

The following paper was accepted for publication and is available as 'A Conflict of Interest at the Tay Bridge Disaster Inquiry' (2022) *Northern Scotland* vol. 13(2), pp.213-6.

A CONFLICT OF INTEREST AT THE TAY BRIDGE DISASTER INQUIRY

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Abstract

The collapse of the Tay Bridge on the evening of Sunday 28 December 1879 was an event of global interest, partly no doubt because of the pathos of the loss of life on a structure that represented the best of engineering triumphs at that time. Many aspects of the disaster have either remained unexamined or have been subject to little sustained or critical research. The legal considerations of all the relevant events of 1879 have not been reviewed in much detail. The crucial engineering lessons for the Empire and the industrial world beyond British limits were such that an inquiry was convened and heard crucial evidence in London. The inherent unfairness in that procedure seems to have been hinted at in the past and is examined closely here.

Keywords: Tay Bridge disaster; fatal accident inquiry; public inquiry; procedural equity

Introduction

The central part of the Tay Bridge collapsed during a storm on the evening of Sunday 28 December 1879. A train and carriages, and all crew and passengers, fell into the river. As an event of global interest, the collapse shocked a world which was keen for news of any major occurrences.¹ The construction of such an apparently advanced bridge meant that the disaster carried a suggestion of the shared experience that gave serious news a greater value.² The extent of the loss of life was, and is, uncertain.³ A statutory inquiry was established immediately, and as soon as 3 January 1880 the three London-based members were in Dundee to take initial evidence and view the wreckage.⁴ There were further hearings later in Dundee and Westminster.

The statutory inquiry was convened on the authority of the Regulation of Railways Act 1871 (c.78) which provided by section 7 that it was to consider 'the causes of, and circumstances attending, the accident'. The legal basis for accident inquiries conducted by the Railway Department of the Board of Trade was said by an administrative historian to have been 'dubious ever since its foundation and an older, more flexible, pattern of investigation had been preferred'.⁵ The newer statutory procedure suggested a formal inquiry for only the most serious of events and that proved to be so as the 1871 Act was not relied on for almost 90 years.⁶ The title page of the subsequent report from the investigation is headed 'Court of Inquiry'.⁷ Two of the commissioners had engineering experience and the third was a lawyer in England.⁸

The three members of the Tay Bridge disaster inquiry failed to agree unanimously the terms of a final report although there was much common ground. The report by one member of the court, the lawyer, was more detailed in its analysis, and more willing to blame named individuals. The majority report was a relatively short one, signed by the other two members. The dissenting minority member said that his colleagues had declined to join him in allocating blame, on the grounds that this was outside their terms of reference.⁹ Nevertheless, the consensus among many modern commentators seems to be that, given the design of the bridge, the cross-bracing of the cast iron columns was bound to fail if subject to a force of a wind equal to or greater than that on the night of the collapse. That

explanation has gone a long way to reinforce the principal conclusion of the official inquiry.¹⁰ There is independent modern support for that general conclusion.¹¹

The whole event retains relevant interest in the context of national disaster management.¹² Serious debate around design and construction issues and the cause of the collapse became part of the curriculum of a modern postgraduate course in engineering.¹³ The contemporary engineers identified difficult technical matters, although such disagreement was common then.¹⁴ Broadly, an intellectual assessment is that there is usually an inner tension to expert disagreement, and perhaps none more so in the aim to provide 'the conclusive answer' to conundrums.¹⁵ Further, it has been argued that:

it is often assumed that questions about which scientists disagree have scientific answers, which are knowable, and perhaps even known, and which would be readily apparent if only the interests were somehow neutralised or circumvented. This 'end of ideology' thesis suggests that science has unique access to answers.¹⁶

From that perspective, the inquiry may be seen as part of the problem that bred uncertainty. With a 'science court', and its assessors, at least some of the experts can be ostensibly disinterested and will reflect the true view of science, rather than the views of the contending parties disguised as science.¹⁷ That has been challenged in the social studies of science where it is thought to be meaningless to think about a disinterested science, especially in policy-relevant areas. It was unreasonable to expect that 'unbiased' assessors have no interest of their own to represent. Accordingly, there can be no disinterested parties, simply those with more-or-less conflicting or compatible interests.¹⁸

Engineering issues

Commentators on the disaster with no training in engineering may find themselves adrift in some issues around the bridge.¹⁹ Within 10 days of the disaster, however, a German mathematician had opined on the event, by reference to unspecified 'new plans reported in English technical journals in 1876'.²⁰ Professor Wilhelm Launhardt offered complex mathematical descriptions of the crucial elements of the bridge, in the context of the particular geographical and meteorological factors peculiar to the location. Whether these contributions add much now to the debate, or did at the time, is necessarily a matter for engineers. It may not be irrelevant that the professor was said to have visited Dundee and seen the bridge during construction.²¹ It seems unlikely that he did not meet Albert Grothe, a fellow German and engineer who was described as 'Manager of the Tay Bridge Contract'.²²

There appear now to be *four* engineering explanations as to why the central spans collapsed in 1879, three of which are of modern origin.²³ There are two essential questions that may now be posed: (i) what was the precise *cause* of the collapse of the bridge? Moreover: (ii) what was the *sequence* of events as part of that collapse? These are not necessarily the way questions are asked by engineers who work within their own discipline, or by lawyers viewing the whole incident. There are well-established in argument lines of inquiry that have been developed further in the literature of the first quarter of the 21st century.²⁴

First, the original court of inquiry of three members reached a conclusion that at best must be acknowledged and yet, not being unanimous, can only represent the state of knowledge of engineering then.²⁵ According to a majority of two of the members of the inquiry: 'the fall of the bridge was occasioned by the insufficiency of the cross-bracings and fastenings to sustain the force of the gale on the night of December 28th 1879 [...] the bridge had been previously strained by other gales'.²⁶ The minority of a sole member agreed with that, and asked further in the form of a rhetorical question: 'Can there be any doubt that what caused the overthrow of the bridge was the pressure of the wind acting upon a structure badly built and badly maintained?'²⁷

