Digging deeper – issue 4, summer 2024

A quarterly newsletter highlighting how the ICE archive helps deepen understanding of our heritage for the engineers and researchers of today.

Contents

It's been busy

By Carol Morgan and Mike Chrimes

It's been a busy few months, with visitors back to pre-Covid numbers and commemorations for the 300th anniversary of John Smeaton's birth in June. More on this later, with a fascinating article on Smeaton's influence on the legal process by Alexander M Aizenman.

It's always good to welcome our colleagues from the library, archive and museum world.

Visits by Jack Hayes, of the Brunel Museum, resulted in an invitation for Carol to attend a sneak preview of the watercolour paintings of the Thames Tunnel, purchased a few years ago by the museum.

The drawings are currently at the London Metropolitan Archive while the museum prepares a new exhibition space, see below.

Researching Marc Brunel's diaries relating to the Thames Tunnel

By Jack Hayes, collections access coordinator, The Brunel Museum

Having seen some of the ICE's large collection of Thames Tunnel material on a previous visit with the Brunel staff and volunteers last December, I was keen to come back and look more deeply.

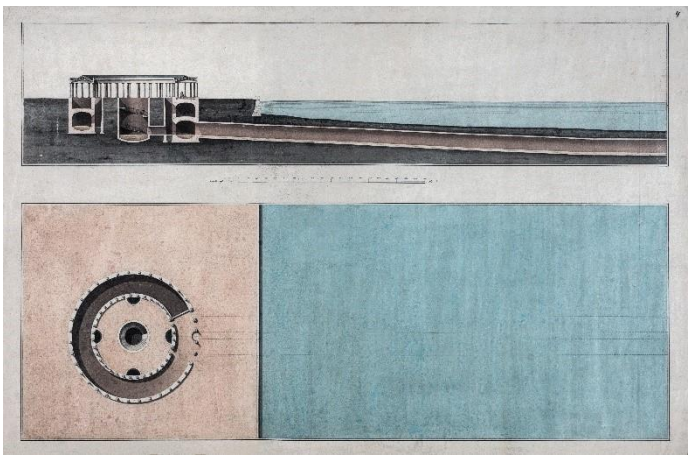
I was particularly interested in looking at the series of Marc Brunel's diaries (ICE TT/BD/1-18) with a view to researching:

- What can Brunel's diaries tell us about physical objects in the Brunel Museum's collections?
- How did Brunel himself describe anecdotes and occurrences in the Thames Tunnel's history?
- How much of Brunel's diary is in French? What is the relevance in the language shift – i.e. why write up some events or meetings in French, and others in English?

Unfortunately, I did not find much useful information in the diaries about specific objects (notably, the tiles used for the tunnel, or individual watercolours in our collection), though the diary did make slightly clearer the process by which the plans and designs were developed and put together by Brunel and his team of draughtsmen, including Joseph Pinchback.

However, I did gather lots of useful information about Brunel's social circles, his daily routines, and his overall demeanour.

I also examined the books of Thames Tunnel plans (ICE TT/DRA/1-3). It was very useful to compare and contrast at close quarters the watercolour plans and drawings held at the ICE with our own set of 32 images, to consider how the two co-existed and were used for differing functions.



Plan and section showing original design including entrance for carriages.

It was interesting to discover there could be another set of Marc Brunel's diaries.

Brunel's diaries have been used as sources by most biographers, including Paul Clements' authoritative Marc Isambard Brunel.

However, Clements does not in general provide citations or bibliographic references for such material.

When I compared passages cited in Clements with the corresponding ICE diary entries, I discovered that the texts did not match up.

This was surprising, until I later found that in some passages of Brunel's diaries, rather than complete the entry, he simply wrote 'In the Town Diary'.

So it seems Brunel kept two copies of his diary – one at his town house, and another at the tunnel works in Rotherhithe.

On some occasions – e.g. the floods of 1827-8 – Brunel clearly wrote up the entry twice, in different words.

In other cases, he only appears to have written it in one diary.

The ‘town’ diaries used by Clements as his main source likely remain in private ownership; the differences between the two versions may well be of interest, as we can imagine Brunel’s thinking shifting as he travelled home from Rotherhithe, digesting the day’s events and the progress of his work.

