

THE TAY BRIDGE DISASTER

A Documentary with Drama for the stage

by Michael J Barry

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Background to the Play:

“The Tay Bridge Disaster” was first produced in an earlier form by Dundee Rep in 1968. It was nominated for an STV Award for Best New Theatre Play in Scotland.

It was staged by a company of twelve performers, and directed by James Lovell, with live music by Alan Barty.

The play was subsequently rewritten and published by Scottish Theatre Editions in 1971, and is now out of print.

This version represents a major overhaul on that published original.

Staging needs to be fluid, dynamic and fast-moving – using ever-changing groupings and stage areas, flexible lighting, simple scenic cut-outs and effective token costume changes. A well thought-out blend of live and recorded sound effects, and use of offstage mics, are also essential.

The Disaster:

The Tay Bridge Disaster was an archetypal historical blunder of the first order – previously paralleled by the Charge of the Light Brigade, and, in more recent years, Aberfan.

Almost everything that could go wrong, did go wrong. The whole episode was an incredible example of irresponsibility parading as delegated responsibility and dynamic buck-passing.

It is not so much one man who was to blame, but an accepted, traditional way of doing things – the sort of set-up that only gets improved after a major mistake. This is Historical Determinism. Some people say that this is how history gets made.

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THE TAY BRIDGE DISASTER

SINGING VOICE: (ECHOING, HAUNTING):
 Of eminent Victorians, famous men
 All mighty conjurors of fire and steam
 Engineers who built the railroad dream
 Those who bridged the Tay like giants a glen
 Out of the mists let them find their ways
 History be sure to help them find their praise.

NARRATOR: At 7.20 on the evening of December the 28th, 1879, the Tay Bridge, the longest bridge in the world, collapsed, drowning 75 people.

A Sunday. The day commemorating the Massacre of the Holy Innocents by Herod. Now known also as the Night of the Great Storm.

CHOIR: (BEHIND NARRATOR) (EITHER TO TUNE OF "COME HOLY GHOST CREATOR COME" - OR TO ONE OF TWO TUNES THAT WERE SUPPLIED BY THE TRADITIONAL MUSIC AND SONG ASSOCIATION OF SCOTLAND):

The bridge is down, the bridge is down,
 The word in terror spreads,
 The train is gone, its living freight
 Lies mingled with the dead.
 The bridge, the bridge, the wondrous bridge
 That spans the Firth of Tay;
 The greatest work of human skill
 The wonder of the day.

NARRATOR: After being open to the public for only 19 months, the High Girders - exactly 13 spans of the bridge, covering one thousand and sixty yards - fell into the river - taking also an engine, five carriages, a brake van, and 75 men, women and children.

For a nation crowned with superb engineering triumphs, this was possibly the greatest disaster of the century, and a tremendous blow to Victorian pride.

A major tragedy - yet in its entirety, a story not without its lighter side - not to be ignored, because however many tragedies afflict the world, we must still live, and we cannot live without laughter.

SFX: THE TAY RAIL FERRY: BEATING PADDLES,
 WATER CHURNING, SEAGULLS, VERY STRONG
 WIND.

NARRATOR: We start in 1849, thirty years before the Disaster, the year in which the bridge's designer, Thomas Bouch (only in his twenties), first started working in Scotland as the Traffic Manager and Engineer to the Edinburgh and Northern Railway. Within two years he had built rail ferries across the Forth and the Tay. But bridges? A bridge across the Tay was a laughable suggestion; only an idiot could suggest it.

TWO PASSENGERS VOMIT OVER SIDE OF SHIP.

A: (NERVOUS) Rough, isn't it?

B: (STOLID) Aye.

A: Aye (PAUSE) Glad I don't have to cross often.

B: Oh aye?

A: Aye (PAUSE) I don't think I've got a very strong stomach.

B: Ah!

C: (CONVIVIAL) You'll soon get used to it.

A: Will I?

C: Aye.

B: Aye.

A: Even the fish?

NARRATOR: The Edinburgh-Dundee train journey was not one that was readily undertaken - for many, many reasons. One was the noticeable presence of two fish-trucks on the train.

C: Aye, even the fish.

A: I hope so, I hope so.

D: (FEMALE RECOVERING TEMPORARILY FROM BEING SICK): It's far too long a journey this for my mind, Reenie.

E: (FEMALE DITTO): I know. You'd think the Caledonian would build a line round by Perth. It might be further, but it wouldn't take so long.

NARRATOR: The journey consisted of train from Waverley to Granton, the ferry across the Forth to Burntisland, train through Fife to Tayport, the ferry to Broughty Ferry, and a third train into Dundee.

D: You're right. Folks'd use it just for the chance of staying in the one seat.

E: They would that, Evelyn, they would that.

THEIR RESPITE ENDS. THEY RETURN TO VOMITING.

A: Aye, I hope so.

C: This is the best train o' th' day. you know.

A: Is it?

C: Aye.

B: Aye. (PAUSE) It is.

NARRATOR: The best train of the day left Waverley at 6.25 in the morning. To cover the 46 mile journey, it took three hours and twelve minutes.

A: Aye.

C: Aye.

B: Aye.

A: (BREATHING MORE HEAVILY): It's bracing though, you can't deny that.

C: Aye, it's bracing alright.

A: Ah! (PAUSE - DEFINITELY FEELING UNEASY NOW): Don't think I feel quite myself, somehow.

B: You're no looking good.
 C: No, you're not.
 A: No. Er - if you'll - er - just - excuse me.

HE RUSHES TO JOIN D AND E AT THE RAIL. HE
 CAN'T IMMEDIATELY FIND A FREE PLACE - IS SICK.

B: Aye.
 C: Poor fellow.

BOUCH: Do you know, Sirs, I think I have the answer to this journey. Bridges! Two railway bridges spanning the Forth and the Tay. A direct route from Edinburgh to Dundee.

C: A bridge! You're not serious? A bridge! (BURSTS OUT LAUGHING)
 Impossible, Sir. Impossible.

B: (GRIM CHUCKLE)

D: A bridge over the Tay? (JOINS LAUGHING) Hey, Reenie, did you hear that?
 A bridge over the Tay.

E: (WEAKLY) He must be joking!

D: No - he's no jokin'. He's English!

GENERAL LAUGHTER - BUT A, D AND E HAVE A
 FRESH ATTACK OF VOMITING.

NARRATOR: In its pioneering days, the railway system was dynamic. The railway age began 3 years before the Battle of Waterloo, with the opening of the Kilmarnock and Troon line in 1812. For the next 40 years railway expansion was tremendous - epitomising Victorian achievement. In Scotland alone 150 separate railway companies were formed - BUT: by 1923, fierce competition and amalgamation had reduced these to only 5 companies.

SFX: ACCOMPANYING WORKMEN LAYING A
 RAILWAY LINE: ESPECIALLY RHYTHMICAL PICK,
 SHOVEL OR SLEDGEHAMMER SOUNDS.

NAVVIES (SINGING): I've navvied here in Scotland, I've navvied in the South,
 Without a drink to cheer me or a crust to cross me mouth.
 I fed when I was working and starved when out on tramp,
 And the stone has been me pillow and the moon above me lamp.

NARRATOR: 1830: 97 miles of track.

NAVVIES: I have drunk me share and over when I was flush with tin,
 And the drouth without was nothing to the drouth that burned within.
 And when e'er I've filled me billy, and when e'er I've drained me can,
 I've done it like a navvy, a bold navvy man
 A bold navvy man
 An old navvy man
 And I've done me graft and stuck it like a bold navvy man.

NARRATOR: 1840: 1500 miles of track.

NAVVIES: I've met a lot of women and I've liked them all a spell;
 They can drive some men to drinking and also some to hell,
 But I've never met her yet, the woman cute who can
 Learn a trick to Old Nick or the bold navvy man.

NARRATOR: 1846: Nearly 10,000 further miles of track authorized.

NAVVIES: I do not care for ladies who are of high degree,
A winsome wench and willing, she is just the one for me.
Drink and love are classed as sins, as mortal sins by some.
I'll drink and drink where e'er I can, the drouth is sure to come.

NARRATOR: 1860: All main lines completed. Thousands of branch lines planned.

NAVVIES: And I will love till lusty life runs out its mortal span,
The end of which is in the ditch for many a navvy man,
The bold navvy man
The old navvy man
Safe in a ditch with heels cocked up, so dies the navvy man.

NARRATOR: Before we get back to Mr Bouch and his crazy ideas, I must just mention two other subjects: bridges - and disasters. Bridges were generally not navvy work and were not usually erected by the same men who built the other works of a railway.

Disasters happened from the very start - but nothing too serious; engineers were philosophic about them: when a bridge built by Brunel collapsed, he remarked:

BRUNEL: I am very glad. I was going to build a dozen like it.

NARRATOR: In 1845 a viaduct fell at Ashton-under-Lyme. 15 were killed. The jury mentioned negligence but gave a formal verdict of Accidental Death.

Thomas Bouch was one of the most famous engineers and bridge-builders of the day.

BOUCH: In 1849 I became Manager-Engineer to the Edinburgh and Northern Railway, which soon became the Edinburgh, Perth and Dundee Railway and was later absorbed by the North British Railway.

NARRATOR: The Tay and the Forth were ipso facto challenges. Man would be forced by history, by economics, by his own pride and ambition to try to bridge them.

BOUCH: I proposed a bridge across the Tay in 1849, in 1854 and again in 1863.

NARRATOR: In 1866 - enter Cornelius Willes Eborall.

EBORALL: The railway lines are being laid by private companies...

PLATELAYER 1: (AGGRESSIVE)...competing...

PLATELAYER 2: (AGGRESSIVE)...in rivalry.

EBORALL: This rivalry often - regrettably - broke out into open warfare.

CALE. DIRECTOR: With the utmost reluctance, the board of the Caledonian Railway have been driven to begin active hostilities against our late ally, the Edinburgh and Glasgow Railway. They have already commenced a series of aggressions.

PLATELAYER 1: Cummon lads - we're no havin' any fuckin' Cale line alongside ours.

PLATELAYER 2: Och, awa hame, small-fry.

FIGHT BREAKING OUT WITH PICKS AND SHOVELS.

EBORALL: 1866 marked the climax of the violent rivalry between the North British and Caledonian Railways. Each tried desperately to prevent the other gaining business.

CALE. DIRECTOR: Our policy is simple - wherever they build a line, we build a line. At the same time, we take over as many subsidiary companies as possible.

EBORALL: At the clerking level, constant squabbling went on where the two companies shared the same station. Even espionage.

DYKESON: My name is Dykeson, and I'm a lowly railway clerk. However I'm a railway clerk with a difference: the North British Railway pay me a wee bittie extra, so's I keep an eye on the Caledonian - quiet like, you know? Well, my wifie had a good idea: she thought mebbe we could get a wee bittie more if the Caledonian were to pay me for spying on the North British for them. So I went along to the Caledonian to see if they were interested in my doing this little service for them - and, you know, they were! I'm earning quite a fair wage now. And do you know something - she's no' stupid, my wife.

