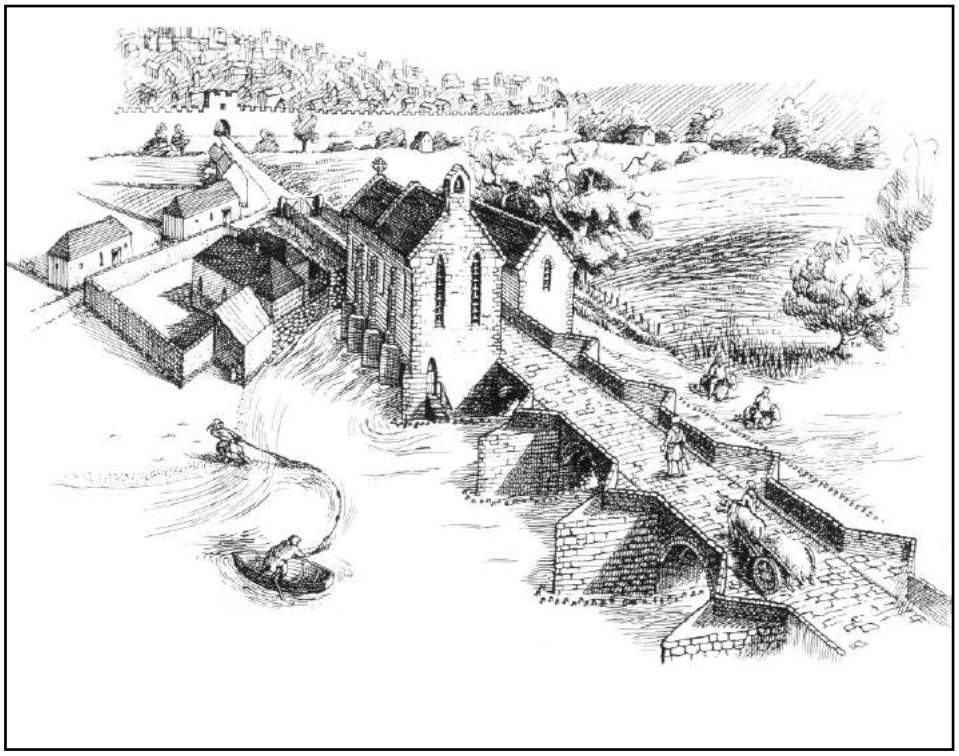
DEVON BUILDINGS GROUP

NEWSLETTER NUMBER 26



Autumn 2008

DEVON BUILDINGS GROUP

NEWSLETTER NUMBER 26, AUTUMN 2008

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Illustrations

Front cover: Exe Bridge, St Edmund's Church and Frog Street, drawn by *Eric Kadow* from a reconstruction by *Stewart Brown*
Medieval Arched Bridges in Devon: © *Stewart Brown*
Bridge Engineering - A Beginners' Guide: *Bill Harvey*
Exeter Bridges: *Bill Harvey*
Exeter Schools 1800-1939: © *Stuart Blaylock*

SECRETARY'S REPORT 2007-2008

This year began with our 22nd AGM at the St Paul's Church Parish Rooms, West Exe, Tiverton on 27th October 2007, at which Ann Adams, Lyn Auty, Jo Cox, Dawn Honeysett, Jenny Sanders, John Thorp, Robert Waterhouse were re-elected to the committee, and Caroline Garrett's co-option onto the committee was confirmed. Lyn Auty was elected Treasurer and Membership Secretary and Peter Child reappointed Secretary. After the business meeting Michael Laithwaite gave us an excellent talk on Tiverton's industrial housing, essentially all erected by Heathcoats [which moved to Tiverton in 1816] for their factory workers, in the North Country tradition, although sometimes they were let out to other workers. By 1860 the firm employed 20% of Tiverton's workers. The firm built housing over a long period from the 1840s to the 1960s, constructing much of the suburb of West Exe. Michael's study of their housing was towards a listing survey which evolved from the Estate Office's concern over unsuitable alterations to the houses once released from their control. Heathcoats was a progressive employer, building the first factory school in the West Country and providing relatively good working conditions. Not all the housing was intended for its workers; the rather grander St Paul's development was not for them but for leasing out. Heathcoat himself first lived in St Peter's Street overlooking the factory but in 1831 moved to Bolham outside the town and subsequently to Knightshayes. Michael described the various phases of estate developments in West Exe. The full gamut of terrace styles was used although with an overall theme of brick walls with sash windows. Cast iron sills, presumably made in the factory, are a common feature, while another characteristic was the use of rounded corners. After lunch we visited St Paul's Church by Manners and Gill of 1854-6, following which Michael guided us around West Exe, showing us the houses which he had described in his talk. We ended up at Loughborough, north of the factory where survive ten now much altered cottages which were purchased in 1816 for the newly arrived workers. This was a thoroughly enjoyable and informative tour and the Group owes its thanks to Michael for leading it and for his talk.

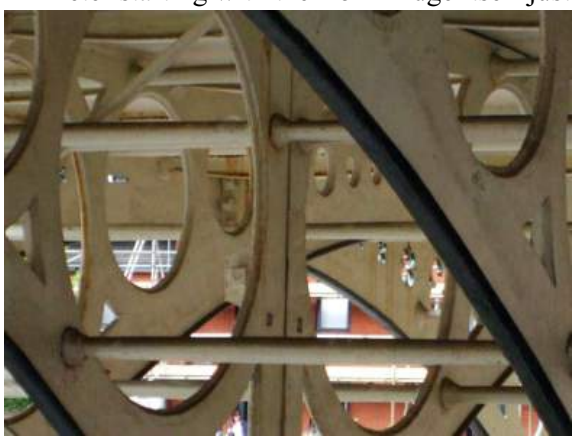
The summer meeting was held in Exeter at the City Gate public house; the theme was 'Devon Bridges'. This was initiated by Bill Harvey who is a member of both the DBG and the Institution of Structural Engineers. It was conceived as a joint meeting but in the event only one member of the IStructE came which was perhaps fortunate given the limited size of the room. After coffee and cakes Brian George, previously DCC's Chief Bridge Engineer talked to us about James Green's achievements in the county. Brian is an authority on James Green, having written a definitive book about him. He described his career from an assistant to the great John Rennie to becoming county bridge surveyor in 1808. In this post he was responsible for numerous projects in Devon, including building or widening some 80 bridges, improvements to turnpike roads, constructing canals and designing buildings. Despite this great opus, Green got into financial trouble and was declared bankrupt in 1837. He ceased to be the county surveyor in 1840 but continued working on major projects until his death in 1849. He left behind him in Devon an extraordinary heritage.

Bill Harvey followed Brian with a wonderfully illustrated demonstration on the mechanical properties of bridge construction. It would be impossible to summarise such a visual talk in writing but his object was to show, particularly by means of models, how bridges do their work in spanning voids. In his words: 'structural engineering is all about our need to put weight where it doesn't want to be' and 'bridges are about putting weight where there is nothing to hold it up'. He illustrated these principles by manipulating his models with great dexterity, showing how beams and arches try to achieve this objective. He described the various types of bridges and how they work. We were all riveted and our comprehension of the world of engineering greatly improved.

After Bill, Stewart Brown concluded the morning with a detailed overview of the medieval bridges of Devon. He started with a description of Exe Bridge, the oldest arched bridge in the county, built c1200. Its arches all seem to be of one period but alternate in being round and pointed -

is this simply a sign of their being from a period of architectural transition? Its arches are ribbed, an English constructional feature, and it sits on piled foundations. Ribbed arches are found in four other Devon bridges but none of these are reliably dated and more analysis is badly needed. He then examined the other medieval bridges in Devon including the much altered great bridges of Bideford and Barnstaple. Dating these structures is very difficult as documentary records are ambiguous and bridge builders tended to be very conservative ; for example the 17th or 18th century bridges over the Tamar are built in a medieval style.

These were three outstanding presentations and it is hoped to publish them in the Newsletter in due course. After a poor lunch at the City Gate, Bill took us on a guided tour of bridges in Exeter starting with the Iron Bridge itself just



outside the pub, then proceeding by way of Bartholomew Street with its view of Millers Bridge to old Exe Bridge where we puzzled over its alternating arch style at some length. We then moved to the Quay where we saw the Cricklepit Suspension Bridge and from there we walked to Trews Weir Bridge and finally back to the Quay and up to Cathedral Close to

see the cast iron bridge over its eastern entrance. This tour proved so exacting that no one had the energy to go on to Cowley Bridge as originally proposed, so James Green did not get his proper share! It was a great promenade nonetheless and Bill is to be doubly thanked for organising much of the day and for conducting us so informatively around the bridges of Exeter.

The committee has met six times during the last year. We were deeply sorry to lose Peter Roseveare who very sadly died early this year. He kept us in touch with the progress of the development of the new settlement at Sherford and its impact on historic buildings in the area right up to the end and he will be missed. We co-opted a new committee member, Peter Marlow, who has retired to Tiverton from being the National Trust's historic buildings officer for Northern Ireland. During the year we have made representations to Devon District Council's on various planning proposals and other matters relating to historic buildings. This included objecting to Mid Devon DC over proposed development behind Park Street in Crediton [our objection was overruled], and to Teignbridge DC about the reinstatement of 16th century panelling in Sandford Orleigh House, Newton Abbot from which it had been removed without consent - it now seems likely that it will go to the local museum. We also made representations to Black Torrington church over their proposal to cover over the fine cobbled path up to the South door. No response has been received and we believe the work is to go ahead. We are concerned that other cobbled church paths in Devon are similarly threatened and are considering whether we can issue some form of guidance on this matter. We have made no listing requests this year, but two from last year were at last determined by English Heritage, who rejected Okehampton Hospital [the old workhouse] for listing on the grounds that it had been too altered [it has since been demolished without any record being made as far as we know], but who accepted our proposed upgrading to 2* of old Tavistock Police Station and Guildhall. This last is our only success over several years in requesting English Heritage to endorse a listing request; upgrading is of course less contentious than listing new. We have commented upon three consultation documents

in the year: the Dartmoor National Park Management Plan, the Devon County Council Historic Environment Role and Action Plan, and the Government's Draft Heritage Protection Bill. If the last comes into force, we shall at the least have to learn a new terminology, as inter alia listed buildings will become 'registered heritage structures'.

Peter Child

Newsletter Editor's Report

Obituaries

Recently, DBG sadly lost two of its most faithful members: Harold Fox in August and Peter Roseveare early this year. Both were west country men and born in Exeter, whose professional lives, as historian and architect respectively, were centred on Devon.

Harold was one of our earliest members and, although living and working in Leicester - latterly as Professor of Landscape History at the University there - all his own researches and publications were on the patterns of settlement in Devon, and how and why they occurred and developed, and sometimes moved. He corresponded regularly with several of his fellow members of DBG and attended its events when he could. Harold was one of these, now rather rare historians, who always made his deductions from source material, and there must be many of us who learned a great deal from him and have reason to be grateful for his generous guidance. He especially enjoyed spending the day with us at the 2006 Dartmoor Conference, where the topic and venues were so close to his heart and were to be the subject of his long awaited masterwork, which will now, sadly, have to be published posthumously.

Peter came to DBG when he was near retirement, joining the committee almost immediately and soon becoming co-ordinator of our caseworkers in the days when we still had members with enough leisure to monitor planning applications. As a lecturer in Planning Law at Plymouth, he was able to give valuable interpretation of its developing intricacies, for the committee's guidance. He continued to try to keep endangered buildings in the Plymouth area photographically recorded and in the public eye - often supported by letters from DBG. Sadly, we were none of us often successful in saving them, although we believe that the Hoe Barn - the last remnant of a great medieval courtyard complex - is still reasonably secure. Peter was a quiet, courteous man, with a nice sense of humour, who was unfailingly helpful to me, during my years as Secretary and whose company I always enjoyed.

Both men are much missed by their friends in DBG and we extend our most sincere condolences to Harold's sister, Phoebe, and Peter's wife, Pat, and to their wider families.

Bridges

The principal topic of this year's Newsletter is that of the 2008 Conference - bridges. These structures, so essential to the movement of people and goods across rivers and wet places, have received far less attention from historians and archaeologists of standing structures than almost all other classes of buildings. DBG's Conference did something to rectify this omission - considering both the engineering principles of their construction and what we can see of our historic bridges still standing.

Historically, from the Middle Ages, bridges have featured largely in local finance. Donations towards their building and upkeep, in the years of piety, could constitute considerable benefit in the after-life, in the way of remission of sins. After the Reformation, churchwardens' accounts show that the civil Quarter Sessions authorised the Constables of Hundreds to levy charges upon their parishes and boroughs, towards bridge repair and maintenance. The bridges were named and, although normally single, in some years a great number were in urgent need of repair, reflecting a period of damaging storms and floods. These accounts are often the only documentary evidence for dating early bridges and the repairs made to them.

On a lighter note

I am offering a modest prize for the best caption to the picture, right, taken at this year's Summer Conference. Suggestions on a postcard, please, to reach me by Christmas.

Two great men

2008 saw the centenary of the death of John Evans (father of Arthur Evans of Knossos fame). He was primarily known as a pioneer in the field of pre-history, but was also a champion of the cause of the integrity of ancient buildings. As President of the Society of Antiquities, he campaigned tirelessly against the then widespread destruction of the medieval fabric of churches, in the name of 'restoration'. In this he was fiercely opposed by the bishops and other clergy who, to his great disappointment, prevailed in Parliament, so that the eventual Ancient Monuments Act of 1882 only provided protection for prehistoric monuments. It is a sobering thought that, if he had only been successful, we should not have had to bemoan the heavy-handed late 19th century 'improvements' to the majority of our parish churches.

