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Tyne Crossings at Hexham up to 1795

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INTRODUCTION

BRIDGES are more or less taken for granted today, but at the middle of the 18th century they were relatively rare in the rural parts of north-east England; this was largely because no particular body was responsible for building them. Subsequently many more bridges were built, a steady proliferation which accelerated rapidly in the nineteenth century. Surviving bridges are by definition the successful ones, but this article includes a discussion of two comprehensive bridge collapses at Hexham in the eighteenth century. In 1986 the highest ever recorded flow rate for any river in the kingdom was measured on the Tyne at Bywell, yet it is believed that in the great flood of 1771, the flow rate at Hexham might have been two and a half times greater.[1] Little wonder, it might be thought, that some river bridges failed to withstand such an onslaught.

For this account of the river crossings at Hexham, the main sources used have been the Trevelyan Papers, the Alemouth Turnpike records, Smeaton's Reports, and Quarter Session records for Northumberland.[2] These sources are not referenced in detail but the subject matter should indicate the particular source being used.

Early fords and ferries at Hexham

Hexham has been an important settlement in the Tyne Gap for centuries. It occupies an important location in the valley corridor for east–west traffic but was less important than Corbridge for north–south traffic. Corbridge developed where the Roman Dere Street crossed the Tyne and the succession of bridges built there, from Roman times on, may partly explain why it was once a more important centre than Hexham.

In June 1263, the Abbot of Holm Cultram claimed free passage of carts and carriages "beyond the bridge of Hexham" as an ancient privilege, presumably implying a bridge over the Tyne.[3] This bridge seems to have been destroyed subsequently for consideration was given to the building of a bridge in 1294; in 1307 the Archbishop was concerned about funds for its repair and completion, and it seems safe to assume that it was never built. Given such few indications of early bridges at Hexham, it is clear that fords and ferries provided the crossings over the Tyne for centuries before a successful bridge was built. There is, not surprisingly, very little documentation for the fords; in Coastley, part of the West Quarter of Hexham, the Order of the Watch in 1522, stipulated that:[4]

> Every Ward shall watch the three fords under Cosely their course, one month from time to time changing at the month end; [they shall] be watched nightly by three of the men of the inhabitants of Hencottes ward and Cosely, the Westwood-house and the Spittell.

The extent to which such watches were maintained is unknown. However, when three Norwich soldiers attempted to cross the Tyne at night in 1634, they were unable to find either ford or ferry at Hexham:[5]

> And now when wee had thought that dangers were pass'd, wee met a gulfe ... at the entrance unto Hexham over the rapid river Tyne, where for want of a boat or bridge, wee were enforc'd in the vale of night to passe a swift, deepe streame over high great stumbling stones, in such danger both

> to o'r horse and to o'r selves; as we had not fortunately happen'd on a guide that knew the foording place well, we had there ended o'r travells.

That the Tyne at Hexham could often be difficult to cross, must have long been known; as Wallis observed in 1769:[6]

> ... the floods after rains and sudden thaws of snow, sometimes come down so hastily, that they surprise and drown the passenger at an instant, or else, which sometimes happens, force him to take refuge on an islet where he is at leisure to lament his situation til the danger is over.

Wallis also suggested that the want of a bridge explained the occasional "thin markets and fairs" and that "A good bridge would, therefore, be the greatest benefaction and blessing that could be bestowed on this antient town". Eleven years later, witnesses informed a House of Commons committee who were examining a proposal for a bridge at Low Ford, Hexham, that:[7]

> The Ford ... is extremely dangerous at Times of Floods, which frequently happen after Rains; that, at such Times, the Bottom of the ... Ford is shifted by the Violence of the Current, which renders the Passage through it always uncertain, and frequently impracticable.

They remembered two men being lost in 1776 while trying to cross the ford during day time, and noted that although there was another ford, higher up (High Ford), it was "equally dangerous and uncertain".

As well as fords there were ferries, although their origins are not known. In 1328, Archbishop Melton ordered the building of a boat at Hexham, which seems to imply that a ferry either existed or was planned at that time, and by 1356 a ferry was farmed to Archbishop Thoresby at 20*s.* p.a. on condition that he did no harm or wrong to its users! In 1547 a water passage called "les fferrye" was farmed out to Robert Armstrong for 10*s.* per year and by 1608 the ferry was known as the "East Boat", with a value of 30*s.* yearly above the rent of 10*s.* p.a. due to the Lord of the manor;[8] it can thus be assumed that the "West Boat" ferry, across the river South Tyne at Warden, was also active. By this time the East Boat ferry belonged to the Hermitage estate on the north bank of the Tyne facing Hexham, and was plied between Tyne Green and Hermitage lands. It continued to be used, with only brief and sorrowful interludes, as the only dry way to cross the Tyne at Hexham, until 1793. As part of the Hermitage estate the ferry was owned by a succession of families until in 1755 it passed to the Jurin family[9]; thereafter the history of the East Boat ferry is bound up with attempts to bridge the Tyne at Hexham.

Several turnpikes, projected in the early 1750s, would pass through or near Hexham: the Newcastle to Carlisle (Military) turnpike (1751), the Aydon–Corbridge–Hexham–Greenhead (Glenwelt) turnpike (1752), and the Hexham to Alemouth turnpike (1752). Several major river crossings were involved on these routes, but County bridges were already in place at Haydon, Chollerford, Rothbury, Hawkhill, and Corbridge. Although not specifically recorded, it is clear that the Alemouth Trustees, whose route crossed the Tyne at Hexham, had no intention to build a bridge there. An undated note, prepared before their 1752 Act was passed, observed that the turnpike would need bridges "near Rothbury, one in Rothbury Forest ... one at Campford, one at Roadley Burn, one over the River Wanspeck", all of which would be small affairs,[10] but a Tyne bridge at Hexham would necessarily be a very considerable and expensive structure; the Alemouth turnpike promoters presumably anticipated that the cost of a major bridge might even exceed their total subscribed capital. Thus if a bridge was to be built at Hexham, it would need to be financed by the County, by private sponsorship, by public subscription, or by a combination of such sources; until then, turnpike users would be confined to ford or ferry—a situation which was not in the best interests of the Trustees or travellers, but one which the Trustees could not ameliorate except through moral support for would-be bridge builders.

The Jurins at Hermitage and Smeaton's first Hexham bridge design

James Jurin I was born in 1684, the son of John Jurin, a London dyer and cousin of William Cotesworth of Gateshead. In 1702 he attended Trinity College, Cambridge, gaining a B.A., and became Master of the Newcastle upon Tyne Grammar School in 1709. By about 1715, having saved £1,000, he left his Newcastle position with the intention of becoming a Physician. In 1719 he was elected a Fellow of the Royal Society and of the College of Physicians, and subsequently became one of the most noted physicians of his time.[11] When he died aged 66 years at his home in Lincolns Inn Fields, he left a considerable fortune, including the Hermitage estate and the ferry, to his only son, James Jurin II; the transfer of the estate and ferry was only achieved after considerable legal difficulties on 30 September 1755. James Jurin II had also been educated at Trinity, Cambridge, was elected FRS in 1756, and was living in Lincolns Inn Fields when he came into his inheritance. He may have moved to Hermitage in that year for he soon considered bridging the Tyne at Hexham, and clearly asked John Smeaton, not then known as a bridge engineer, to prepare a design. In 1777 Smeaton noted that:

> I cursorily viewed the situation opposite the Hermitage, where I formerly proposed to build a bridge in 1756.