EBORALL: But Dykeson overreached himself, and was ignominiously dismissed - by both companies.

PLATELAYER: Out on the tracks - it was gang warfare. It was guid - made a change, like - except once I mind it led to murder.

NARRATOR: In 1866 Cornelius Willes Eborall was appointed by Parliament to act as standing arbitrator between the two companies.

EBORALL: I had a busy five years. The companies had much at stake.

TWO YOUNG BOYS ARE HAVING A TRAIN RACE.
THEY MAKE THEIR OWN TRAIN SOUNDS AND
WHISTLES.

BOTH BOYS: London!..

BOY 1: York..

BOY 2: Crewe...

BOY 1: Berwick - and into the hands of the North British...

BOY 2: Carlisle - and into the hands of the Caledonian...

BOY 1: Edinburgh...

BOY 2: Carstairs!..

BOY 1: Granton pier...

BOY 2: Stirling...

BOY 1: Ferry to Burntisland...

BOY 2: Perth...

BOY 1: Tayport...

BOY 2: (TRIUMPHANT) Dundee..

BOY 1: Ferry to... WHAT!

BOY 2: Dundee, you numbskull! AND Forfar! AND Aberdeen! I win! So - (RUDE RASPBERRY).

GIRL SINGER: Oh! Mr Porter, what shall I do?
I want to go to Aberdeen and they're taking me back to Crewe.
Send me back to Dundee as quickly as you can.
Oh! Mr Porter, what a silly girl I am.

NARRATOR: The North British Railway's Board of Directors acquired a new Chairman - John Stirling of Kippendavie.

STIRLING: We DO need a bridge, gentlemen.

DIRECTOR 1: Well, Sir - Mr Bouch still has his plans.

BOUCH: If the North British is going to survive, it MUST have a bridge.

DIRECTOR 2: But Mr Bouch - we still have no money.

STIRLING: Gentlemen - Dundee also needs a bridge. Indeed it is possible that Dundee businessmen might invest in a bridge.

BOUCH: It's not expensive. I have the plans here.

STIRLING: I think we should invite Mr Harrison and Mr Heppel to examine them and report back.

NARRATOR: As soon as this proposal got out - the protesters got to work.

PATRICK MATTHEW: It is an experimental novelty, highly liable to serious accident, of total or partial destruction. Such a rainbow bridge must sustain the very strongest winter tempests, that generally take place in the early part of January.

NARRATOR: Or the late part of December?? That was Patrick Matthew, the venerable, octogenarian prophet of Gourdiehill - the local crank!

CALE. DIRECTOR: A fine and worthy idea - but we must express our considerable doubts as to its feasibility! And can the North British really afford to pay for it? If however it is feasible -we feel strongly that it should not be a monopoly interest for one company only.

NARRATOR: The Caledonian Board!

STIRLING: A good deal has been said as to the Tay Bridge being an aggression upon the Caledonian and a commencement of the old state of warfare. I wish distinctly to deny this. It is not an aggression in a fair sense of the word.

NARRATOR: Other protest was short and to the point:

VOICE 1: It'll cost too much!

VOICE 2: Not with our money!

VOICE 3: Too low - our shipping can't get through!

VOICE 4: It'll foul up Dundee harbour!

VOICE 5: What about us pedestrians?

ALL (SINGING): There was a railway porter on the North South Eastern line,
Whose intellect was limited, whose age was 49
His post was situated at the Muddle-Puddle Junction;
The stations' names he'd call out indistinct-ly but with unction.
And all this porter had to do thro' morning, noon and night,
Was to waggle to and fro a wretched bell with all his might;
And shout this sentence in a manner which you all must know:
"Change here for London, Chatham, Peckham, Brighton, Margate, Bow".
"Change here for London, Chatham, Peckham, Brighton, Margate, Bow".

NARRATOR: If bridges were to be built over the Forth and the Tay, then Thomas Bouch was the obvious man to build them. His reputation stood high.

HAMILTON ELLIS: He was a bridge-builder of repute. His great bridges on the Barnard Castle and Tebay line were among the wonders of their period; they stand to this day. Bouch was to be regarded as senior bridge-builder. Brunel was dead. Stevenson was dead.

NARRATOR: Hamilton Ellis, railway historian. Bouch had built the Tees Bridge, the Deepdale Viaduct, the Beelah Viaduct, the Redheugh Bridge, the Bilston Burn Viaduct, and the Hownes Gill Viaduct - more in fact than any other engineer of his age. And 300 miles of railway - again more than anyone else.

O.S. NOCK: His rather superficial ways and flair for speculative administration were in very striking contrast to the innate caution and solid reliability of contemporary engineers.

NARRATOR: O. S. Nock, also a railway historian. Bouch's enormous reputation appears to have been built upon the painstaking work of some of his subordinates.

"THE ENGINEER" ED: Was Bouch the true designer of the Tay Bridge? He was no mathematician. He made little use of calculations. His ability as a designer of bridges was not of a high order. He seems to have "put a bit on here, and taken a bit off there" more in accordance with instinct than with scientific reasoning.

We may justly describe him as a recklessly ambitious engineer, possessing an incomplete knowledge of the forces with which he had to deal. However, in fairness - he was at least as wise as his generation.

NARRATOR: "The Engineer" - an eminent journal writing a retrospective professional view in 1940. But wisdom after the event is easy - that is the historical value of events. Mind you - Bouch was cheap. His bridges were light. Not like Robert Stevenson! He always worked on the basis of providing two of everything where one was enough - and that can cost money. Bouch didn't have much money anyway.

BOUCH (SINGING, DIGNIFIED):

I'm forever blowing bubbles, pretty bubbles in the air.
They fly so high, nearly reach the sky,
Then like my dreams, the fade and die.
Fortune's always hiding - I've looked everywhere.
I'm forever blowing bubbles, pretty bubbles in the air.

STIRLING: Have Mr Harrison and Mr Heppel examined the plans?

NARRATOR: Mr T. E. Harrison, the eminent engineer...

HARRISON: At the request of your board, I have examined all the details of this design, and I have had all the strains and the strength of the different parts carefully calculated. It is sufficiently strong in all its parts. I am satisfied that it provides for all that is necessary.

STIRLING: Thank-you Mr Harrison.

HARRISON: I have, as requested, asked Mr Heppel...

NARRATOR: ...well-known for his mathematical knowledge and acquaintance with similar works...

HARRISON: ...to make an independent examination.

STIRLING: Mr Heppel.

HEPPEL: I can have no hesitation in stating my complete conviction of the sufficiency of the design in every particular.

PATRICK MATTHEW: The North British, as well as some of the Dundee people, seem too much in the hands of scheming engineers, whose love of fame has interfered with their better judgment and prudence. Even were they to succeed, not in obtaining a return of interest for the capital invested (sunk is a better word) - that is out of the question - but in erecting the bridge, I could not admire it.

EDITOR, DUNDEE ADVERTISER: There is something almost sublime in the prophetic warnings of Patrick Matthew, the Seer of Gourdiehill. After all - do we not print them in the Dundee Advertiser?

NARRATOR: For all the fun he provided and all the scorn he received, it is now shocking beyond belief that Mr Patrick Matthew, who died as the foundations were being laid, should have forecast so accurately so many of the scientific phenomena surrounding the future disaster.

BOUCH (REPRISE): I'm forever blowing bubbles, pretty bubbles in the air.

STIRLING: (ADDRESSING MEETING): During the last three years the North British have been labouring under great difficulties. Myself and my colleagues have been well-abused in some of the public prints, and I must take this opportunity to thank you, the shareholders, for the cordial support you have on every occasion given to us when we have called you together.

NARRATOR: The last real hurdle was to convince the North British shareholders. This was not to be easy - especially as some of them were Caledonian shareholders as well. John Stirling, the Chairman, was the main driving force behind the scheme, and at two stormy general meetings in 1869 he overcame most of the opposition.

STIRLING: The most important point in the Directors' Report is, of course, the Tay Bridge. I will ask you to so far place confidence in your Board as to believe that there is no mere supposition of what the traffic might be. We have the actual facts to depend upon. We do not propose to go into this arrangement blindfold.

The Tay Bridge is a serious undertaking. We have had various tenders given in from some of the largest contracting firms in England, and, conditionally on the passing of the Act, the approval of the shareholders, and the raising of the money, we have accepted the one given by Messrs. Butler and Pitts, Yorkshire, for £229,680 for the bridge. They are prepared to take the risk to finish the bridge for that sum.

Under all these circumstances, the directors are unanimous in recommending to the shareholders to approve of this report, and authorize us to go on and establish the Tay Bridge as a separate undertaking.

ARKLEY: I, for one, have no confidence whatever in the finances of the company. I am glad I have not invested in the debenture stock; if I had I would have regretted it very much. I hope the shareholders of the unfortunate North British will look better to their finances before they allow themselves to be led astray by any such expensive project.

STIRLING: I am glad to find that hitherto we have had no opposition from any Dundee shareholder except Mr Arkley, who I believe is a large Caledonian shareholder, and brother-in-law to a Caledonian director.

KINLOCH: The renewal of the Tay Bridge scheme is fraught with the most serious consequences, and I fear might have the effect of putting an end for an indefinite period to any hope of the original shareholders receiving dividend. I mean to move a substantive resolution that it is not expedient at present to entertain the scheme.

STIRLING: Mr Kinloch, when he was a Director of the North British, was a strong supporter of the Tay Bridge. I wish it to be distinctly understood that we are starting this as a separate undertaking - that the North British, as a company, are not liable for any of the expense. We expect that the public will come forward and enable us to raise the money. So would Mr Kinloch agree to abandon his motion?

- KINLOCH: I must adhere to my motion. The time has not arrived for reviving the Tay Bridge scheme.
- STIRLING: May I then have a show of hands for those in favour of Mr Kinloch's amendment - and against - and now for the original motion - that we go ahead with the scheme - and against. I declare the motion carried.
- KINLOCH & OTHERS: Rubbish. The amendment is carried.
- STIRLING: I must hold that the motion is carried.
- GENERAL CRIES OF "The amendment is carried" AND "I propose that the roll be called" ETC
- STIRLING: Every proxy that has been sent in is in favour of the report.
- KINLOCH: It will be a most improper thing, on the part of the Chairman, to use proxies, after such an overwhelming majority of those present have voted for the amendment.
- WILSON: I submit that the proxies you hold cannot be legally used, because you have not sent proxies to every person. It is taking the meeting by surprise.
- ARKLEY: It is quite evident the Board have sent proxies to their friends.
- KINLOCH: One gentleman here says he sent a proxy representing £15,000 against the scheme.
- PATON: You had no right to bring the proxies into play after putting the vote.
- STIRLING: If any shareholder wishes it, we are prepared to take a poll on the subject.
- PATON: You are too late to make that proposal, because you declared the motion carried, which notoriously it was not; the amendment was carried.
- WILSON: The Board everlastingly trample on the liberties of the shareholders.
- PATON: I am thoroughly satisfied there were more than two to one for the amendment.
- ARKLEY: This chicanery is unbecoming the Chairman of a large company like this.
- MEETING IN GREAT DISORDER WITH SEVERAL PEOPLE TRYING TO SPEAK AT ONCE.
- ARKLEY: Did you issue proxies to a limited number or to all?
- STIRLING: We issued them to a number of the largest shareholders.
- KINLOCH: I am a large shareholder, and you sent me no proxy.
- ARKLEY: Nor did I get any proxy.
- STIRLING: (FORCEFULLY): I adhere to my ruling that the motion is carried. I shall use the proxies, and I will tell you the reason why. Although this meeting is numerous, we know that a large number of the shareholders here hold a merely nominal amount of stock. (UPROAR)... ..Gentlemen, gentlemen - order, please. Now - Mr Fyldes - yes - Mr Fyldes?
- FYLDES: Gentlemen - this disorder is unseemly and misplaced. It has been clearly demonstrated that the time has come when this scheme should be carried out. The only argument that I have heard advanced by the opponents of the scheme is that the time has not come.
- STIRLING: Thank-you Sir. Mr Wauchope?
- WAUCHOPE: I support the motion submitted by the Chairman, who has clearly and honestly shown that the shareholders will not be injured in the slightest degree by going on with the project.
- STIRLING: Mr Clark?