Secondly, it was suggested that the central part of the bridge was blown down by the wind.²⁸ Perhaps that view of a crucial witness was stated too simply: the wind was not the *sole* cause of the catastrophe but rather the final element in a combination of factors that overwhelmed the bridge in the condition that it was immediately prior to collapse. That has been suggested by asserting that the combination of the relevant wind loading on the train and the condition of the high girders was sufficient to make 'the latticework columns fail in shear.'²⁹

It was the presence of the train then that led to the consequences of the culmination of debilitating factors, it was not any one of them alone.³⁰ Yet, the suggestion that the condition of the bridge was such that 'if the bridge had not fallen in this storm, another storm would have brought it down at some stage', is arguably speculation.³¹ The point is emphasised merely to show that what is properly a matter for meteorologists, might lead to a crucial element that is more for engineers.

Thirdly, it has been argued that the derailment at a crucial point of the train and its tender and carriages brought about the collapse. The point of this theory is that, due to a known misalignment of the rails, the train with uplift due to known aerodynamic forces, came off the track. A carriage hit the side of the bridge and that in turn caused the cast iron lugs connecting bracing parts on the columns to fracture. These consecutive events caused the pier structure to collapse.³² The only part of the bridge to collapse was that where the train was passing. There was subsequent support for the theory from other, non-engineering, commentators.³³

Finally, a theory of fatigue has been proposed.³⁴ That argument is that there were the dynamic effects that caused the failure of the cast elements that were so crucial in the bracing on the structure. There was ample contemporary evidence of the movement of the bridge, from workers maintaining it once constructed, and regular foot passengers who were able to walk across from one bank of the Tay to the other in the absence of any security constraints.³⁵ Issue has been taken, by others suitably qualified to argue the point, about the evidence of fatigue on which the theory was based with a counter-argument that the evidence relied on was too weak to support the thesis.³⁶

Scots law and the disaster

Hitherto, the relevance of Scots law to the disaster has been neglected. The office of coroner in Scotland had long fallen into desuetude.³⁷ There was a notable absence of a thorough medical examination of all the recovered remains of the deceased which may, or may not, have proved to have been a relevant omission in the available evidence. Forensic medicine in Scotland of the time was a developing subject and yet progress was being made.³⁸ However, the paucity of medical results meant that there was insufficient detail from which any reasonable conclusion might be inferred.³⁹ A general medical description of *drowning* for all those thought or known to have died in the disaster suggests an initial strategic decision by the relevant authorities that there would be no criminal proceedings.⁴⁰ There does seem to have been an absence of any subsequent medical study of the circumstances around the universal cause of death by 'drowning'.⁴¹

The entries in the statutory registers for *recovered* bodies of known passengers and, separately, *unrecovered* bodies of known passengers were almost identical.⁴² For the former group, the general narrative of the cause was: 'Accidentally drowned from fall of railway train and portion of the Tay Bridge into the Tay River. *Not certified* [emphasis added].' For the latter group, the general narrative of the case was: 'Accidentally drowned from fall of railway train and portion of the Tay Bridge into the Tay River. *Not certified* [emphasis added]. Body not recovered at the date of registration'.⁴³

The reference to an absence of certification meant that the registration was completed administratively by the Procurator Fiscal, as local public prosecutor, with a responsibility for investigating all sudden, suspicious and unexplained deaths in order to exclude criminality.⁴⁴ It may be that the remains of the deceased were examined superficially by registered medical practitioners on behalf of the Procurator Fiscal and their medical view informed the registration.⁴⁵ The legal approach was stated in a later textbook:

It is not in every case necessary to adduce medical evidence as to the cause of death. When the character of the injuries sustained leaves no possible doubt that the subsequent death was due to the accident, as, where a man's head is severed from his body – such evidence is useless. In more doubtful cases, and especially if a criminal charge is likely to follow, - as in accidents from careless or reckless driving, - a medical report may be indispensable, and in some instances, even a post-mortem examination of the body.⁴⁶

The wholesale registration of drowning was entirely in keeping with settled legal practice.

Medical report

At least one medical assessment is available.⁴⁷ Presumably that was sought because it may have identified the presence of some intervening factors indicating, for example, crimes of malicious mischief or vandalism because of industrial sabotage directed at crucial parts of the bridge, or perhaps even a more robust politically-motivated criminal attack on the viability of the structure.⁴⁸ In the construction of the bridge, there had been dangerous conditions, and resulting deaths.⁴⁹

Amongst the railway company papers is a handwritten six-page document headed 'copy report' with the date 23 February 1880 on the backing sheet.⁵⁰ The author, Dr David Greig, was a general medical practitioner in Dundee.⁵¹ He seems to have kept a note of his regular but superficial examination, merely a viewing, of the remains of the deceased at the Tay Bridge railway station in Dundee. Initially, the remains were taken to the station where, in what had been a refreshment room for passengers, they were laid out on tarpaulins for their identification by relatives.⁵² It is likely that these facilities for the reception of the remains of the deceased were organised by the railway company representatives and the local police, with the assistance of funeral directors and staff.⁵³ This is all suggestive of the improvisation of the time, and ultimately was intended only for sight recognition.⁵⁴

Dr Grieg commenced his report by noting that he was instructed by Thomas Thornton, a solicitor in Dundee and the senior representative there of the North British Railway Company, with its head office in Edinburgh. The doctor refers to many of the deceased numerically which suggests it was by reference to a list, probably the police one.⁵⁵ That list was most likely simply a notation and allocation of a number by a constable at the door of the railway station room as the remains that had been recovered passed him when brought to the temporary mortuary room prior to identification by nearest relatives and then removal.⁵⁶

The essential elements of the brief report of Dr Grieg were that, acting on the instructions of Thomas Thornton, on 9 January 1880 he visited the mortuary at Tay Bridge Station. he saw about half a dozen bodies. The two he examined, (22) and (23), had no wounds and all had the appearance of having died from drowning. He returned in the evening but there were no new bodies. In conversation with mortuary staff, he heard that the bodies generally had no wounds although the woman found first had her legs broken and a man had his thigh broken.

