at Cahir Station, 1955

The following accident to be described was another attributed to the inefficiency of the signalling system. In this particular instance the driver failed to obey the signal. Why, we do not know because he died due to the accident. Perhaps the signal was not clear enough. It should also be noted that the guard also did not obey the signal.

7.1 Description of Accident

On 21 December, 1955, at about 7.30 a.m. a goods train laden with beet and coming from the direction of Clonmel passed through Cahir Station, entered a siding on the west side of the station, demolished the buffer block at the end of the siding, broke through the floor of the viaduct which carries the railway across the River Suir and plunged into the river 40 feet below.

The driver and fireman of the train were killed and the locomotive, the tender and the 22 goods wagons were wrecked. The goods wagons and the goods van at the rear of the train remained on the track and the guard was not seriously injured.

7.2 Conclusions Reached After the Enquiry

1) The engine No. 375 and the tender appear to have been in proper working order and there is no evidence of any existing defects which may have caused or materially contributed to the accident.

2) The train was not overloaded.

3) The brake power available on the train was normal for a goods train and was sufficient to enable the train to be kept under control by the train crew using care and vigilance.

4) The driver and guard were aware that their train would cross the down mail train at Cahir. They had no grounds for assuming that their train would have a clear non stop run through Cahir Station.

They must have known that in the circumstances they would find the home signal at Cahir at 'DANGER' and that even if the signal were cleared on their rear approach to it they would have to pass through the station at a slow speed to exchange staffs.

5) The up distant signal was at 'CAUTION' and the up home signal was at 'DANGER' when the B.53 passed them.

The signals were properly exhibited and were visible at a sufficient distance.

6) The train passed the 'up' home signal at 40 m.p.h. where it should have stopped.

7.3 Cause of the Accident

After the inquiry the cause of the accident was determined. The B.53 was out of control and the only explanation found by the jury was that the driver disobeyed the signals. When the guard saw the signal he applied a brake but was too late. The guard was accused of not keeping a good lookout.

It was then decided that the operation of the signalling at Cahir Station was irregular.

CHAPTER 8

Accident Near Donegal, 1949

The staff and ticket system was the cause of an accident on the Co. Donegal Railway line in 1949. A report was carried out to find the exact cause of the crash.

8.1 Description of Accident

A collision occurred on the ballyshannon branch of the Co. Donegal Railways Joint Committee's System at a point about half a mile from Donegal Station at about 2.15 p.m. on 29 August 1949, between the 2.10 p.m. railcar from Donegal to Ballyshannon and a special goods train travelling from Ballyshannon to Donegal.

The railcar was telescoped - the driver, James McIntyre, instantly killed. Two passengers in the railcar died of injuries shortly afterwards and several other passengers suffered severe injuries. The locomotive of the goods special sustained minor damage: the driver, fireman and guard, the only persons on the train, were uninjured.

8.2 Cause of Accident

The investigators came to the conclusion that the primary cause of the accident was the action of the driver of the railcar, James McIntyre, deceased, in leaving Donegal Station and proceeding towards Ballyshannon without a staff for the section, contrary to the rules of the Joint Committee.

8.3 Contributory Circumstances

It is difficult to understand how the driver could have been so forgetful or so careless as to take his railcar out of the section without the staff and, as appears probable, against the signals.

As mentioned previously the driver may have thought that he had the staff. Apart from this there were a number of circumstances which taken in conjunction with even momentary forgetfulness on the part of the driver, could have led to the accident taking place.

No effective control appears to have been exercised by the station master over the movement of trains and railcars in Donegal Station. Every driver, it would appear, was expected to know by experience what he should do. No instructions were given to the deceased driver when he arrived in Donegal Station. It was assumed that he knew what to do and that he had information from elsewhere.

Further, the driver had no guard on his railcar and his shunting movements were carried out without any directions. Having no guard he received no starting signal at the platform and had no-one to correct him, if through forgetfulness, he was making a mistake.

CHAPTER 9

An Accident Caused by Damaged Rails

Railway Accident Near Gorey, Co. Wexford on 31 December, 1975.