CLARK: I too think we have nothing for it but to go on and make the bridge, and I have great pleasure in supporting the motion.

STIRLING: Thank-you gentlemen. The motion is carried.

NARRATOR: The shareholders were convinced; the public were convinced; the Caledonian withdrew their opposition. On the 15th July 1870, the third Tay Bridge Bill received the Royal Assent. One year and one week later, the bridge's foundation-stone was laid.

SFX: DURING GROTHE'S LECTURE, A MONTAGE OF ALL THE MAIN SOUNDS THAT GO INTO THE BUILDING OF SUCH A BRIDGE RUNS BEHIND, COMING UP AT KEY POINTS IN GROTHE'S SPEECH.

INITIALLY: A SEDATE CROWD IN A LECTURE-HALL ACOUSTIC.

GROTHE: Ladies and gentlemen. It is a great pleasure for me to be able to address so distinguished a gathering. My name is Grothe and I am the Works Manager for the Tay Bridge, responsible to Mr Gilkes, the contractor. I sincerely hope I shall convey to you my excitement at being associated with such an awe-inspiring scheme.

Let me say two things to start with: firstly - in the methods of construction employed at the Tay Bridge there are many which have never before been used.

Secondly - the quantity of materials we are going to use is stupendous. Just listen: 3520 tons of cast iron, 6281 tons of malleable iron, 90,600 cubic feet of timber, 8600 tons of cement, 2 million rivets, 10 million bricks, 27,000 cubic feet of dressed ashlar, and 3200 cubic feet of rough ashlar. Now isn't that just stupendous?

It will take up to 600 workmen, six years to build, and will cost £350,000. There is a single line of rails, the bridge is 3450 yards in length, and consists of 85 spans.

In most cases the foundations of the piers are formed of iron cylinders filled in with brick and concrete. A cylinder weighs about 40 tons. It is sunk to its proper position...

GROTHE FADES A LITTLE TO BACKGROUND, ALLOWING THE ACTUAL SCENE TO REGISTER BETWEEN HIS WORDS.

GROTHE: ...and the water is forced out of it by air compression.

SFX: AIR COMPRESSION PUMPING, WAVES HITTING CYLINDER SIDE, HOLLOWNESS WITHIN.

GROTHE: Workmen then descend the shaft and excavate the soil. While they do this, the cylinder settles down around them under its own weight - until the rock-bed is reached.

SFX: WORKER LET DOWN IN CYLINDER BY ROPE, CONTROLLED FROM ABOVE. THEN SPADES AND PICKAXES AND LIVE DIALOGUE LINES SUCH AS:

VOICE 1: Christ, it's hot. I'm all of a muck sweat.

VOICE 2: Be thankful. It's just as like to be freezing. So freezing you canna grip the rope.

VOICE 3: Fill that basket, son.

BOY'S VOICE: I canna see. The candle's gone oot.

VOICE 3: You don't need to see. Just fill the frigging basket.

VOICE 4 (ABOVE): Mind below! Basket's slipped.

SFX: CRASH NEARBY AND A CRY OF PAIN.

VOICE 5: God in heaven - I'm deid!

VOICE 1: Do that guttered brain o' yours some guid. Are you alright?

VOICE 5: Aye. I think so. Bleeding, but alive.

BOY'S VOICE: Is this edge stopped on rock?

VOICE 3: Whit? Christ you're right. Hold it everyone. Hold it!

GROTHER: Once the cylinder is set on the rock base, it can be made firm above, and the workforce can be hauled out and start on the next one. It's a simple process, but it needs strong, willing men.

VOICE 3: Name o' God, let it no sink.

VOICE 2: Whit d'ye mean?

VOICE 3: I canna see the other side. If it's quicksand, we're in trouble.

SFX: CYLINDER STARTING TO CANT OVER.

VOICE 3: Oh Christ, it is in the sand. Oh, God save us. Breathe deep, lads - don't panic - and hold yer heads. Try and get out round the sides as she goes.

VOICE 2: An' swim clear fast as you can.

SFX: WATER STARTS SLOSHING DOWN ON THEM AS IRON SCRAPES AGAINST ROCK. SOME MEN PANIC AND START SCREAMING. THE RATE OF WATER INCREASES DRAMATICALLY AND MANY DROWN. ABOVE, A SHIP'S ALARM BELL RINGS FRANTICALLY.

BOUCH: 11th December 1873. To the Chairman and Directors of the North British Railway Company: Gentlemen, the foundations on the north side, I regret to say, have turned out worse than the borings led me to expect. I propose therefore to enlarge the foundations in order to reduce the pressure on them. I can further reduce this excessive pressure by building the piers of strong iron columns, instead of brick - commencing the ironwork beyond the corroding action of the salt water.

GROTHER: So you see, Ladies and Gentlemen, why it is we have changed the design. We have lessened the number of the piers from 89 to 85, and increased the width of the central spans from 200 to 245 feet. These are the raised spans built in to let the Perth shipping through. This means there will now be one less central span - 13 instead of 14. I hope no one here is superstitious, ha, ha, ha!

BOUCH: These suggested alterations in the design arise entirely from the foundations turning out different from what was anticipated. I remain etc, Thomas Bouch.

GROTHER: So, in conclusion: we now have an iron super-structure. Looked at from a distance, it may seem that the iron-work is very light, but I assure you, it is not so in reality. A latticed-girder of wrought iron gives great stiffness and lateral strength.

NARRATOR: The quality of the ironwork, produced for the bridge, came in for a lot of criticism in the later Board of Trade inquiry, led by Henry Cadogan Rothery, Wreck Commissioner.

SFX: BEHIND INQUIRY ARE IRON-MAKING SOUNDS: A COLUMN IS CAST, A HAMMER USED FOR TESTING - KNOCKING LUGS OFF, WHICH ARE BURNT BACK ON AGAIN.

ROTHERY: The court should now consider the work carried out by the Wormit Foundry. We must find out what the quality of the iron-work was like: whether the iron was good or not, whether it was evenly cast, and how well the lugs were cast onto the body of the columns; we must also consider the question of responsibility for bad workmanship. McGowan.

McGOWAN: I was a foreman moulder. The iron was very bad. It was the worst I ever remember seeing.

ROTHERY: Foreman.

FOREMAN: The coke was inferior coke - in the sulphur.

ROTHERY: Hampton.

HAMPTON: Scabbing occurred. Removed by chipping by a chisel. These columns then went to the bridge with the rest.

ROTHERY: Baird.

BAIRD: Columns were unequally thick. Lugs were wanting too. They were burnt on, and then went to the bridge.

ROTHERY: Hutton.

HUTTON: Burnt on lugs did not hold like the original casting.

ROTHERY: Milne.

MILNE: Small holes were filled up with putty or Beaumont's Egg - composed of beeswax, resin, iron borings melted up, and a little lamp black.

ROTHERY: Gibb.

GIBB: Mr Ferguson, the foreman, ordered us to hide the damaged columns from the bosses. We covered them up.

ROTHERY: Thank-you. And now - Tasker.

TASKER: Aye.

ROTHERY: Tasker, did you not think it was your duty to point out any defects in the column to the contractors?

TASKER: No. I had a foreman over me, it was the foreman's duty.

ROTHERY: Did you think it was right to fill up the holes that you filled up?

TASKER: I do not know.

ROTHERY: Did you think it was wrong?

TASKER: I do not know. I did what my gaffer told me.

ROTHERY: Did you think at the time that it was right or that it was wrong?

TASKER: I do not know for that.

ROTHERY: What do you think about it now? Do you think now that it was right or it was wrong?

TASKER: I do not know what I think about it.

ROTHERY: Have you no opinion?

TASKER: No opinion at all.

ROTHERY: Did you think that those holes would endanger anybody's life?

TASKER: I did not think it.

ROTHERY: You would not let columns go out, I suppose, that you thought would make the bridge dangerous?

TASKER: I had nothing to do with that.

ROTHERY: Did you think that those columns would make the bridge unsafe or not?

TASKER: I had no idea about it.

ROTHERY: You would not pass an opinion upon that?

TASKER: No.

SFX: FOUNDRY SOUNDS UP QUICKLY.

WORKMAN: Mr Ferguson - that's Mr Grothe and Mr Camphuis in the yard now.

FERGUSON: Then get the pokes over those columns, quick. Cover them completely. Hey you, Tasker - give him a hand. Move it, lads, if you want your jobs. Ah, good morning, Sir, and how are we today?

SFX: COURT-ROOM SETTING AGAIN.

ROTHERY: Ferguson.

FERGUSON: I took over from McGowan as Foreman Moulder, Sir. The casting was well done and carefully done under my supervision.

ROTHERY: Mr Camphuis.

CAMPHUIS: I was manager of the foundry - responsible to Mr Grothe, of course.

ROTHERY: You were responsible for inspecting the columns that went to the bridge?

CAMPHUIS: Yes. I have had no experience of testing iron. I've never tried it. Accidents will happen.

ROTHERY: Mr Grothe.

GROTHE: I am resident engineer at the Tay Bridge works. I have not much experience in foundry work. Mr Ferguson had charge of the Foundry. He was subject to constant supervision by myself and Mr Camphuis.

SFX: COURTROOM FADES

NARRATOR: On the 26th December - 3 years and 1 day before the disaster - the last pier was floated out to the bridge.

McGONAGALL: Beautiful railway bridge of the silvery Tay!

NARRATOR: Yes! William McGonagall, Dundee's most famous poet - in person! Renowned for going from verse to worse, at least he provides a first hand record of the whole Tay Bridge saga.

McGONAGALL: Beautiful railway bridge of the silvery Tay!
 With your numerous arches and pillars in so grand array,
 And your central girders, which seem to the eye
 To be almost towering to the sky.
 The greatest wonder of the day,
 And a great beautification to the river Tay,
 Most beautiful to be seen,
 Nearby Dundee and the Magdalen Green.