There then followed three dates on each of which a single body of a man was examined and it was noted that there were no wounds. There was a single list of three further dates when the remains of men were examined. On 13 January 1880 Dr Greig examined three males (27, 28 and 29): (27) and (28) each had right leg broken at knee, and with no wounds or other injury except slight abrasions.⁵⁷

There followed a list of eight separate dates when eight further bodies of men, women and children were examined. On two of the bodies there were noted to be a 2-inch scalp wound on the right temple and, separately, a similar cut under the chin. The bodies discovered later in the month were decomposed.⁵⁸

From 9 January 1880 to 23 February 1880 Dr Grieg made about 30 visits to the mortuary and examined 16 bodies, and concluded that all death was caused by drowning.⁵⁹ The coincidence of fractures to legs and a thigh must be a notable observation, but so too is the absence of any comment about there being any fractures of the skull, spine, arms or hands, or dislocation of the body of anyone. The comment of 'no wounds' was recorded repeatedly although Dr Grieg did note occasionally some minor wounds or 'slight abrasions'. He seems not to have specified the position on the human body of any injury, nor described them.

There were contemporary descriptions for the public: newspapers were not slow to publish the details. It was noted on the body of the David Johnstone, the passenger guard, that his: 'face [was] scarcely discoloured, is a little swollen and at the ears there are some marks of blood'.⁶⁰ James Leslie had 'no bruises about the face which is, however slightly bruised'.⁶¹ John Marshall, the train's stoker, was recognised by colleagues although 'cut through [...] on both cheeks', and had marks to his face that were thought to be indicative of his being on the tender when the crash took place.⁶² The remains of Robert Fowlis 'bore no marks of violence'.⁶³

These descriptions suggest an absence of, for example, a violent explosion which would have led to dislocation of some the bodies. Further, the absence of major wounds implies strongly that the whole of the high girders fell *very* promptly. It would be of course a matter for medically-qualified

person, a forensic pathologist, to offer an assessment of the nature, extent and location of the fractured bones noted. Yet, there was a strange coincidence of broken legs and a thigh, in the context of what seem to be a minimal number of superficial or obvious wounds. These suggest extreme dynamic forces following from a sudden collapse of the bridge.

The reason for considering the actual condition of the remains of the deceased and the final medically assessed cause of death, seems necessary given one theory proposed by modern commentators. William Dow argued that the latter carriages had experienced a derailment due to misaligned rails and that contributed to the fall of the bridge. That idea was supported by Charles McKean who described in detail the collision between a second-class carriage and the guards van behind it 'crushing David Jobson and his companions to death'.⁶⁴ It was been said that there is no real evidence to support McKean's 'colourful account of the last seconds of the ill-fated train'.⁶⁵

Particularly, first, it is not known now how Charles McKean knew where David Jobson had been sitting, or who his companions were who sustained similar crushing injuries. Secondly, Dr Greig examined the remains of David Jobson and described what he saw as: 'head dark and swollen – but no marks of violence'.⁶⁶ That external examination does not support a description of 'crushing'. Moreover, Charles McKean refers to the impact of the fall of the train resulted in train crew and passengers having had 'broken many of their limbs'.⁶⁷ The limited available medical evidence suggests only broken lower limbs.

The identified fractures and the signs of drowning do suggest a very sudden fall from a height with no time for the deceased in life to grab hold of fixtures or fittings in the carriages as an instinctive reaction, although some may have done so to no avail. There is ample evidence of the carriages being recovered, yet badly damaged to differing extents, and the carriages were still retained within the girders in which the train had been travelling at the pertinent time. Thus, the whole of the high girders had broken away from the rest of the bridge and fallen immediately with the carriage into the water.⁶⁸ The medical causes of death seem to have been based on very superficial examination.⁶⁹ The paucity of information as to the condition of all of the deceased probably reflects the state of many of the remains which had been in the water for a substantial length of time before recovery.

Medical inferences

What is forensic medicine? Dr. Douglas Maclagan, the Professor of Forensic Medicine at the University of Edinburgh, answered his own question when speaking to the British Medical Association at Bath.⁷⁰ He asserted that there was a need for a qualified doctor of medicine to examine 'the death registers' to ensure that 'all causes of death are clear and free from all elements of suspicion'.⁷¹ While any element of suspicion was of serious interest to forensic pathologists, they had surely realised that they could see before them evidence of a crime that others could not. Forensic pathologists of the era had may not have appreciated the value of their observations for reasons other than crime.

By the mid-Victorian era, the Procurator Fiscal, as personally nominated appointee of the local Sheriff, examined the circumstances of any sudden, suspicious and unexplained death. These duties were not inconsistent with the role of public prosecutor because the quasi-inquisitorial state of investigation meant that the facts were being sought out. Professor Maclagan did not think much of the principle of Coroners' Courts, believing them then, the mid-Victorian era, to be 'an anachronism and an anomaly'.⁷² However that may be, from the whole tenor of his talk, there were no doubts about the working of the Scottish medico-legal system.⁷³

What might have been some of the thinking around the emerging modern forensic medicine about Tay Bridge disaster deaths? The strategic aim then was, apparently, to *exclude criminality*, in the formal sense as it was understood then. The occurrence of a death in the industrial context did not necessarily imply criminality. Once any suggestion of criminality had been discounted, the pursuit of an explanation of the cause of the disaster ceased to be a matter for the public prosecutor but became one for the representatives of the individual, or businesses, to vindicate their rights. In any event, as a matter of administrative demarcation, the investigation of railway accidents was the responsibility of the Board of Trade.⁷⁴ That left the cost of detailed inquiry with central government.