This year also saw the centenary of the birth of our own William Hoskins, father of local and landscape history, whose ideas on the integrity of ancient churches was so similar to Evans'.

The world of archaeology is celebrating Sir John Evans with a volume of 14 essays on various aspects of his life and work (*Sir John Evans 1823-1908*, published by the Ashmolean Museum), and with a Centenary Project website.

More modestly, Devon County Council and the Devon Archaeological Society organised a little tribute evening to Professor Hoskins, in his favourite little unrestored church of St Mary, Honeychurch. The speakers were John Allan, Stuart Blaylock, Simon Timms and a daughter of the great man, who read passages from his work, by the light from a single lamp. It was a wonderfully atmospheric occasion. A wet evening dried up and, afterwards, the participants saw some of the interior of the adjacent demesne farm, and the exterior of another, important, Grade II* farmhouse and its yard of ancillary buildings.

We salute the memories of both these men as we, in our own times and circumstances, try to continue to promote the greater understanding and protection of our historic places and buildings.

Ann Adams

MEDIEVAL ARCHED BRIDGES IN DEVON

Introduction

This article is a review of present knowledge regarding medieval bridges in Devon. It is the opinion of the writer that bridges comprise a somewhat neglected area of study, and that much more basic archaeological recording of bridge structures is needed for further progress to be made, both in Devon and in many other parts of the country. There are some 30 stone bridges in Devon, possibly more, which are either largely medieval in date or contain one or more medieval arches. Few of these can be dated more closely than 'medieval' or 'possibly medieval', which in some cases may be all that we can ever say, although one would hope that future study will refine dating methods. Since most readers will have little familiarity with the subject, a short general historical background of bridges in England up to the 19th century is included as an appendix, compiled in large measure from research by Dr. Anita Travers.

Three surveys of Devon bridges have been compiled in the past. A very useful record is a series of measured plans and elevations made by T Whitaker in the mid 19th century when he was County Bridge Surveyor. These are preserved in bound volumes in the Devon Record Office. They are however small scale surveys intended to assist repair rather than to clarify the bridges' structural history. There are also written notes by James Green, who was appointed first County Bridge Surveyor in 1808. The second survey was completed in 1938 when Charles Henderson and Edmund Jervoise published *Old Devon Bridges* as part of a series of books on the ancient bridges of England commissioned by the *Society for the Protection of Ancient Buildings* (Henderson and Jervoise 1938). This series related standing bridge structures with surviving documentary evidence, and is the starting point for most subsequent studies of bridges across the country. The third is an article titled 'The Chronology of Devon Bridges' written by DLB Thomas and published in the *Transactions of the Devonshire Association* in 1992 (Thomas 1992). This makes further headway regarding the general development of Devon's bridges and contains a list of bridges with known or suggested dates of construction up to 1900. The most comprehensive recent overview of English medieval bridges is a book titled *The Bridges of Medieval England – Transport and Society 400-1800* by David Harrison, published in 2004 (Harrison 2004).

What is evident from the existing studies is that bridges are in the main difficult to date closely unless there is reliable supporting evidence from dates inscribed in the stonework, date tablets or documentary sources. Inscribed dates and date tablets occur only from after the medieval period, the earliest in Devon being at Spara Bridge over the River Teign which has a tablet recording its construction by the county in 1660. Documentary references to bridges are generally sparse and usually relate to repairs made at various dates rather than to construction, and there is often some doubt as to whether a bridge has been repaired in a minor way or substantially rebuilt. Some references relate long-standing traditions regarding the original builder of a bridge, which may not always be trustworthy.

Another way to date a bridge is by architectural style. This approach is however far less conclusive for bridges than it is in other areas of architectural study since bridges are essentially functional structures whose builders were permitted relatively few avenues for architectural expression and development by comparison with, say, houses and churches. Moreover, it is known that some bridges were modelled on existing bridges elsewhere, so that bridges of quite different dates can look alike. That being said, certain features of bridges are taken to denote a medieval date, including pointed arches, ribs, and double chamfered arch rings. However, pointed arches do occasionally occur at a later date, and ribbed arches continued to be built in the north of England into the post-medieval period. General developments over time include a gradual increase in arch spans in relation to the width of piers, such that early bridges in lowland areas normally have narrow arches only a little wider than the piers, whilst later ones have larger arches and proportionally narrower piers. In upland areas however, especially in the north, bridges with very large spans in proportion to

Fig. 1 The Medieval Exe Bridge, Exeter

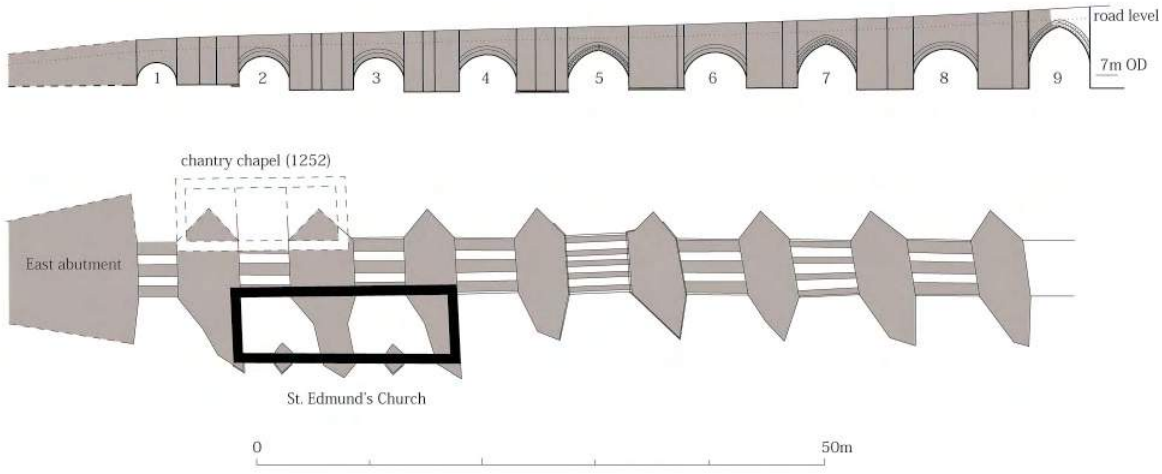


Fig. 2 Plan and elevation

their piers were built as early as the 14th century. Height above water level is another indicator of date. Early bridges usually have arches sprung from close to normal water level, whereas later ones tend to spring from higher up.

It can be seen from the above that although some general trends do exist, caution needs to be applied when attempting to date a bridge by style alone. Indeed, some other features of bridges may even be misleading. For instance, it might be expected that the standard of construction would improve over time, but this is not always the case. Many medieval bridges were faced with good ashlar and display nice architectural touches such as the double chamfered arch rings mentioned above, whereas a good number of bridges built in the early post-medieval period are plain rubble structures which were regarded as sufficient by their builders, often the county, whose primary concern was economy. There are regional variations across the country in the style and construction of bridges, but these have only recently begun to be recognized. There are local groups of bridges of similar style which evidently relate one to another, suggesting that these were built at about the same time, possibly by the same builders. Equally, however, one may have provided a model for the construction of the others at later dates.

The Old Exe Bridge at Exeter

Only one medieval bridge in Devon has been securely dated by archaeological means, the Old Exe Bridge at Exeter. This is the oldest standing arched bridge in Devon, dating from c1200. It is probably the best preserved long bridge of early medieval date in the country. One half of the bridge survives as a scheduled ancient monument, preserved within a small landscaped park (Fig. 1). The bridge was surveyed and recorded from 1975-79 (Fig. 2; Brown 1991). At the same time, excavations took place around some of its piers and on the nearby riverbank, where a sandbank grew up against its east abutment from c1200 - 1240, after which houses were built on the newly available land. The bridge is also the most chronicled in Devon. According to John Hooker, Exeter's first historian, the two men primarily responsible for the completion of the bridge were Nicholas Gervase and his son Walter. Nicholas was a prominent citizen of Exeter from the late 12th century until the late 1220s, and steward of the city's merchant guild. He is said to have taken charge of the building operations whilst Walter, who became Mayor from 1236 to 1238, travelled widely to collect money to pay for the construction works and the purchase of property to endow a trust for the future upkeep of the bridge. It is clear however that the two men were acting on behalf of the borough, and that the bridge was a borough undertaking.

The bridge originally contained 17 or 18 arches. The first 4 arches from the Exeter side are semicircular or round, and Norman in style. Thereafter the arches alternate between pointed and round. The round arches each have 3 broad rectangular ribs 1m wide supporting a rubble-built vault. The pointed arches have either four or five narrow chamfered ribs 0.5m wide. St. Edmund's church was built above the second and third arches as part of the bridge construction, so also dates from c1200. Another church, that of St Thomas Becket, stood on the river bank at the west end of the bridge by 1214. A chantry chapel was built opposite the church in 1252. Close study of the masonry facework and its coursing has shown that all the arches are original, and that the pointed arches are not the result of rebuilding following flood damage, as some writers have suggested, so the bridge is truly transitional in date, incorporating both Norman and Gothic style arches. The roadway was on average 4.2m wide, very wide for a medieval bridge, sufficient for two carts to pass. The road was paved with stone, and would have had parapets and triangular refuges for pedestrians above each of the cutwaters (illustration on front cover). Some of the arches show a decorative pattern of alternating dark and light coloured stone types.

The first round arch has a single arch-ring, the others two, the upper one being stepped out from the one below (Fig. 3). Their wide ribs, 1m across, have quoin stones with rubble infilling between. The construction of each rib would have required wooden formers or centring of the same width. Then, once the ribs were in place, planks could be set between them, across their backs, and the mortared rubble mass of the arch vault laid on this framework. The ribbed round arches of Exe

Fig. 3 Exe Bridge - a round arch, showing broad ribs and two arch rings.

Fig. 4 Exe Bridge - a pointed arch showing narrow ribs with decorative alternating stone types and three arch rings, the lower two being chamfered.

Bridge are similar to the banded barrel vaults of Norman church architecture, which allowed long vaults to be erected in stages, a useful technique for building bridges where construction work might necessarily be intermittent.

The pointed arches have three chamfered arch-rings, the lower two being chamfered (Fig. 4). The narrow ribs are made up of single stones with chamfered sides. The centring for these narrow ribs would have been lighter and easier to manoeuvre. The vaults are rubble-built like the round arches. The style of the pointed arches no doubt derives from the pointed ribbed stone vaults which were first used in church architecture in the 12th century.

Ribbed construction

Ribbed construction of bridges is a predominantly English feature. Some 140 ribbed bridges are known from England, the great majority being medieval in date, although some were built into the 18th century. One survives in Scotland. There are only two ribbed bridges surviving in France, both thought to have English influence, if not English builders. Other early medieval bridges at important crossings in England were ribbed, including London Bridge, begun c1176. Ribbed construction is common in some areas and rare in others. Some counties have very few, like Devon (4). Cornwall has only one (Yeolm Bridge), on the Devon border. Ribbed bridges are much more common in the North of England.

Foundations

The piers were founded on rafts of volcanic stone rubble and river gravel. The foundation rafts closest to the river bank simply raised up the river bed to the usual water level, and the piers were built up from there. Those further out were contained within pens of driven oak stakes or piles, the piles holding the foundations firmly in place. The rafts built in deep water were more substantial (Fig. 5). First, the existing river bed was dug away so that the stone rubble foundation could be made deeper. Then, the river bed was stabilized by driving large piles in a rectangular grid pattern – some can be seen upstream from pier 7. The piles almost certainly continue beneath the pier itself, providing a proper piled foundation. After that, two or three rows or pens of stakes were driven in the shape of the pier to be constructed, each pen containing a rubble raft, so that the foundation was gradually built up to the normal water level in tiers. In places, wattles were found woven between the stakes to better contain the rubble and gravel. The piers in the deepest channel of the river, to the west of the surviving arches, may have been more elaborate still. Thirty of the stakes and piles were removed for examination. These had all been pared to a point but none had been shod with iron, as is sometimes found elsewhere.

This kind of piled foundation was common for lowland bridges built on river or estuarine alluvium. In upland areas, streams and rivers usually have rocky beds, so bridges were built directly on bedrock or foundations made up of large boulders.

Weir

Just downstream from the bridge was a stake weir, rows of which can be seen in Figs. 5 and 6. A fish weir is said to have been built in this position by Sir Hugh de Courtney, who died in 1340, but it is certainly possible that at least parts of the weir are earlier and original, intended to regulate the flow of water passing beneath the bridge arches. Water passing beneath bridge arches speeds up, since the width of the waterway has been restricted. This causes scouring around the piers which can lead to undermining. By holding up the river just downstream from the bridge, the flow beneath the arches is slowed, and the scouring effect reduced.

Flood Defences

Another method of protecting the pier foundations from scouring, as well as battering by floating driftwood and ice, was to encase the piers within outer defences made up of stone rubble contained within further rows of wooden stakes, again with wattling and brushwood woven between them. At Exeter these were called ‘defeynes’. At London Bridge, similar features called ‘starlings’ were built of more substantial timber piles which are thought to have been set in place at the construction of the bridge. At Bideford Bridge in N Devon, stake and wattle ‘sterlings’ provided protection for the piers up until the mid 19th century.