NARRATOR: On the 1st August, 1877, the last girder was floated out to the bridge.

- McGONAGALL: Beautiful railway bridge of the silvery Tay!
That has caused the Emperor of Brazil to leave
His home far away, incognito in his dress,
And view thee ere he passed along en route to Inverness.
- NARRATOR: Twenty people had died during the construction of the bridge.
- McGONAGALL: Beautiful railway bridge of the silvery Tay!
The longest of the present day,
That has ever crossed o'er a tidal river stream,
Most gigantic to be seen,
Near by Dundee and the Magdalen Green.
- NARRATOR: At 2.30 am on Tuesday, 26th August 1873, during the sinking of the foundations at pier 54, an airbell exploded, killing 6 men: James Gellately, Alexander Clelland, John Denholm, James Herd, William Stewart, and Charles Thomson.
- McGONAGALL: Beautiful railway bridge of the silvery Tay!
Which will cause great rejoicing on the opening day,
And hundreds of people will come from far away,
Also the Queen, most gorgeous to be seen,
Near by Dundee and the Magdalen Green.
- NARRATOR: At 8.15 pm on Friday, 2nd February, 1877, a fierce storm blew girders 12 and 13 into the Tay - and also William Loughran.
- McGONAGALL: Beautiful railway bridge of the silvery Tay!
And prosperity to Provost Cox, who has given
Thirty thousand pounds and upwards away
In helping to erect the bridge of the Tay,
Most handsome to be seen,
Nearby Dundee and the Magdalen Green.
- NARRATOR: 13 others completed the death roll of the Tay Bridge, until the 13 high girders collapsed.
- McGONAGALL: Beautiful railway bridge of the silvery Tay!
I hope that God will protect all passengers
By night and by day,
And that no accident will befall them while crossing
The bridge of the silvery Tay,
For that would be most awful to be seen
Near by Dundee and the Magdalen Green.
- VOICE: To the Dundee Advertiser, 5th September, 1873. Sir.

Every great undertaking has its fatal risks. But the business and duty of this world must proceed. The battle is not turned back by the death of even the bravest and the best; other brave ones step in where the brave have fallen. But the life is not lost which is spent or sacrificed in the grand enterprise of useful industry; that life survives in the work attempted.
- SFX: "SEE THE CONQUERING HERO COMES" IS
PLAYED QUIETLY UNDER BY A BRASS BAND.
- NARRATOR: On the 26th September, 1877, the first crossing of the bridge was made.
- McGONAGALL: Beautiful railway bridge of the silvery Tay!
And prosperity to Messrs Bouch and Grothe,
The famous engineers of the present day,

Who have succeeded in erecting the railway
 Bridge of the Silvery Tay,
 Which stands unequalled to be seen
 Near by Dundee and the Magdalen Green.

NARRATOR: On the 31st May, 1878, the Tay Bridge was officially opened.

SFX: THE MUSIC SWELLS. PROLONGED CHEERS AND
 APPLAUSE.

[ACT 1 BREAK OF STAGE SCRIPT]

ACT 2

NARRATOR: On the 31st May, 1878, the Tay Bridge was officially opened.

Present were representatives of the authorities of the different counties and burghs of Scotland, the high officials connected with the leading railways of the kingdom, a numerous attendance of gentlemen identified with the commercial and manufacturing interests, and a large assemblage of the citizens of Dundee and surrounding country. The VIPs' train was crowded.

THE VIP "TRAIN" STARTS TO MOVE. INDISTINCT
 NOB-TYPE CONVERSATION IS MADE
 ENTHUSIASTICALLY, PUNCTUATED BY GIRLISH
 GIGGLES AND LITTLE SHRIEKS OF EXCITEMENT.

NARRATOR: All who had the opportunity of witnessing the ceremony must have experienced that gratification which proceeds from the happy and successful accomplishment of any great work.

SFX: ADD IN SEA, GULLS, STEAMERS WHOOPING
 AND BRAYING, CHURCH BELLS.

NARRATOR: The weather, so important an element in any open-air celebration, was simply magnificent, the sun shining out brilliantly, and there being scarcely a cloud in the sky.

SFX: THE SUDDEN CLATTER OF THE HIGH GIRDERS.
 LIVE FEMALE SHRIEKS AND HYSTERIA.

NOB-VOICE 1: Oh, I say! The High Girders! Don't worry, me dear.

NOB-VOICE 2: Calm down, old girl. No cause for panic.

SFX: GROWING CHEERS FROM WAITING CROWD AS
 THE TRAIN ARRIVES IN DUNDEE STATION. BRAKING
 SOUNDS, STEAM RELEASED.

SFX: THE BAND'S PLAYING COMES TO AN END AND
 RELATIVE SILENCE DESCENDS FOR THE SPEECHES.
 EACH SPEAKER IS TAKEN OVER BY A MUSICAL
 INSTRUMENT IN "SPEECH MODE" (VOCODED?) TO
 SYMBOLISE THE BODY OF THE SPEECH AND THE
 STYLE OF THE SPEAKER.

NARRATOR: Lord Provost Robertson.

ROBERTSON: Mr Cox, will you allow me the pleasure, in the name of the Magistrates and Town Council of Dundee, to give a hearty welcome to... (TUBA? TAKES OVER) ...only to announce that after my predecessor in office, ex-Provost Cox, has addressed you we will fall into processional order and march to the Albert Hall where luncheon is to be served.

APPLAUSE

COX: Ladies and gentlemen, and gentlemen of the Town Council of Dundee, in the name of the shareholders of the Tay Bridge undertaking I have to thank you... (OBOE? TAKES OVER) ... offering my cordial congratulations to all concerned in this great work - and with these remarks I now declare the Tay Bridge formally opened.

APPLAUSE AND CHEERS. CALLS FOR MR STIRLING.

STIRLING: Ladies and gentlemen, it is with great pleasure I am here this day to see the opening of this great undertaking... (SMOOTH TROMBONE? TAKES OVER)... and do much to promote the prosperity of the town of Dundee. Thank-you.

NARRATOR: The ceremony of formally declaring the bridge, station and other works open for traffic having been completed, the gentlemen holding invitations formed themselves into processional order, and marched to the Albert Hall.

SFX: BAND PLAYS A "LIVELY AIR" WHILE UNDERNEATH:

VOICE 1: Jolly good show, old boy.

VOICE 2: You've all done very well, I must say.

VOICE 3: Congratulations Sir - very impressive, everything.

VOICE 4: Thank-you for your help, Councillor.

VOICE 5: An honour to be able to assist such a splendid achievement.

VOICE 6: Well done, well done.

VOICE 7: Ah, but without yourself...!

VOICE 8: We must have a wee chat in a day or two. Just finalize a few things.

VOICE 9: I think we've come out of it very nicely.

VOICE 1: As they say - it's all a matter of who you know.

VOICES: Congratulations, well done, jolly good show, splendid, impressive achievement, jobs for the boys, who you know, heroes of the hour.

SFX: BRIEF REPRISE OF THE EARLIER SECTION WHERE THE COLUMN CANTS OVER IN THE WATER AND THE TEAM OF WORKERS INSIDE TRY TO GET OUT. THE MUSIC IS LOST BEHIND.

NARRATOR: Arriving in Albert Square, the gentlemen entered the Great Hall of the Albert Institute Buildings by the great staircase, which was neatly ornamented with plants and evergreens. When all had been comfortably seated...

LIVE/SFX: BRIEF SURREALISTIC MONTAGE OF THE BANQUET: FOOD STUFFING EFFECTS, GROWING INCREASINGLY GROTESQUE - INTERSPERSED WITH M.C. ANNOUNCING RANDOM SPEAKERS, + UP TO 14 TOASTS TO ALL AND SUNDRY. CHEERS, APPLAUSE, LAUGHTER AND THE OCCASIONAL BELCH.

NARRATOR: A vote of thanks to the Chairman concluded the proceedings. The tables were tastefully decorated with flowers and plants supplied by Messrs Laird and Sinclair, Nethergate, and a conspicuous object on the table was "The Tay Bridge Sauce" prepared by Mr J.N. Davidson, chemist, Nethergate.

HUTCHINSON: (FROM HIGH OR OFF) Lower away - slowly. Hold it there! Tie off.

NARRATOR: In early 1878 the Tay Bridge was inspected by the Board of Trade - who did not escape criticism for part-responsibility in the subsequent disaster. Their inspector was Major-General Charles Scrope Huthchinson, R.E. In a minute to both Houses of Parliament in July 1880, the Board of Trade said:

BOARD OFFICIAL: We have always placed entire confidence in Major-General Hutchinson. No more competent, conscientious and intelligent officer could have been found to whom to entrust the inspection of the structure in question. We are of the opinion that his conduct of that inspection has not been such as to forfeit our confidence.

SFX: AN ENGINE PASSES OVERHEAD OF HUTCHINSON. THE BRIDGE'S STRUCTURE CREAKS AND RATTLES AROUND HIM.

HUTCHINSON: Yes, yes. Right. Uh-huh. Good. (SHOUTING) Three this time.

HUTCHINSON: For the purpose of adequately testing the structure, the North British Company placed at my disposal 6 new goods engines - total weight being 438 tons, or 1 1/2 tons to the running foot.

SFX: THREE ENGINES PASS OVERHEAD OF HUTCHINSON. THE BRIDGE'S STRUCTURE CREAKS AND RATTLES AROUND HIM.

HUTCHINSON: Yes, yes. Right. Uh-huh. Good. (SHOUT) Six this time.

HUTCHINSON: I then went underneath the bridge, and climbed about the columns. I climbed up and held onto the columns and the braces when the engines were going over. I observed nothing at all to give me an uncomfortable impression about the stability of the columns. These results are in my opinion to be looked upon as satisfactory.

BOUCH: As a bridge-builder, it was the most strict inspection I ever experienced of the many I have had through the Board of Trade's hands.

BOARD OFFICIAL: The Board of Trade has power to postpone the opening of a railway line if it thinks this would be attended with danger to the public by reason of the incompleteness of the works. The Board HAS NO OTHER POWERS.

NARRATOR: Hutchinson's report included some recommendations:

HUTCHINSON: - To reduce as much as possible the expansion of the girders in hot weather, I should strongly recommend their being painted white. - It will not be desirable that trains should run over the bridge at a high rate of speed, and I would suggest 25 m.p.h. as a limit which should not be exceeded.

- Very careful attention will be required to ascertain that no scouring action is taking place in the foundations.

- When again visiting the spot I should wish to have an opportunity of observing the effects of high wind when a train of carriages is running over the bridge.

BOARD OFFICIAL: The work was submitted to the ordinary tests, and it might still have been standing had proper means been taken to maintain it. Major-General Hutchinson seems, indeed, to have suspected its weakness, and gave a warning which was not sufficiently attended to.

HUTCHINSON: Subject to the above requirements, I see no reason why the Board of Trade should object to the railway on the Tay Bridge being used for passenger traffic. I have etc. C.S. Hutchinson, R.E.

