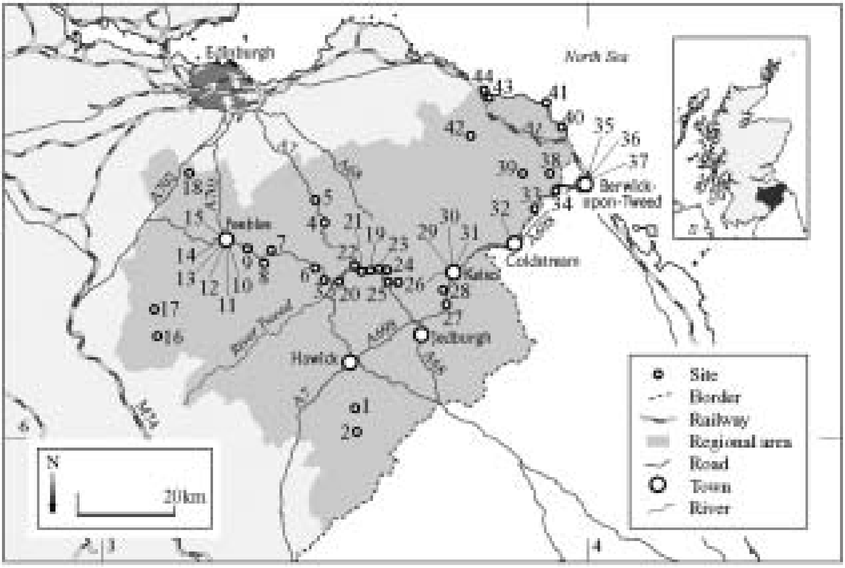




**Scottish Borders and Berwick-upon-Tweed**

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38. Hutton Mill Bridge
39. Allanton Bridge
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41. St Abbs Head Lighthouse
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44. Cove Harbour

# 2. Scottish Borders and Berwick-upon-Tweed

## Introduction

In this chapter the Tweed bridges are outstanding for their variety and development. Of masonry examples, Ashestiel (1848, 2-6) at $131\frac{1}{2}$ ft is one of the world's largest rubble spans. Tweed Bridge, Peebles, and Canongate. Jedburgh (2-12) are among the earliest. Above Peebles, Neidpath Viaduct, on a curve with skewed arches, is one of the finest Scottish examples of the railway engineer's art (1864, 2-13). At Drygrange, three bridges demonstrate the development of best practice over two centuries. The earliest was built in 1780 as part of a nationwide improvement of turnpike roads in the Industrial Revolution with a span of 105 ft (2-24), not quite so dramatic as the present 1973 steel bridge or the dominating 23-arch red sandstone Leaderfoot Viaduct of (1865, 2-23). Downstream, Mertoun Bridge is fascinating in having begun its existence as a timber bridge in 1841 (2-26).

Continuing downstream, Kelso Bridge of 1804 (2-31) is one of the finest Tweed bridges (2-31), and Coldstream Bridge of 1767, also a fine bridge, was the earliest of John Smeaton's major bridges (2-27). The largest bridges are at Berwick-upon-Tweed, the Royal Border (1850, 2-35), the Royal Tweed 1928 (2-36) and Berwick (1634, 2-37). Although now just in England, these bridges have been included for completeness of the Tweed bridges development theme.

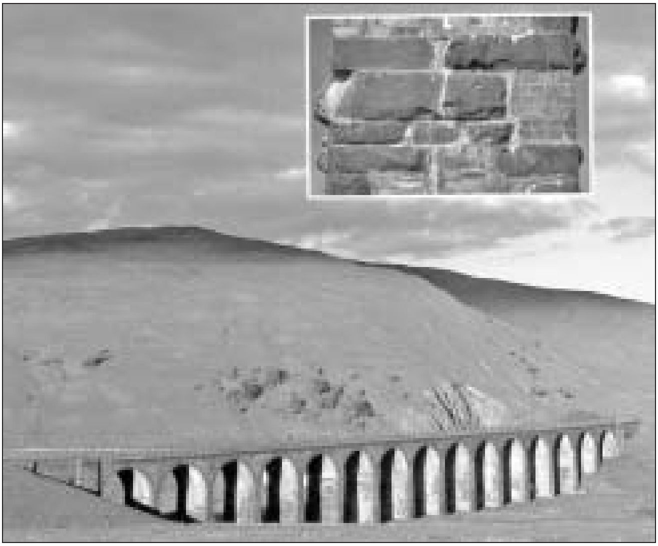
The challenge of crossing the Tweed also led to the development of iron suspension bridges, the most notable being Union Bridge, near Paxton, (1820, 2-34); Dryburgh Abbey (1817, 1818, and 1911, 2-25); Gattonside (1826, 2-19); Kingsmeadows (1817, 2-10) and Galashiels (1816, 2-10) both among the world's earliest of their type; and Priorsford, Peebles (1905, 2-11). Late-19th century girder examples exist at Tweed Bridge, Innerleithen (2-8) and the viaducts at Haughhead and Cardrona (1864, 2-9).