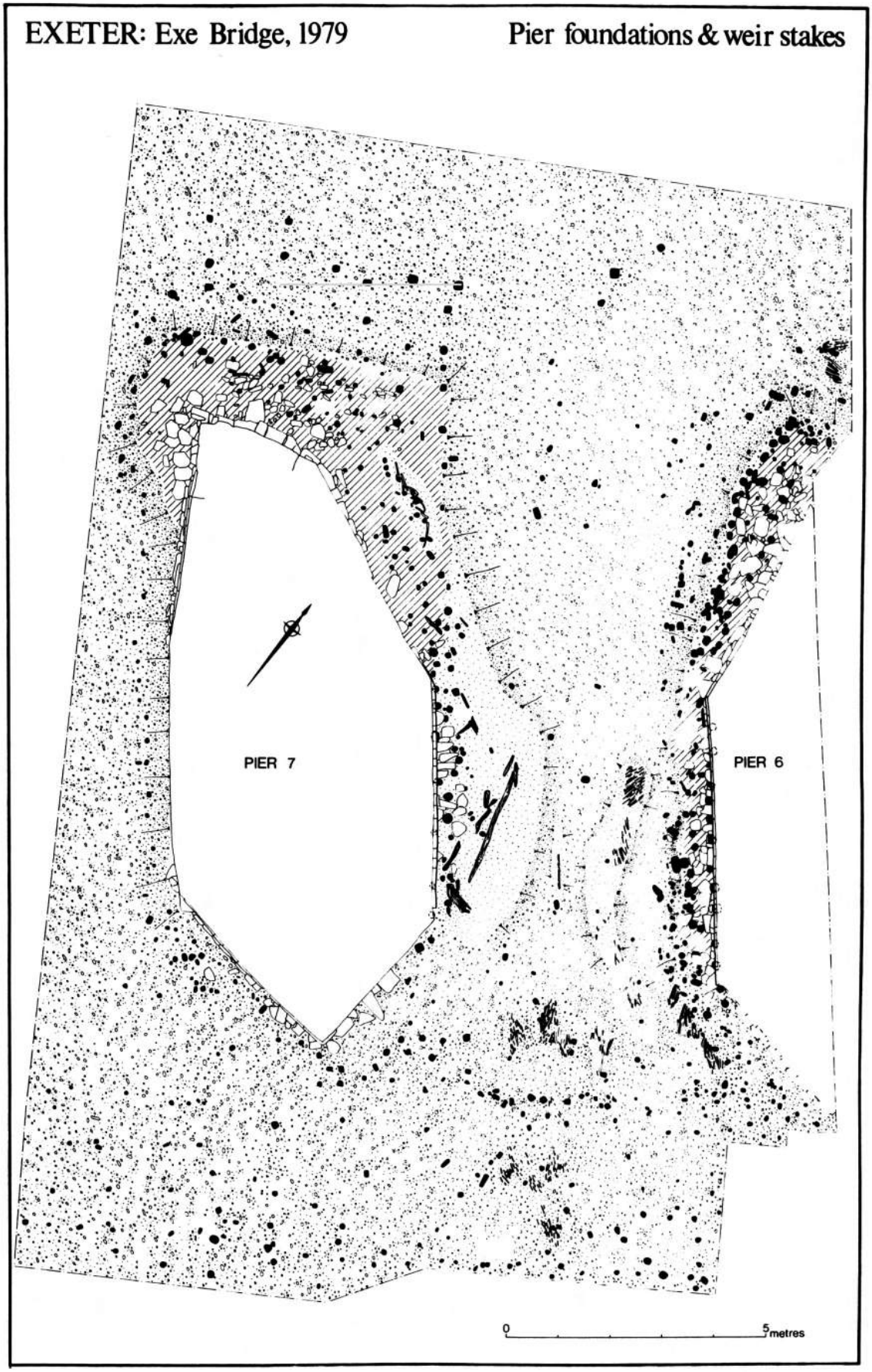


Fig. 5 Plan showing excavated pier foundations and stake weir downstream (stake rows at bottom).

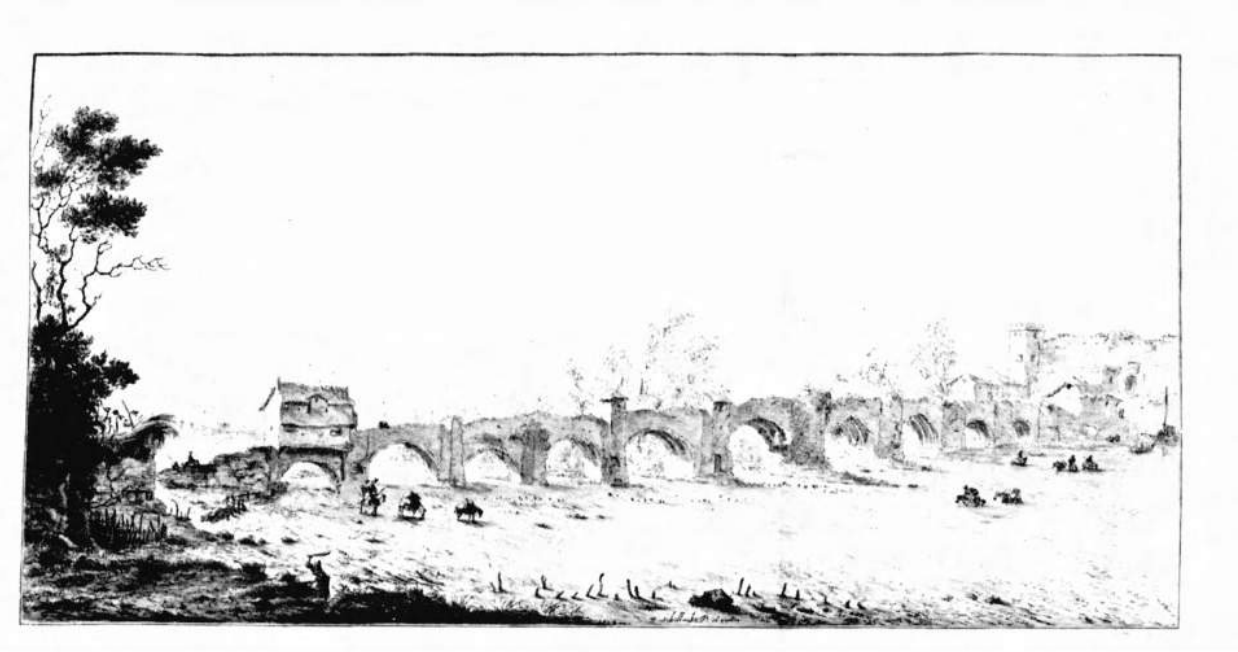


Fig. 6 Drawing by W. Schellinks 1662, showing stake weir below Exe Bridge and horsemen fording the river to avoid paying bridge toll.

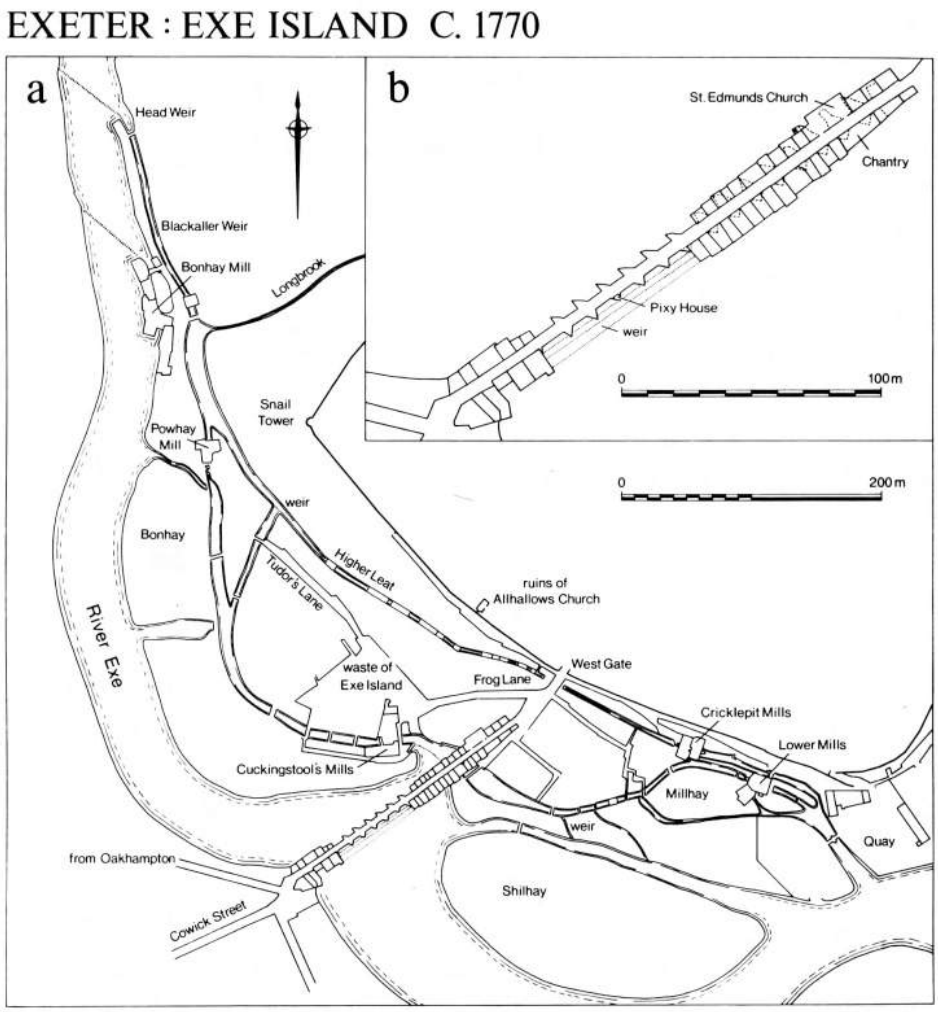


Fig. 7 Plan from the Chamber Map book showing Exe Island c. 1770 when Exe Bridge was still standing intact.

Repairs
The bridge and defences were in need of almost constant repair. The bridge piers themselves blocked at least 40% of the river waterway, and with the additional defences, this must have risen to 50% or more. The bridge therefore acted as a partial dam. At times of low water this was not a problem, but when winter floods came, the bridge was put under stress, and floating debris would batter the underside of its arches. There were many instances of damage caused to the bridge by floods. The western end of the bridge was most at risk, since here, the arches spanned the deepest and most swiftly flowing part of the river. Major repairs took place in 1286, 1351, and 1384, the last said to have been necessary after a disastrous flood carried away a number of the western arches which then had to be made up again in timber. Soon after, the wooden sections became dangerous and had to be replaced in stone by the borough at the large cost of £2000.

Chantry Chapel
The chantry chapel was built and endowed by Walter Gervase and consecrated in 1257, the year of his death. In 1546, however, the chantry was suppressed, and in 1553 it was sold as a private dwelling. The building was supported on stone walls built against the bridge masonry and stood until the 19th century.

The Bridge Trust and Wardens
A bridge trust was set up to manage and finance the maintenance of the bridge. Wardens of the bridge were appointed annually at the Mayor's Court. They administered the funds and property of the Trust and were responsible for the day-to-day maintenance of the bridge structure. The wardens kept detailed annual account rolls which survive with few omissions from the years 1343 to 1711, numbering 345 rolls in all. This is the second best series of Bridge Wardens Accounts surviving from the medieval period in England, after London Bridge.

The number of properties held by the Bridge Trust grew over the years by donations and bequests. Grants of land were made in 1247 and 1256, and in 1257 Walter Gervase bequeathed certain of his lands and properties including mills and a great weaving shed. By the end of the 14th century the estate managed a minimum of seventy properties in the city and its suburbs, including corn and fulling mills in Exe Island and fifteen shops on the bridge. Rents from these properties provided an income of about £16 a year, whilst the annual profit from Cricklepit mill was £20-£30. In the late 15th and early 16th century there were up to seven lime pits in St Mary Steps parish. In 1559/60, there were two dozen racks or tenters for drying cloth next to the water leading to the New Mills. The Trust even entered into agriculture; in 1389, Millhay field, lying between Cricklepit mill and the river, was ploughed, sown with beans, rolled, hoed, weeded and harvested.

Bridge Toll
Toll is recorded only for wagons crossing the bridge, and these would have been wagons from outside the city, since Exeter citizens were exempt. In 1345/6 the toll for one wagon crossing the bridge was 2d. The annual sums collected are generally low, for instance - 4d in 1344/5, and 5s in 1360/1. In some years the accounts fail to record any figure for bridge toll, so it was clearly not an important part of the bridge income, as is known to be the case at bridges elsewhere in the country.

Other features of the bridge (known from the warden's accounts)

Gate
A number of the 14th-century accounts record repairs to a gate or barrier (barre) at the Exeter end of the bridge. The gate must have been hung from masonry supports since two masons were hired for one day to install it. The gate was probably fairly small and may have been little more than a barrier to prevent the free passage of wagons. It had evidently been removed before the late 16th century since it is not shown on the map of the city printed by Hogenberg at that time.

The Bridge latrine
Warden's accounts for 1345 and 1425/6 record repairs to a 'latrine on the bridge'.

Pixey House
The historian Jenkins describes an open space

at the centre of the bridge 'where there was a doorway and a flight of steps that led down to a long vaulted room commonly called the Pixey or Fairy House'. This may possibly be the same feature as the latrine. The derivation of the name 'Pixey House' is uncertain; it may stem from Pyx, a money box, or Pixidis, revenue from tolls.