Smeaton's design of that year, and an estimate presumably drawn up by him, remain in the Trevelyan papers (fig. 1 and Appendix 1). Smeaton also had private rooms at Lincolns Inn Fields and by 1750 was presenting lectures to the Royal Society (elected Fellow in 1753); it is almost inconceivable that he did not know the Jurins personally. In the following year he visited the Low Countries to study canal and harbour works and in 1756 he began his Eddystone lighthouse, his first major commission and one which was to bring him much fame; his

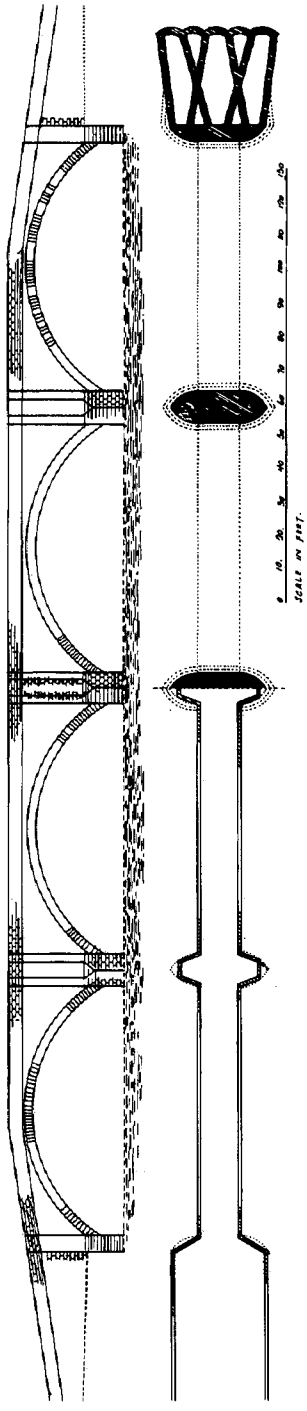

Fig. 1 Smeaton's design of 1756.

understanding of foundation work and masonry construction was clearly evidenced in this project. He had also studied bridges for some years, his design for Blackfriars bridge (1753–60) over the Thames being rejected in favour of a design by Robert Mylne.

Smeaton's 1756 bridge design was approved by Sir Walter Blackett, Lord of the Manor, MP, JP and Trustee of the Alemouth turnpike, and by Lancelot Allgood and Edward Blackett, also JPs and Trustees, in March 1756. The bridge was to have four segmental arches each of 76ft (23m) span with a span to rise ratio of 3·45, the piers being 10ft (3m) wide; the width between parapets was only to be 11½ft (3·5m) but with half-hexagonal retreats above the cutwaters, and the total width of water to be spanned was some 302ft (92m). Smeaton intended to lay a foundation of "rough block stones", presumably on the river bed, for his estimate allowed for coffer dams and pumping, but no bearing piles. Unlike his later bridges, Smeaton's Hermitage design was devoid of ornamentation. The building of the bridge, and a single 40ft (12m) arch "over the back stream" (probably a mill race on the south side of the river), plus the "raising the road over Tyne Green for 100 yards [91m] and making good the road over the Island", would cost some £2,895. The bridge was to be located at or near the High Ford where the waters must frequently have been shallow, and it can be assumed that it was intended to close down the East Boat ferry on completion of the bridge. It was intended to be a toll bridge but:

> It is designed that all Carriages and Horses loaded with Coals, Lime or Limestone shall pay but once a day ... and that all the fords both above and below the intended bridge shall be left open and free for all passengers who chuse.

This proposal must have been welcome news to the Trustees of the Alemouth turnpike but, for no known reason, the bridge was not built; it would have been Smeaton's first bridge, and had it failed, which was a distinct possibility, this would have done much to dent his early reputation. In September 1756, Jurin married Mary, daughter of Alderman John Simpson of Newcastle, and agreed just prior to the marriage, that after his wedding, he would surrender the ferry to two trustees—Sir Edward Blackett and George Colpitts—but would retain a life interest in it which would pass to his wife should he die first, and then to his rightful heirs for their lifetimes. But he further agreed that, with the consent of the trustees, the ferry could be sold by himself or his heirs, the trustees to handle the sale and any monies raised, the latter being vested in a new trust to ensure an income for Mary during her lifetime. Meanwhile the ferry was rented out:[12]

> To be let ... for three years ... The Ferry or Boat Rake known by the name of Hexham-East-Boats, situate near Hexham ... together with the Boat-House, Stables, an acre of Meadow Land and other conveniences. [Apply] to Mr. Thomas Chatty ... Hermitage

An undated but probably contemporary letter from Chatty, presumably Jurin's agent, refers to "what is generally paid at the Boat":

Ferriage paid at the Boat

Every Man Woman or Child	½d.
A Horse, Cow or Ox	1d.
A Cow and its calf	2d.
Sheep:	
Up to 7 sheep	1d.
8–12 sheep	2d.
13–16 sheep	3d.
17–22 sheep	4d.
23–27 sheep	5d.
Pigs great & small—each	1d.
Every poke of Corn, Coals, Potatoes, or any other things, whether upon a horse or in a cart	½d.
Milk Barrels when full—each	½d.
A horse, Bullock or calf skin	1d.
A Pedlar with a long Pack	1½d.
A Pedlar with a box	1d.
A Spinning Wheel or Knack Reel	1d.
A Box or Chest	½d.
Butter Firkins—each	½d.

I have heard that five shillings is usually paid for a

> dead corps but cannot tell whether it is true as none happened to come whilst Ned Hedley was employed.

Jurin's only child died in 1760 and he himself died at Hackney on 3 July 1762, to all intents and purposes intestate for no will could be found. Advertisements seeking its whereabouts were placed in local newspapers by Sir Edward Blackett and John Simpson, but to no avail, and the Hermitage Estate with its ferry passed to his five sisters, then living in the south of England.[13]

The Blackett–Gott Bridge

The desire for a bridge over the Tyne at Hexham did not diminish and in 1764, Sir Walter Blackett, intending to acquire the ferry, asked Smeaton to design another bridge. Smeaton declined claiming that he was too busy, but Blackett pressed on, and before coming to an agreement with the County in 1767, was already considering how such a bridge might be financed. In an undated document drawn up for Blackett, a proposal for a new bridge, "at a place called the Spittle Pool near Hexham", and roads leading to it, was costed at £5,000.[14] It was hoped that a subscription of £1,000 would be obtained from the County, £500 from small subscriptions in and around Hexham, and £1,000 from "interested Noblemen". If £500 could be obtained from elsewhere then the outstanding £2,000 might be obtained from central government; an Act would cost a further £200, and the settlement over the ferry might cost a further £1,200. The "boat house, other edifices, warrens, water fences, landing places, posts, boats and ropes" thereby obtained would be vested in trustees:

> ... because it may be found proper to Continue the Ferry not-with-standing the Bridge ... to be built near a measured mile to the West of it, and many people coming from the North, North East and east from the Ferry and also going from Hexham to those parts, would rather chuse when the water is boatable, to make use of the Ferry than go about two miles about for the benefit of the Bridge, and it is possible that the Ferry would, even after the building of the Bridge, lett for about £20 p:Ann: or at least for an Annual Rent worth notice, besides a Continuance of it for these reasons, seems to be a conveniency to the publick.

It was also suggested that the right to an "open Carriage Road as well as a Bridle Road" by the riverside where an existing road ran, should be acquired to give easier access to the bridge. It was anticipated that the owners of Hermitage and other grounds needed for new roads on the north side of the river would co-operate since the new bridge should increase the rental value of their lands to a level equal to those in the Township of Hexham.

Subscribers to the bridge would be expected to pay in three instalments, the first when the contract was let, then during construction, and the third on completion; two subscription books would be opened at the Morpeth Christmas Sessions for 1767, one in Hexham and the other in Newcastle. One of the first to subscribe was the Duke of Northumberland, but hundreds of people from many walks of life offered subscriptions, some as low as 5s. 0d.; in the event some failed to pay the first call and over 200 people failed to pay the complete subscription.

The necessary purchase of the ferry proved to be a difficult affair, but after much to-ing and fro-ing, with legal advice from several parties, it was agreed that Blackett could purchase the ferry for £1,200 once the last arch of the proposed bridge was turned, enabling pedestrians to cross. Any subsequent ferry rents would be vested with Blackett and the ferry would continue with him, free from all incumbrances in title. This agreement would, however, be void if the bridge was not complete within 5 years of its signing.