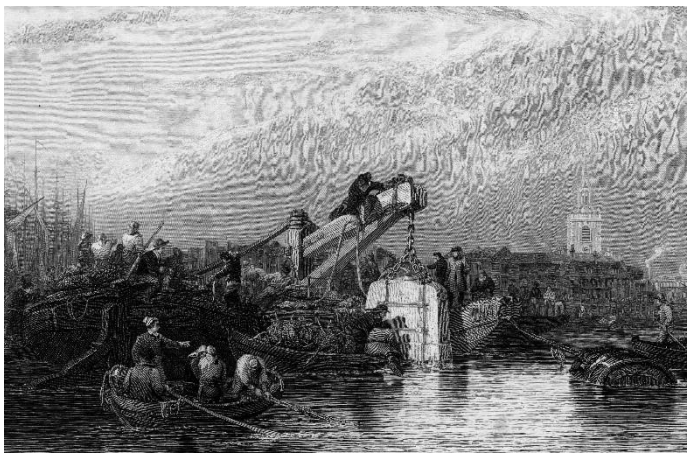
It is well known that I K Brunel went down repeatedly in a diving bell to examine the river’s irruption into the tunnel being built, and in some cases took visitors down with him.

These included, for instance, the Prussian naturalist Alexander von Humboldt, who wrote that the pressure in the diving bell caused him to bleed from his mouth and nose for days afterwards.

In Brunel’s diary, I found an intriguing entry, which noted that Sophia Brunel, I.K. Brunel’s sister, also went down in the diving bell, with her friend, a Miss Baldwin.

At the Brunel Museum we’re keen to emphasise the role of the women in the family, who were hardy and integral to the family’s legacy.

Sophia Brunel’s trip in the diving bell seems to confirm much of this: far from simply a quiet ceramicist and dutiful wife, Sophia did things that shocked even hardy travellers like Humboldt.



The diving bell being lowered into the river.

So what to do with the information I’ve found.

The Brunel Museum will temporarily close in October 2024 to allow for a complete renovation and will reopen in summer 2025 in a new form, with entirely new galleries and objects which have never before been publicly displayed.

These diaries will feed into our gallery texts and interpretation, and will allow us to go directly ‘to source’ in discussing the Brunels, the Thames Tunnel, and the intrepid workers who built it.

As to my interest in the bilingual aspect of the diaries, I’m also working on a concurrent project examining Brunel’s French-language correspondence. Examination of the diaries’ bilingualism, and of the lists of individuals to whom he writes, is feeding into this project now in its early stage, which is being supported by an art fund, the Jonathan Ruffer Curatorial Grant, and will be submitted for publication in due course.

I’d like to thank Carol for her advice and support in carrying out the research – I’m looking forward to returning to the ICE Archives for future work!

The Thames Tunnel report books were presented to the ICE in 1909 by ICE Member, Saxton Noble.

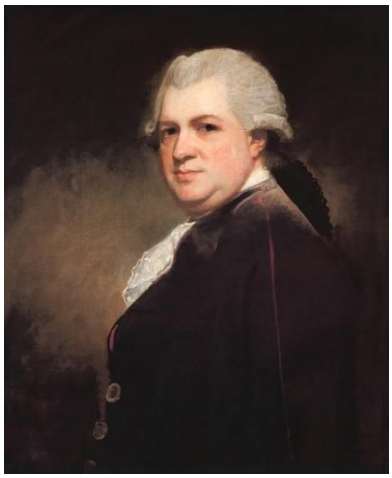
Marc Brunel's diaries were presented in 1950 by Lady Noble, widow of Sir Humphrey Brunel Noble.

This material complements the Brunel material held by the Brunel Museum and the Brunel Study Centre in Bristol.

Brunel Museum website

John Smeaton's anniversary

By Carol Morgan



Portrait of John Smeaton by George Romney

Continuing from our previous article, we have now published four blogs with more to follow.

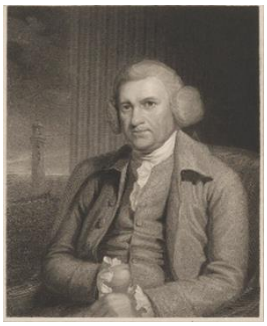
- Why we should celebrate Smeaton
- Smeaton and the copy press
- Smeaton and Watt: the race to develop the steam engine
- Smeaton: the first expert witness

The text was too long for our blog guidelines but we have included the full submitted text below for those who want to find out more.

We posted on X (Tweeting still sounds better) daily in June. We are using the hashtag #Smeaton300 and we will be happy to help promote any Smeaton related events being held by other organisations on X and, or LinkedIn throughout the year.