LIVE/SFX: DURING NARRATOR'S SPEECH, WE CROSS THE BRIDGE ON A PASSENGER TRAIN, WITH OTHER PASSENGERS, A STEAM ENGINE UP FRONT, THE CLATTER OF THE HIGH GIRDERS, SEAGULLS OVERHEAD, LAPPING WATER BELOW.

NARRATOR: The Tay Bridge succeeded, beyond the wildest hopes, in bringing prosperity to Dundee, and the North British Railway Company. With the Newport Railway opened, land values on south Tayside rose rapidly. Within a year of the bridge's opening, the N.B.R. were carrying 84% of the Edinburgh-Dundee traffic, 59% of the Edinburgh-Aberdeen traffic; Dundee-Fifeshire traffic doubled, and so did season tickets. In 6 months the goods and mineral traffic to Dundee rose by 40%. The North British now dominated the railway industry in the North of Scotland.

LIVE/SFX: THE TRAIN ARRIVES IN DUNDEE STATION.

NARRATOR: After the opening of the bridge, many famous personages came to visit it.
Prince Leopold:

LEOPOLD: (26, ARISTOCRAT, SCOTTISH TITLE) I say - very jolly bridge.

NARRATOR: (TRANSLATING) It's a nice bridge. Captain Wentzel of the Royal Guards of the King of Holland & General Delprat of the Dutch army:

WENTZEL/DELPRAT: Het is een fijn brug en mij feliciten uw machtig constructie.

NARRATOR: Well, I don't know about you, but that was double-Dutch to me. The Emperor of Brazil:

EMPEROR: Sim nao tenos bananas.

NARRATOR: (TRANSLATING) Yes! We have no bananas. General Grant, ex-President of the U.S.A.:

GRANT: (DRAWLING THROUGH CIGAR IN MOUTH) It's a very long bridge.

NARRATOR: (TRANSLATING) It's a very long bridge. The most important visitor was, of course, her Britannic Majesty, Queen Victoria.

EDITOR: The Dundee Courier and Argus. Saturday 21st June, 1879. Dundee was en fete yesterday in honour of an event which is of very rare occurrence in our local history. The visits of Royalty, like those of still more exalted personage, are certainly "few and far between". It is after an interval of 35 years that Dundee has again been honoured by a visit from the Queen, although it cannot be said that the visit was a protracted one.

COURT OFFICIAL: Her Majesty desires me to inform the Corporation of Dundee that she will be most happy to have her train halted at Tay Bridge Station and to receive the said Corporation's address through the window of the royal coach.

SFX: THE ROYAL TRAIN DRAWS INTO STATION. A WOOSH OF STEAM USHERS IN THE LAST PHRASE OF THE ANTHEM. A WINDOW IS LOWERED.

PROVOST: Unto the Queen's Most Excellent Majesty: May it please your Majesty:- We, your Majesty's loyal and dutiful subjects, the Provost, Magistrates and Town Council of the Royal Burgh of Dundee, beg leave humbly to approach your Majesty...

HE DRONES ON SOTTO VOCE WHILE MACGONAGALL TAKES THE LIMELIGHT.

McGONAGALL: All hail to the Empress of India, Great Britain's Queen!
 Long may she live in health, happy and serene;
 Loved by her subjects at home and abroad;
 Blest may she be when lying down
 To sleep, and rising up, by the Eternal God;
 Happy may her visions be in sleep...
 And happy her thoughts in the daytime;
 Let all loyal subjects drink to her health
 In a flowing bumper of Rhenish wine.
 And when the final hour shall come to summon her away,
 May her soul be wafted to the realms of bliss,
 I most sincerely do pray, to sing with saints above,
 Where all is joy, peace and love -
 In Heaven, for evermore to reign,
 God save the Queen, Amen.

PROVOST: (FADING IN)...to reign over a prosperous, happy and contented people. Signed in name and by authority of the Town Council, William Brownlee, Provost; William Hay, Town Clerk. Your Majesty, we present you this scroll. Thank-you, Your Majesty. And now, Your Majesty, I present Mr Thomas Bouch, the Chief Engineer of the Tay Bridge.

BOUCH: Your Majesty!

QUEEN VICTORIA: (VOCAL BUT NON-VERBAL ACKNOWLEDGEMENT)

PROVOST: May I present ex-Provost Cox, who has done so much to expedite the project...

COX: Pleased to meet you, Your Majesty.

QUEEN VICTORIA: (VOCAL BUT NON-VERBAL ACKNOWLEDGEMENT)

NARRATOR: And then at last, over their shoulders, the Queen at last recognized a familiar face - Sir John Richardson of Pitfour.

QUEEN VICTORIA: Is it not sad to hear of the unfortunate death of the Prince Imperial in Zululand?

NARRATOR: And so the Royal visit ended...

SFX: TRAIN WHISTLE.

NARRATOR: Her Majesty waved and sat back, and the train moved off..

SFX: STEAM TRAIN STARTING TO MOVE

NARRATOR: ...up and over the bridge, taking the salute of the boys on the training-ship, Mars, of the ladies and gentlemen in their carriages on the Esplanade, of Thomas Barclay at the Wormit signal box at the far end of the bridge - and so, south into Fife.

READER: The Times. Friday 27th June, 1879. Court Circular: After the Council, Mr Justice Charles Bowen, Mr Henry Bessemer, Major-General Henry Edward Thuillier, C.S.I., and Mr Thomas Bouch, C.E. were severally introduced to Her Majesty's presence by the Rt. Hon. Sir Michael Hicks-Beach, Secretary of State for the Colonies (in the absence of the Secretary of State for the Home Department), and received the honour of Knighthood.

SFX: FANFARE

QUEEN VICTORIA: Arise Sir Henry Bessemer.

BESSEMER: One of the Royal carriages awaited my arrival at the station, and conveyed me to the Castle, where I had the honour of passing through the quaint and interesting ceremony of kneeling

kneeling on one knee before Her Majesty, and receiving a gentle blow across the shoulder from a light and beautifully jewelled sword, and was commanded to express my gratitude by kissing the hand of Her Most Gracious Majesty.

QUEEN VICTORIA: Arise Sir Thomas Bouch.

BESSEMER: I afterwards took lunch at the castle, and then returned to London.

SFX: DISCREET ROYAL LUNCHEON

BESSEMER: You've built a bridge or something, haven't you? Somewhere up north, I hear?

BOUCH: Yes.

BESSEMER: Hope you used steel? It's much the best thing for bridges, you know? The metal of the future - though I say it myself.

BOUCH: No. I used wrought and cast iron.

BESSEMER: Well, tell you what: if it falls down - you can use steel when you put it up again. (LAUGHS)

NARRATOR: The Board of Trade inquiry into the disaster stated:

ROTHERY: The wrought iron employed was of fair strength, though not of high quality as regards toughness; and the cast iron was also fairly good in strength, but sluggish when melted, and presented difficulty in obtaining sound castings.

SFX: MUSIC HALL MUSICAL INTRO.

MUSIC-HALL M.C. My Lords, Ladies and Gentlemen - for tonight we'll merry, merry be; tomorrow we'll be sober! My Lords, Ladies and Gentlemen - it's the 27th of December in the glorious year of 1879 - and the new decade is just round the corner. You don't need me to tell you what that means - yes! It's Saturday night again!

And here to welcome you to Dundee Music Hall - "The Place to Spend a Happy Evening!" - is Dundee's own brilliant bevy of bumptious beauties, the Tayside Follies - in a parabolic and prophetic parody of that new pyrotechnic pre-eminent Parisian Prance - the Can-Can!

SUITABLE GROANS AND CHEERS FROM CAST DURING THIS - AND THEN SFX: THE BAND STRIKE UP WITH A WILD CAN-CAN. ONCE ESTABLISHED, IT FADES DOWN TO BACKGROUND LEVEL FOR THE FOLLOWING LIVE VOX POPS.

J. LENG: I think I might describe it as a prancing motion.

J. BLACK: I felt a motion of swaying from side to side.

W. ROBERTSON: There was a very perceptible vertical - and lateral vibration.

A. HUTCHISON: I felt uncomfortable.

W. ROBERTSON: I did not feel comfortable on the bridge.

A. HUTCHISON: You felt as if the carriage floor rose up beneath you - a sort of impulse while the train seems to rise.

W. ROBERTSON: I considered it dangerous.

T.D. BAXTER: I certainly confess I felt alarmed. There was one day I was glad to get off the bridge.

A. HUTCHISON: I gave up using the Tayport train in the beginning of September.

REV. GRUBB: There was an effect something similar to shocks of electricity felt in the ears, first in one ear, then in the other - especially in passing through the higher girders.

J. LENG: I thought the speed exceeded what I understood to be the regulation of 25 miles an hour. Some ladies were in a state of apprehension.

SFX: MUSIC COMING UP AGAIN SLOWLY.

A. HUTCHISON: ...inside the high girders mainly...
...oscillations being repeated so frequently...
...motion of the bridge...
...excessive speed of the train...
...the motion was alarming...

SFX: MUSIC ENDS DRAMATICALLY. SUDDEN SILENCE.

T.D. BAXTER: I never crossed the bridge after this.

LIVE/SFX: WILD APPLAUSE FOR THE CAN-FADE TO SILENCE.

SFX: STEAM RELEASE FROM TRAIN - HEARD FROM WITHIN CARRIAGE. RAGING WIND BLUSTERING OUTSIDE.

PORTER: Ladybank!

LIVE/SFX: RUNNING FOOTSTEPS, CARRIAGE DOOR OPENS, BENYON FALLS IN, SHUTS DOOR AS TRAIN STARTS TO MOVE OFF.

BENYON: Oh, dear me, dear me. Excuse me Sir - but is this right for Dundee?

ALEXANDER: Yes, indeed. Quite right.

BENYON: Good, good. Dear me Sir, I have just narrowly missed going to Perth.

ALEXANDER: Ah! Wrong end of the train?

BENYON: Yes, yes, indeed, Sir. I don't know if I shall ever get used to this practice of sending the same train to different destinations. It does confuse, doesn't it?

ALEXANDER: Yes, it does a bit. You're bound for Dundee?

BENYON: Yes, indeed, Sir. Allow me to introduce myself - Mr Benyon; I'm a photographer from Cheltenham.

ALEXANDER: Cheltenham!

BENYON: Yes - in England.

ALEXANDER: Ah! Yes. Er - Alexander - Pat Alexander. I'm due to get out at Leuchars to stay with friends in St Andrews. But I fear on such a dreadful night as this, the carriage may not be waiting for me. So I may accompany you to Dundee.

BENYON: And very welcome too, my good Sir. Tell me -this new bridge I've heard so much about. Does it really withstand storms as bad as this?

VOICE OF PATRICK MATTHEWS (SLIGHT ECHO):

Such a rainbow bridge must sustain the very strongest winter tempests, that generally take place in the early part of January.

ALEXANDER: Yes, Sir - truly an engineering marvel. You need have no qualms on that score.

SFX: THE TRAIN BRAKES TO A HALT.

ALEXANDER: Ah, Leuchars if I'm not mistaken.

PORTER (DISTANT): Leuchars!