Meanwhile other matters had been proceeding apace and with some subscriptions coming in, Blackett came to an agreement with the County and the Trustees of the Alemouth turnpike, to build the bridge from "Tyne Green thro' the Spittal Pool to the grounds opposite" (i.e. at or near the earlier proposed site); the estimated cost was now £3,459 and the County agreed to contribute £1,000, in four

equal instalments. The County insisted that the bridge should be free from toll, and that Blackett would maintain and repair it for 7 years after completion against a bond of £3,000; thereafter the County would take responsibility for the bridge. Blackett agreed to fund the approach roads which would begin, on the south side, at the east end of Chairway Lane where it met the Alemouth turnpike, extending along the lane but turning north from its west end to the bridge location; on the north side of the bridge, a new section of road was to lead in a north-easterly direction to meet the Alemouth turnpike. After their completion the new roads would be deemed part of the Alemouth turnpike, thereafter to be kept in repair by the Trustees; Armstrong's map of Northumberland of 1769 shows the situation (fig. 2).

William Gott of Woodhall in the West Riding, and George Brown of Cambo, both described as masons, would oversee construction of the bridge. Gott was superintendent of works on the Aire and Calder Navigation, for several years had built and repaired county bridges in the West Riding, and had recently completed the bridge at Ferrybridge; he was well known to Smeaton and Blackett. Brown was clerk, treasurer, and surveyor to the Alemouth turnpike and was also surveyor to the county bridges of south Northumberland. Gott designed the bridge while Brown was to act as resident supervisor; they bound themselves to Blackett for the contract sum, and would receive the £3,459 at intervals between 1768 and the completion of the bridge. Gott's plain design was, however, somewhat more elegant

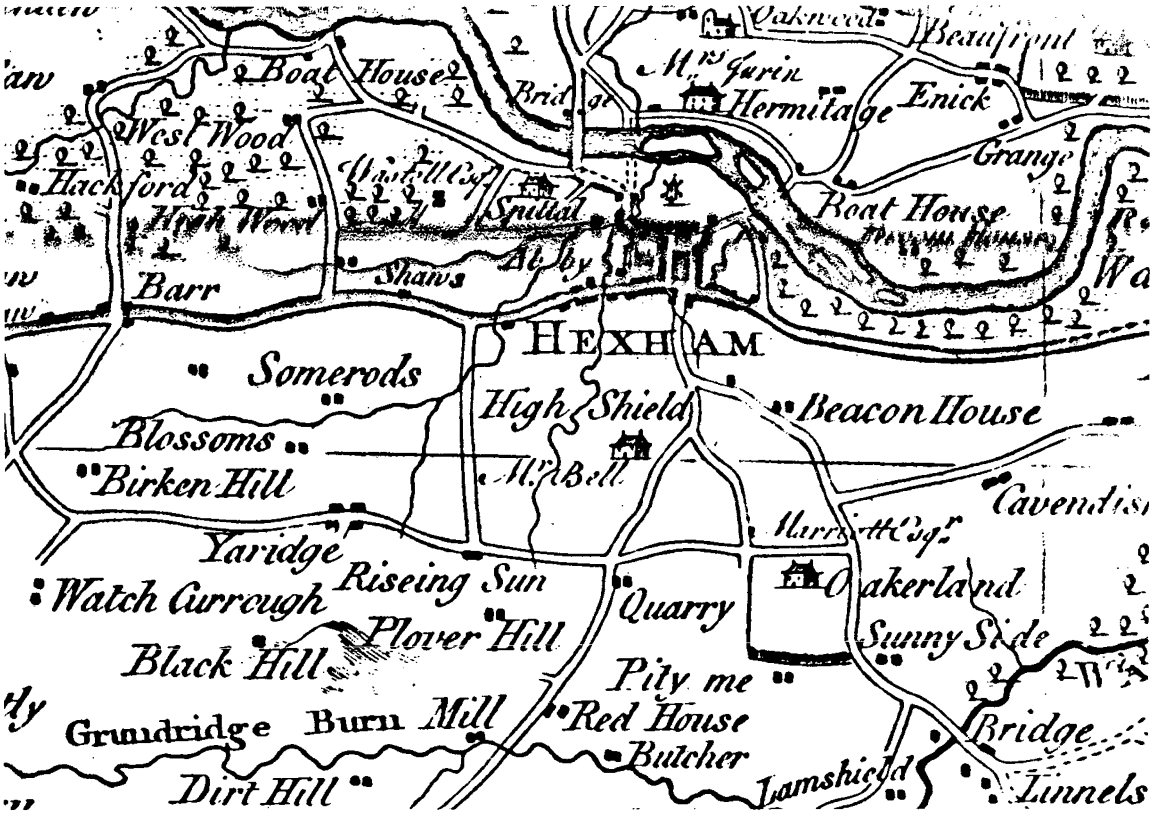

Fig. 2 Detail from Armstrong's map of Northumberland, 1769.

than Smeaton's 1756 version (fig.3). It was to have seven unequal segmental arches with spans varying between 40ft and 70ft (12 and 21m) and a span to rise ratio of about 4. The piers, which varied in thickness between 8 and 11ft (2·4 and 3·4m) were to be founded on timber platforms set on tapered timber piles, and the total width of waterway would be 360ft (109m). The piers would be founded in "broad coffer dams of earth" kept dry by chain pumps, upon piles driven down some 10 to 13ft (3 to 4m), and a supporting timber platform 1ft (0·3m) thick laid over, about 3·3ft (1m) below the river bed.

The foundation stone for the new bridge was laid on 15 October 1767:[15]

> At noon, Sir Walter Blackett, bart. went ... to the river, accompanied by all the gentlemen and freeholders in the neighbourhood, a pair of colours being carried before them, drum beating, music playing, attended by the company of butchers with marrow-bones and cleavers; then followed the company of free-masons; and last came Sir Walter and all the gentlemen, and in this manner proceeded to the river, where he laid the first stone of the bridge ... in the presence of some thousands of spectators, to whom three hogsheads of ale were given upon Tyne-green; after which there was a grand entertainment given at the abbey to the gentlemen and freeholders, who amounted to one hundred and seventy; and in the evening several hogsheads of liquor were drunk by the populace, and the streets rung with 'Success to the Bridge of Hexham' and 'Long live Sir Walter Blackett'

Blackett received his first instalment of £250 from the County in January 1768 and was to receive subsequent instalments each January of the next three years. By December 1768, work had reached the stage where a temporary foot-gang bridge was needed to facilitate further construction, but recognizing that pedestrians would use this, rather than the ferry, Blackett offered Mr. Atkinson, the then tenant of the ferry, 16s.0d. per week recompense for loss of revenue for as long as the foot-gang was pass-

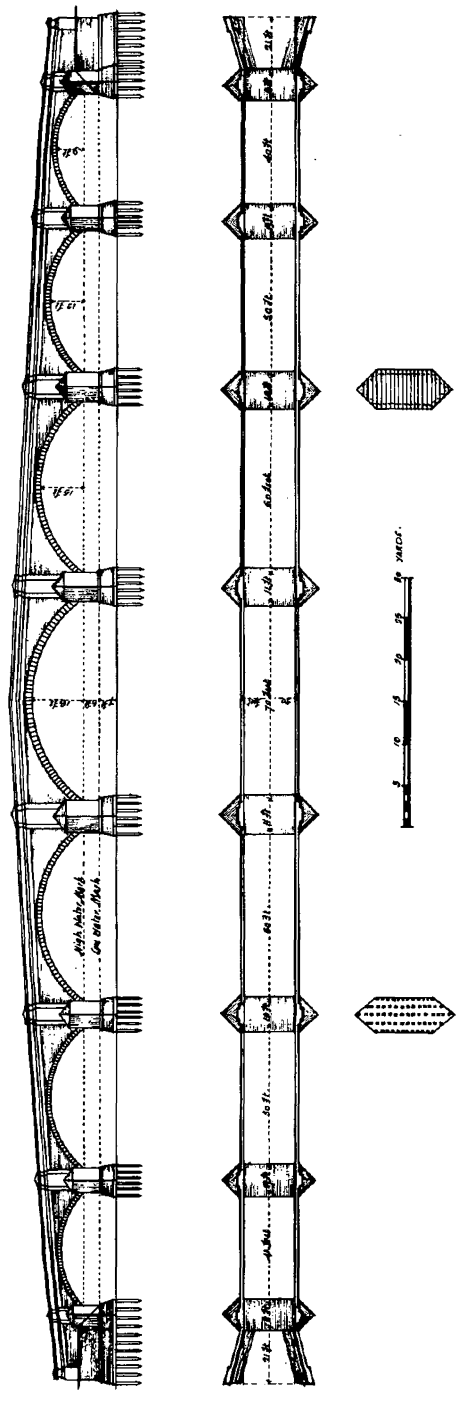

Fig. 3 The Blackett–Gott bridge, 1770–71.