There was at work then a process of parallel responsibility. The Procurator Fiscal as local public prosecutor was required to assist where possible the officials of the Board of Trade and give them ‘all the aid which lies in his power [...], he has a duty to perform independently of those officials. He is bound to investigate *every fatal accident* [emphasis in original], of whatever description it may be, which happens in his jurisdiction.’⁷⁵ There was in 1879 no common law or statutory authority in Scots law for any public inquiry into these deaths by accident and one view, probably not uncommon was that no such inquires appeared to be called for in the public interest.⁷⁶

The police were involved and the Procurator Fiscal was required to report to Crown Office in Edinburgh where Crown Counsel, who assisted the Lord Advocate as the national public prosecutor, considered these reports. By that means, the Lord Advocate could be put on notice and advise the executive or the legislature of the need for change or improvements in some particular aspect of law or administration that gave rise to the death. With the Tay Bridge disaster there was no doubt that the matter was a railway accident and therefore a matter for the Board of Trade.⁷⁷ The Procurator Fiscal, however, did exercise his duty and properly registered all the deaths.⁷⁸ That was done in accordance with the requirements and limits of the time. Yet, there was contemporaneous debate about the failing of the system in the then modern conditions in Scotland.⁷⁹ A medical commentator of the system complained of ‘ill-judged parsimony’ by the legal authorities in Scotland, although authorised expenditure was a matter for Treasury in London.⁸⁰

Procedural unfairness

In the mid-Victorian era *laissez faire* was ‘a dominant political philosophy of public purpose and intervention’ for commercial ventures.⁸¹ Specifically, there was said to have been an uneven pace with which local and central authorities assumed any new regulatory duties and, although that did happen, it was only ‘grudgingly and haltingly’.⁸² Intervention was exceptional because of a general ‘perception that a fair and disinterested government was by definition a frugal and unobtrusive one’.⁸³ Yet, there was a general supervisory role for the Board of Trade and that developed particularly with statutory intervention in 1840.⁸⁴ Perhaps the problem highlighted by the Tay Bridge disaster was that the nature and extent of that role was simply too general in its slow evolution. Nevertheless, the inspectors came to be valued for their experience and that had a market value should they wish to enter the business world of railways.⁸⁵

The minimal legal regime around the Tay Bridge disaster is a part of the historical assessment, even allowing for different generational ideas of what in law ought to have been done. First, construction of great works includes a human cost.⁸⁶ Without coroners’ hearings, or anything comparable, in the jurisdiction of Scotland, there was no local and *public* accountability and therefore also no adverse publicity with attendant political pressures and that may now be regarded as a major deficiency in the law.⁸⁷ The whole approach and narrative were dominated by considerations of engineering issues around design and construction, which were central to much of the business of industry.

Second, the lawfulness, in the sense of inherent fairness, of the Board of Trade Inquiry might now be doubted as there was a clear conflict of interest. That did not consist in the Board of Trade inquiring into its own regulation policy as such.⁸⁸ The absence of direct (and disinterested commercial) supervision and critical accountability seems to have permitted the selection throughout of the least expensive option in construction: catering for significant wind loading would have increased costs. Sir Thomas Bouch, who had designed the Tay Bridge, said as much, but he was not then asked where else in the whole venture he had saved on costs.⁸⁹

A decade before the disaster, Sir Thomas had taken advice on the question of wind pressure. He had received a reply from William Yolland on behalf of the Board, with what must be considered normative and authoritative advice about tonnage and wind pressure that coincided with that of Sir Thomas. Yolland was later a member of the inquiry itself and by then Chief Inspector of Railways.⁹⁰ Yolland was an inspector as such and working on behalf of the Board of Trade about various contemporary railway issues.⁹¹ There is a sense that the Board of Trade then had not settled their role as being that of an advisory or regulatory body.

Accordingly, it can be argued that a Board of Trade representative with supervisory responsibilities and duties as an inspector of railways had been involved in an original discussion

bearing on a critical issue of construction and was then in a place to deflect or dilute the true place of technical responsibility.⁹² Moreover, the conclusions of the Court of Inquiry included a suggestion agreed to by Yolland that rules ought to be made for the engineering profession regarding wind pressure in railway structures.⁹³ Thereafter, the Railway Department of the Board of Trade appointed a commission to inquire and report, which was done by two of the members of the original Court of Inquiry, Messrs Barlow and Yolland.⁹⁴

The relevant modern legal issue is the concern about bias and, also, *the appearance of bias*, and what a fair-minded and informed observer would conclude with knowledge of the background about the proceedings.⁹⁵ In the mid- to late-Victorian era, the relevant ancient principle of natural justice was *nemo iudex in causa sua* [no one is to be a judge in his own case].⁹⁶ The decisions and reports of the inquiry were split into that of two members of the inquiry, Barlow and Yolland, who stated a general overall criticism, and also a report of the single remaining member of the inquiry who directed his criticism at Sir Thomas Bouch.⁹⁷ In short, it would seem, to put it no higher, that the view of a member of the inquiry concerned a central technical issue about which he had advised on earlier.⁹⁸ That is to be regarded as more than a ‘supreme irony’.⁹⁹

Third, the prosecuting authorities in Scotland were independent of the British regulating, principally the Board of Trade, and an invitation to the former to prosecute Sir Thomas made by the latter was refused.¹⁰⁰ It would doubtless have been expedient politically to have Sir Thomas, designer of the bridge, answer an indictment in a criminal court. The Lord Advocate, John McLaren, as the public prosecutor acting in the public interest, thought however that the designer had acted in good faith with the degree of skill and knowledge he professed, albeit in error induced by the defective results of scientific research of that time.¹⁰¹ In any event, a prosecution would have been compromised by Yolland having to give evidence.