Hermit

Bridges elsewhere often had hermits living on or close to them who collected tolls from travellers, ostensibly for the upkeep of the bridge, which they undertook themselves, although some are said to have abused their position for the sake of an easy life. Possibly this was the case at Exe Bridge. In fact, it is recorded that in 1249, a troublesome female hermit had shut herself up 'upon Exebridge' and was obstructing the traffic.

Houses and Shops on the Bridge

Houses and shops were built on the bridge from at least the early 14th century. The earliest records mention two shops standing to the east of St Edmund's Church in 1319. There were two more shops to the west of the church by 1351. The one nearest the church, like the majority of buildings on the bridge, was built of timber framing above bridge level. A small stone pier that supported its back wall still stands against the corner of the church tower.

By the late 14th century there were nine shops clustered around the church and chantry chapel, including two described as newly constructed in 1365. Three more are known to have stood elsewhere on the bridge and a further three were situated at its west end, opposite St Thomas' church.

Moore's Almshouses

In 1519, three almshouses were erected to the east of the chantry chapel, replacing two earlier buildings that had stood there previously. The almshouses accommodated three poor men, and were not demolished until 1848.

Later bridges

By the mid 18th century, the increased volume of traffic using the bridge had become a problem. Plans to widen the bridge were rejected, and in 1769 the proceeds from the Bridge Trust estate were transferred to the Turnpike Trustees, who were empowered by an Act of Parliament to erect a new bridge and administer the funds for its upkeep. At this time a plan was made of the whole area prior to the rebuilding of the bridge. Fortunately it shows us the whole medieval bridge before its western half was demolished, together with the shops and houses on it, the Pixey House, and the weir (Fig. 7). The new bridge was completed in 1778. This was replaced by a single span steel structure in 1905, which in turn was replaced by the present twin bridges completed in 1969 and 1972.

Medieval Bridges around the County

By contrast with Exe Bridge, other medieval bridges in Devon are far less well documented, less fully recorded, and much more difficult to date closely. Since so few bridges are securely dated, there are problems in establishing how they developed over time. The following descriptions of selected individual bridges are intended to illustrate some of the variety which exists, as well as some of the problems in dating. Many of the descriptions refer to the article by Mr DLB Thomas (above), who brought to light some important documentary sources not considered earlier, and whose chronology currently comprises the best guide we have.

Clyst St. Mary Bridge

Clyst St. Mary Bridge is one of three other ribbed bridges surviving in Devon other than Exe Bridge. Two ribbed arches survive at the west end of a long causeway crossing the broad flood plain of the River Clyst. Two more medieval unribbed arches at the east end span a mill leat of medieval origin. The first written record of a bridge dates from 1238, but the earliest parts of the present structure probably date from soon after Bishop Bronescombe of Exeter purchased the Clyst estate in about 1265. Subsequent bishops were responsible for the bridge's upkeep. In 1310, improvements cost the large sum of £24 10s 8d. In the same year, Bishop Bitten set aside £300 for the construction of a chapel dedicated to St. Gabriel at the east end of the bridge. The chapel had a priest by 1311 and later became a hospital for infirm and retired clergymen.

Fig. 8 Clyst St. Mary Bridge, showing one of two low segmental arches with narrow chamfered ribs.

Fig. 9 Yeolm Bridge, showing one of two pointed arches with narrow chamfered ribs.

The two ribbed arches each have four narrow chamfered ribs and chamfered arch-rings similar to the pointed arches of Exe Bridge, but the shape of the arch is low rise segmental (Fig. 8). This form is thought to have first appeared in the late 13th or early 14th century, occurring throughout the medieval period, most frequently in the North of England. The ribbed arches probably belong to the later 13th century, whilst the two unribbed segmental arches at the east end may have been erected in 1310.

Other bridges in Devon known to have had medieval chapels associated with them are Exe Bridge, Barnstaple, Bideford, Colyton, Ottery St. Mary, Plym Bridge, Taddiport, Tiverton, and Totnes. None now survive, apart from the remains of St. Edmunds at Exeter.

Yeolm Bridge

Yeolm Bridge, over the River Attery, on the border between Devon and Cornwall, near Launceston, was probably built by the Abbots of Tavistock, who held the adjacent manor of Werrington in which they had a park. There are however no surviving records. Its two arches each have three chamfered ribs and two chamfered arch rings, similar to Clyst St. Mary Bridge, although the shape of the arches is pointed (Fig. 9). The arches bear a very close resemblance to the mid-late 13th century ribbed and pointed vault of North Gate at Launceston Castle, which could have provided a model. A date of c. 1350 has been suggested for it, and this would seem reasonable, although it could be even earlier.

Stoke Canon Bridge

Stoke Canon Bridge over the River Clyst is a causeway bridge like that at Clyst St. Mary, and contains three arches over the main river channel and three other, widely separated arches over branch streams, plus a seventh arch over a mill leat at the Exeter end. The bridge is first mentioned in a will of 1296. In 1326, Bishop Stapledon bequeathed £4 for its upkeep. Extensive repairs were carried out in 1609 and again in the 19th century, when the bridge was widened. The present bridge is almost certainly largely medieval in date. Its earliest surviving arch is not ribbed like Clyst St. Mary Bridge, but has a similar low segmental form (Fig. 10). The arches spring from close to normal water level. The springers are curved, an unusual feature. It has two arch rings, both chamfered. The building stone is volcanic trap ashlar. The arch certainly could date from the 14th century or even a little earlier. The arch was widened on its upstream side sometime in the medieval period, when an arch of similar form, but without the curved springers, was added. The main river channel is spanned by three arches of similar form and construction to the widening of the first arch. They are now partially hidden behind 19th century widening, but can be seen to have had chamfered arch rings indicating a medieval date (Fig. 11).

Bideford and Barnstaple Long Bridges

The late medieval long bridges at Bideford and Barnstaple are striking monuments which provide a good impression of medieval long bridges elsewhere in the country which once crossed wide estuaries but which have now been lost. Various dates of construction have been suggested for the present bridges, the most likely being around the mid 15th century, or possibly a little later, as argued by Mr Thomas.

Bideford Bridge across the River Torridge is first mentioned in 1326, when Bishop Stapledon left £2 for its repair. In 1459, the bridge was described as of wood and in a dangerous condition. Its twenty-four acutely-pointed arches are built of hard local stone in a very plain style with a single, unchamfered arch ring (Fig. 12). They vary in span, probably owing to the difficulty of finding suitable foundations on the estuarine river bed. The total length of the bridge is 225 yards. The bridge was widened with additional stone arches in about 1820, and footways were built out on corbels around 1920. There were formerly two chapels at its ends, probably erected before the bridge was rebuilt in stone since they were both in need of great repair in 1459.

Barnstaple Bridge shows many similarities, and it seems likely that the two are closely associated. Indeed, Bishop Lacy granted indulgences for the two bridges together in 1425 and again in 1437. Mr Thomas dates the present stone bridge to between 1437 and 1543, whilst earlier writers placed its construction soon after 1437. The

Fig. 10 Stoke Canon Bridge, showing the earliest low segmental arch which has no ribs.

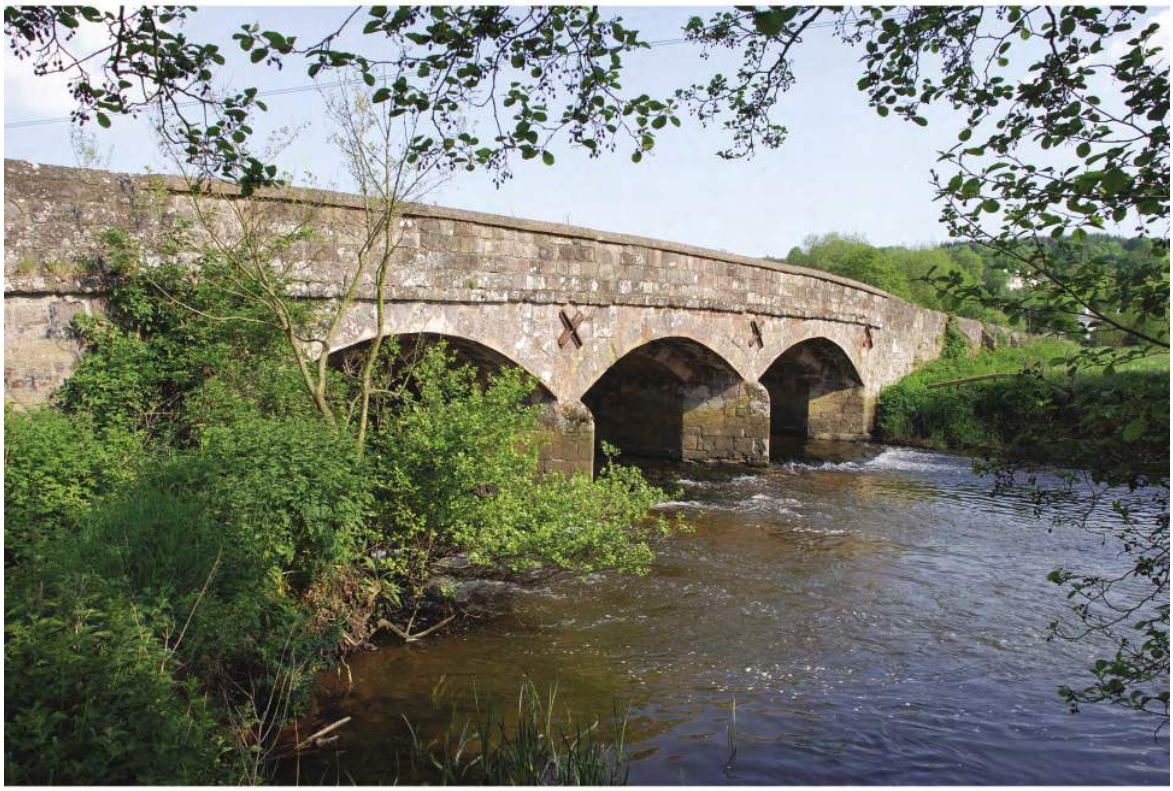


Fig. 11 Stoke Canon Bridge, showing the three river arches of later medieval date, partially hidden behind 19th-century widening.

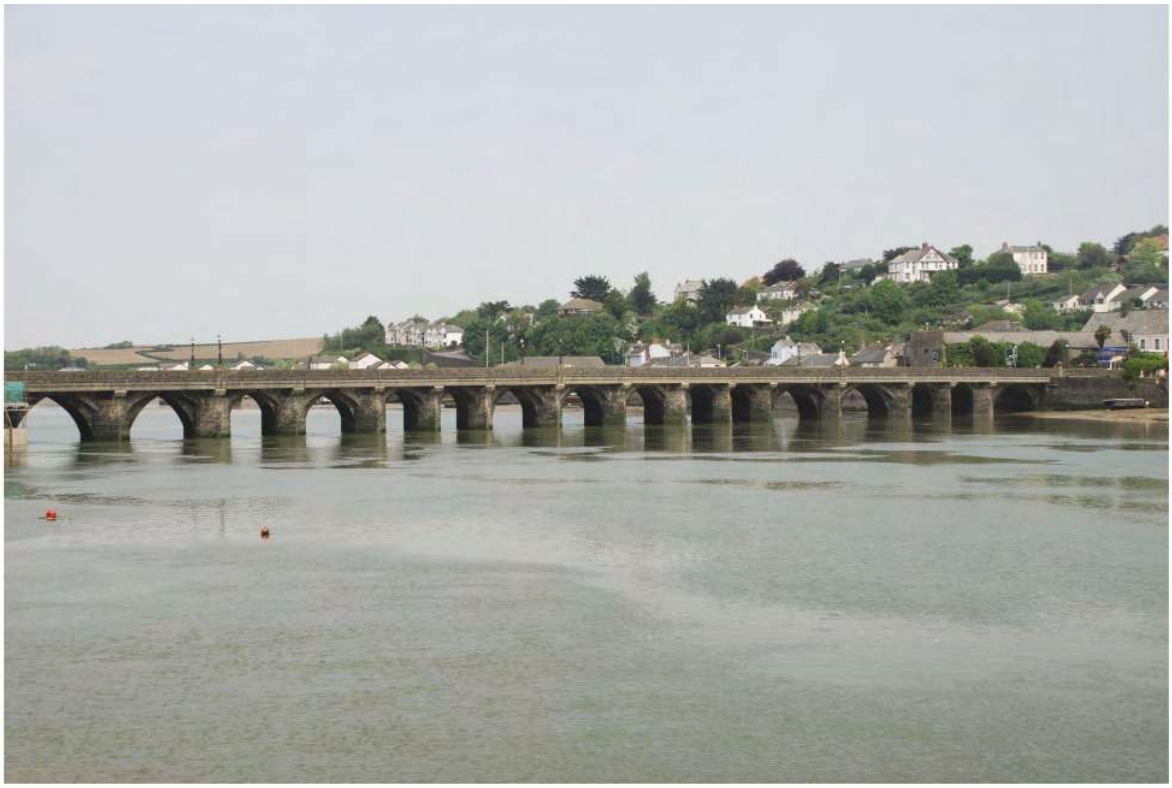


Fig. 12 Bideford Long Bridge, showing its twenty-four pointed arches which were widened in about 1820.