able. The foot-gang was in use by 19 June 1769, and by 31 August the third arch of the bridge was turned; this event signalled the second call on subscriptions. By 16 November the last arch had been turned and Atkinson's compensation assessed at £17.12s.0d. for 21 weeks and 3 days. By May 1770 the bridge was not yet fully completed and, as anticipated, the ferry was rented out again, to John Glendenning, for one year from 12 May 1770, subject to his quitting on 24 hours notice; the rent was appropriately low, at £6.10s.0d. p.a. At last, in September, Sir Edward Blackett laid the final stone and gave a "genteel entertainment". The bridge was inspected by Gott, and having declared it "executed according to the Plan and Dimensions and in a Workmanlike manner", it was certified complete by the JPs; Sir Walter had now received his £1,000 from the County and he was reminded of his obligation to keep the new bridge in reepair:

> ... and make good the said Bridge and every part thereof or such part thereof as during the said term of seven years shall happen to fall down or be washed away or otherwise become ruinous.

This condition was not particularly born of pessimism concerning the project; that it may seem to express foreboding is mere coincidence.

The bridge was formally opened on 29 September 1770 but John Glendenning again took the ferry from 12 May 1771 at £6.15s.0d.; Acomb toll gate, on the Alemouth turnpike, let for £94 p.a. in that year, having stood at only £65 p.a. since 1760, in anticipation of heavier traffic to and from Hexham. More than a year after the bridge opened, several of the promised subscriptions had not yet been received and Blackett was obliged to insert a notice to this effect in the *Newcastle Courant* of October 1771, a plea which was almost certainly to no avail, for during the night of 16–17 November 1771, there occurred:[16]

> The most dreadful inundation that ever befell that part of the country. The beautiful bridge at Hexham ... which had only been finished the year before with great rejoicing, was totally demolished during the night.

The waters at Hexham had risen some 13ft (4m) above normal level, and of all the bridges over the Tyne, only that at Corbridge survived, even though the villagers were said to be able to wash their hands in the river merely by leaning over the bridge parapets. The flood:[17]

> ... that has ever since been distinguished by the name of the Great Inundation [was] swelled to a degree of violence far exceeding anything that had before this been experienced, handed down by tradition or imagined.

Gott's bridge had lasted only 14 months and rather than attempt to rebuild it as his agreement required, Blackett agreed to forfeit his bond of £3,000 to the County—it remained unpaid at the time of his death. He further absolved Gott and Brown from their bonds, and from any blame for the collapse, on the basis that such a flood could neither have been foreseen nor designed against. Happening at night, there were no witnesses to the collapse. Some believed that it had simply been pushed over once the arches were submerged; Smeaton was to suggest that the flood had stripped out the entire gravel bed around and beneath the piers, causing them to collapse; later he suggested that the ease with which the gravel and underlying quicksands were stripped out had been exacerbated by the weakening of the gravel bed during piling for the piers. Later still, when he had greater cause to reflect on the matter, Smeaton suggested that only one of the piers might have been directly undermined, but that the high span to rise ratio of the arches, with large consequent horizontal thrust on the piers, then resulted in the collapse of all the piers and arches.[18]

As bridge surveyor for the County, George Brown now had the unenviable task of reporting on damaged and destroyed bridges. His inspection of Hexham bridge must have been particularly melancholic and his receipt of £6, in addition to his salary, for "extraordinary trouble in surveying the County bridges after the late flood", can only have provided little consolation.

Prompt action was taken to restore what little was left of the ferry. Glendenning was given 24 hours notice to surrender the ferry on 20 November 1771 and work to replace it commenced soon after. In March 1772, Nicholas Scott was paid £3.19s.6d. for carpentry work on a "Carriage for a boat to go to Hexham", and in May the ferry was again rented out, to Joseph Toppin for one year at £60, two boats being mentioned in Toppin's agreement; the agreement also allowed for an early termination of the lease should another bridge be built.[19]

John Wooler's attempted bridge

By 11 January 1772 a committee had been established to collect subscriptions for flood relief in Hexham, the committee being allowed to draw £200 from the County treasurer immediately. Again there was no diminution in the desire for a bridge and the County had in effect made a profit of £2,000 on the failed enterprise, once Blackett paid up his bond. Smeaton and his assistant John Wooler had been called in to advise on the collapsed medieval bridge between Newcastle and Gateshead, and later in January the County Justices asked them to prepare plans for the rebuilding of the Haydon, Chollerford, and Hexham bridges. Smeaton and Wooler appear to have declined this commission and the County entered contracts with others for the Haydon and Chollerford bridges while some work clearly went ahead at Hexham; the available information, taken mainly from Quarter Sessions records, is somewhat confusing because orders and payments made at quarterly meetings mask the actual chronology of events.

In October 1772, the County paid John Fryer the sum of £26.5s. for surveying and drawing plans of the environs of Hexham, Haydon, and Chollerford bridges, and in April of the following year a sum of £300 was set aside towards rebuilding Hexham bridge. Presumably with the full intention of rebuilding to a design by Fryer, the County magistrates ordered their treasurer to apply to Blackett for the £3,000 bond. If forthcoming, the treasurer was then to pay £2,000 to the undertakers for rebuilding the bridge "upon their producing a certificate ... that they have given a sufficient security for rebuilding the bridge". More monies were made available in July 1773 and in October, Thomas Laybourne (sometimes Layburn) & Lowinger Maddison, both of Hexham, were paid £200 towards rebuilding Hexham bridge.[20] Then, six months later, Fryer was paid 9 Guineas for boring, and for drawing a plan and section of the Tyne at Hexham. However, this re-building work appears to have come to a standstill, and sometime during 1774 John Wooler was formally engaged to progress a replacement bridge. During that year Brown, as county surveyor, had carried out test borings in the river bed, and claimed to have found a stratum of clay right across the river, at about 150ft (45·6m) upstream of the failed bridge, and only 4ft (1·2m) below a gravel crust. Deciding that the clay bed would offer a good base for piled timber-platform pier foundations, similar to those employed by Gott, Wooler began preliminary works at this site. At first he seems to have inherited the Fryer design and initially approved of it. A formal agreement was made with Laybourne & Maddison by November 1774, to build and finish a new stone bridge:[21]

> ... at or near Hexham, near where the late bridge stood together with all the Breast Walls Roads and Avenues to and from the same according to a Plan drawn by Mr. Fryer and approved by John Wooler Esq ... and that they would compleat the same or on before 24 June 1777 for £5,000 together with all the materials from the former bridge and whatever further monies John Wooler thinks necessary for the Tarras to be made use of in building the same.

The contractors were to give their personal security for £3,000 and to agree that £2,000 out of the contract sum of £5,000 would be withheld for 7 years after completion, during which period they would keep it in repair; this retention would then be paid with interest of 5 per cent, to begin from the time when the bridge was finished.

Laybourne and Maddison were given an initial £450 while Fryer was paid £17.5*s*. for

drawing the plans for the bridge. The north land-breast was completed early in 1775, at which time Wooler recommended that Jonathon Pickernell be brought up from London to act as resident supervisor.[22] While it is apparent that the contractors carried out some work, their agreement must not have been sealed, for in April 1775, tenders were sought for the bridge to be built according to Wooler's plan; the construction would, in part, use the large quantities of materials "lying handy" from the destroyed bridge. However, the Sessions of April 1775 noted that there had been no response to advertisements for tenders for the bridge and the magistrates therefore ordered that:

> ... the sd. bridge be built by days work at the expence of this county under the direction and inspection of Mr. John Wooler and Mr. John Pickernell ...