John Smeaton gentleman of science and expert surveyor: how Smeaton helped redefine expert testimony

By Alexander M Aizenman

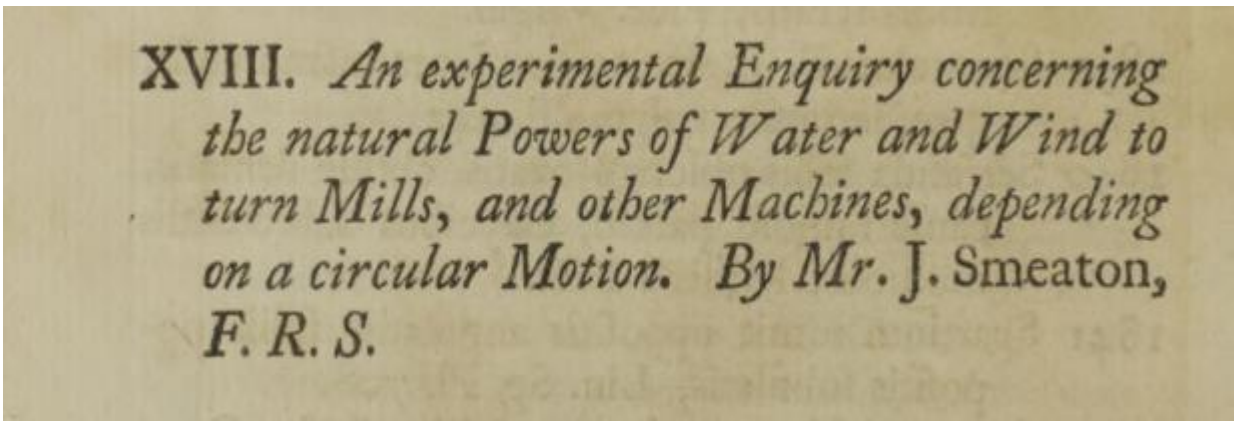


John Smeaton, engraving by Richard Woodman.

In 1782, John Smeaton's evidence on the decay of Wells Harbour marks the formal beginnings of the scientific expert witness.

By the 1780s, civil engineer John Smeaton was a well-connected and highly regarded figure in mid-18th-century gentlemanly scientific circles.

Elected fellow of the Royal Society in 1753 he had already published several papers in the society's journal, Philosophical Transactions, including, for example, on the ability of water and wind to generate power.


XVIII. *An experimental Enquiry concerning the natural Powers of Water and Wind to turn Mills, and other Machines, depending on a circular Motion. By Mr. J. Smeaton, F. R. S.*

Title from Smeaton's 1759 article published in Philosophical Transactions Volume 51, Issue 51.

Additionally, Smeaton coined the usage of the term civil engineer to refer to this emerging class of professional, mathematically literate civilian infrastructure designers and planners.

By the 1760s, Smeaton had established a practice based in Austhorpe and developed a reputation as a consulting engineer.

Of special relevance, Smeaton was most known for specialising in harbours and was a natural fit to be hired by parties disputing over the decay of a harbour.

Smeaton, an old friend of the court

Due to his reputation, Smeaton was often called to court and before parliament as a scientific consultant.

Smeaton's status and recurring presence in the courtroom resulted in a working and friendly relationship with Lord Mansfield the long-serving and deeply transformative Chief Justice of the King's Bench.

Representing neither party in a trial, as an arbitrator, Smeaton reported directly to the judge and functioned as an impartial clarifier of scientific facts.

This arrangement was representative of the workings of an older—and during Smeaton's largely extinct—way of administering the law.

In this older system, the judge was far from the impartial rule enforcer we are familiar with and was personally responsible for conducting the majority of the trial, including, for example, personally calling and questioning witnesses.

The long 18th century saw the rise of the still-in-existence advisory legal system in which the trial was dominated by dueling solicitors who called and cross-examined witnesses to vindicate their clients.

This relatively new professional class of solicitors employed increasingly complex tactics to try and sway the jury in their client's favor. Here, Smeaton and Lord Mansfield proved to be central figures in the formal debut of the expert witness.

The case so far

The case in which Smeaton took on the foremost role in developing expert evidence as a witness rather than an arbitrator is known as Folkes versus Chadd, Bartt and others or simply, Folkes v. Chadd.

The background for this case revolves around the consolidation of land ownership in the county of Norfolk in 1719.