Fourth, at the conclusion of the inquiry, the Board of Trade inspector of the then new bridge in 1878, was asked to comment on the findings and he did so to the Assistant Secretary of the Railway Department of the Board of Trade.¹⁰² That was supplemented by a personal reference in favour of the inspector by the Board of Trade, signed by Joseph Chamberlain as President.¹⁰³ The support for the inspector was bolstered by a short statement of what in law the Board of Trade could in law do and not do.¹⁰⁴ It also identified the small size of the department and limited authority exercised: the inspection did not guarantee the design of the bridge. Pity was stated for Sir Thomas Bouch who designed and constructed the bridge but it was asserted he was responsible for the defects.¹⁰⁵

Finally, one commentator has written explicitly that the first Tay Bridge ‘as built was going to fall down sooner or later thanks to the alteration of the plans, the inferior construction, and the inadequate maintenance’.¹⁰⁶ As to the physical collapse, it may all come to a conclusion of the simplest kind: the weakest part of an extremely deficient bridge was blown down by extreme wind which coincided with a train and carriages crossing on the bridge at the crucial point.¹⁰⁷ The medical evidence may well support the suddenness of such a fall.

Concluding remarks

The collapse of the Tay Bridge in 1879 occurred in the absence of any powerful political or legal restraint by government on the freedom of an engineer with a reputation of ‘building economically’ to produce ‘adventurous slimline designs’.¹⁰⁸ The construction of the bridge may be said to have been an example of tripartite corporatism involving the government, suppliers of capital and the railway industry as purchasers.¹⁰⁹ Yet, when something went wrong catastrophically the Board of Trade as a department of national government authorised the only investigation and provided its own inspectors to sit as members, one of whom had offered relevant advice earlier at the design stage.

The individual engineer who had sought that advice, and presumably weighed it in the balance of relevant criteria during the design process, alone bore professional responsibility for the disaster.¹¹⁰ The Board of Trade controlled the investigation and the conclusions, and also took up the suggestion for further research by employing several of the personnel who sat at the Court of Inquiry. In short, the Court of Inquiry into the Tay Bridge disaster of 1879 was unfair procedurally. It is a reasonable suggestion that the individual lawyer sitting as part of the Court of Inquiry ought to have acknowledged and acted on the procedural error of an obvious conflict of interest.

Notes

1. Ben Wilson, *Heyday: Britain and the Birth of the Modern World* (London, 2016) xxviii, 287-92, 327-31.
2. *Ibid.* p. 289.
3. David Swinfen, *The Fall of the Tay Bridge* (Edinburgh, 2nd ed., 2016), Appendix 1; and Robert S Shiels, 'The Investigation of Sudden Deaths and the Tay Bridge Disaster of 1879' 2016 *Juridical Review*, pp. 213-26.
4. The inquiry by the British authorities into the loss of the Titanic liner was established 8 days after the loss of the ship: Iain McLean and Martin Johnes, 'Regulation Run Mad': The Board of Trade and the loss of the Titanic' (2000) 78(4) *Public Administration*, pp. 729-749, at p. 731.
5. Henry Parris, *Government and the Railways in the Nineteenth Century* (London: Routledge & Kegan Paul, 1965) p.217.
6. Ministry of Transport, *Report of the Public Inquiry into the Accident at Hixon Level Crossing on January 6, 1968* (Cmnd. 3706) (London: HMSO, 1970). That accident raised a question of policy and the Ministry of Transport was represented separately: *ibid.*, para.7, p.7.
7. The Railway Regulation Act (c. 78) provided by s.7(1) for the appointment of 'any person or persons possessing legal or special knowledge to assist an inspector in holding [an inquiry], or may direct the county court judge, stipendiary magistrate, metropolitan police magistrate [named in the order],' without specifying the jurisdiction of England. The Act, by s.16(3), provided for the possible appointment of Scottish judicial office-holder.
8. Henry Rothery was a member of the Doctors' Commons, an English legal qualification of specialists in ecclesiastical and admiralty courts. Previously, he had been a Wrecks Commissioner.
9. Report of the Committee of Inquiry into the Tay Bridge Disaster, with Proceedings and Minutes of Evidence, and Report of Mr Rothery. *Parliamentary Papers*, (London: HMSO, 1880) [c.2616] XXXIX 1.
10. Swinfen, *The Fall of the Tay Bridge*, p. 105.
11. *Ibid.* Professor Roland Paxton FICE at Heriot-Watt University, Edinburgh, in the Foreword supports the work of Professor Swinfen as deserving 'to be regarded as the final word in this subject'. That comment, however, appears to be directed at the historical narrative of the engineering issues.
12. Ian Henderson, 'The British Approach to Disaster Management: A Fresh Look at the Tay Bridge Disaster, 1879' (1998) *Northern Scotland* 18(1) pp. 57-74.
13. The course was at the Open University: see Peter R Lewis and Ken Reynolds, 'Forensic engineering: a reappraisal of the Tay Bridge disaster' (2002) 27(4) *Interdisciplinary Science Reviews* 1-12, 11, fn.2; and Colin R Gagg and Peter R Lewis, 'The rise and fall of cast iron in Victorian structures – A case study review' (2011) 18(8) *Engineering Failure Analysis*, 1963-1980.
14. Christopher Hamlin, 'Scientific Method and Expert Witnessing: Victorian Perspectives on a Modern problem' (1986) 16 *Social Studies of Science*, pp. 485-513.
15. *Ibid.*, pp. 485-6.
16. *Ibid.*, p. 486.
17. *Ibid.*, p. 486.
18. *Ibid.*, pp. 486-7.
19. Robin Lumley, *Tay Bridge Disaster*, (Stroud, 2013) 179: 'I must confess that as unqualified amateur I dare not come to a complete conclusion as to why the bridge collapsed that night the way it did'.
20. Wilhelm Launhardt, 'The Tay Bridge and the probable cause of its collapse' *Hannover Courier*, 6 January 1880, morning edition, issue no. 10113, 5. Launhardt studied and later taught at the technical school in Hannover, now Leibniz University, Hannover.
21. Anonymous article, 'A German Opinion of the Disaster', *The Scotsman*, 15 January 1880, p. 5.
22. Albert Grothe, 'The Tay Bridge: Part I' and 'The Tay Bridge: Part II' *Good Words* (1878) 40-4; pp. 103-6.
23. That assertion of four general theories may possibly be too much of a simplification. Lewis, *Beautiful Railway Bridge of the Silvery Tay*, 192 lists under the heading of 'Theories' eleven individuals or pairs who have offered a view. The author of the present article is grateful to Iain MacLeod and Tom Martin for their advice on aspects of the engineering associated with the original Tay Bridge.
24. Henderson, pp. 66-68.
25. P.J.G. Ransom, *Iron Road, The Railway in Scotland* (Edinburgh, pb. 2007), pp. 82-85 and p. 308, fns. 2-5 places emphasis on similar subsequent collapses elsewhere.
26. Report of Court of Inquiry, pp. 15-16.
27. 'Report of Mr Rothery', Report of Court of Inquiry, p. 41.