After commencing work on the first pier foundation, Pickernell found not clay, but quicksand at 4ft (1·2m) down. Indeed, he was able to push an iron bar, some 46ft (14m) long, down into this sand by hand only, meeting "no more resistance than chaff". To further prove the quicksands in the presence of the county authorities, he had driven a trial pile into the river bed which he was able to do at a rate of $2\frac{1}{2}$ inches (6·4cm) per stroke to a depth of 26ft (8m) without stopping. Wooler noted that:[23]

> This is really a most unhappy circumstance [for the JPs] after all their trouble and expences hitherto, the attempting to get a Bridge upon such an enormous depth of Quicksand, over a river so subject to great Floods as the Tyne, may be deemed so hazardous as to be next to imprudence itself: ... this wretched quicksand renders the attempting a Bridge ... little better than folly.

Wooler declared his planned bridge impossible unless the entire river bed was paved with a 42ft (13m) wide and 6ft (1·8m) deep masonry deck, over a timber sleeper foundation close piled to 30ft (9m) depth along the outsides of the foundation. This relatively expensive but basically sound proposal was never given serious consideration for its cost was regarded as being beyond the County's purse, but as the Justices had by now spent some £3,500 on preliminary works and materials, they were reluctant to abandon the project. Consequently they continued to employ Pickernell on site, and indeed, when George Brown declined to continue as surveyor of the county bridges in July 1776, Pickernell was appointed in his place; perhaps Brown believed, or was informed, that his credibility had been overstrained by the misleading results of his river bed investigations. Pickernell eventually found a site which seemed promising, adjoining the Sandhoe estate owned by Henry Errington and almost one mile below that of Gott's bridge.[24] Pickernell's findings encouraged Errington to consider sponsoring a new bridge and to this end he engaged Smeaton to consider its feasibility, to design a bridge accordingly, and to direct its construction if all seemed well.

The Errington–Smeaton bridge

By now Smeaton had a string of successful civil and mechanical engineering works under his belt, including the Coldstream (1766), Perth (1771) and Banff (1779) bridges. He was regarded as the foremost engineer of his day, the creator of the profession of civil engineer. He knew the area, having designed the Jurin bridge, and having been employed as a Receiver for the Greenwich Hospital's Northern Estates from 1764. He had visited Gott's bridge while it was under construction and made his own judgement on its failure. Thus on 6 February 1777, Errington met with the Justices at Cambo to present his proposal for a new Tyne bridge at Hexham, at or near the site recommended by Pickernell, for an estimated cost of £5,700 plus "materials provided by the County for building a bridge a little higher up the river". The proposed site was described as being:

> ... about 50 yards below the Boatway and nearly in line with a little bridge that crosses the Mill Leat and to land upon the North end upon the Close East of the Boat House that is situate between that and the Lane.

Smeaton would be paid an initial £300, then £280 for each pier and abutment completed, £250 at the closing of each arch, and the remainder on completion. Errington's agent, John Donkin, proposed to build for £400, a "substantial" public high road to turnpike standards, to link with the Alemouth turnpike from the north end of the bridge, but no specific arrangement seems to have been made for a new south-side road. Errington's bond would cover the cost of the bridge and road, plus £3,000 worth of materials from the previous attempt.[24] Thus Errington offered security of £9,100 for completing the bridge by 25 March 1780 and for maintaining it for 7 years after completion. The County accepted these proposals, entered a formal agreement with Errington on 2 June 1777, and paid the first part of the agreed £5,700, a sum of £860, in the following month. At the same time the County treasurer was asked to call on the representatives "of the late Sir Walter Blackett" for the interest due on £2,500 of his bond, and for an initial £500 of the unpaid bond.

In October, Errington was paid a further £840, but at the Sessions where this order was made, complaints were raised by "several of the principal Gentlemen, Freeholders and Farmers" that too much County money had already gone into the building and repairing of bridges which were not County bridges. The Court therefore agreed that only those new schemes which had been authorised by Parliament should receive County support. Thus, armed with Smeaton's design, and with preliminary work underway, Errington and the Justices petitioned Parliament in February 1778 for an Act to enable the Justices to execute their agreement with Errington. The petition embodied the main terms of the agreement but added that the bridge would be deemed a County bridge 7 years after its completion, and that the new road would become a part of the Alemouth turnpike.

The petition was referred to a committee and Sir William Middleton gave a favourable committee report to the House in March. As already indicated, witnesses testified that the ford near where the bridge was to be built was extremely dangerous at times of flood, and that the bed of the river was often shifted by the violence of the current. Others observed that the ford higher up the river, presumably that which formed a part of the Alemouth turnpike, was equally dangerous and uncertain.[25] Permission was granted to bring in an appropriate Bill and the Royal Assent was gained on 15 May 1778.

Using a sharpened iron bar, Smeaton had inspected the bed of the river at the proposed site, and concluded that he could safely found the piers on the gravel bed, but only if the gravel crust and sands beneath some of the piers were disturbed as little as possible; he now believed that such disturbance had been the cause of Gott's failure. In January 1777 he was able to inform Donkin that he had a full design for the proposed bridge, to be built at a cost of £6,960, but that additional costs for a small bridge over a mill leat, the road formation from that arch to the bridge proper, wayleaves, and superintendent's salary, would raise the cost to £7,250. He also informed Donkin that:

> ... though I have no doubt of building a bridge there, yet to do it with a probability of safety against such a flood as that of 1771, which at that time was not thought of, is impossible there or in any other situation near Hexham for less money than the amount of the ... estimate.

Clearly confident of success, and with the knowledge of the 1771 flood in mind, Smeaton's design was for a bridge of nine arches, rather than the seven of the earlier attempts, "that it might have more legs to stand on in consequence of the natural weakness of the stratum". The bridge would be 518 ft (157·5 m) between the abutments, 20 ft (6 m) wide overall and about 18 ft (5·5 m) between the parapets, and would reach a height of 31 ft (9·4 m) above the normal river level to the crown of the centre arch. The south end of the bridge was to be "wharfed up" with walls extending 150 ft (45·6 m) to give a slope no worse than 1 in 12. Eight of the nine river arches were to be segmental while that at the north termination

would be elliptical; the central span was to be 51 ft (15·5 m) wide and this was to be flanked by spans of 50½ ft) (15·3 m), 50 ft (15·2 m), 48 ft (14·6 m), and 37 ft (11·25 m). In addition the sloping south wharf wall was to be penetrated by two flood relief arches, each of 18 ft (5·5 m), and the mill leat arch of the same span. The piers were to have "wide feet" and those at the centre of the river would sit directly on undisturbed gravel, for there the gravel was thinnest and must not therefore be disturbed. To prevent scour of the gravels from beneath the piers, defence works of heavy rubble stones ("beton") would be placed around the foot of each pier; each piece of the beton would weigh not less than 1 ton and all would be clamped together. The central piers would be founded in caissons, since to employ coffer dams would endanger the integrity of the gravel crust, but the abutments and their nearest piers, where the gravel was thicker, would be founded on piled platforms in coffer dams with sheet piling. The architectural features of the bridge were to be similar to those which Smeaton had used at Coldstream, Perth, and Banff, masonry roundels in the spandrels with projecting "keystones" on vertical and horizontal axes, projecting triple keystones to the arches, modiglions under a plain cornice at the parapet base; this so-called "Smeaton style" was in fact borrowed by Smeaton from a 1762 design for Coldstream by Robert Reid of Haddington (fig. 4).

Construction initially proceeded without mishap but a flash flood in July 1778 scoured underneath some of the centre piers before their protective girdle had been put in place. Smeaton admitted some responsibility for this "disagreeable misfortune", suggesting that the need to push forward the work had persuaded him that it was not necessary to fully protect any pier before the next was commenced. He remained confident of the "natural strength and compactness of the gravel bottom" but betrayed an element of doubt when he wrote:

> I could not have supposed so much derangement would have happened in the course of two or three summer freshes. I hope I shall not find matters irretrievable.

The immediate disaster was not irretrievable but it was an ill omen. Smeaton now decided to sheet-pile all piers and to use a diving bell[26] to underpin the disturbed piers with piles, quite contrary to his original intention to found on undisturbed gravel; the cavities in the river bed beneath the damaged piers were to be filled with rubble stones from Oakwood Bank quarry. Another flood in December caused little damage, encouraging everyone to continue with the new plan.