BENYON: Ah, you're right.

SFX: WINDOW LOWERED. STORM SOUNDS UP.

ALEXANDER: Porter! Porter!

PORTER (CLOSER): Yes, Sir?

ALEXANDER: Is my carriage here from St Andrews? Alexander's my name.

PORTER: No, Sir - there's no carriages here tonight.

ALEXANDER: Ah - thank-you.

SFX: WINDOW CLOSED. STORM RECEDES.

ALEXANDER: Well, Sir - we brave the bridge together.

SLIGHT PAUSE.

PORTER (MID-DISTANCE): Mr Alexander, Sir - that's your carriage here now.

ALEXANDER: Good, good. Well, it's been very pleasant meeting you, Mr Benyon. I hope you enjoy your stay in Dundee.

BENYON: Thank-you, Sir - and a safe journey to St Andrews. Goodbye.

ALEXANDER: Goodbye.

LIVE/SFX: DOOR OPENS, ALEXANDER STEPS OUT, CLOSSES DOOR, WALKS OFF INTO WIND.

SFX: DISTANT WHISTLE OF TRAIN. IT STARTS TO MOVE OFF, GATHERS SPEED.

SFX: SLOW MIX - AS TRAIN SOUNDS GO INTO BACKGROUND AND MUSIC-HALL CHORUS COMES TO FRONT.

CHORUS: Rule Britannia, Britannia rules the waves,
Britain never, never, never shall be...
Bur-i-ed
With the merma-ids,
At the bottom of the deep blue sea.
Hey!

[ACT 2 BREAK OF STAGE SCRIPT]

ACT 3

SFX: OUTSIDE THE WORMIT SIGNAL BOX, THE HURRICANE IS BLOWING STRONGLY. INSIDE, BARCLAY, THE SIGNALMAN IS STOKING THE STOVE. THE DOOR OPENS AND WATT ENTERS, CLOSING THE DOOR BEHIND HIM.

BARCLAY: Oh, it's you. Shut the door man. Come in and warm yourself.

WATT: Thanks. It's a terrible night and no mistake. I haven't seen the like of this storm for many a year.

BARCLAY: I don't think I've ever seen one like this. I keep thinking the cabin's about to fly away, it's creaking and groaning that much

WATT: Well, I can tell you - it had me over twice just now coming up from the cottages. I reckon on it being a hundred mile an hour out there.

BARCLAY: A hundred! How about the bridge?

WATT: Oh, they'll have reckoned on a gale like this. It's no secret the way the Ochil Hills funnel the south-westerlies along the river. That'll be alright. How about some tea?

BARCLAY: The kettle's on. Sit down and keep an eye on it. I'm expecting...

SFX: BELL RINGS.

BARCLAY: ...ah, that's it the now.

WATT: St. Fort?

BARCLAY: Aye. The 5.20 from Burntisland.

WATT: Wonder what it was like for all thae Edinburgh folk crossing the Forth in this!

BARCLAY: Och - it wasna sae bad this afternoon.

SFX: BARCLAY ACKNOWLEDGES TO ST FORT WITH A MANUAL BELL-PULL.

BARCLAY: Right, that's St Fort acknowledged. Now the North cabin.

SFX: HE REPEATS WITH ANOTHER BELL-PULL TO THE NORTH CABIN.

BARCLAY: Their answer will you show the bridge is still there! Whit's the time? Right.

HE WRITES THE TIME IN THE BOOK.

BARCLAY: Seven fourteen!

SFX: THE NORTH CABIN ACKNOWLEDGES: ONE BELL, TWO BELLS, ONE BELL.

WATT: Here's some tea.

BARCLAY: Thanks. Right - where's the baton. Keep the tea hot for me. (BEAT) There she is the now.

HE OPENS DOOR, LEAVES, CLOSES DOOR. INDISTINCT SHOUTED DIALOGUE WITH THE DRIVER OFF. THEN THE DOOR OPENS, HE ENTERS, CLOSES IT AGAIN.

BARCLAY: That's some gale. Had me over there, an' all. Safe or no - I'm glad I'm not in Mitchell's boots. I think I'd rather swim across than drive a train over that height up.

WATT: Dave wouldn't go over if he thought it was dangerous.

BARCLAY: Well, may the Good Lord give them a safe crossing.

CUT TO THE CABIN OF THE TRAIN. SFX: GALE BLASTING THROUGH.

MITCHELL: Alright, my little beauty, that's twenty - that's enough for you on a night like this. Name o' God, that wind is strong away from any shelter. (PAUSE) There's the lights o' Dundee now. Come on girl, you're doin' fine. (PAUSE) Must be gettin' near the high girders 'bout now. (PAUSE) Name o' God, that wind. That's bad, that is. (PAUSE) Where are those high girders. Canna see them through the rain. (BEAT) Name o' God!

SFX: METAL WRENCHING LOUDLY AGAINST METAL. THE TRAIN AND CARRIAGES ARE PLUNGING INTO THE TAY, CARRIAGES BREAKING UP AS THEY FALL. SCREAMING THROUGH THE GALE. THE LONG-HELD SPLASHING AS THE TRAIN HITS THE RIVER, EACH CARRIAGE HITTING THE PRECEDING ONE FIRST, THEN THE RIVER. THE STORM CONTINUES RELENTLESSLY. SLOW FADE OUT.

A CHALLENGING COMBINATION OF SCENIC CUTAWAYS, MAYBE FLOWN, AND FLASHES OF LIGHT SHOULD BE ABLE TO ACHIEVE SOMETHING ACCEPTABLY CONVINCING! A SPRINKLE OF WATER ON THE AUDIENCE IN THE DARKNESS WOULD CAP THE EFFECT.

NARRATOR: 29th December 1879.

CAST: SING LAMENT (EITHER TO TUNE OF "COME HOLY GHOST" OR TO ONE OF TWO TRADITIONAL TUNES AVAILABLE).

The bridge is down, the bridge is down,
The word in terror spreads,
The train is gone, its living freight
Lies mingled with the dead.

NEWSBOY 1: Appalling catastrophe!

NEWSBOY 2: Dreadful accident of the Tay Bridge!

NEWSBOY 3: Fall of a train into the river!

NEWSBOY 4: Supposed loss of 200 lives!

CAST LAMENT: The bridge, the bridge, the wondrous bridge,
That spans the Firth of Tay;
The greatest work of human skill
The wonder of the day.

EDITOR "THE TIMES": The Times: No one clearly saw the disaster. None have escaped to tell how it occurred. A trail of fire and a sudden shower of sparks seen for a moment from the shore were the sole signal made by the train as it shot into the abyss below. The scene at the Tay Bridge station is appalling. Many thousand persons are congregated round the buildings, and strong men and women are wringing their hands in despair.

CAST LAMENT: But what's the strength of bolt and bar
And what's the skill of man
Compared with Nature's blast that blows
Produced by Nature's fan.

EDITOR "GLASGOW HERALD": The Glasgow Herald: Her majesty, the Queen, has promptly made enquiries into the dreadful disaster. The following message was yesterday received by Provost Brownlee:

PROVOST: "Can you give me any particulars of the appalling calamity reported to have taken place at the Tay Bridge? The Queen is inexpressibly shocked, and feels most deeply for those who have lost friends and relatives in this terrible accident".

CAST LAMENT: How large and strong the beams may be
That stretch across the span;
But let the tempest breathe its blast
And iron yields like wands.

EDITOR "THE TIMES": The Times: The result of the investigation of the Board of Trade inquiry will be eagerly awaited, as on it depends the future, not only of the Tay Bridge, but also of the proposed suspension bridge over the Forth.

CAST LAMENT: 'Twas sad to see the open gap
At morrow's light of day
But sadder still to think of those
That perished in the Tay.

MINISTER 1: The seventh verse of the eighth chapter of the book of Jeremiah: "Yea - the stork in the Heaven knoweth her appointed time, and the turtle and the crane and the swallow observe the time of their coming, but my people know not the judgment of the Lord".

The lessons in the text come home to our hearts and consciences with peculiar force and solemnity when we think of the inexpressibly appalling disaster which has so recently cast a gloom, like a funeral pall, not only over our town, but over the length and breadth of the country.

When I was preaching last Sabbath evening on the uncertainty of life, urging upon you the need of being always ready, even on quick notice, to leave this world as you would like to leave it, and enter the next as you would like to enter it, little did any of us imagine that a fearful proof of life's uncertainty, and of the need for all this, had taken place upon the Tay Bridge at the moment I was speaking. Not in the still small voice, but in a voice of storm and terror God has been, and is still, speaking to us.

Through storm and night the fated company, with only the fraction of a brief hour between them and eternity, were being hurried to the yawning gulf. Did any thought or feeling of fear shoot into their souls as they swiftly neared the dark river? We know not.

Swept along by a power that never shies at danger, while the tempest howls among the roaring wheels, and dashes the rain like pellets against the carriage windows. A muffled roar, mixed with the rattle of quivering metal, tells them that they have left the solid earth; the river flows darkly below, flecked here and there with the foam of its turmoil; and they begin to busy themselves with the preparations for alighting at the terminus. Yes - The Terminus; that - is - reached.

In a moment, in the twinkling of an eye, one hundred lives or more are ended. With one terrific sweep, the tempest, by the breath of his nostrils, hurls them into eternity. Their joys and sorrows, their hopes and fears, their home yearnings, their pleasures, whether guilty or hallowed, their worldly business and labours, their earthly life and all that entered into it, suddenly and swiftly cut short. We stand appalled and paralysed in the presence of such a catastrophe. "Be ye also ready".

CAST LAMENT: Ah! what is life, a fleeting breath,
A thread that's snatched away.
In midst of life we are in death
It's taught us day by day.

EDITOR "THE SCOTSMAN": The Scotsman: The part of the bridge which was blown down by the fury of the gale is the 13 central high girders, measuring over 1000 yards. Little of the iron-work remains, girder and column having shared a common fate. The number of lives lost is now known to be between 75 and 80.

NARRATOR: The list of the dead is known to include:
David McBeath, guard, 33 years of age, residing in Castle Street, Dundee -
unmarried.

McGONAGALL: Beautiful railway bridge of the Silv'ry Tay!
Alas! I am very sorry to say
That ninety lives have been taken away
On the last Sabbath day of 1879
Which will be remembered for a very long time.

NARRATOR: David Mitchell, driver, residing in Peddie Street, Dundee - Married, and leaves
a widow, and six of a family, mostly young.

McGONAGALL: 'Twas about seven o'clock at night,
And the wind it blew with all its might,
And the rain came pouring down,
And the dark clouds seem'd to frown,
And the Demon of the air seem'd to say -
I'll blow down the Bridge of Tay'.

NARRATOR: Mrs Cheap, aged 50, domestic servant to Mr David Ruthven, flesher, Lochee.

McGONAGALL: So the train sped on with all its might,
And Bonnie Dundee soon hove in sight,
And the passengers' hearts felt light,
Thinking they would enjoy themselves on the New Year
With their friends at home they lov'd most dear,
And wish them all a Happy New Year.