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28. John Thomas, *The Tay Bridge Disaster: New Light on the 1879 Tragedy* (Newton Abbot, 1972), p. 163.
 29. D.R.H. Jones, 'The Tay bridge disaster: faulty materials or faulty design?' *Engineering Failure Analysis* (1994) 1(3) pp. 243-53.
 30. It is arguably *the* critical aspect of the cumulation of all failings associated with the Tay Bridge that the appalling weather was 'at its height' at about 1900 hrs on the relevant night, as the train crossed the bridge: P.J.A. Burt, 'The Great Storm and the fall of the first Tay Rail Bridge' (2004) 59(12) *Weather* (Journal of the Royal Meteorological Society) pp. 347-50, p. 348.
 31. *Ibid.*, p. 349.
 32. William Dow, a lecturer in physics at a college in Dundee advocated that explanation: 'Is this the real reason why the Tay Bridge fell?' *Dundee Courier and Advertiser*, 28 December 1979; for a contrary view, see John Thomas, letter to Editor, *Dundee Courier and Advertiser* 8 January 1980, and reply from William Dow 'Fallen girder was the key to Tay Bridge Disaster', 11 January 1980. See also William Dow, 'Destined for disaster' *The Scots Magazine*, 132, 3 (December 1989). Mr Dow did not publish his views in formal academic style with systematic reference to sources. His notes seem to have been for local public talks: e.g., *Dundee Courier*, 7 January 1994, 5. These notes do not specify sources, Tay Valley Family History Society publication, 'The Tay Rail Bridge: the disaster – revisited', (dated November 2006 with the added words 'since updated'). Some of Mr Dow's papers, include these notes, seem to have been a printed version of a *PowerPoint* presentation in the archives of the University of Dundee: MS 415/2. See also R.W. Duck and W.M. Dow, 'Side scan sonar reveals submerged remains of first Tay Railway Bridge', (1994) *Geoarchaeology*, 9(2), pp. 139-53.
 33. Charles McKean, *Battle for the North; The Tay and Forth Bridges and the 19th century Railway Wars* (Edinburgh, 2006).
 34. R. P. Lewis and K. Reynolds, 'Forensic Engineering: A Reappraisal of the Tay Bridge Disaster', (2002) *Interdisciplinary Science Reviews* 27(4) 1-12; R. P. Lewis, *Beautiful railway bridge of the silvery Tay: Re-investigating the Tay Bridge Disaster of 1879* (Bath, 2004).
 35. An old man, David Will, who was born in c.1864 and died in 1952 recalled walking over the first Tay Bridge when it was opened: *Dundee Courier*, 2 August 1952, 2.
 36. T. J. Martin and I. A. MacLeod, 'The Tay rail bridge disaster revisited' (2004) *Proceedings of the Institute of Civil Engineers*, p. 157, pp. 187-92.
 37. R.A. Houston, *The Coroners of Northern Britain, c.1300-1700* (London, 2014).
 38. See e.g., Sydney Smith, 'The History and Development of Forensic Medicine' (1951) *Br. Med. J.* 1 (4707) 599-607; and Nicholas Edward Duvall, 'Forensic Medicine in Scotland, 1914-1939': Doctoral thesis, University of Manchester, 2013.
 39. Robert S Shiels, 'Forensic medicine and the investigation of sudden deaths in late Victorian Scotland' 2014, *Scots Law Times* (News) pp. 64-9.
 40. Robert S Shiels, 'The corroboration of a cause of death in criminal investigations' 2014, *Scots Law Times* (News) pp. 27-32.
 41. For details of the individual deceased see: Murray Nicoll, Clare Nicol and Grant Buttars, *Victims of the Tay Rail Bridge Disaster of Sunday 28 December 1879*, Tay Valley Family History Society (2005).
 42. For the Scottish system of registration see William C. Smith, *The Secretary for Scotland* (Edinburgh, 1885) 30-34 and Anne Cameron, 'The Establishment of Civil Registration in Scotland' (2007) 50(2) *The Historical Journal*, pp. 377-95.
 43. Nicoll, *et al*, *Victims of the Tay Rail Bridge Disaster*, p. 76.
 44. Henry Hilton Brown, *The Procedure in Accident Inquiries and Investigations* (Edinburgh, 1897) explains the statutory reforms of 1895, and with reference to earlier practices; e.g., Chapter 2. See also Robert S. Shiels, 'The Investigation of Sudden Deaths and the Tay Bridge Disaster of 1879' 2016 *Juridical Review*, pp. 213-226.
 45. The instruction by the Procurator Fiscal of written reports from doctors for the many recovered remains would probably have incurred substantial additional fees for the Treasury for what may then have been regarded as an 'obvious' fact.
 46. Brown, *The Procedure in Accident Inquiries and Investigations*, 13.
 47. There may be others but these are not cited in the existing literature: Lumley, *Tay Bridge Disaster: The Peoples' Story*, for example, at 150-3 describes injuries to specific individuals (without giving sources) and also the pathology of drowning.
 48. Intentional destruction of the Tay Bridge has not been considered in literature although it coincided with the outset of an era of violent reaction to continuing British involvement in Ireland: K.R.M. Short, *The Dynamite War: Irish-American Bombers in Victorian Britain* (Dublin, 1979). The campaign of violence extended to Glasgow: Charles T. Couper, *Report of the Trial of the Dynamitards* (Edinburgh, 1884). That indictment reveals allegations of explosions at a gasworks, a bridge for a canal and a railway building in the