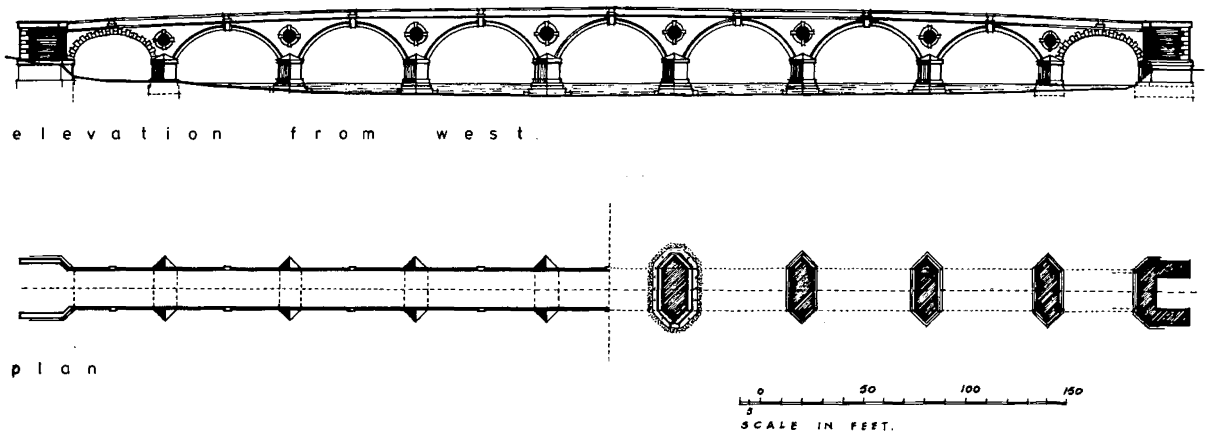

Fig 4 Smeaton's design of 1777.

Smeaton's bridge was partially opened in July 1780, when Errington crossed it and made a presentation to the workmen, completed around Christmas, and together with the new road section on the north side, finally certified complete in January 1781. Pickernell, presumably satisfied with his work, now retired from his position with the County, and after a while:

> ... even the Gilligate people ... ceased their visits [to the bridge], who before had constantly after every flood, come to inspect, in hopes of finding something correspondent to their prayers and wishes for the downfall of the bridge.

Had they kept their vigil their pessimism would have been rewarded, for on Sunday evening 10 March 1782, there was a fall of "rain saturated snow" in the Hexham area, followed by a "violent hurricane". On the following morning, Donkin observed that the river covered the upstream cutwaters of the bridge but scarcely touched their downstream side, a fall of some 4 or 5ft (1·2 to 1·5m) as the water rushed through the arches. Within minutes he saw particles of lime falling from the south arch and immediately after a longitudinal crack opened up in the soffit of the arch. Then the spandrel walls between the third and fourth arches from the north began to splinter and shake before giving way as the two arches and a pier collapsed completely; within half an hour only two or three arches remained. Although not so great a flood as that of 11 years earlier, Ridley Hall bridge was also destroyed and Haydon Bridge was rendered impassable.

Smeaton's bridge had lasted a mere 21 months; its piers had been undermined, possibly because the rubble girdle around their feet had so restricted the waterway through the arches that the torrent first removed the rubble and then scoured out the gravel.[27] It was nothing short of ironic that Smeaton, in 1760, had published a brief statement on his principles of bridge design which noted that "The principal strength of a bridge consists in its foundation ... this being well secured, the superstructure ... seldom fails". An inquest now began in earnest. A writer to an unidentified newspaper, dated 16 March 1782, noted:

> We are sorry to inform you that the new bridge here is nearly swept away by the late flood, which was viewed with regret by hundreds of the inhabitants, and more particularly on account of the amiable Henry Errington Esqr; whose goodness to the people in this neighbourhood can never be forgotten; he being the original in building the second bridge, when almost every expectation was vanished of having a bridge. The care he took in building it, shewed his desire for its duration, by employing the greatest philosophers and architects that could be got to give directions in building the said bridge, which was duly attended to by his workmen. However, some people not so much skilled in bridge building, suggested at that time, from laying the frames of the pillars upon mud and sand in the bed of the river, that every flood would wash away the sand and gravel between the pillars, and in a few years the fabric would be undermined and fall; and this suggestion has proved too true. To make a bridge withstand the violence of the flood 'tis impossible here, without framing and penning across the river, which might be done for about £600 and might in all probability have been the saving of 3 or £4,000 with the use and safety to the inhabitants of so valuable a fabrick.

Smeaton's initial reaction to the collapse, however, was to observe that he had not appreciated nor been warned of the "degree of violence that this river now appears to be capable of", a somewhat surprising excuse in view of recent events of which Smeaton was well aware. But feeling some blame for the disaster, he was soon to confess to Pickernell that:

> All our honours are now in the dust! It cannot now be said, that in the course of thirty years practice, and engaged in some of the most difficult enterprizes, not one of Smeaton's works has failed: Hexham Bridge is a melancholy witness to the contrary.

In fact, Smeaton, who had been prepared to "risk his credit as an Artist" on his Hexham bridge, was shattered by this disaster. In failing health in October 1783, he still had "the Horrors of the River Tyne painted upon his imagination".

Errington, the County authorities, the Alemouth turnpike Trustees and users, might also have been greatly disheartened by the failure of the bridge. For Errington and Smeaton, the ensuing months and years were to prove very difficult as Errington was plunged into litigation with the County, in the course of which Smeaton's role in the affair was to be much questioned. By his original agreement, Errington was required to maintain the bridge for 7 years after completion. He now had two alternatives, either to re-build the bridge if anyone could be persuaded to carry out the work, or to pay his bond to the County. After an acrimonious court case, with Robert Mylne acting on behalf of the County, Errington had to stump up at least a part of his bond, totalling £4,000, for failing to honour his contract.

Mylne's role in the litigation was an interesting one. He was in some respect Smeaton's only equal in the art of bridge building, having designed Blackfriars bridge over the Thames and the Newcastle bridge to replace that lost in the 1771 flood;[28] all that the County required of him was to determine whether Smeaton's bridge *could* be rebuilt. Mylne first observed Smeaton's collapsed bridge in April 1783 when he seems to have devoted a day in studying its failure and engaging a Mr. Wake to drive an exploratory borehole near the north end of the collapsed bridge.[29] His report to the County magistrates, presented towards the end of the month, gave an explanation for the collapse which was broadly similar to Smeaton's, but he added that sufficiently deep foundations would allow the bridge to be rebuilt. In September he provided a second report wherein he argued that undue haste during construction had "laid the seeds of ruin", but to maintain the reputation of "so great an artist" as Smeaton, he was prepared to state categorically that Smeaton's directions were not followed "and of course ... he was deceived". He concluded that Smeaton could, if he so desired, undertake to reconstruct the bridge according to the original agreement; this was a technical point, made without particular regard to the engineering difficulties involved (although Mylne no doubt sincerely believed that they could be overcome), but was the fundamental strategem in the County's case against Errington. It was not until June 1788 that Smeaton placed on record his view of Mylne's reports:

> There are so many points contained in the ... reports ... in which I entirely differ with that gentleman in opinion, that to make the proper observations upon the whole, would draw me out to a length that in the present state of things I would wish to avoid ... I shall ... pass over the compliments that Mr. Mylne's politeness prompts him to pay me on this occasion: and particularly as they seem to be at my own expense.

Smeaton dismissed most of Mylne's criticisms and indeed challenged his assumptions based on the single boring by Wake (a man more used to colliery work and not competent in the matters of bridge building, according to Smeaton), but admitted that he would not have advised Errington that a bridge could be built, except where money was unlimited, had he or anyone realized that such a flood could occur. Smeaton was tacitly agreeing that the bridge could be rebuilt, but his argument was not totally convincing for it is difficult to believe that Smeaton did not realize the truth—that the 1782 flood had not been as great as that of 1771.