Fig. 13 Barnstaple Long Bridge, showing its sixteen pointed arches which were widened in the 18th and early 19th century.

bridge now contains 16 arches, most of which are acutely pointed (Fig. 13). One or more arches at the northern end are said to have been rebuilt in 1589. The arches vary in span like Bideford Bridge. The roadway has been considerably widened on its upstream side. There are records of widening dating from the 18th and early 19th centuries.

Horrabridge Bridge

Horrabridge Bridge, over the River Walkham, on the road between Plymouth and Tavistock, contains three acutely pointed arches (Fig. 14). These are so similar to Barnstaple Bridge that Mr Thomas suggests that the bridge must have been built at about the same time, describing it as a 15th century structure, although its arches have two unchamfered arch rings rather than just one. The Assize Roll of 1345 names the surrounding settlement as 'Horebrigge', indicating a bridge of some kind. In 1396, Bishop Stafford granted an indulgence for its upkeep. The bridge might well date from the 15th century, but it could be even earlier. The bridge lies on the boundary of three parishes, and has an old boundary stone built into its parapet, a fairly common feature found at a number of other bridges in Devon as well as elsewhere in the country. Some putlog holes for scaffolding used during its construction can still be seen around its arches.

Huckworthy Bridge

Huckworthy Bridge, which crosses the River Walkham upstream from Horrabridge, dates from the medieval period since it appears on a 16th century map of Dartmoor now in Exeter Museum. It contains two arches of different sizes and shapes, the larger arch possibly having replaced two earlier arches, as suggested by Jervoise in *Old Devon Bridges*, although this is not immediately obvious. The smaller arch is pointed, the other segmental or obtusely pointed (Fig. 15). Both arches have two arch rings, the lower of which appears to have been built in an alternating pattern of thick and thin stones, somewhat similar to the alternating dark and light decorative pattern in the pointed arches of Old Exe Bridge (above). The smaller arch retains three projecting corbels used to support timber centring for its construction.

Rothern Bridge

Rothern Bridge over the River Torridge is a stately bridge with four pointed arches which have been widened on both sides by building segmental arches from cutwater to cutwater (Fig. 16). The masonry of its piers is battered outward toward the bottom, an uncommon feature which lends the bridge a rather curious appearance. The bridge is thought to be medieval in date, and is first mentioned in a will of 1423.

Staverton Bridge

Staverton Bridge on the River Dart is one of the best preserved and most beautiful medieval bridges in Devon (Fig. 17). Its seven obtusely pointed arches were thought by Jervoise to date from 1413, when Bishop Stafford granted indulgences for its rebuilding. Mr Thomas, however, disagrees, and cites a document of Bishop Lacy's time, dating from 1436, in which the bridge is described as of wood. He goes on to describe the shape of the arches as nearly semicircular with little more than a hint of a point, and suggests that this shape may be transitional in the development from the truly pointed arches of medieval date, to semicircular ones which came back into fashion in the 16th century.

At the springing of its arches there are three large sockets which once held large horizontal beams on which the centring was erected. The bridge has not been widened, so retains its original narrow roadway and the usual triangular pedestrian refuges over the cutwaters. One of the refuges is however built up from the riverbank in rectangular form, a unique feature in Devon, possibly for a small structure rising above bridge height.

New Bridge, Gunnislake

At New Bridge, Gunnislake, over the Tamar, on the Devon/Cornwall border, the present bridge incorporates a ribbed arch which is clearly earlier than the other six (Fig. 18). The arch is now a land arch standing on the Devon side of the river. It is pointed and has five plain granite ribs springing from a granite impost. There was evidently no bridge here when William of Worcester visited Cornwall in 1478, but in 1539, Leland attributed its building to Sir Piers

Fig. 14 Horrabridge Bridge, showing pointed arches similar to Barnstaple Bridge.

Fig. 15 Huckworthy Bridge, showing one pointed arch and one segmental arch.

Fig. 16 Rothern Bridge, showing its four pointed arches which were widened in the post-medieval period.

Fig. 17 Staverton Bridge, showing four of its seven pointed arches.

Edgecumbe, of nearby Cotehele. Sir Piers was active from 1492 until his death in 1539, so this arch probably dates from the late 15th or early 16th century. Charles Henderson, in his book 'Old Cornish Bridges' dates the first appearance of granite in bridges away from the moors to the end of the 15th century, and bridges built largely of granite ashlar to the early 16th century or later. This is certainly the latest ribbed arch surviving in Devon. It is different from the other ribbed bridges in the county in that it has only a single, unchamfered arch ring, and the ribs spring from an impost. The rest of the arch is built of local stone rubble, rather than ashlar.

The six river arches are entirely different in character. They are built largely of coursed granite ashlar, with arches so slightly pointed as to appear round (Fig. 19). The arches are unribbed and much larger and higher than the land arch. They spring from imposts 13ft above normal water level. The arches have two arch rings, the uppermost oversailing the one below, and made up of long, narrow voussoirs. The uppermost arch ring is more decorative than structural. At road level, there is a projecting string course supporting a rubble-built parapet.

Charles Henderson, in his *Old Cornish Bridges*, doesn't mention the land arch and dates the ashlar granite bridge to the early 16th century, built by Sir Piers Edgcumbe. Mr Thomas on the other hand, in his 'Chronology of Devon Bridges' mentions a contract for rebuilding the bridge dated 1773, and concludes that this part of the bridge must be late 18th century in date, the land arch probably being a remnant from the 16th century bridge. David Harrison in his *Bridges of Medieval England* describes this bridge, plus three others over the Tamar, as 'magnificent medieval bridges', following Charles Henderson's view. The other three bridges all share similarities of style with the ashlar part of New Bridge, and form a distinct group of bridges across the lower Tamar, namely Horse Bridge, Greystone Bridge, and Higher New Bridge, which all have late medieval origins and were probably first built by the abbots of Tavistock, although they would appear to have been rebuilt since then.

Horse Bridge

Horse Bridge, a little further up the Tamar, is first mentioned in 1437 when the Bishop of Exeter granted indulgences of 40 days to those contributing towards its construction. As at New Bridge Gunnislake, there is a land arch which appears to be earlier than the river arches. Charles Henderson thought the land arch was a small flood arch belonging with the other arches, but Mr Thomas suggests it is an arch surviving from the 15th century bridge, whilst the present six river arches date from c1685, when there are records of damage caused by floods. The land arch is pointed and springs from an impost. It has three arch rings, the middle one projecting out from the one below (Fig. 20). The arch however is built of local slate stone ashlar, not granite. Above is a projecting string course supporting the parapet. Between the land arch and the river arches there is a change in construction which would tend to support Mr Thomas's contention that the bridge has been largely rebuilt.

The six river arches are built in a very similar manner to the early land arch, apart from their shape which is round rather than pointed (Fig. 21). The other details are identical. The builders clearly attempted to match the earlier bridge in almost every way. Mr Thomas argues that this is not uncommon in the Tavistock area, where many bridges built or reconstructed in the post-medieval period have medieval trappings borrowed from earlier bridge styles, a characteristic which can be misleading when trying to date them. Here, then, is an example of a late medieval arch providing a model for a much later, post-medieval rebuilding, which in turn may well have been contemporary with the very similar river arches at New Bridge Gunnislake, as well as at Greystone Bridge (below).

Horse Bridge has curious features on the upstream side of all its cutwater points. These are projecting corbels or brackets set some 6m above water level. Charles Henderson suggested that they may have been associated with a fish trap, but this would seem rather unlikely. Their purpose would be best regarded as uncertain for the present. One other bridge in Cornwall has similar brackets, but no more have been noted in Devon.

Fig. 18 New Bridge, Gunnislake, showing the ribbed land arch.

Fig. 19 New Bridge Gunnislake, showing the river arches dating from 1773.

Fig. 20 Horse Bridge, showing the pointed land arch.

Fig. 21 Horse Bridge, showing five of the six round river arches of probable post-medieval date.

Greystone Bridge

Greystone Bridge, higher up the Tamar, comprises five semi-circular arches very similar to the river arches at Horse Bridge, the only difference being that some of the stones in its three arch rings are granite (Fig. 22). Mr Thomas suggests that it was built at about the same time, in the late 17th century, replacing an earlier bridge known to have been erected c.1439, when indulgences for its construction were granted by the Bishop of Exeter. The bridge was indeed in need of repair in 1651 and again in 1679. This bridge is however described as medieval in David Harrison's recent book. Such differences of opinion serve to illustrate the difficulties in assessing the true number of surviving medieval bridges.

Greystone bridge, even if post-medieval in date, retains two features of interest. Firstly, it has imposts with empty sockets surviving just above them, showing where horizontal timbers were set for centring used during construction of the arches; and secondly, there are two impost courses to each side of the central arch (Fig. 23). None of the writers on Devon's bridges mention this latter feature. Possibly, the doubling up of imposts was associated with a more elaborate centring arrangement, or perhaps there is another explanation. On the Devon side of the bridge, there are two flood arches which are simpler in construction and have only single arch rings. These are however clearly contemporary with the river arches since the coursed masonry facework is continuous along the length of the bridge. This means that there is no remnant of an earlier bridge surviving here.

Higher New Bridge

Higher New Bridge, higher up the Tamar again, has the same form of triple arch rings and segmental arches. Leland visited the bridge in 1539, and states that it was built by the abbots of Tavistock, who owned estates thereabouts. He mentioned three stone arches and another smaller land arch, which is how the bridge survives today, a fact which has evidently persuaded all writers on Devon's bridges that this is indeed a medieval bridge, including Mr Thomas. This is somewhat perplexing since the bridge is built of granite ashlar, and is virtually identical to Greystone Bridge, as well as the river arches of Horse Bridge and New Bridge Gunnislake, which Mr Thomas argued were all rebuilt in the post-medieval period.

Charles Henderson mentions indulgences granted toward the bridge by Bishop Oldham in 1504, and is happy to accept this date for its construction. There are however, numerous signs of repair in many parts of the structure, and some of the arches are deformed, possibly having been rebuilt after partial collapse. The arches retain empty sockets for centring just as at Greystone Bridge.

The present writer would argue that the land arch is entirely different in character from the others, and represents a remnant from a medieval bridge which was largely rebuilt at a later date. It has just one arch ring and is built of local stone rubble with crude granite dressings (Fig. 24). Oddly, Mr Thomas doesn't refer to this arch at all. It would surely seem likely that here is a similar situation to Horse Bridge and New Bridge Gunnislake, where a single arch from a medieval bridge has survived post-medieval rebuilding of the river arches (Fig. 25).

The four bridges over the Tamar mentioned above certainly fall into a local group, but it would appear to be one of post-medieval date, rather than medieval. Three have a land arch surviving from their medieval predecessors, but these are quite different one from another. That at New Bridge, Gunnislake, is pointed and ribbed; that at Higher New Bridge is segmental and plain; and that at Horse Bridge has three arch rings, a feature which appears in the later rebuilding of all four.

Lydia Bridge

All the bridges mentioned so far were originally cart bridges, with roadways generally just wide enough for one cart to pass over at a time. There were even narrower medieval bridges for packhorses and pedestrians. Lydia Bridge, over the Avon near South Brent, was originally a narrow packhorse bridge, as can be seen from beneath its single arch (Fig. 26). The original roadway has since been widened to 3m.

Fig. 22 Greystone Bridge, showing four of its five semicircular arches.

Fig. 23 Greystone Bridge, showing the two imposts beneath the central arch.

Fig. 24 Higher New Bridge, showing the land arch.

Fig. 25 Higher New Bridge, showing the three river arches.

Fig. 26 Lydia Bridge, a narrow medieval packhorse bridge, late widened.

Fig. 27 St. Thomas' Bridge, Launceston, a medieval footbridge.

St. Thomas' Bridge, Launceston

Footbridges were even narrower. A bridge known as St. Thomas' Bridge, just across the border with Cornwall, over the shallow River Kensey near Launceston, is a delightful little structure. It is thought to have survived from medieval times, and is still much in use today (Fig. 27). According to Charles Henderson, it was built to provide access between the medieval monastery of St. Stephen and the township of Newport across the river, where many of the monastery's tenants lived.

Conclusion

Existing accounts of Devon's ancient bridges, very valuable as they are, have not made use of modern archaeological methods which should be able to identify different phases of construction more clearly than in the past. It would be very beneficial if a systematic approach were to be adopted for recording bridges across the county in order to build up a catalogue of architectural and structural features. This would at least establish the full range of evidence surviving in the structures themselves, and hopefully lead to a more detailed typology. In addition, it may be the case that not all documentary references to bridges have been brought to light. It would seem likely however that the dating of many bridges will always remain somewhat imprecise, and rely on a balance of probabilities linking documentary references of particular dates to standing structures containing masonry of different periods.

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APPENDIX

Bridges in England – historical background up to the 19th century

(drawn from research by Dr. Anita Travers and various published sources, principally Harrison 2004)

At most places where there was a bridge in 1750, there had been one in the 13th century, and in many cases, there had been a bridge by 1100. The creation of an extensive network of bridges on the new road system developed following the Roman period was an impressive achievement of medieval England.

Saxon and Norman Bridges (c670 to c1200)

In the Saxon period, Roman roads in England, together with their bridges, were mostly lost, and replaced by a new road network. The first bridges at many river crossings were built in the 500 years between 750 and 1250, in England as well as across the whole of Europe. Numerous Saxon charters record that the making and repair of bridges was one of three burdens (*trimoda necessitas*) laid upon all holders of land by the state. For major bridges, liability for their upkeep commonly rested on local administrative units, the counties, hundreds, hides, and vills, who could demand labour-service and building materials from a number of landholders round about, upon penalty of a large fine if disregarded (later, bridge duty was often commuted into a money payment).