From 1719 to 1721 Sir Thomas Coke, 1st Earl of Leicester and Sir Charles Turner, Lord of Wells Manor sought to reclaim 8,000 acres of salt marshes on both sides of the Wells Harbour channel in Norfolk.

To prevent tidal flooding a series of embankments were constructed.

Over the next few decades those dependent on the harbour, such as shipowners and town merchants, entered into a voluntary subscription, securing funds to build sluices to save the harbour.

In 1777, a recently constructed sluice was destroyed by a storm.

Those financially invested decided enough was enough and turned their attention to removing what they had always suspected to be the cause of the harbour's decline: the embankments Coke and Turner built nearly 50 years earlier.

A series of complex legal manoeuvres were required for this issue to be justiciable, that is triable, but in the end, the then owners of the embankments and surrounding land, Martin Browne Folkes and Robert Hales, brought an action of trespass against the commissioners of the harbour, represented by George Chadd.

Ultimately, during a series of trials, the central issue of this case became whether the embankments were responsible for the decay of the harbour or if the harbour's decay was a natural phenomenon.

Should the decay be a result of nature, Folkes and Hales would bear no responsibility and be allowed to keep their embankments.

It was this question, effectively on the science of the harbour's decay, that a man such as Smeaton seemed especially well-qualified to answer.

The problem with expert testimony

By the 1780s, the idea of an expert witness, that is, someone who by virtue of their specialist knowledge should have their opinion on a matter be accepted by the court was not a novel concept.

For example, there is a long history of special exceptions, such as those made for medical personnel.

However, outside the special exceptions for medical personnel, such expert testimony when it was heard was accepted by the court at the judge's discretion rather than because it was truly allowed.

The central problem facing the would-be expert witnesses was that they were informing the court of their opinions, often based on speculative theories that were not directly linked to observations.

The underlying principle that guided courtroom procedures was that only sense perception — observations made by the five senses — offered the kind of certainty that the courtroom demanded.

This was exactly the opposite of the nature of Smeaton's eventual testimony as —after making initial observations of Wells Harbour — Smeaton would, as a scientist does, draw expansive theoretical connections about the effects and cause of the harbour's decay.

Yes, these speculations were well-informed and based on Smeaton's experience and long practice as a surveyor and observer of harbours; however, the key question was, would and should the court accept this distinction?

In summary, the court had to determine if Smeaton, due to his expertise, would be exempted from the court's normal rules.

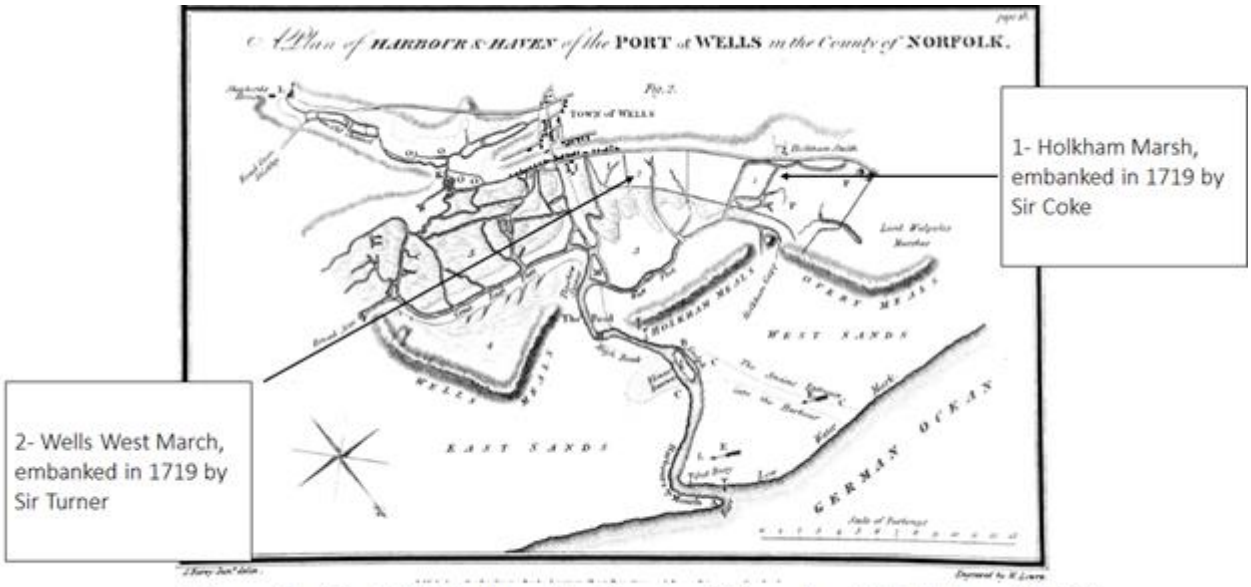
Smeaton takes on the case

Smeaton was in such demand that both sides involved in the dispute attempted to hire him!