Mylne inspected the collapsed bridge again "from end to end with a view to repair etc." in October 1783, and in January of the following year produced a "long report of opinion and advice on Hexham Bridge, with a long estimate of a supposed repair thereof". During that and the next four or five years he was involved in the Chancery case against Errington, and also with Ridley Hall bridge and other commissions around the country.

Back to the ferry

Meanwhile, following the collapse of Smeaton's bridge, travellers across the Tyne at Hexham once more resorted to fords and ferries. The turnpike Trustees held a special meeting to consider an application from the tenant of Acomb tollgate for a reduction in his rent on account of the fall of the bridge.[30] Blackett had died childless in 1777, the year which saw the

commencement of the construction of Smeaton's bridge. His estates passed to the son of his only sister, Sir John Trevelyan, who now held the Hermitage and the ferry; the latter would have been kept in operation while Smeaton's bridge was being built, and possibly throughout its short life. Sir John, whilst claiming that the bridge collapse was to his and Errington's detriment, nevertheless now realized that "Hexham Ferry may in time be of consequence"[31] and soon began its reinstatement. The ferry passage, its landings and boats, had been severely damaged by the flood, and between October 1782 and August 1783, oak timber was bought for a new boat, gangs of labourers were regularly active in clearing sand and gravel from the passage, and a new gangway was built out into deep water. In November 1783, payments were made for securing posts and landings, and for clearing the passage, while Mary Dowell sold "Ale etc [for] Workmen in the water clearing pssage". From December 1783 to May 1784, John and Bartholomew Bowlt, boat builders, were paid a total of £121 for extensive work, including a new boat; the bill included nearly £20 for "Workmans board etc" implying that they had been brought to Hexham to do the work. Other payments over the next 10 years covered painting the proprietor's name and residence on two boat sterns, the carriage of a smaller boat from Newburn "when driven from her moorings by violence of a high flood', ale given to men for "securing Boat when Rope broke on her passage in a high water", the splicing and repairing of a "Great Rope", and the building of a "flat boat". In 1791 John Bowlt was paid £88.11*s.*3*d.*, probably for a new boat, and £20.18*s.*10*d.* was paid for a new rope from the Howden Dock.[32]

The rent for the ferry through this period was £70 p.a. and given the high expenditures the venture may only have made modest profits for the Trevelyans. In the last month of 1793 a boatman was employed at £22 p.a. and the ferry probably ceased operation in 1795 when another bridge opened at Hexham.

Smeaton's bridge rebuilt

Mylne had advised that Smeaton's bridge could be re-built at or near the same site, although other than his reports submitted between 1783 and 1788, he had no direct involvement with its rebuilding. Certainly his diary contains no reference to Hexham bridge after 1788.[33] In fact the bridge was rebuilt by William Johnson and Robert Thompson, both County bridge surveyors who had been involved in the building of Mylne's Ridley Hall bridge and may have profited from their experience in that project; Johnson had also been commissioned to oversee the rebuilding of Chollerford bridge which was completed in 1775.

At the Easter Sessions 1789, the Justices ordered that Hexham bridge be rebuilt at the expense of the County and that Johnson and Thompson should immediately employ workmen to clear the foundations and prepare stones and other materials for the rebuilding. In July the surveyors were requested "to ensure an early beginning for laying the foundations the first favourable weather next spring", although it is apparent that the foundations were not completed until October of the following year, by which time some £1,500 had been spent.

Work must then have proceeded fairly smoothly, and a considerable flood in July 1792 had little apparent effect on the advanced works. The new bridge was partially opened on 19 September 1793 when the last arch was completed and pedestrians could safely cross; the *Newcastle Courant* of 21 September reported:

> It is with pleasure we hear, that the last arch of the new bridge over the Tyne, at Hexham, was closed on Thursday last, and consequently now open for foot passengers. The greatest demonstrations of joy was shewn by the inhabitants of the town and its vicinity, on the occasion, and every person seemed animated with the most heartfelt satisfaction, at the near completion of that truly valuable and useful structure—great praise is due to the builders, for having taken every precaution to secure the foundations. The workmen paraded the street in procession on the occasion, and a most joyous evening closed the happy, long wished-for day.

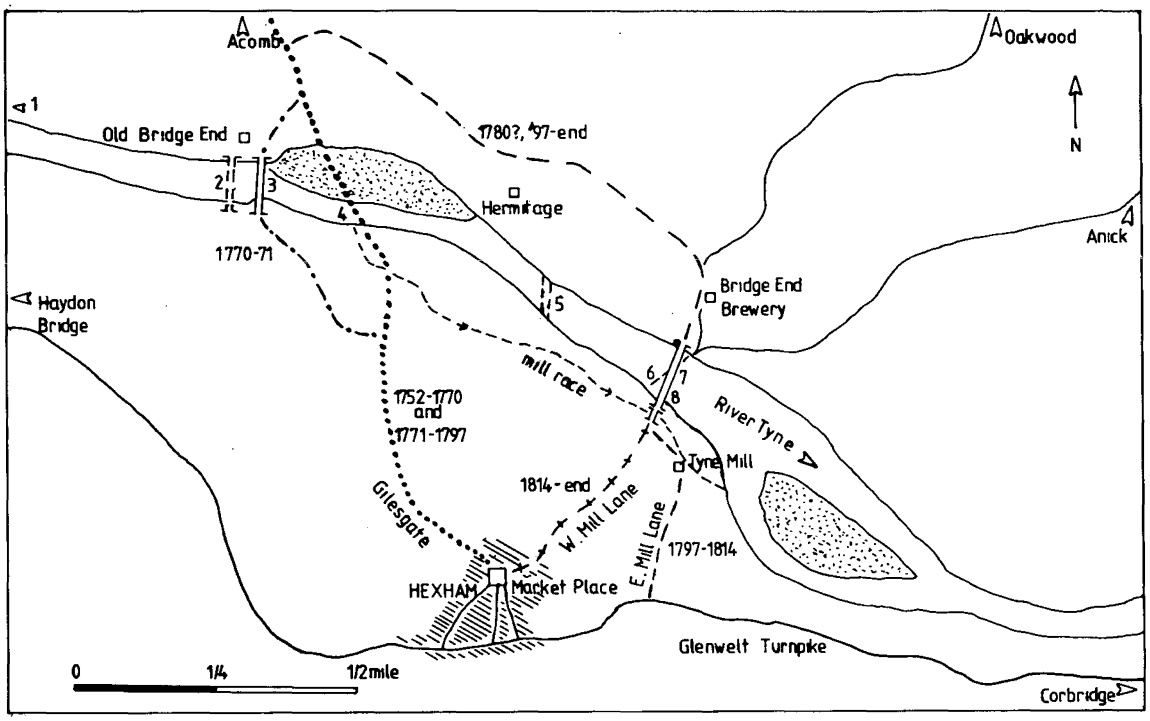

Fig 5 Tyne river crossings at Hexham and the routes used by the Alemouth turnpike.
Legend:
1 West Boat ferry, Warden
2 Wooler's bridge attempt, 1775
3 Blackett–Gott bridge, 1770–1
4 High Ford
5 East Boat ferry
6 Low Ford
7 Errington–Smeaton bridge, 1781–2
8 County–Smeaton bridge, 1795-present

The bridge superstructure of nine river arches, two flood arches and the mill leat arch, together with the ornamentation, was to Smeaton's design and dimensions within inches. The pier foundations, however, were radically different although they approached the solution earlier recommended by Wooler—a forest of piles was driven into the bed of the river and a timber framing laid over them, right across the river bed.[34] The newspaper account also dryly noted that "in all probability" the new bridge would stand the tests of time.

It was common practice to allow pedestrians to cross partly completed bridges, but there was still much to be done before the new Hexham bridge could be fully opened. This seems to have been achieved sometime in 1795, the date recently found carved on the north-east abutment. Johnson and Thompson had performed their task well, and certainly to the satisfaction of the magistrates, for in July 1796 the Grand Jury recommended to the court that they should be paid a "handsome sum" out of the County funds for their "extraordinary trouble, care and attention respecting the building of Hexham bridge now completed". Both men were given a lump sum of £50 and saw their salaries increased from £25 to £40 p.a.