A number of bridges are mentioned in Domesday, most often because they needed repair. Norman landowners employed their vassals to build bridges, usually at places that gave convenient approaches to their estates. Major new bridges were funded by charitable donations. Bridge building or donations to bridges remained one of the most important 'good works' undertaken by dutiful Christians throughout the medieval period.

Most Saxon and Norman bridges were built of timber. Excavations have uncovered two different types. Timber girder bridges were built with upright posts supporting a roadway comprising horizontal beams or planks set closely together.

The uprights were either driven piles, or formed parts of trestles with sole plates set in the river bed. The other type of timber bridge was built of piers comprising diamond-shaped wooden boxes, or caissons, filled with rubble. There were also long piled causeways across wide valley bottoms, fens, and estuaries, raised above the normal water level with earth or brushwood, or supporting a plank roadway. Some causeways were simply long mounds with flattened tops built of earth, gravel, or other ballast, forming an embanked roadway. The ballast was often dug from ditches to one or both sides. One such causeway, the Holland causeway on the road from Nottingham to Boston, was nearly four miles long and incorporated thirty timber bridges each 10ft wide and 8ft high.

Bridges with stone piers and timber roadways are recorded from the 13th century and later medieval period, but probably existed much earlier. At a few such bridges, the original timber roadway was later replaced by stone arches. One of the first major stone-vaulted bridges to be built in England was Grandpont (Folly Bridge) in Oxford, which was a long causeway interspersed with stone arches. By the late 12th century, major stone-arched bridges were being built in many parts of the country.

Later Medieval Bridges (c1200 to c1540)

In medieval times, investment in the road system was concentrated on bridges, and large sums were spent on them. Bridges were often built only five miles apart. The quality of road transport was better than has often been assumed, and the volume of cart haulage far greater.

There are more than 200 vaulted stone bridges surviving in England which contain at least some medieval stonework. A good number of these were probably in existence by c1300, as was the case across Western Europe. By the 16th century, existing major bridges of timber had been replaced by bridges with stone arches. Some late medieval bridges in the north of the country had arch spans greater than in any contemporary church.

Earlier obligations to repair large bridges fell into disuse, and exemptions from bridge work were widely granted. Instead, other means were found. Bridge gilds were formed to raise funds for their construction and repair. Town officials, usually bailiffs, sometimes undertook the responsibility, collecting money from tolls, and rents from donated property, which they then managed. The town thereafter would commonly appoint bridge wardens to oversee the bridge estate and repairs to the bridge. Sometimes, the bridge estate would be managed by a formal trust, or less formal group of trustees. In the early 13th century, the crown granted the right of *pontage* to some major bridges, allowing tolls to be collected for bridge works, although this seldom provided as much as bridge-work liabilities or donations.

The upkeep of bridges became regarded as a religious duty, and indulgences were granted by diocesan bishops to the faithful who subscribed. Chapels were built on, and near bridges, usually for priests to say mass for the bridge's benefactors. By the 16th century there were more than ten bridge chapels in Devon, and over a hundred in the country as a whole. Bridges and churches could be commissioned by the same clients, and designed and built by the same masons. In the early 12th century, Bishop Flambard ordered the building of Framwellgate Bridge in Durham, at the same time that he was building the vaulted nave of his cathedral. In the late 14th century, master mason Henry of Yevele worked at both Canterbury Cathedral and Rochester Bridge. He also designed the nave of Westminster Abbey, and was warden at London Bridge, where he built a new chapel on the bridge. He also contracted with Westminster Abbey to construct Moulsham Bridge in Chelmsford.

Sometimes, endowments of money or land made to bridges were placed in the hands of monastic houses and hospitals, although by the 14th century, many had failed to keep up their duty, and further donations to them dried up. The church was also a feudal landlord, and built numerous bridges on and leading to their estates.

Although English law did not oblige the construction of a bridge, it obliged maintenance once the bridge was there. Failure to maintain a

public bridge was a public nuisance presentable at a court leet. More than that, it was a misdemeanor, and a Grand Jury might insist on someone's guilt at Assizes or Quarter Sessions if an ancient responsibility could be shown. But these were exceptions. The general rule of the Common Law was that, in default of any special liability, the County was responsible for the maintenance of public bridges situated within its area.

'In 1285 the Statute of Westminster established that it was the responsibility of the manor to maintain the king's highway outside the towns, but it was not until 1530 that a county rate was permitted to finance the repair of those bridges for which there was no acknowledged responsibility.' In the late 15th century, William of Worcester visited and described many bridges around the country. Many bridges were visited and described by John Leland between 1533 and 1543.

In 1530, King Henry VIII introduced a Statute of Bridges. This was a fairly short Act, well constructed and drafted, which laid down a basis of bridge administration that remained virtually unchanged until 1888 when the county councils were formed. The object of the Act was to ensure that "decayed bridges" should not, merely because of lack of local knowledge as to who should maintain them, "lie long without amendment to the great annoyance of the King's subjects". Bridges were to be maintained by the counties, which meant the magistrates in Quarter Sessions, unless it could be proved that some other body or individual had always been responsible for doing so. In practice, it meant that a county maintained all the bridges in its geographical area except private bridges, bridges in boroughs and small footbridges. Authority was granted to levy a rate, and appoint two collectors and two surveyors. If no other body could be proved responsible, other than a corporate town, then liability for maintenance of bridges, and 300 feet of highway each end, should fall on the county. Some counties were slower than others to take bridges into their care (Devon did not appoint surveyors until 1703), so in these areas, the majority of bridges were still maintained by the medieval system of private funding.

Mid sixteenth century to late 18th century

From 1555 to 1835 the parish was responsible to quarter sessions for the upkeep of roads. Information about bridges and roads can be found in assize records at the Public Record Office. There are 46 volumes of Devon quarter sessions order books 1592-1970.

Across England as a whole, fewer new bridges were built between the early 16th and late 18th centuries than in medieval times. In 1675, John Ogilby published the first detailed maps of principal roads, marking and giving brief descriptions of many bridges.

c1760 to the 19th century

In the late 18th and early 19th century, many bridges, especially major bridges, were widened or reconstructed. At the same time, there was a shift to new ways of funding bridges. Often, an Act of Parliament authorized a group of Trustees to undertake work on a particular bridge. The Acts commonly allowed trustees to take tolls for a limited period to cover the initial costs. Small bridges were sometimes funded by local worthies, Turnpike Trusts or Navigation companies. In 1808, turnpike trustees looked after about ten per cent of road mileage in the county.

Throughout the 19th century, the county's role in the upkeep of bridges continued to increase. The Bridges Act 1803 made it lawful for magistrates to appoint a surveyor of bridges. After consultation with the magistrates in Shropshire, Devon appointed James Green in 1808, when the county was responsible for over 230 bridges. The title 'County Bridge Surveyor' soon became just 'County Surveyor', a position held by his successors until 1888 when county councils were formed and turnpikes discontinued.

Stewart Brown

BRIDGE ENGINEERING - A BEGINNERS' GUIDE

Structural Engineering

Structural engineering is all about our need to put weight where it doesn't want to be. We hold a weight in the air by putting something underneath it. The chair you are sitting on is a prime example and the simplest chair (a piece of rock, a tree stump) just works. It provides what we call a DIRECT LOAD PATH. As soon as you decide you want something lighter or prettier you get into structural engineering.

First, though, a bit of Newton. Weight pushes down. To hold a person up, something must push back, otherwise we would just accelerate downwards. If we push a cup across a table it accelerates and if we stop pushing, or if someone pushes back on the other side, it stops. ENGINEERING STATICS is about holding things still by ensuring that forces always balance. That can be quite complicated, not least because things can move by turning as well as sliding. A very simple, light weight chair can be made by putting a seat on a pole, a shooting stick. Here we start to learn about STABILITY. A shooting stick will not stand up on its own unless very carefully balanced. The load path is still direct, straight to the ground, but we need to provide very small stabilising forces with our feet. From a shooting stick we can also learn some interesting things about strength. There is much more of a limit on how much weight can be put on a shooting stick than on a rock or a tree stump. A garden cane is strong enough to make a shooting stick, but only a very short one. A 1m cane will not break but it will not stay straight. This tendency to BUCKLE is one of the major problems of structural engineering and we will come back to it shortly.

If we tie a piece of rope to the branch of a tree and tie a stick to the bottom of it we can also make a seat. It has many advantages over a shooting stick, but most of all it is a swing, a thing to play with. Another important concept, Engineering is about increasing the value of simple things. A smile on a child's face is a great return for a few minutes engineering work.

But the swing has some more very important lessons for us. The rope seems to do the same job as the pole of the shooting stick but it looks much simpler. No need for added stability and no need for STIFFNESS. A very thin piece of rope will make a swing, but we have seen that a shooting stick pole has to be fat to work. Strong materials are much more efficient in TENSION than in COMPRESSION. The most important thing here, though, is that the load path is indirect. The weight of the child is carried up to the tree directly, but then the tree has to do some work. A small tree won't do. To think about why we need to build another toy. A Seesaw is a complex thing but for now we are most interested in having a person sitting on the end of a plank. Without someone on the other end it doesn't work.

A see saw is a rather unstable way of letting two people sit on the same log (a bit like a shooting stick for two, but the balance issue here is two dimensional). The load path, though, is indirect. They are not sitting ON the log but some way away from it and the force is transferred by a MOMENT. Moment is measured by how big the force and how far away it is from the support. A longer plank means a bigger moment. The plank

has to be thicker if it is still to work.
A moment is caused when two forces act but they don't meet. That sounds simple, but I am not talking about the two people on the seesaw but of one person and the upward force from the log in the middle. So long as the plank is strong enough, what is on the other end doesn't really matter. It could be a big weight near the log or a much smaller one further away (if you have two children of different weight you can make a very satisfactory seesaw by just positioning them carefully so they balance). Children learn this for themselves very quickly. If one end of the seesaw is in the air because someone is sitting on the other end, they will climb on in the middle where they can reach and slowly shuffle along until they reach a balance. The seesaw can be tipped by pushing off the ground with your feet or by rocking backwards and forwards, moving your weight towards the support and away, slightly reducing or increasing the moment.

Bigger children need bigger planks. Longer planks need to be thicker too. Are two, 40mm planks as good as one 80mm one? Can we do anything useful with one long and one short plank? Back to our swing for a moment. The branch is like half a seesaw, but where is the other half? Well, a tree will rock in the wind, but it has been designed by nature to resist and a small person on a swing creates much less moment than the wind on the leaves of a tree. The branch and the tree trunk are both forms of CANTILEVER and we will hear more about them shortly too.

If your child wants a swing and there is no handy tree, it is most unlikely that you will try to build a cantilever or replica tree. The most common thing would be to build a goal post or doorway frame (in engineering they are called portals). Now the piece at the top is supported at both ends and does not need to be very strong. It is an upside down seesaw. The weight is split two ways (and therefore halved). The top piece has become a BEAM.

In fact there would be something to be said for attaching the ropes at the top of the uprights and having a light weight timber between the uprights (why?) In public playgrounds and on bought swings, instead of two strong uprights there are often four much weaker inclined ones. Indeed, playground swings often have three poles at each end, arranged as a tripod.

Buckling

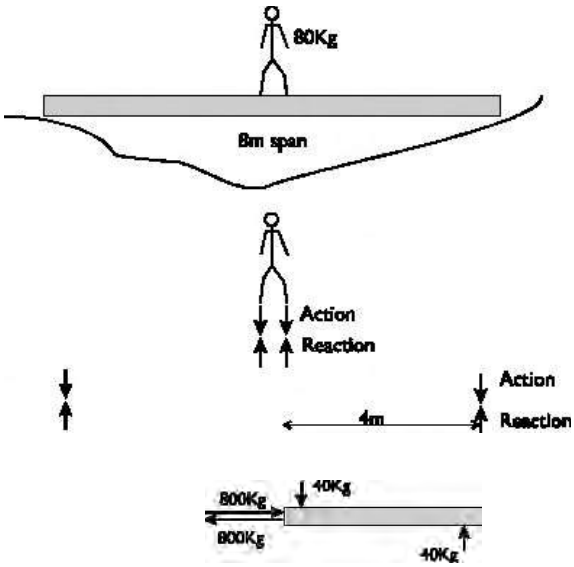
Buckling is when we put something in compression and it tries to get out of the way. Tensile members can't do that. We have looked at buckling of struts but buckling happens at many different levels and in many different ways. An empty drinks can with a board can be used as a seat but with even the smallest encouragement, the sides will buckle and the can will concertina. Engineers have to watch out for buckling in many cases and make sure, in their design, that it will not create problems

Bridges

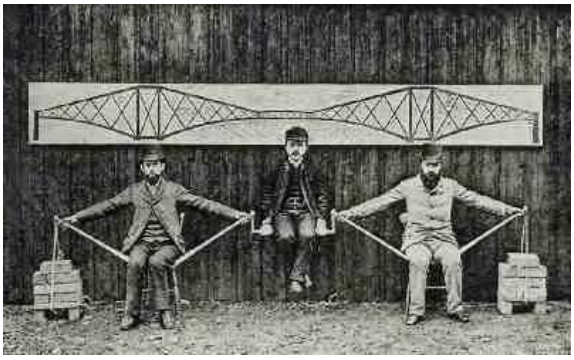
What has all this to do with bridges? Well just about everything as we will see. Bridges are about putting weight where there is nothing to hold it up. There is some argument about the oldest form of bridge, a fallen tree or a looped vine, but the difference is immediately obvious. The tree trunk must be thick but a vine is only thin. What is the trick? There is still a weight in the wrong place so there is still a moment.