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- city centre at Glasgow. The Possil Road explosion did not succeed but it was directed at letting out water from the Forth and Clyde Canal and would have put a stop to navigation in the canal: Couper, *ibid.*, p. 50.
49. E.g., Swinfen, *The Fall of the Tay Bridge*, 'A Catalogue of Accidents' pp. 43-5.
 50. Dundee City Archives: GD/TD/1.
 51. Anonymous, 'Obituary: The Late Dr David Greig, Dundee' (1890) 36(2) *Edinburgh Med. Jo.*, 198-200.
 52. Henderson, (1998) p. 61.
 53. There does not seem to be any police history in regard to the disaster. There is therefore no known assessment of the ability of a provincial police force to deal with an event of the magnitude of the 1879 collapse.
 54. Vicki Daniel, 'The Social History of Disaster Identification in the United States, 1865-1950' (2020) 10(1) *Academic Forensic Pathology*, pp. 4-15, pp. 7-9.
 55. Each of the named deceased individuals may be identified from the easily available record of the deaths: Nicoll et al, *Victims of the Tay Rail Bridge Disaster*. That study, p.6. makes clear that the police list numbering was followed for their study.
 56. The police were guaranteed expenses and a £5 gratuity for each body recovered. The secretary of the North British Railway Company had written in these terms to the local Chief Constables for jurisdictions where bodies were likely to be recovered: *The Scotsman*, 3 January 1880, p. 7.
 57. These are the remains of Wm Veitch, a passenger, and David McBeth, the latter a railway guard at work, whose recovery was reported with injuries: *The Scotsman*, 14 January 1880, 7. They are listed in Nicoll, *et al*, *Victims of the Tay Rail Bridge Disaster*.
 58. These bodies were all referred to by number and some by name and number: (30); (31) John Scott; (32) Isabella Neish; (33) Murdoch; (34) Wm. Beynon; (35) Peter Salmond; (36) G McIntosh; (37) David Jobson.
 59. Reporting drowning as a cause of death without there having been a full dissection was common at that time: Dr Francis Ogston Jr., 'A Critical Review of the Post-Mortem Signs of Drowning' (1882) *Edinburgh Medical Journal* 27(1) 865-73. The study was of 170 deaths in the Aberdeen area and 130 of the deceased were examined internally. The author provided a consideration of external signs and a relevant table of these: pp. 865-68, and Table 1 at p. 868. The limit of the study was restricted: 'Many other cases have been omitted for the sake of clearness, where, from advanced decomposition or other causes, the signs of drowning were not well marked, or were mixed with those of other fatal injuries': *ibid.*, p. 865.
 60. *The Scotsman*, 6 January 1880, p. 5.
 61. *The Scotsman*, 7 January 1880, p. 7.
 62. *The Scotsman*, 8 January 1880, p. 5.
 63. *The Scotsman*, 13 January 1880, p. 5.
 64. McKean, *Battle for the North*, p. 5.
 65. Swinfen, *The Fall of the Tay Bridge*, p. 102.
 66. Dundee City Archives: GD/TD/1, p.4; the absence of evidence is also referred to by Swinfen, *The Fall of the Tay Bridge*, 10; and Lumley, *Tay Bridge Disaster*, p. 176.
 67. McKean, *Battle for the North*, p. 5. No source is cited for the point.
 68. Photographs of a railway carriage still in place when a girder was recovered shows that the carriage is not on the rails and is actually at right angles to the rails: Gren, *The Bridge is Down!* photographs on p. XIII in the collection between pp. 112-3.
 69. William Dow commented on the superficial nature of investigations, notable the absence of maps of the position of 'where everything was on the river bed': 'Fallen girder was the key to Tay Bridge Disaster' *Dundee Courier*, 11 January 1980.
 70. Douglas Maclagan, 'Forensic Medicine from a Scottish Point of View' (1879) 23 *Jo. of Jurisprudence*, pp. 1-23, p. 6.
 71. Maclagan, *ibid.*, p. 21.
 72. Maclagan, *ibid.*, p. 12.
 73. He was not the only voice in that regard: see M. Bain, A. Bentley, T. Squire, 'Sir Henry Duncan Littlejohn – A Dynamic Figure in Forensic Medicine and Public Health in the Nineteenth Century' *Jo R Coll Physicians Edinb*, 1999, 29: pp. 248-52, p. 252.
 74. The first law book in Scotland on the subject was Henry Hilton Brown, *The Procedure in Accident Inquiries and Investigations* (Edinburgh, 1897).
 75. *Ibid.*, p. 9.
 76. *Ibid.*
 77. *Ibid.*, Chapter 8.
 78. The Registration of Births, Deaths and Marriages (Scotland) Act 1854 (c.80) placed such a duty, by s.40, on the Procurator Fiscal in every case in which a precognition 'touching the death of any person' was taken.