He even tried to serve as an intermediary between the harbour commissioners and the landowners hoping to find a compromise but these efforts ultimately failed. Eventually, Folkes and Hales secured Smeaton's employment and so Smeaton set out to complete his investigation of the principal cause of the harbour's decay.

Smeaton submitted his report on 4 May 1782.

Figure 1: Title from Smeaton's 1759 article published in Philosophical Transactions Volume 51, Issue 51 Figure 1: Title from Smeaton's 1759 article published in Philosophical Transactions Volume 51, Issue 51



A Plan of the Port of Wells, from John Smeaton's "Report on Wells Harbour" (1782)

Smeaton's report

In keeping with his reputation, Smeaton's report was well organised, clearly reasoned, and expansive in its findings.

It also found that the harbour's decay was predominantly natural.

Smeaton's report also found that the commissioners of the harbour in fact had the power to save the harbour through 'industry, Art, and the Hand of Man'. However, the sluice they had constructed was of poor quality and not used with great enough frequency.

In short, Smeaton's report squarely laid the blame for the harbour's decay at the feet of the harbour commissioners, whereas Smeaton's clients, perhaps unsurprisingly, were completely innocent.

The court rejects Smeaton's testimony

The subsequent trial, which was the second trial on this issue, was held in the Court of Common Pleas before Justice Henry Gould.

Sir Henry Gould by Thomas Hardy, published by Hugh Richards1 March 1794, The National Portrait Gallery.

Smeaton's report, along with the other experts involved in the trial, was submitted to the court record and circulated to the jury before the trial.

The defense counsel led by George Harding made the calculating decision of not calling their expert witness to the stand and instead relied on eyewitness evidence to attest to the harbour's evident decay.

When the prosecution tried to call Smeaton to the stand as an expert witness, Harding objected, arguing that Smeaton's evidence was not rooted in direct observations and as such inadmissible.

Justice Gould, a lower court judge with a reputation for adhering to a traditional and conservative administering of his courtroom, agreed with the objection, essentially stating that Smeaton's report and by extension testimony touched on such speculative conclusions such as 'whether the removal of the embankment will contribute to a material amendment' of the harbour's conditions.

This kind of reasoning, regardless of profession or pre-existing knowledge, was rooted in opinion, which contradicted the formal law of the courtroom.

Indeed, Judge Gould ultimately found Smeaton's testimony "could be no foundation for the verdict of the jury, which was to be built entirely on facts, and not on opinions".

‘Men such as Smeaton know best’: the formal acceptance of expert testimony

In response, the Folkes and Hales legal team appealed Gould’s ruling to the King’s Bench, under the leadership of the imaginative and reformist Lord Mansfield, to address the specific issues as to whether or not Smeaton’s testimony and report should be considered proper evidence.

William Murray, 1st Earl of Mansfield by John Singleton Copley (1783), The National Portrait Gallery**.**

Mansfield considered himself a well-informed philosopher who greatly supported and believed in the explanatory and transformative power of natural philosophers and technical professionals.

As a result, Mansfield took the opportunity not just to rule on this case but to clearly and affirmably expand the rules of evidence.

Mansfield’s extraordinary ruling is evocatively captured in the 1831 published account of the trial by Henry Roscoe, who working off the fragmentary notes of the then-present court reporter Sylvester Douglas, attributed the following words to Mansfield:

“It is objected that Mr. Smeaton is going to speak, not as to facts, but as to opinion.

“That opinion, however, is deduced from facts which are not disputed- the situation of banks, the course of tides and of winds, and the shifting sands.

“His opinion, deduced from all these facts, is, that mathematically speaking, the bank may contribute to the mischief... Mr Smeaton understands the construction of harbours, the causes of their destruction, and how remedied.

“In matters of science no other witness can be called. The cause of the decay of the harbour is also a matter of science, and still more so, whether the removal of the bank can be beneficial.

“Of this, such men as Mr. Smeaton alone can judge”.

With Mansfield's ruling on 21 November 1782 the court finally and clearly formalised that expert testimony was not just proper evidence but the best kind of evidence for the court to consider "in matters" of science.