In a log bridge, the moment is entirely locked in. The fibres at the top of the trunk push and those

at the bottom pull. The compression and tension as engineers prefer to call them can be very big.



Actually in a bridge the load is supported by two external moments. Part of the load goes to each end so a man weighing 80kg standing in the middle of the bridge shown with say 8m span puts half his load to each end and creates a moment at the centre of 40x4, 160kgm. That whole moment must be taken by the compression and tension in the wood and the log is about 0.4m diameter, so the forces are about 0.2m apart and the forces must then be 160/0.2, 800kg. A rope bridge of the same span might sag by 1m. The tension in the rope would then be only twice the weight of the man, 160Kg. Of course, that only works if there is something else for the rope to pull against. In the picture it is the surrounding rocks, but in a sense, the trick of a rope bridge is that it only has to provide half the structure. The compressive part is provided by the earth and is free. Good engineering then!



Here is a picture of the Forth Rail Bridge (which, incidentally, shows a Japanese engineer sitting in the centre. He had come half way round the world in the 1880s to learn from the construction of this great bridge). The tension and compression parts are very evident (wood in compression, arms in tension. At the time (and for 40 years afterwards) this was the biggest bridge in the world. Baker saw that the biggest problem for a big bridge is holding itself up. A beam becomes quite unsuitable because the strength of a beam has to be at the centre and that means lots of weight at the centre. A cantilever such as the Forth Bridge generates the supporting moment at the support where carrying extra weight is not much of a problem.

But this bridge is also a TRUSS. It isn't a solid piece but has big MEMBERS where the compression and tension are and relatively small ones holding those big ones in position. Solid webs of sheet steel only make sense up to about 100m span. Beyond that it is cheaper to make up the web from smaller pieces working in compression and tension and so save a lot of weight. Cable stayed bridges are the modern form of the Forth Bridge cantilevers. The second Severn crossing is a good example. The little bridge at the end of South Street is not. A cable stayed bridge has a deck with some biggish beams but not big enough to span the whole way. There is then a mast or tower and a set of balanced cables which hold up the deck at various places in the span. The calculations for such bridges are fiendishly difficult and they only really became possible with computers so they are a distinctly post 1945 phenomenon. Both the deck and tower do a lot of work in compression and must be designed to resist buckling.

Better Beams

A log forms a natural beam but it is heavy. A lot of wood can be trimmed away without reducing the strength much. Squared logs are much easier to fasten things to so that is a change that happened quickly. There are real advantages in keeping a log whole, though. Wood is not very good at compression and trees grow with the outer shell slightly stretched as it grows from the centre. This makes it much better able to resist bending and ship builders soon learnt that it was better to use a whole tree of the right size than to trim one to suit as a mast.

Tall thin beams seem like a good idea but when you try that, they have a tendency to tip over in the middle. This is one reason why most bridges have the beams underneath. The deck acts as a beam sideways and stops the top of the beam bending sideways. Steel beams can conveniently be made with a tin waist (web) and wide wide top and bottom (flanges). The wide flanges have a built in resistance to bending sideways which is good and the thin webs keeps the weight of material down.

Arches

For many centuries, the words arch and bridge were effectively synonymous. Until 1675 there was no real understanding of how arches work. Everything was built by rule of thumb. When rebuilding London, Christopher Wren and Robert Hooke needed to be able to design abutments for arches and so need to know the thrust. Hooke worked out that an arch was actually just the reverse of a hanging chain. In 1846, William Barlow (later the designer of the St Pancras train shed) showed that it was impossible to know the actual thrust in an arch, but that it was possible to know limits between which it must lie. A replica of one of his models is shown here, with one like Hooke's idea to compare.

Skew Arches

Skew arches (ones where the abutments are offset sideways) used to be called Oblique arches and are by no means new. The mediaeval exe bridge is slightly skew. Our understanding of skew arch bridges is still developing but engineers have designed them at least since the advent of the canal era. Much can be learnt from a close study of existing bridges and there are some very interesting ones around Exeter. In the mid 19th century, engineers formed the opinion that thrust in a skew arch would flow on the skew line and that beds in the stone or brick should be at right angles to the thrust. If you try to do that you get some very complicated shapes and William Froude, the Devon engineer who was an assistant to Brunel, built bridges in this way. The bridge over the railway at Cowley Bridge is built in this way. The complex bedding can be seen from the footpath above, or even better from the gateway into the railway lands to the west of the bridge.

Building Arches

To build an arch you first need a frame to support the masonry until it is complete. There are many ways of doing that and engineers, from the earliest times, have strived to use materials as cheaply as possible. That often means with the minimum number of cuts. Timber trusses were not nearly as common as might be expected. Arches were used made from straight timbers butted into specially made wedge pieces. Cutting the stones correctly was particularly difficult if the shape was complex. Parabolas are often stated to be the best shape but MOST arches are circular curves or sometimes multiple parts of circles. Brunel could use a true ellipse for the Maidenhead arch because he didn't have to work out the circumference to decide how to cut the stones. He knew that he could start the bricklayers from each end and get them to work to a fit in the central flat section. Calculating equal stone widths round an ellipse, and setting out the radial joints would be far more difficult that anyone would wish. Using three centred curves can produce much more sensible shapes and setting out the joints is easy. For example, an arch of 1:4 span to rise ratio might have the central radius equal to the span and in that case, the side radii need to be 3/16 of the span. The lengths of the various arks can then be computed and a rational number of Voussoirs decided on. The little bridge on the mill leat beside the custom house has two, three centred spans.

Bill Harvey

EXETER BRIDGES

There are many more bridges around Exeter than you might think and very many of them have features which make them worthy of study. We will take in many old and newer bridges in the course of a gentle walk through the city, but there are others which are worthy of comment and I will add notes about them even if we don't get to see them.

Iron Bridge

The iron bridge was built in 1835/6 to remove the steep drop into the Longbrook Valley on North Street. Some consideration had been given to a causeway created by a pair of retaining walls filled with rubble as was done above the Bull Meadow on Magdalen Street. The ironwork was cast at Blaina Ironworks and delivered by sea from Newport to the Exeter Basin. Each arch rib is cast in two halves and there are six ribs in each of six spans. A rough calculation says these are 5 tonne pieces so over 200tonnes of iron in the arches alone.

The original Iron Bridge of 1779 was cast in single sided moulds so there was only pattern on one side. Here the moulds are double sided so technology must have developed considerably in the intervening period The columns, of course, are double sided and hollow. They were cast horizontally with a mould in two halves and a core. The cores tended to float in the molten iron and were therefore usually much closer to one side than the other producing very eccentric columns which look perfectly symmetrical. It is worth noting the nuts and bolts and other connections, none of them mass produced as they would be now. The deck is made with "Buckle Plates", iron plates pressed into a slight dish shape so they work as arches but with some form of concrete placed on top.

Millers Crossing

Not a piece of history but an interesting design. Cables tend to be rather elastic compared to their

strength and if they are inclined too close to the horizontal they don't provide much support. A single mast on the side of the river would require very shallow or very long cables.by using two masts the alignment can be much improved. It is strange that this idea, normal in cranes in the 1960s should take so long to reach bridges but I know of two similar ones built about the same time.

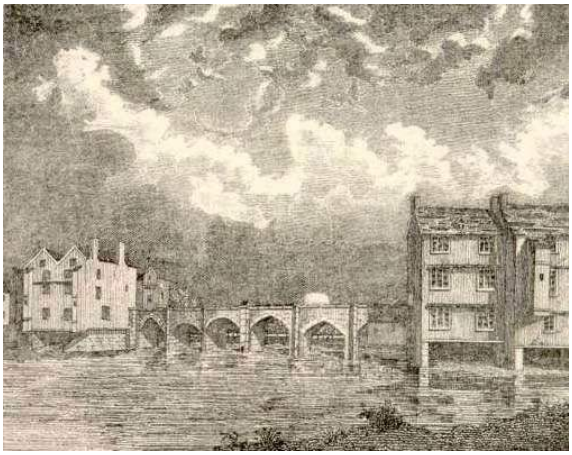
Flower pot field

This is a typical Brunel (or perhaps Froude) bridge with shallow arches and slender piers and was originally presumably a watercourse. Once access was required, one span was replaced with a beam and the balancing thrust was lost from the pier so the remaining arches were under ringed with brick. Note that the brick is laid in parallel courses not spirals which would have been almost impossible in this overhead working.

Exe Bridges

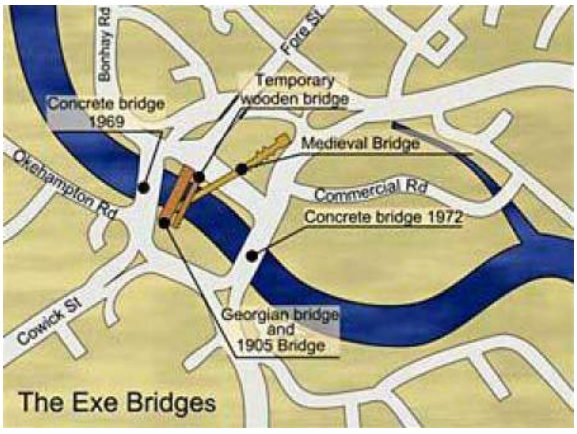
Of course, the mediaeval Exe Bridge is the most interesting, but what about the remains of its replacements.

It seems unlikely that the original bridge had such different arches. Damage due to flood



would result in continuous replacement. The bridge piers are surrounded by large "starlings". In the old London bridge it was obvious that these grew over the years as the original piers were eroded. Each extension reduced the space for the river and increased the speed of flow so that at peak tide there was a step of 12 ft in the water flow from upstream to downstream.

The first replacement was a three span arch bridge built in 1778. That involved major re-direction of the road system as is visible in this early 70s aerial photo. From the ground, it isn't so obvious that the old bridge runs into Cowick street so directly.



The Georgian bridge must have restricted the flow of the river almost as much as the original

The one remaining span of the Georgian bridge shows a distinct lack of concern over skew.

A very similar parapet to this appears in Fore Street where it crosses the mill leat. That crossing must be of a similar age to the new bridge. Is new bridge street between retaining walls or is it a hidden viaduct?

The flood pressures would be eased considerably by the 1905 single span bridge. It is an interesting form called a three hinged arch as can be seen in the photo below.

St Thomas Viaduct

There is a large number of railway bridges around the city and many have interesting features. St Thomas viaduct is a very slender structure, very similar to the flower pot field bridge as originally conceived but it has been much altered over the years. Perhaps the most interesting features are the parallel construction of the original single broad gauge track widened to twin track later, and the approach to the span over Cowick Street where the apparent abutment conceals part of a rather larger span arch on each side.

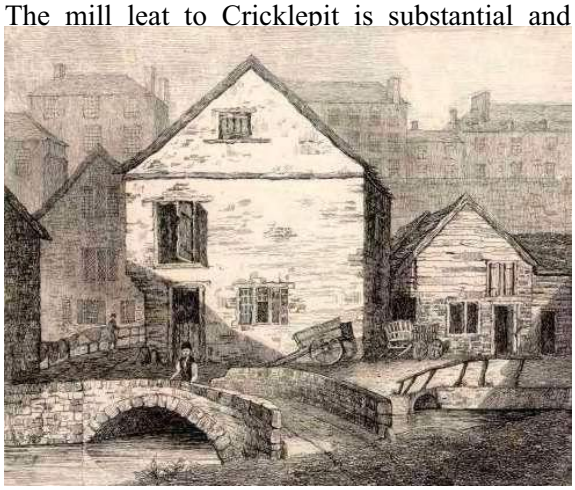
Here the abutments look solid.

But look up in the footway and part of the arch is obviously hidden.

On the north side, the original arch vousoirs are visible up to the edge of the abutment wall which looks like a later addition. Presumably, the engineer doing the widening was less confident than the original designer.

Cricklepit

The mill leat to Cricklepit is substantial and



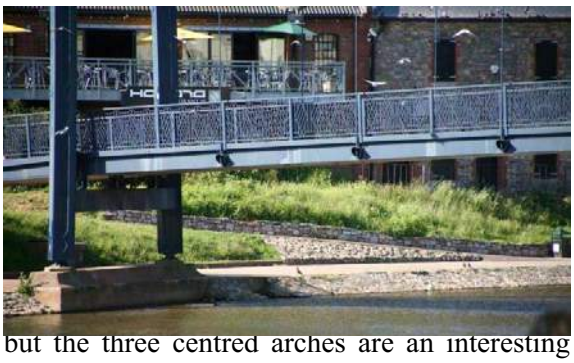
would have had a number of bridges, at least one will now be lost under Western Way. The one above, though might still be present. Note the branching channel and complex arching below.

The modern Cricklepit bridge is an unusual suspension bridge. The deeply sagging cables

and high towers are far from the more normal proportions of Trews Weir downstream. It does show up, though, the way the cables pull straight between the hangers, and the (very necessary) hinges at the bottom of the towers to allow them to sway as the backstays expand when the sun comes out. Where does it get its stiffness from?