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79. James Craig, *The Law of the Coroner and on Medical Evidence in Preliminary Investigation of Criminal Cases in Scotland*, (Edinburgh, 1855) 19-9; Anonymous, 'Official Inquiry in Cases of Sudden Death', (1858) 2 *Jo. of Jurisprudence* pp. 271-6.
 80. *Ibid.*, p. 28.
 81. Roger Middleton, 'Government and the economy, 1860-1939' in Roderick Floud and Paul Johnson (eds.) *The Cambridge Economic History of Modern Britain: Volume II: Economic Maturity, 1860-1939* (Cambridge, pb. 2006) p. 473.
 82. Philip Harling, *The Modern British State: An Historical Introduction* (Cambridge, pb.2001) p. 3.
 83. *Ibid.*, pp. 3-4.
 84. Henry Parris, *Government and the Railways in the Nineteenth Century* (London: Routledge & Kegan Paul, 1965) p. 28.
 85. *Ibid.*, pp.111-112.
 86. Prebble, *The High Girders*, 217 mentions the 20 men who died in the construction, although the circumstances of their deaths have not been studied in the general histories.
 87. C.f., the report by Lord Cullen: 'Public inquiry into the shootings at Dunblane Primary School, 13 March 1996' (HMSO; Cm., 3386, ISBN 0 10 133862 7) following hearings at Albert Halls, Stirling.
 88. C.f., McLean and Johnes, 'Regulation Run Mad': The Board of Trade and the loss of the Titanic', *ibid.*, at p. 733.
 89. Report of the Select Committee on the North British Railway (Tay Bridge) Bill, with Proceedings and Minutes of Evidence', *Parliamentary Papers*, 1880 (311), XII, 1: (3 May 1880) p. 420: Q & A 16,939, and Q & A 16,940; Iain MacLeod and Tom Martin, 'The legacy of the Tay Rail Bridge collapse' (2018) 157 *Journal of Engineering*, pp. 27-31, p. 29 and pp. 30-1.
 90. Report of the Select Committee on the North British Railway (Tay Bridge) Bill, with Proceedings and Minutes of Evidence', *Parliamentary Papers*, *ibid.*, (30 April 1880) p.400, Q & A 16,478. The advice on crucial point was in a letter in 1869. See also, Thomas, *The Tay Bridge Disaster. New Light on the 1879 Tragedy*, pp. 198-9; Swinfen, *The Fall of the Tay Bridge*, p. 105 and pp. 111-2; Lumley, *Tay Bridge Disaster*, pp. 173-4.
 91. Parris, *Government and the Railways in the Nineteenth Century*, p. 181, p. 189, pp. 193-194.
 92. McLean and Johnes, 'Regulation Run Mad': The Board of Trade and the loss of the Titanic', *ibid.*, at p. 738 identifies a similar personal conflict of interest.
 93. *Tay Bridge Disaster: Report of the Court of Inquiry* (Cmnd. 2616) (London, 1880) para. 8 and p. 16.
 94. *Report of the Committee Appointed to Consider the Question of Wind Pressure on Railway Structures* (Cmnd. 3000) (London, 1881). Rothery thought that the issue of wind pressure was for the engineering profession to investigate and not for the Board of Trade.
 95. It is unnecessary now to consider how the law has developed since 1879. The doubtful legal proceedings of the inquiry into the collapse in 1879 is of course a separate matter from any conclusion arising from the engineering and other studies.
 96. Scots lawyers may have preferred the phrase with the comparable meaning, *nemo debet esse iudex in propria causa*: see John Trayner *Latin Maxims and Phrases* (Edinburgh: William Green and Sons, 4th edn. 1894) pp. 376-7. Ironically, Mr Trayner, counsel at the inquiry, was the author of this textbook.
 97. Thomas, *The Tay Bridge Disaster. New Light on the 1879 Tragedy*, 179; Swinfen, *The Fall of the Tay Bridge*, pp. 119-120.
 98. McLean and Johnes, 'Regulation Run Mad': The Board of Trade and the loss of the Titanic', *ibid.*, at p. 743 for a similar point about the need for an independent inquiry.
 99. Lumley, *Tay Bridge Disaster*, p. 174.
 100. Henderson, (1998) p. 70 and fn.47.
 101. The Lord Advocate may not have known of the conflict of interest arising from the Board of Trade at the time he intimated his decision on prosecution. Not everyone acts in the public interest: economists expect regulators to operate in the interests of the regulated industry: McLean and Johnes, 'Regulation Run Mad': The Board of Trade and the loss of the Titanic', p. 746.
 102. Paper headed 'Observations of Major-General Hutchinson', dated 12 July 1880.
 103. Paper headed 'At the Council Chamber, Whitehall', dated 15 July 1880.
 104. By reference to the Railway Regulation Act 1842 (c. 55).
 105. *Ibid.*, p. 2.
 106. Dow, 'Destined for disaster', p. 286.
 107. Thomas, *The Tay Bridge Disaster*, p. 163.
 108. Henderson (1998), p. 64 and p. 69.
 109. McLean and Johnes, 'Regulation Run Mad': The Board of Trade and the loss of the Titanic', *ibid.*, pp. 746-7. See the point, at p. 747, about the consumer interests being excluded from the Titanic report which is what happened in regard to the Tay Bridge inquiry.

110. *The Tay Bridge Disaster: Report of the Court of Inquiry*, *ibid.*, pp. 44-45, para. 120, and p. 48, para. 138.