The train involved in this accident was the 08.05 hr. Rosslare Harbour/Dublin passenger train. It was derailed near Cain Bridge which carried a single line railway track over a public road.

As a result of the accident 5 people died and 43 people were injured. The accident occured in daylight. The weather conditions were dull and overcast, it was raining. The train consisted of a locomotive and 8 vehicles. There were 94 passengers on board.

9.1 Cause of the Accident and Damage Caused

The derailment commenced when the locomotive reached the bridge. It passed over the public road with the five leading vehicles and was derailed. The locomotive came to rest at the toe of the embankment.

The three leading vehicles were completely wrecked. The fourth and fifth vehicles were badly damaged. Damage to the permanent way was substantial.

After a full inquiry conclusions as to the cause of the accident were as follows:

1) The 08.05 hr. Rosslare Harbour/Dublin passenger train was derailed at Cain Bridge, which carried the railway over a public road, when it ran into a section of railway track that was unsupported and out of alignment.

2) The track was damaged due to a road accident which occurred shortly before the derailment.

3) Responsibility for this accident cannot be

attributed to any member of the train's crew. Nothing in the mechanical condition of the train contributed to the derailment.

4) A clearance of 15 feet was marked on the plans of the bridge, yet when measured the clearance height was only 13 ft. 10 inches.

9.2 Conclusions

The conclusions are clear and precise but when reading further into the inquiry, some further details were noted:

There were no signs to advise road users of the bridge clearance. Cain Bridge was deemed structurally sound but corrosion on the bridge was later noted, drainage holes were seen to be blocked and the mark on a girder indicated that there had been an accident previous to the one which caused the derailment.

New laws were introduced after the inquiry which should have been carried out when bridges were first developed and particularly so, when high vehicles such as transporters, trucks and buses took to these roads.

The laws were as follows:

1) All metal railway bridges should be examined frequently for evidence of corrosion and blocked drains.

2) Bridges over public roads should be frequently examined for signs or marks which indicate they have been struck by road vehicles.

The two laws reflect exactly what was found due to the inquiry into the Cain Bridge accident. In this instance, it took the death of five people to develop the laws.

It is, of course an extra financial burden for C.I.E. to carry out such laws but in order to prevent a similar disaster it is essential that they carry out the new procedures.

CHAPTER 10

Accident at Buttevant, Co. Cork, 1980

The Minister for Transport, directed by order, that J.V. Freeney, BE, MIEI, assisted by Declan Budd, MA, LL.B., Barrister of Law, hold a formal investigation under Section 7 of the Regulations of Railways Act, 1871, into the causes and circumstances of the railway accident which occurred at Buttevant, Co. Cork on 1 August 1980 and, as a result of which 18 passengers died and 75 persons suffered injuries of varying severity.

The hearing lasted 13 days: 56 witnesses gave evidence under oath, administered pursuant to powers in the Regulations of Railways Act, 1871.

10.1 Description of Scene and Circumstances

Buttevant Station is 137¼ miles from Dublin (Heuston Station) on the mainline railway to Cork. The total distance from Dublin to Cork is 165½ miles by rail.

Buttevant is a Block Post between Charleville (Rathluirc) on the Up side (129¼ miles from Dublin) and Mallow on the Down side (144¼ miles from Dublin) and has not been a stopping place for scheduled passenger trains for some years.

There is a double railway line through the station with sidings connected to both running lines. The sidings are now mainly used by ballast trains and by permanent way machines. There are platforms at both running lines.

The signal cabin is located near the Rathluirc end of the Up platform. There is a gated public road level crossing adjoining the signal cabin. Running signals for both Up and Down movements consists of two-aspect, colour-light distant signals and semaphore home, starting and advance starting signals. All running signals are controlled from the signal cabin.

Both Home signals and the Up starting signal are interlocked with the level crossing gates.