Commercial Road

Perhaps only an arch engineer would love this



but the three centred arches are an interesting form.

Canal swing bridges

Moving bridges are very complex. They work

quite differently when in position and carrying traffic than when opening. Little ones like this can be allowed to rock as the loads run off and on, but bigger swing bridges such as the one at Countess Wear have to be locked and then the cantilever becomes a beam. The blacksmith work here is really rather beautiful.

Trews Weir

Notice how much shallower the cables are here than at Cricklepit. The large number of hangers means the cables take a smoother curve. The towers are concrete and quite short, so quite stiff. There is almost certainly a sliding saddle on the top of the towers to allow for expansion in the back stays. With the combination of a stiff truss and a shallow cable, adjustments get a bit fine and one bay of the cable goes up instead of down.

South Gate footbridge

Not a spectacular piece of engineering. This is NOT a cable stayed bridge. The cables are a decorative element and are actually detrimental to the structural behaviour. If you go past it, try shaking the backstay cables and think about how much (little!) tension there must be. Then see if you can spot where it all goes wrong. If you want the answer, email bill@obvis.com.

Cathedral Close footbridge

This fine iron bridge of 1814 has a new steel deck but still has the original parapets and lamp

brackets

New North Road Railway bridge
This is a fairly ordinary arch but it is built on a curve and has successive spans at different skews which must have been an interesting challenge to the designer. It contradicts, very firmly, received wisdom about how arch bridges work.

Cowley railway bridge
It is quite unlikely that you will have taken any

notice of this structure. It is a skew arch bridge of three centred form with a very complex coursing in the arch. The best place to see it is from outside the railway gates on the west side. Please be careful on the road, though and think carefully too about where you might park. When I went on a rece I took the precaution of using

my bike.

The science of computing the shape of stones in a complex setting like this is called stereotomy. William Froude, the designer of this bridge, contributed notes on how to do it but went on to become world famous in the field of naval architecture and fluid mechanics.

In brickwork, the pattern could be left pargely to the bricklayers but it is obvious here the difficulty they had.

The adjacent bridge over the Culm is of a simpler semi-circular shape but also skewed and built by the same designer. The complex coursing

becomes simpler much more quickly.

Cowley Bridge
[from DCMS scheduling description]
Stone bridge spanning the River Exe 3km

upstream from Exeter. It is located on the site of a succession of bridges at this spot, the earliest of

which to be recorded dates to 1286. The bridge carries the road which connects Exeter with Crediton and north Devon and is listed grade 2*. Designed in a classical style by James Green, it was built over the course of 1813-14 to replace an earlier bridge which was found to have been too narrow. It is constructed largely of local volcanic trap stone and has three segmental arches with a total span of 50m, these arches being supported by two piers which also provide the cutwaters. There are pilasters above the cutwaters with large round-headed niches all fashioned in trap ashlar as is the dentilled exterior string course at road level. The ashlar parapet above the string course has coping stones of granite. The voussoirs are of trap ashlar as are the abutments. The total length of the bridge inclusive of its abutments is about 74m and it is 11m wide. The designer of the bridges, James Green [1781-1849] was Devon County Bridge Surveyor 1808-1841 and Cowley Bridge is considered to be his most important work.

Pynes Bridge

This little bridge, at the turning to Upton Pyne, crosses the Creedy in three slightly skew shallow arches. What makes it special is the piers which

are simple granite columns rising from the water and the cast iron shoes which form the springing for the arches. Lots to learn here about the way skew bridges work.

Bill Harvey

EXETER SCHOOLS 1800–1939: an update

The main aim of this note is to provide a reprise of the 2004 article in *DBG Newsletter* **22**, which revealed the wide variety of school buildings surviving in the city from 1800-1940. The 2004 article grew out of discussion on the growing threat to historic school buildings in meetings of the Devon Buildings Group committee over a number of years. Pronouncements of central government policy, the clear trend towards replacement rather than refurbishment, the fact that very few school buildings were listed (and the associated problem of the state of the listing for Exeter), and the indifference of the local planning authorities to the qualities of historic school buildings, were all factors that made us aware of the priority and urgency of the question. As it turned out this awareness was timely, even belated, since by the time the article was published plans were already well in place for the demolition and replacement of four primary church schools (St Sidwell's School; St Michael's School, Heavitree; Pinhoe School; and St Nicholas' RC School).

It is our purpose here to bring this article up to date, as the four-to-five years since it was researched and written have seen a number of radical developments in policy relating to school buildings, which are reflected in changes 'on the ground'. Government programmes have been established with the aim that all children will be educated in new or refurbished buildings by 2020: the 'Building Schools for the Future' (BSF) programme (for secondary schools/older children) and the 'Primary Capital Programme' (for primary age children). As with many such initiatives, the inflexible pursuit of policy and the drive to meet targets has sometimes resulted in manipulation of figures and in inadequate standards of design and building (see, for example, Booth 2008). Partly as a result of this, several of the school buildings featured and illustrated in the 2004 article are no more, and others remain under threat.

Arguably the most significant loss has been the demolition of St Sidwell's School. This was built in 1853–54 to a design by the notable Exeter architect Edward Ashworth (Fig. 1), and was the only school building by him known to survive (although another school illustrated by Ashworth in a watercolour painting in a private collection has since been identified at Chevithorne, near Tiverton, and this may well be his work). The redevelopment of the school was carried out as a part of the programme of rebuilding four Exeter church schools (above), and it was a condition of the funding from central government that all four schools kept to a tightly organised schedule. It was also made clear that finance was only available for new build, and not for repair or refurbishment of existing buildings. As a result of the very tight conditions and timescale, dissent from and objection to the scheme were more-than-usually unwelcome in diocesan and county education authority circles. Despite this the DBG attempted first to point out the value of Ashworth's buildings; second to try to get the building listed; and third to object to the cavalier way in which a building of 150 years' standing could be discarded in favour of one with a professed lifespan of as little as 25 years.

DBG committee members attended a public meeting with the staff and governors of the school, officials from the diocese and the county council, county councillors, and the developers in January 2005. Here a number of arguments were advanced as *fait accompli* for the demolition of the building. These arguments fed through into the justification of the demolition in the planning application in due course. Some of the most specious of these were that the building was passed its 'use-by date', was unsuitable for 21st century schooling, and was damp and hard to maintain. The most cursory inspection of the building by a conservation-minded eye could see that the worst areas of decay were in the later 20th century accretions; that such damp as there was in Ashworth's buildings was only caused by repeated application of unsympathetic modern paint finishes on the mid 19th century fabric; and that there had been a systemic failure of maintenance in recent years (perhaps because the building had already been ear-marked for replacement).

In opposing the loss of this building our main points of objection were:

Fig.1 Edward Ashworth's illustration of the St Sidwell's School as built, lithographed by William Spreat, 1854.

Fig.2 Photograph of the old school from the corner of York Road prior to demolition, July 2006, looking north-east.

1 The loss of amenity to the local community, of one of the oldest and finest public buildings in the parish.
2 The loss of value and significance on a local and regional scale, by the destruction of one the few remaining secular buildings in Ashworth's body of work.
3 The anti-sustainable trend represented by the demolition of a sound 150-year old building, perfectly capable of lasting another 150 years if repaired and maintained properly, in favour of a short-lived (in historical perspective) and wasteful new build.
4 Although the large and high-ceilinged classrooms of Ashworth's school building, with fine open timber roofs may not have fitted current educational ideas for classrooms, they would have made magnificent public assembly rooms and the like. We suggested that the original 1853-54 core be retained for this purpose, with the new classrooms being built to the proposed L-shaped plan around the north and west sides of the site to meet contemporary educational needs.

All of this had no tangible effect: English Heritage declined our request to list the building on the grounds that it was of insufficient architectural quality and had been too much altered. In Exeter, the official indifference (even hostility) to the building ensured that the development control committee supported the rebuilding, the chairman of the committee going out of her way to damn the building as 'in decline' and adding (according to the contemporary report in the *Express and Echo*): 'The atrocities [*sic*] of children being educated in such a building far outweigh any historic value it may have.' The new buildings went up in the course of 2005-06, with the old buildings continuing in use while the construction advanced. These were then demolished during the summer vacation of 2006 (Figs 3-4). The buildings were recorded by staff of Exeter Archaeology during demolition and archaeological monitoring of the construction took place as a condition of consent. Readers can form their own judgements of the respective claims of the old and new buildings, and whether the new will rival the old in quality or longevity (Figs 1-4). Only the bell has been retained in the new building. Much was made of this stratagem - as a memorial to the 'much-loved' old school (so loved that the staff, governors, and responsible authorities were united in their wish to see it pulled down).

Fig.3 Demolition in progress in September 2006, looking north-west.

Fig.4 Photograph of the new building, looking north-east from a similar view-point to that of Fig. 2, September 2006.

A similar story can be told of St Michael's, Heavitree. This 1870s church school by George Packham had suffered much inappropriate modern alteration (Parker 2004, 26 and fig. 15), but the core of the building remained and its architectural qualities became clear as the modern accretions were removed (Fig. 5). Despite a very effective and vocal local campaign of opposition to the proposal, and the fact that the main part of the building was occupied as a popular public library - and not as a school - the whole building was demolished (Fig. 6) and replaced by a modern structure on a different part of the site. Fortunately the twin houses for master and mistress still remain. Another case

Fig.5 St Michael's School, Heavitree, with modern accretions removed, in September 2006.

Fig.6 Demolition of St Michael's Heavitree in September 2006.

was the loss of the Charles E. Ware buildings of 1908 at Hele School (Parker 2004, fig. 30), plus the 1930s extensions by the City Architect John Bennett (Fig. 7). One incidental benefit of this demolition was that John Hayward's original buildings of 1849–50 were briefly exposed to full view again during the construction programme (Fig. 8; compare the 1901 view in *ibid*., fig. 6). These have been repaired and now form an administration block adjacent to the new buildings; is this not an approach which might have been considered at both St Sidwell's and St Michael's Schools?

Montgomery School, Manor Road, St Thomas, is the first of John Bennett's new schools for the city (Parker 2004, 42 and figs 31–32). The future of these surprisingly unaltered buildings of 1929–30 remains under review. In the mean time much more of the original glazing has been lost since our last report in 2004.

The fact that none of these school buildings was listed reflects the retarded state of the statutory lists of buildings of architectural and historic interest for the city (last systematically revised in 1974). In the light of this the DBG committee attempted to draw up a list of priority cases for protection, and has been applying for some of these for consideration for listing, so far without success. Pre-eminent among these was Cowick Street First School, which (we judged) had the right balance of architectural amenity and lack of radical accretions (Parker 2004, figs 11–12). This building has ceased to be a school since 2005, although it remains in quasi-educational use as a nursery and children's centre. This has been refused. Others considered were Bishop Blackall, where an attempt by the local residents' association to get the Victorian and Edwardian complex (in a florid Baroque style: *ibid.* fig. 23) listed has also been turned down by English Heritage. The future of this complex remains in doubt at the time of writing.

Some more positive developments can be noted at St David's School (by Rhode-Hawkins, 1868), where wholesale redevelopment now looks unlikely, and the buildings of which have had a temporary reprieve following lobbying by a local amenity group (although some reconstruction and refurbishment are still proposed). Additionally unsightly 'portakabins' have now been removed, with consequent gains to the distinction of the building (Fig. 9, compare Parker 2004, fig. 14). Nearby, the conversion to domestic dwellings of the Episcopal Schools, Mount Dinham, is in progress at the time of writing, with the retention of much original fabric, and at the Institute for the Blind on St David's Hill to the north-east (*ibid*., 46 and fig. 37) some buildings are under conversion as a part of the same development, although the future of others is still uncertain. St Loyes' School/Chapel in Wonford Street, an interesting multi-purpose church and school building of 1881 by R. Medley Fulford, is undergoing conversion to domestic use, again as this note is written.

Another surprising change has taken place at Exeter School (by William Butterfield, 1880), which is listed (Grade II). Here, in contrast to the pattern of demolition elsewhere, a new range has been constructed on the south side in a sympathetic interpretation of Butterfield's design (Fig. 10). It seems that no scruples about 'contemporary design' affect the architects and governors of private schools!

Various lesson have been learned, and the 2004 article has had a modest influence on a national scale, by helping to awaken and develop interest in the subject of neglected school buildings and the current threats to their well-being and survival. The estimable organisation SAVE Britain's Heritage had (as with so many other subjects) anticipated this by several years, recognising the threat to historic school buildings in its own publication on schools (SAVE 1995). One gratifying aspect of the influence of the 2004 article is in the appearance of a publication on the subject of the future of historic schools by English Heritage, owing a visible debt to the DBG article (English Heritage 2005) and in publications and a conference on school buildings by the Victorian Society (Saint and Holyoak 2007).

Nobody wishes to act as a block on valid new development; rather, our objections have been driven by a wish to see the best of this marvellous collection of buildings preserved,

Fig.7 & 7a The 1931 building and loggia by John Bennett at Hele's School in August 2005, during the stripping of the building prior to demolition.

Fig.8 The original buildings of Hele's School by John Hayward and others, after demolition of the 20th century buildings; seen from the tower of St David's Church in September 2005.

Fig.9 The east wing of St David's School, Dinham Road, with the temporary classroom building removed, September 2008.

Fig.10 Exeter School, Victoria Park Road showing the new building attached to Butterfield's range of 1880, August 2006.

and adapted to continue to serve the educational and philanthropic purposes that were so central to the vision of their founders and builders.

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