NARRATOR: Joseph Anderson, compositor in the Courier and Argus office, Dundee, and
residing at 13 South Ellen Street. A native of Auchtermuchty, he joined the train at Cupar, Fife.

McGONAGALL: So the train mov'd slowly along the Bridge of Tay,
Until it was about midway,
Then the central girders with a crash gave way,
And down went the train and the passengers into the Tay!
The Storm Fiend did loudly bray,
Because 90 lives had been taken away,
On the last Sabbath Day of 1879,
Which will be remember'd for a very long time.

NARRATOR: Archibald Bain, aged 26, and Jessie Bain, aged 22, son and daughter of Henry
Bain, farmer, Mains of Balgay.

McGONAGALL: It must have been an awful sight,
To witness in the dusky moonlight,
While the Storm Fiend did laugh, and angry did bray,
Along the Railway Bridge of the Silv'ry Tay.
I must now conclude my lay
By telling the world fearlessly without the least dismay,
That your central girders would not have given way,
At least many sensible men do say,
Had they been supported on each side with buttresses,
At least many sensible men confesses.
For the stronger we our houses do build,
The less chance we have of being killed.

NARRATOR: A letter has been received from a Mr Pat P. Alexander of St Andrews, that places beyond doubt the fate of Mr Benyon, a photographer from Cheltenham, who it was feared joined the train at Edinburgh.

CAST LAMENT: Dry up your tears ye friends that weep
And lean upon the Lord.
The widows' stay be the orphans' friend
It's taught us in His Word.

MINISTER 2: Not one of these as yet unnumbered victims dies in vain. Each death has probably prevented many deaths, and this long and terrible array of human destruction has, I am sure, formed a turning-point in the system of modern engineering.

"Fire, hail, snow, vapour, and stormy wind fulfil His Word". I desiderate, as one result, that there may be manifested a widespread desire that these Sunday trains should be abolished, and thus officials be relieved of duty on that day, and also the temptation be removed from thousands from desecrating it.

At the risk of being called Puritanical, I should say that if there is a voice louder than another in this terrible event it is that God is determined to guard His Sabbath with jealous care.

Individuals and companies should "remember the Sabbath Day to keep it holy". In the case of a railway company it is a violation of the Divine Law with a view to gain.

Philanthropy is not the principle of railway management, directorship or traffic. If ever the hand of God was in any event, it was in that of last Sabbath evening. It occurred on the Lord's Day.

'He maketh winds His messengers, and flames of fire His Ministers'.

NARRATOR: The North British Railway Company have offered the sum of £5 for every body recovered. The sum of £20 has been offered privately for the recovery of the body of Mr Benyon of Cheltenham. The station refreshment-room had been set up as a mortuary - but after a week, it was still empty. Crowds waited, day in and day out, for news. Some news. Any news

LIVE/ SFX: SUBDUED CROWD SOUNDS..

WOMAN 1: Soup or tea, my dear.

OLD MAN: Soup, please.

WOMAN 2: There's some bread at the end there.

OLD MAN: Ta.

WOMAN 1: Mrs Geddes, aren't those three girls the Cheap sisters?

WOMAN 2: Yes, the poor dears. Their mother was on the train. You mind, she was in service to David Ruthven.

WOMAN 1: Aye, I mind her well. The poor bairns. She was a bonnie woman. What a shame. I'll just pop over a minute.

WOMAN 1 CROSSES FLOOR TO THE THREE GIRLS.

WOMAN 1: Oh, my loves - still no news yet?

SISTER 1: Not yet, Mrs Adam. How long can it be?

WOMAN 1: I don't know, lass, I really don't know. But, my dears - have you considered - I mean, are you prepared for the worst?

THE TWO YOUNGER SISTERS BURST INTO TEARS.

WOMAN 1: Oh, there, there. I'm sorry.

SISTER 1: Do you not think there's any hope?

WOMAN 1: It's been a week now, my dear. I don't think anyone would hold out much hope after all that time. Ask God for comfort. I know He'll help you in this sad time.

SISTER 2: But if they're all dead, Mrs Adam, why haven't they found any of the bodies?

SISTER 3: She can't be dead. She can't be dead. God wouldn't let it happen.

SISTER 1: Oh, sister, we must be brave, and not hope too much. Mrs Adam is right - a week is a long time.

WOMAN 1: Let me give you some soup. It'll warm you, and make you feel a bit better.

SISTER 1: No, thank-you. We'll be all right.

WOMAN 1: How about a mug of tea, then?

SISTER 1: No thank you.

WOMAN 1: It'll be a comfort? (BEAT) Alright, dear. Be brave. If I hear anything I'll come and tell you right away.

SISTER 1: (BREAKING DOWN) Bless you.

SISTER 2: Oh Jessie, don't! Be brave.

SISTER 3: She can't be dead! She can't, she can't!

FADE SCENE.

EDITOR "THE COURIER": The Dundee Courier: Diving operations were resumed yesterday at the scene of the Tay Bridge Disaster, with a view to recovering the bodies of the unfortunate passengers. The greater part of the train has now been found. The diver Harley relates his experience as follows:

SFX: ON BOARD A DIVING-SHIP. THE SHIP'S ENGINES MANOEUVRING, AND THE SOUNDS OF A WINCH RAVELLING AND UNRAVELLING.

HARLEY: (JUST COME ON BOARD) The water was very muddy. Believing the carriages to be enclosed between the girders, as in a cage, I mounted upon the uppermost side of the one I touched, and crept along the lattice-work, putting my legs through at short intervals to see whether any carriage was lying underneath.

I had not proceeded more than a few yards when I followed with my feet the woodwork of a carriage. Supporting myself upon my hands, I felt about with my feet in the compartment. I did not come into contact with anything, however. On going down again, I explored the whole of the compartment with the grappling iron, but could find nothing but cushions and padding.

The third time I went down I examined carefully the bed of the river to see whether any bodies were there, but I could find nothing. By this time, the tide was beginning to flow, and it became necessary to suspend operations.

EDITOR "THE TIMES": The Times: About 9 o'clock this morning a body was observed floating in the water near the beach east of Taygrove, East Newport. After some trouble it was landed, and was found to be that of a woman evidently about 65 years of age. The body has been taken in charge by the Health Officer.

CROWDED STATION REFRESHMENT-ROOM AS BEFORE. VOICES PASS NEWS ON TO EACH OTHER, COMMENTS BEING REPEATED TO THOSE BEHIND.

VOICE: It's a body.
 VOICE: Covered in a sheet.
 VOICE: Wonder who it is?
 VOICE: Who do they think it is?
 VOICE: They don't know.
 VOICE: She's in her sixties, they say.
 VOICE: An elderly woman.

THESE COMMENTS REACH THE CHEAP SISTERS.

SISTER 1: An elderly woman!
 SISTER 2: Oh no, I don't want it to be her.
 SISTER 3: (SCREAMING) It can't be her, it can't be her.

MRS ADAM JOINS THEM.

MRS ADAM: Be brave, darlin's. Come, take my hands. You must be brave and see if it's her.
 SISTER 2: (CRYING HYSTERICALLY) I don't want to, I don't want to.
 SISTER 1: We must. Please, be brave. Please, help me be brave too. Hold my hand.
 Alright... Mrs.. (CRYING TOO)

THEY MOVE THROUGH THE CROWD, WHO MURMUR SYMPATHETICALLY ON EITHER SIDE OF THEM.

MRS ADAM: These are the daughters of Mrs Cheap. Their mother was on the train. They should see - the body. Alright, girls. Very brave now. Hold me tight, dear.

PAUSE WHILE SHEET IS REMOVED. THEN HYSTERICS. IT ISN'T THEIR MOTHER, BUT THE EXPERIENCE IS TOO MUCH FOR THEM.

MRS ADAM: No - that's no' her. I don't know who she is. Come on, my loves. We'll go and say a wee prayer in the chapel, shall we.

FADE SCENE.

EDITOR "DUNDEE ADVERTISER": The Dundee Advertiser: The body of the woman which was found below Newport on Monday, was yesterday identified as that of Ann Cruickshanks, who has been upper housemaid in the service of Lady Baxter of Kilmaron during the past 15 years.

NARRATOR: The Board of Trade Inquiry into the disaster sat from 26th February to 8th May 1880. It examined 120 witnesses and asked 19,919 questions. Henry Cadogan Rothery, Wreck Commissioner, was one of the three men appointed to hold the investigation.

ROTHERY: Before we examine Sir Thomas Bouch, there are four very important points to be considered. We have already heard some of the evidence led concerning the Wormit Foundry. With the absence of all supervision from proper and competent persons, we can hardly wonder that the numerous defects - in particular the imperfect casting of the columns and the fatal defects in the lugs and bolt-holes - were allowed to pass. Sir Thomas Bouch and his assistants exercised no superintendence whatever. These are charges of a very grave and compromising character.

NARRATOR: The question of train speeds on the bridge was dealt with. Evidence was led from several sources alleging speeds of up to 42.94 m.p.h. The engine-drivers were unanimous in stating that they had kept below the 25 m.p.h. recommended by the Board of Trade.

ROTHERY: Mr Henry Noble. You are the Inspector of the Tay Bridge?

NOBLE: Yes.

ROTHERY: Had you not instructions to report to your superiors in the railway company any defects that you should discover in the structure of the bridge?

NOBLE: No, I never had any such instructions.

ROTHERY: Had you general instructions to repair anything you might find defective?

NOBLE: I never had any instructions at all.

ROTHERY: No instructions to repair and no instructions to report?

NOBLE: No.

ROTHERY: What were your instructions when you went there?

NOBLE: My instructions were to look after the foundations in the bed of the river in relation to the piers.

ROTHERY: So far as you know, there was no one there charged at all with the duty of looking after the ironwork?

NOBLE: Not underneath the platform. I expect they knew that I should do it.

ROTHERY: You had no instructions?

NOBLE: I had no instructions.

ROTHERY: What were you bred to?

NOBLE: I was apprenticed to a brick-layer, and I worked myself out, and I am now an inspector of brickwork.

ROTHERY: But you have no engineering skill?

NOBLE: No.

ROTHERY: You have no knowledge of ironwork?

NOBLE: No.

NARRATOR: Noble stated that he had noticed a chattering of the cross-bars on the columns, and that he found the cotters or wedges were coming loose. He told no one and tried to mend them himself. He also found slits in the columns, one of them 7 feet long. He put iron bands round them and told Bouch, who approved.

ROTHERY: As regards wind pressure - there seems to have been little concern taken over this problem from the designers and engineers. Sir Thomas Bouch seemingly left these mathematical trivia to unsupervised assistants.

Opinions on wind pressure admittedly vary somewhat, and confusion has arisen between the two scales used for measuring wind pressure. We recommend official guidance on this point in the future. We will now call Sir Thomas Bouch. Mr Bidder?

BIDDER: You are a civil engineer?

BOUCH: I am.

BIDDER: In the course of your experience have you built many large bridges and viaducts?

BOUCH: A great number. I do not suppose anybody has built more, but of course the bulk of them have been ordinary viaducts, with stone piers and arches.