Post script

Smeaton died in October 1792, aged 68 years, one year before his rebuilt bridge was partially opened. He had "risked his credit as an Artist" on the bridge and its collapse was a shattering personal blow. Its failure, his failure, was very public and much scrutinized. He had written, shortly after the collapse, that news of its destruction:

> ... came to me like a thunderbolt ... and all the experience I have gained is not to attempt a bridge upon a gravel bottom in a river subject to such violent rapidity.

Smeaton was never to be able to put his late-found experience to the test and it might be argued that he should have benefited from the collapse of Gott's bridge, from the setbacks while his own bridge was being constructed, and from the testimony of those who had long spoken of the shifting nature of the bed of the Tyne at Hexham. But Smeaton was human and, like a number of gifted engineers before and since, he erred. People remain fallible while nature remains unpredictable, and which Art presents greater risks than bridge building? It is perhaps more revealing that Smeaton's bridges at Coldstream, Perth, and Banff still stand, than that his Hexham bridge fell.

ACKNOWLEDGEMENTS

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APPENDIX 1

Trevelyan Papers (WCT 311) Robinson Library, The University of Newcastle upon Tyne
Estimate of Building a Bridge of four Arches over the Tyne from the Hermitage to Tyne Green near Hexham

To constructing a Coffer Dam for Each Pier	45	0	0
To 50 Cubick Yards in clearing the foundations at 6*d.*	1	5	0
To 12 men pumping 28 days at 1*s*, 0*d* per day	19	12	0
To 1,568 Cubick feet of rough Block Stones in the foundations from the wood side at 3*d.* per foot laid in their places all charges included	19	12	0
To 1,722 Cu feet of square blocked Stones from Acomb fell laid in Terrass for the shaft of the pier below water mortar etc. included at 10*d.*	71	15	0
To 1,650 Cube feet of square blocked stones from Do. for the shaft of the pier above water laid in common mortar at 9*d.*	61	17	6
To iron, lead etc. for the cramps	5	0	0
Charge for each pier	224	1	6

				£
To 4½ piers Abutments included at 230£ each				1035
To 3,087 cubick feet of stone in Each Arch from Acomb fell laid in Lime at 9*d.*	115	15	3	
To 4 Arches at £120 each				480
To 2,121 feet of rough timber for the centers at 10*d.*	88	7	6	
To fraiming and setting up Do. being 100 Square at 7*s.*	35	0	0	
To Iron work about the centers	10	0	0	
To removing and setting up 2 Centers at 5£ each	10	0	0	
	143	7	6	
To Timber fraiming and setting up the centers				150
To 2,744 superficial feet of Aisler work above the [solid?] of the piers in the fillatts over the Arches and under the parapets winning hewing and leading from Acomb fell at 16*d.*	68	12	0	
To 8,074 superficial feet of Aisler in the parapet, winning, hewing, leading, mortar etc. setting at 8*d.*	290	3	0	
	358	15	0	
To Aisler Work in the parapet etc.				360
To 1,011 square yeard of [running?] and Coarse walling materials work and leading from the Oak Wood at 20*d.*	84	5	0	
To 2,860 cubick yards of stone shivers for filling the flanks at 8*d.*	95	7	0	
To 2,470 square yards of paving at 5d.	10	15	10	
	189	17	10	
To rubble walling filling and paving				190
The 4 Arches				2215
To building an Arch of 40 foot over the back Stream				140
To raising the road over Tyne Green for 100 yards and making good the road over the Island				140
To Tools Engines & Incidental Expences				400
			Total	2895

NOTES AND REFERENCES

[1] Archer, D., *Land of singing waters* (Spreddon Press, 1992), 87–8; Archer, N., *Estimation of historic flood discharge on the River Tyne* (Unpublished dissertation, University of Birmingham, 1991), 16.

[2] The information taken from the Trevelyan Papers is that which mainly concerns the Hermitage estate and the East Boat Ferry; these papers are housed in the Robinson Library at the University of Newcastle upon Tyne, under the reference number WCT 311. The papers concerning the Alemouth Turnpike are held by the Northumberland County Record Office, reference NRO 530/15. The Quarter Session Records are now held at the Morpeth Branch of the Northumberland County Record Office under reference QSO. Smeaton's reports were published in three volumes as *Reports of the late John Smeaton FRS, made on various occasions in the course of his employment as a Civil Engineer* (London, 1812).

[3] *Northumberland County History*, [NCH], III (1896), 263.

[4] *NCH*, IV (1897), 9.

[5] *NCH*, III (1896), 254.

[6] Wallis, J., *Natural history and antiquities of Northumberland and Durham*, II (1769), 93.

[7] *House of Commons Journals*, 36 (1778).

[8] *NCH*, III (1896), 264.

[9] An *Abstract of title to Hexham East Boat Rake*

from the Court Rolls of the Manor of Hexham, can be found in the Trevelyan Papers [WCT311, Abstract].

[10] Allgood papers, NRO ZAL 98/4.

[11] *Dictionary of National Biography*, 30 (1892), 229; *NCH*, IV (1897), 147f.

[12] *Newcastle Journal*, February 1758.

[13] *NCH*, IV (1897), 147–8.

[14] WCT 311.

[15] Sykes, J., *Local Records*, I (1865), 264.

[16] Sykes, 283.

[17] *Smeaton's Reports*.

[18] According to Ruddock, E. C., "The foundations of Hexham bridge", *Geotechnique*, 27, 3 (1977), 385–404, the remains at the site today tend to support that view.

[19] An inventory for the ferry ropes etc., for 1776 gives:

One Large rope across the River
One Small rope reaching across the River
Two Small ropes on the North Side of the River
Two fir Poles with an Iron Hook at the End of each of them
One Iron Chain and a lock and key for each Boat.

[20] The same contractors were also repairing Haydon bridge, (QSO 11).

[21] QSO 11, 2 November 1774; "Tarras" seems to mean hydraulic cement.

[22] This was Jonathon Pickernell Senior, later to become engineer to Whitby harbour from 1781 to his death in 1812; his youngest son Jonathon Pickernell Junior, 1765–1814, became Engineer to Sunderland harbour.

[23] NRO ZAN M17/57.

[24] Note that *NCH*, III (1896), 265, mistakenly credits John Errington for the new initiative.

[25] *House of Commons Journals*, 36 (1778).

[26] This was probably the first time that a diving bell had been used on a civil engineering project. Smeaton sent full details of the diving bell to Pickernell and assured him that:

> Were I with you when it is put in use, I should be the first to go down in it as there is no more danger . . . than being let down into a coal pit by a rope; and if it shall happen that all your masons are too fine fingured, I fancy a couple of colliers to take turn and turn, will find it a very comfortable job; a particular encouragement must however be given. (*Smeaton's Reports*)

[27] Ruddock (1977) has analysed the collapse and compared it with that of the Gott bridge.

[28] Ruddock has compared the bridge building styles of the two men in Ruddock, E., *Arch bridges and their builders* (CUP, 1979). Gotch has looked at Mylne's work on Tyne bridges in Gotch, C., "Robert Mylne and Tyne bridges" *AA*, 4, XXXIII (1955), 87–99; this account is flawed, mistakenly credits Mylne with the Hexham and Chollerford bridges, and refers to a "Mr. Golt", meaning "Mr. Gott"; NCH refers to Gott as "Yolt".

[29] Richardson, A. E., *Robert Mylne* (Batsford 1955). After Smeaton's death in 1792 his fellow Civil Engineers, including Mylne, arranged for the publication of most of his surviving reports and drawings, i.e. *Smeaton's Reports*. Mylne was particularly active in this respect and contributed to the preface to the published collection.

[30] *Newcastle Courant*, 27 April 1782.

[31] NRO ZBL 232; Trevelyan also noted that Errington was considering building a wooden bridge in the belief that no stone bridge would stand.

[32] The firm of "Bowlt" or "Bolt" is not noted in the first Newcastle Directory of 1778.

[33] Pers. Comm. E. Ruddock; Richardson (1955).

[34] Ruddock (1977) illustrates the piling and framing of this bridge.