Rail development had been in progress at Buttevant for several months, prior to the accident. Facing points leading to the Down siding and a crossover between the two main lines had been installed but were not connected to the signal cabin. A subsidiary cabin had been taken out of service. A crossover on the Rathluirc side of the level crossing which was due for removal as part of the rail development work was still connected to the signal cabin.

On the day of the accident train speeds were restricted to 25 m.p.h. on the section of the Down line between 133½ and 134 miles from Dublin because of track maintenance work.

There was no restriction on the 75 m.p.h. maximum speed permitted on the section of line through the station. The accident occurred in daylight. Weather conditions were good at the time.

10.2 Train Description

The train involved was the daily 10.00 hr. Dublin/Cork passenger train which had a "Super Express" sectional classification in the current C.I.E. Timetable.

The train consisted of an 071 Type locomotive hauling 12 coaches. The weight of the train was estimated at 461 tonnes.

Before continuing with the detailing of the cause of the accident, it is essential to relate the reason for giving so much information on area setting, signals and train description.

The basic reason is to convey the fact that this modern setting for a disaster differs greatly from the previously described accidents. In these descriptions various systems have been discussed, designs for rail control and the developments of communication with drivers.

However, the Buttivant train ran on the most modern system in Ireland. Signals, as they are now, were clear and correct.

10.3 Conclusions

The tragic accident occurred because a set of unconnected facing points on the Down main line at Buttevant Station were partly or wholly made into the Down siding, when the 10.00 hr. express Dublin passenger train reached them, and the train, travelling at 65 m.p.h. was diverted into the siding, it was derailed.

The facing points were installed about four months before the accident but had not yet been connected to the signal cabin. During the two months prior to the accident these points were used a number of times to accommodate ballast train eight engine and maintenance machine movements into and from the Down siding.

The facing points had been operated about 30 minutes before the accident to facilitate the movement of a ballast cleaner and as the express approached the points were being hand-operated again by a points man in the mistaken belief that a recently arrived light engine which was standing on the Up was about to cross the Down siding.

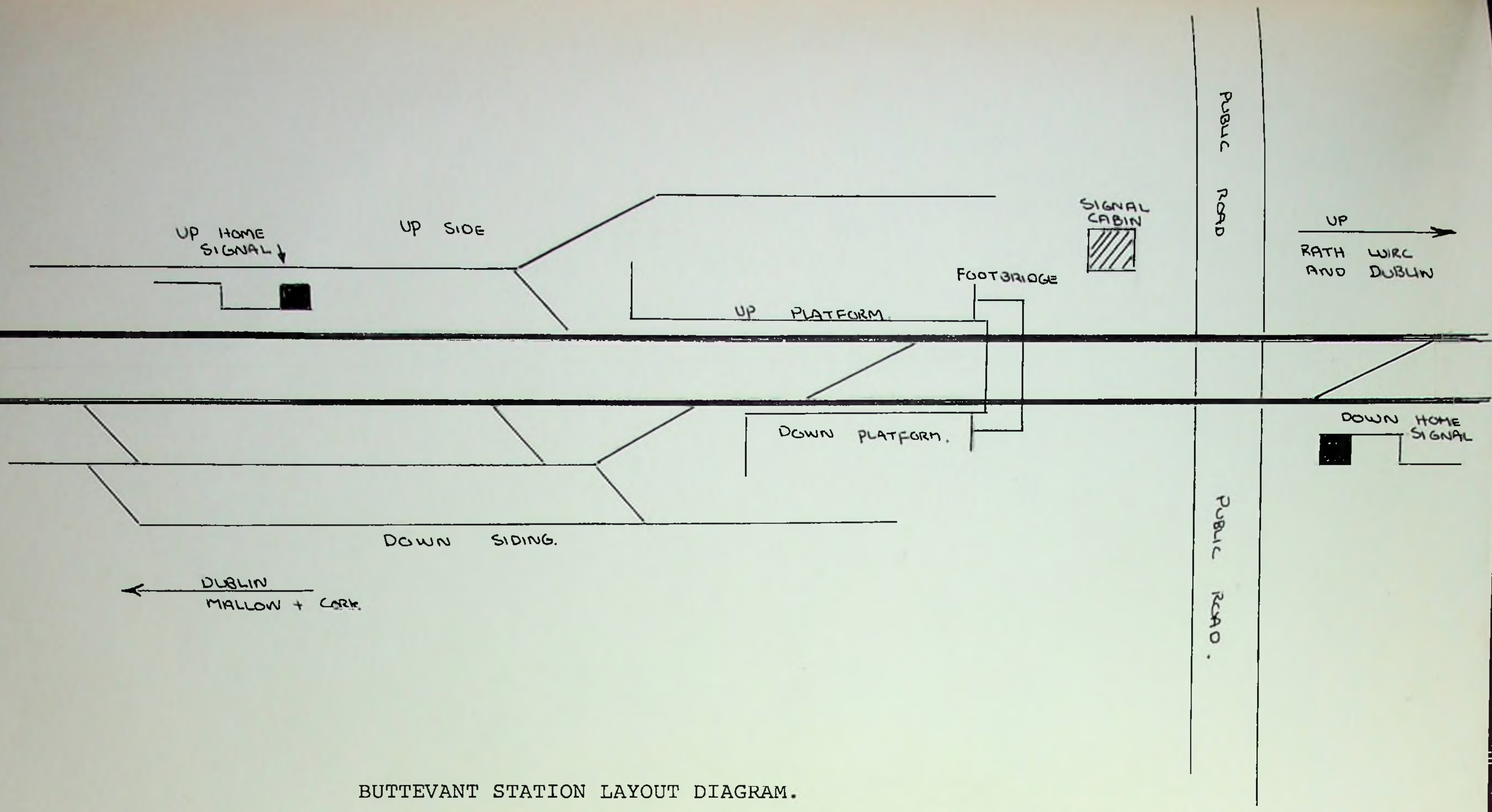
When the passenger train came into sight the pointsman tried to remake the points for the main line but was unable to do so before the train reached them.