BIDDER: You had also, I believe, built previously to the Tay Bridge several iron viaducts - and bridges of considerable size?

BOUCH: Yes, both iron girders and superstructure upon stone piers and brick piers, and also viaducts entirely of iron.

BIDDER: I believe you engaged the services of your assistant for calculating the details of the strains of the Tay Bridge, Mr Allen Stewart, also a civil engineer?

BOUCH: Yes. He had higher mathematical attainments than I had, and I was glad to get his assistance - only I had erected a great many girders of that form before I knew Mr Stewart.

BIDDER: He, I believe, went into the detailed calculations of the strains of all the parts of the girders for you?

BOUCH: He did. Of course he went into them according to my directions and orders as to the form of the thing, and under my supervision too.

BIDDER: You were engineer-in-chief and generally responsible for the execution of the work?

BOUCH: I was.

BIDDER: Obviously it was impossible that you, or any other engineer, could with his own eyes see every rivet and every joint?

BOUCH: I could not. I appointed inspectors who, I thought, would see to that.

BIDDER: You selected competent men, and you believe they did their duty?

BOUCH: Yes.

BIDDER: Have you anything to say with regard to the cast iron?

BOUCH: The cast iron was tested with a transverse strain; that is always done in the foundry.

BIDDER: Do you know that it was tested at the foundry, or do you presume it?

BOUCH: I was told so, and that it turned out favourably. I was told that.

BIDDER: By whom?

BOUCH: By my own people.

ROTHERY: The question asked you is: are you aware that the cast iron was tested at all by anybody at Wormit?

BOUCH: No, not any special test.

ROTHERY: Will you give to the court your opinion as to what did cause the accident that destroyed the Tay Bridge?

BOUCH: Well, I have thought a great deal about it very anxiously, and my own opinion is fixed now: that it was caused by the capsizing of one of the last or the two last carriages - that is to say, the second-class carriage and the van; that they canted over against the girder.

BIDDER: Against the leeward girder?

BOUCH: Yes.

BIDDER: And so coming into collision with the girder?

BOUCH: I think so.

- BIDDER: In your judgment would the collision of the second-class carriage and the van with the leeward girder, going at the speed at which the train was presumably going, be sufficient to destroy the bridge?
- BOUCH: I have no doubt of it. Practically, the first blow would be the momentum of the whole train until the couplings broke. If you take the body of that train going at that rate it would destroy anything.
- BIDDER: Did you in designing this bridge make any allowance at all for wind pressure?
- BOUCH: Not specially.
- ROTHERY: You made no allowance?
- BOUCH: Not specially. (PAUSE) I was getting such an excessive strain apart from the question of the wind that I thought it was providing for all wind that could arise. (PAUSE) I believe I am right in saying that there was no engineer of that day who had made a special calculation as to strains in respect of wind.
- BIDDER: Taking the bridge as you built it, did you anticipate that the vibration of passing trains as well as the wind pressure on both sides of it at different times would have a tendency to loosen the bracings?
- BOUCH: No; that loosening of the bracings took place because of the conical holes. I had no knowledge of them - none of us had.
- BIDDER: Therefore you made no provision whatever against such an event?
- BOUCH: I can only answer that question by saying that I designed the holes to be square holes. However during the pressure of a high wind the column would not yield to the extent of going out of its shape or form; it would come back again - unless you pass the limits of elasticity.
- BIDDER: You say that not anticipating the loosening of the ties, you made no provision for such a case; were not the cotters themselves a provision for tightening up any slackness that might occur?
- BOUCH: Certainly.
- ROTHERY: I must ask you some questions, and I will endeavour to put them in such a way that they shall not in any way distress you, for we all have a feeling for you under the circumstances; but you can quite understand that it is our duty to ascertain the cause of this casualty, and nobody, perhaps, has a greater interest in that cause being ascertained than you yourself. You have told us that you think the cause of the accident was the train coming into collision with the girder - with the ties, I suppose?
- BOUCH: Yes, I think it was caused by those two things - coming into collision with the ties and being capsized by the wind.
- ROTHERY: You think it came into collision with one of these and broke it?
- BOUCH: Yes, I think that would be the way.
- ROTHERY: Do you think that the mere breaking of any one of these ties of the girder would be sufficient to bring it down?
- BOUCH: I do not know that the mere breaking of any one of them would be sufficient, but there are several struts and ties where this second-class carriage and the van were found, and I have had the whole thing surveyed and made into a plan.
- ROTHERY: Do you think that taking away two of these and the strut there would be sufficient to bring the bridge down?

BOUCH: Most undoubtedly, with that wind.

ROTHERY: Put the wind aside. Do you think that the breaking away of two of those ties and the strut would be sufficient to bring the bridge down?

BOUCH: Yes.

ROTHERY: You think, therefore, that this bridge was so constructed that if one or two of these ties gave way the whole bridge between the high girders would come down?

BOUCH: I think so; that is to say if you cut them.

ROTHERY: So constructed that if the one or the other of these ties gave way...?

BOUCH: I do not know as to one, but certainly two.

ROTHERY: If two of them came down, the whole length of the bridge between the high girders would come down?

BOUCH: Of course the girder coming down sends the pier down, and they all go one after the other like.

ROTHERY: To the Rt. Hon. the President of the Board of Trade, London, 30th June, 1880.

After conducting an inquiry into the causes of the Tay Bridge Disaster, we have arrived at the following conclusions:-

The iron columns though sufficient to support the vertical weight of the girders and trains were, owing to the weakness of the cross bracing and its fastenings, unfit to resist the lateral pressures of the wind.

The imperfections in the work turned out at the Wormit Foundry were due in great part to a want of proper supervision.

The supervision of the bridge after its completion was unsatisfactory.

If, by the loosening of the tie bars the columns got out of shape, the mere introduction of packing pieces between the gibs and cotters would not bring them back to their positions.

Trains were frequently run through the high girders at much higher speeds than at the rate of 25 m.p.h.

The fall of the bridge was probably due to the giving way of the cross bracing and its fastenings.

The imperfections in the columns might have contributed to the same result.

I think that the error in the borings ought not to be passed over in silence. It is clear that this led to the alteration of the piers from brickwork to iron columns, and that that undoubtedly was the cause of the casualty.

The conclusion then to which we have come is that this bridge was badly designed, badly constructed, and badly maintained, and that its downfall was due to inherent defects in the structure, which must sooner or later have brought it down.

For these defects Sir Thomas Bouch is, in our opinion, mainly to blame. For the faults in design, he is entirely responsible. For those of construction, he is principally to blame, in not having exercised that supervision over the work, which would have enabled him to detect and apply a remedy to them. And for the faults of maintenance he is also principally, if not entirely, to blame, in having neglected to maintain such an inspection over the structure, as its character imperatively demanded.

I have the honour to be, Sir, your most obedient, humble servant, H.C. Rothery.

EDITOR "THE RAILWAY TIMES": The Railway Times: We regret to have to announce the loss of another life, a result, though perhaps an indirect one, of the terrible Tay Bridge Disaster. Sir Thomas Bouch, the engineer, after an illness extending over several weeks, expired at Moffat on the 30th October, 1880, at the age of 58, within 12 months of the calamity that shattered his reputation and his health.

His last illness was evidently brought about from having to bear the burden of public condemnation, and even to face the prospect of a criminal charge.

However we can still deplore the loss of a great builder. Up to the time of the accident no one doubted the stability of the work. It was regarded as a triumph of engineering skill. Those who examined it were engineers of experience and ability, and in any error of judgment, they should share the responsibility. Sir Thomas is survived by a widow, a son and two daughters.

NARRATOR: 29 bodies were never recovered from the Tay.

EDITOR "DUNDEE COURIER & ARGUS": Dundee Courier and Argus, 1st April, 1881: A meeting of the Tay Bridge Disaster Fund was held yesterday at Dundee. The fund amounted to £6527, of which £500 had been returned to the North British Railway Company and £1910-17s expended in relief. It was ultimately agreed that the balance of the fund be returned to the individual subscribers.

NARRATOR: In 1938, a man called David Mitchell asked for assistance from the fund. His father had been the driver of the 5.20 from Burntisland on the 28th December 1879. David Mitchell had been 8 at the time.

In 1882 John Stirling of Kippendavie died - but he lived long enough to see work started on the second Tay Bridge, which was opened on the 20th June, 1887.

McGONAGALL: Beautiful new railway bridge of the Silvery Tay,
With your strong brick piers and buttresses in so grand array,
And your thirteen central girders, which seem to my eye
Strong enough all windy storms to defy.

SFX: MUSIC STARTS GENTLY UNDER.

McGONAGALL: And as I gaze upon thee my heart feels gay,
Because thou art the greatest railway bridge of the present day,
And can be seen for miles away
From north, south, east or west of the Tay
On a beautiful and clear sunshiny day,
And I think nobody need have the least dismay
To cross o'er thee by night or by day,
Because thy strength is visibly to be seen
Near by Dundee and the bonnie Magdalen Green.

COMPANY FINALE: (TO MUSIC)
Oh, I'm a Dundee weaver, and I come frae Bonnie Dundee,
I met a Glesga fella an' he came courtin' me,
He took me out a walkin' upon the Dundee Law,
And there the dirty wee rascal stole ma thingamajig awa.
And there the dirty wee rascal stole ma thingamajig awa.

SFX: MUSIC CONTINUES UNDER.

McGONAGALL: And for beauty thou art most lovely to be seen
As the train crosses o'er thee with her cloud o' steam;
And you look well, painted the colour of marone,
And to find thy equal there is none.

COMPANY FINALE: He took me out a courtin' down by the new Tay Brig,
 He showed to me a bonny wee bird, perched upon a sprig,
 He showed to me a bonny wee bird, frae a linnit to a crow,
 But I never saw the bird that stole ma thingamajig awa.
 But I never saw the bird that stole ma thingamajig awa.

McGONAGALL: Which, without fear of contradiction, I venture to say
 Because you are the longest railway bridge of the present day
 That now crosses o'er a tidal river stream,
 And the most handsome to be seen
 Near by Dundee and the bonnie Magdalen Green.

COMPANY FINALE: He's left me now in Dundee, looking bonny, young and fair,
 And I'll put on my bonny new shoes, and tie up my bonny brown hair,
 And I'll put on my corsets tight to make my body look sma,
 And naebody'll guess by my rosy cheeks my thingamajig's awa.
 And naebody'll guess by my rosy cheeks my thingamajig's awa.

McGONAGALL: And as you have been opened on the 20th day of June
 I hope Her Majesty Queen Victoria will visit thee soon,
 Because thou are worthy of a visit from Duke, Lord or Queen,
 And strong and securely built, which is most worthy to be seen
 Near by Dundee and the bonnie Magdalen Green.

COMPANY FINALE: Now all you Dundee weavers take this advice from me:
 And never let a Glesga bloke an inch above your knee,
 And never stand at the back of a 'close, or up against a wa'
 For if you do, you can surely say your thingamajig's awa.
 For if you do, you can surely say your thingamajig's awa.

END.

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