More specifically, it was the clarity and persuasiveness exemplified by Smeaton's renowned and profession-defining reports that exemplified Mansfield's idealised and optimistic trust in the clarifying power of scientific testimony.

The long legacy of Smeaton's expert testimony

English and American common law is precedential, meaning judges and lawyers refer to previous cases and rulings for guidance and as explicit justification for present rulings.

As a result of this practice of looking backwards, the legacy of John Smeaton's unique testimony and Lord Mansfield's hearty endorsement of "men of science" as exemplified by Smeaton, dots the historical record including the recent past.

In 1972, the US Supreme Court in FPC v. Florida Power & Light Co reaffirmed that 'well-reasoned expert testimony' can serve as 'substantial evidence' when first-hand observations are not possible.

The court, in making this argument, which they regarded as so exceptionally well-established, that it did not require substantial examination, pointed to the long legal legacy of such testimony, beginning with Smeaton's report on Wells Harbour.

The court noted how "The weight of such [expert] testimony was properly recognised by Lord Mansfield some 190 years ago".

Nowadays, the presence of the expert witness or scientist, such as a consulting psychologist or engineer, as the above ruling suggests, is practically taken for granted.

It only makes sense that the opinions of those with specialist knowledge must be taken into account for the court to function.

Such was precisely Lord Mansfield's belief those 240 years ago that "in matters of science… men such as Smeaton know best."

However, it is worth remembering that Smeaton as an expert witness was hired by those involved in the trial and not an impartial arbitrator.

Ultimately, the legality of Smeaton's testimony is wide-ranging and complex.

On one hand, his esteemed background and considerable technical knowledge affirmed to the court the explanatory power of science in the courtroom.

On the other hand, his testimony cemented a trend of interested parties bringing forth their own expert witness, who with the authority of the scientific method, could and would assert the correctness of their client.

It is precisely this ambiguous legacy that makes remembering the optimistic beginnings of the expert witness, and Smeaton's central role, so important.

Further reading

For the most detailed account of the Wells Harbour cases to date including extensive discussion on the role of Smeaton and other experts see: Tal Golan, Laws of Men and Laws of Nature (London, 2004), pp.5-51.

For Smeaton's report on Wells Harbour, see: John Smeaton, "Report of J. Smeaton upon the state and condition of Wells Harbour, in the county of Norfolk" in Reports of the Late John Smeaton: Made on Various Occasions, in the Course of His Employment as a Civil Engineer (Cambridge Library Collection: Cambridge University Press, 2014), pp.18-37.

For the formal court-reported account of the Folkes v. Chadd see: Roscoe, Henry, Reports of cases argued and determined in the Court of King's Bench, in the twenty-second, twenty-third, twenty-fourth, and twenty-fifth years of the reign of George III: From the Manuscripts of The Right Hon. Sylvester Douglas, Baron Glenbervie. and also from the manuscripts of Mr. Justice Lawrence, Mr. Justice Le Blanc, Mr. George Wilson, &c., Vol. III (London: S. Sweet and Stevensand Sons; Dublin: R Milliken and Son, 1831).

For a biography on Smeaton, see:

A. W. Skempton, "Smeaton, John (1724–1792), civil engineer."Oxford Dictionary of National Biography (Oxford University Press: 2013).

For more on Mansfield's long legal career and effect on the development of English law, see:

Norman S. Poser, Lord Mansfield Justice in the Age of Reason (London: McGill-Queen's University Press, 2013).

James Oldham, English Common Law in the Age of Mansfield (United Kingdom: University of North Carolina Press, 2004).

Recent acquistions and newly listed material

Reports relating to Wylfa nuclear power station pressure reactor

We have received a box of reports relating to Taylor Woodrow's works at Wylfa, Anglesey, 1962-86.

Channel tunnel cuttings and press releases

We have received 3 ring binders of cuttings, press releases etc. relating to the Channel tunnel 1986 - 1994. These have all been arranged chronologically. A fourth binder contains examples of forms of contract used.

Elan valley dam and aqueduct photographs

We have received five photo albums and a set of negatives of modern copies of construction photographs, April 1885-July 1904, provided to Halcrow whilst they were responsible for maintenance.

The originals were with Severn Trent Water Authority. We will be contacting them to confirm where the originals are held.

We hope you have enjoyed this newsletter. If you have any comments, would like to submit an article, or appear as a guest archive, please contact us: archive@ice.org.uk.

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