After the inquiry it was said that the pointsman was not authorised to use the points which were unconnected to the signal cabin. It was then recommended that unconnected points should be linked to the signal cabin where indicators display their status if they have to be used.

Padlocks should be placed on redundant points which could then be used only by the Inspector-in-Charge.

Altogether eight recommendations were written up in the report after the inquiry.

The accident was over and forgotten, 18 people were dead and buried and hundreds of people were brokenhearted.



BUTTEVANT STATION LAYOUT DIAGRAM.

TWO PIECES of wood and a missing flagman — those were the seemingly small ingredients of the fatal muddle that resulted in the Republic's worst rail horror at the weekend.

And the man at the centre of the tragic events, 64-year-old grandfather Willie Joe Condon, said last night:

"I suppose they'll blame me for it all. I suppose I'll be sacked now. Will they put me in jail?"

He revealed to me that the direct cause of the disaster was two wooden wedges — known as scotches — jammed into the points on the main line at Buttevant Station.

Mr. Condon himself had jammed the scotches into the points in order to bring a hopper truck across the tracks into a siding, as part of the infilling work being carried out on the tracks.

But he was adamant that he was not expecting an express train from Dublin to pass through at the time.

"It's not my job to know when trains are coming in and out of the station. When a train is approaching it's up to the flagman to warn me by waving his flag. There is always a flagman on duty. But that day there was no flagman at work."

While the points were still jammed open by the scotches, Mr. Condon said, he walked about 100 yards to the signal box at the station. There, the signalman, Mr. Dinny Joe Sullivan, asked him to close the level crossing gates, an operation carried out to halt road traffic when a train is passing through.

Mr. Condon claimed he was not expecting a train at this time. In fact, the ill-fated express was running on a revised schedule to cater for the bank holiday rush.

Mr. Condon said he first went back towards the wedged points — but when he got there, he saw that another CIE worker had already closed the level crossing.

"I saw Dinny Joe (the signalman) shouting at me and the Dublin express screaming into the station hooting. I rushed for my crowbar to get out the scotches."

"I got one of the scotches out of the points. Before I could start at the second scotch the train was on top of me. I dived under the ballast train standing in the siding. I was showered with debris."

If he had kept on trying to get out the second scotch, he would not have succeeded — and would have died along with the other 17 victims.

When he came out from under the ballast engine, it was all over. "I could not believe the wreckage. I tried to help two people out. I saw the blood and the dead."

He wandered dazed among the rescue workers till he was found at 6 p.m. by relatives, upset and talking to himself.

C.I.E. officials sent him home in a car to his cottage at Churchtown, Buttevant. Later, he made statements to the Gardai and C.I.E.

'I suppose they'll blame me for everything'

"They'll blame me", he repeated last night, still deeply shocked by all that happened. "But how was I to know a train was coming? There was no flagman to warn me."

Mr. Condon, who is due to retire in a year's time, was a newcomer to Buttevant. "Why was I moved from Mallow station seven weeks ago?" he asked. "I had been based there until that time."

Back at Buttevant station when I asked workers to show me a "scotch", CIE divisional engineer, a Mr. Sides, in charge of a team of workers rebuilding the tracks at the scene, ran onto the track and broke up the interview with CIE workers.

He ordered the Press off the track and said we needed to have signed "an indemnity document" before we would be allowed on the track.

Mr. Condon's story, if corroborated at the sworn public inquiry instituted by Transport Minister Mr. Reynolds, means that CIE will find it difficult to avoid accepting culpability for the disaster.

If the inquiry finds CIE to blame, the payment of an estimated £30 million in compensation to the victims and relatives of victims of the tragedy will be little more than a formality.

Irish Independent, Monday August 4th, 1980

CONCLUSION

The problem of the factors contributing to accidents is remarkably complex, however the techniques of human factors' engineering permit an understanding and point to possible avenues for solution. Essentially it was found that existing modern technological knowledge must and can be applied to the design of the environment and equipment for optimum performance and minimum accident liability of man.

Though the present lack of knowledge in certain areas emphasises the need for further basic research in the fields of physiology, psychology, sociology and human engineering, the most reassuring feature of the vast literature on safety is that occasionally concrete evidence appears showing that accident liability can indeed be altered by careful manipulation of various factors.

The design of controls and information displays to provide optimum minimum error, working situation has been and is still one of the major subjects of human factors engineering. These represent interphases between the man and the machine.

Operation of junctions and signals must be rapid and accurate. All controls must be easily identifiable. In the engine and signal box, all switches etc. should be within the operator's immediate reach, all vital controls should be at the optimum position of operation.

A special type of information display is that relaying a warning of some unexpected, impending hazard, error or otherwise undesirable event. There are varying degrees of the importance of such warnings all the way from status indicators to extreme emergencies and the response priority and speed required will vary accordingly.

Warning displays should be

a) Attention alterting
b) Informative
c) Non distracting
d) Simple
e) Non damaging
f) Infrequent

There are two modes of warning signals used today

1) Visual warnings - usually lights or flags

2) Auditory warnings - made by a number of sound producing devices

Even when machines have been well designed for human use, operators make mistakes. Improvement of equipment can only reduce errors to a finite limit. The remainder is inherent in the complexity of the human system.

Fatigue is a frequent cause of accidents. Fatigue in all its forms can affect performance, efficiency and accuracy.

Completing a study of railway accidents, it is apparent that bad signalling is one of the main causes of disasters. The history of signal development indicates a definite advancement in the system.

The new Bray to Dublin electric line will be completely automatic. Signal boxes will soon be a thing of the past, all the levers and wheels becoming museum pieces. Sadly enough, the old traditional stations are becoming massive city centre shopping areas on the continent. In Ireland we are slowly but surely following the European trend. Personal attention has become computerised in Dublin stations. Everything today is moving faster, including people. Daily advancement in rail systems lessens the eventuality of accidents on the line. We can see for ourselves that all forms of transport are becoming more economical and safer.

Nevertheless, with all the technological advancement in railway engineering there will always be the possibility of major accidents because there is always room for error by man or by the machine.

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