Away from the Tweed there are fine examples of railway engineering at Teviot Viaduct, Roxburgh (1850, 2-28) and Shankend (1862, 2,1). Teviot Viaduct also has an iron tension footbridge of the same date across the extended bases of its piers. Tunnels are represented by Whitrope (1862, 2-2) and Neidpath of 1864 (2-13). Notable road bridges are Old Manor Brig (1702, 2-14); nearby Manor Bridge (1883, 2-15), a fine low rise traditional style example; Henderson's Pease Bridge (1783, 2-43); Allanton (2-39); and Hutton Mill, first a tension truss, then a lattice girder and now a composite reinforced concrete and steel beam bridge (1837, 2-38).

Historically, the largest water supply project in the area is the Talla Scheme with the later development of the Fruid-Menzion watershed. This scheme involved the construction of Talla Reservoir and a 35-mile aqueduct to Edinburgh which was completed in 1905 (2-16 to 2-19).

Maritime projects are represented by Eyemouth Harbour, partly designed by Smeaton, Cove Harbour (2-39 & 2-44) and St Abbs Head Lighthouse (1862, 2-41).

Unusual works include the concrete Waverley Castle Hotel, Darnick (1871, 2-21) and Kelso cauld or weir across the Tweed dating from ca.1250 (2-30).



Railway Heritage Trust Annual Report 2000–01

Shankend Viaduct

# 1. Shankend Viaduct

NT5214 0597

An impressive masonry viaduct over Slitrig Water with 15 × 34 ft semicircular arch spans up to 35 ft high, built from 1859 to 1862 in bleak and sparsely populated hill country for the Border Union Railway. The viaduct, which has been extensively repaired with brick patching, formed part of the legendary North British 'Waverley Route' through Sir Walter Scott country, officially opened between Edinburgh and Carlisle on 1 July 1862 and closed in 1969. The viaduct formed part of the Whitrope contract which extended south for about 4½ miles and included Whitrope Tunnel. The designer, according to the current inventory, was Charles Jopp and the contractor, William Ritson. The present owner is BRB (Residuary Ltd) who intend to waterproof the structure in 2007. In 2000 repair work of pinning, grouting and brick replacement (see inset) helped to preserve the viaduct. [1]

# 2. Whitrope Tunnel, Sandy Edge

NT 5245 0118

One of the longest railway tunnels in Scotland at 1208 yards, containing the summit of the former Waverley Route 1006 ft above sea level near its south end with an

Whitrope Tunnel

Matthew Stoddon, Waverley Route Heritage Assn

approach gradient from the north of 1 in 96. It is located in desolate country three miles south of Shankend Viaduct and accommodated a double track. On 2 July 1862, the day after the line was opened, 'passengers looked out on a snow covered landscape dotted with the rusting abandoned equipment', which was auctioned from 5–7 January 1863. Special trains stopped at the south end of the tunnel and at Shankend viaduct for the sales which took place as soon as the trains arrived.

The contract for the tunnel at this remote location under difficult ground and weather conditions was overspent. The tunnel, excavated through old red sandstone conglomerate resting on clay slate, stratified sandstone and beds of shale interspersed with thin bands of limestone and sandstone, required partial lining with brick and stone. The appalling wetness of the site, which turned the ground into slurry, caused the contractor many problems. Measurements taken at three shafts in the tunnel workings showed that 425 gallons of water per minute were cascading into the tunnel. A force of 230 men, working at ten faces, cut through the rotten strata. Keeping them relatively dry and getting enough air to them were major problems for Ritson and 2 ft square air boxes were installed worked by fans attached to pumping engines. These had to be steam operated as the horse gins had insufficient capacity.

The engineer was John F. Tone and the contractor, William Ritson. The line closed in 1969 and is now owned by the Forestry Commission. The Waverley Route Heritage Association, formed in 2001, is taking an active interest in reopening the tunnel, now made more difficult by recent roof falls. [1, 2]

## 3. Yair Bridge

**HEW 1118**
**NT 4581 3255**

A substantial three-span rubble masonry bridge over the Tweed west of Melrose built in 1762. It was rebuilt above the arch rings in 1987–88 incorporating reinforced concrete relieving arches and mass concrete. Although much of the original stone was re-used as facing, this picturesque bridge is not as authentic as its appearance now implies.

## 4. Old Bridge, Stow

**NT 4583 4439**

This 1655 bridge spans the Gala Water directly opposite the church at the south end of the village and is easily seen from the A7. The overall length of the structure, which is partly a causeway, is about 125 ft and includes three segmental arches increasing in size from 10 ft to the main span of 47 ft which has a rise of about 12 ft and an arch ring of thin undressed stone. The bridge was built by the Kirk Session for the convenience of worshippers on the west

Roland Paxton

Old Bridge, Stow

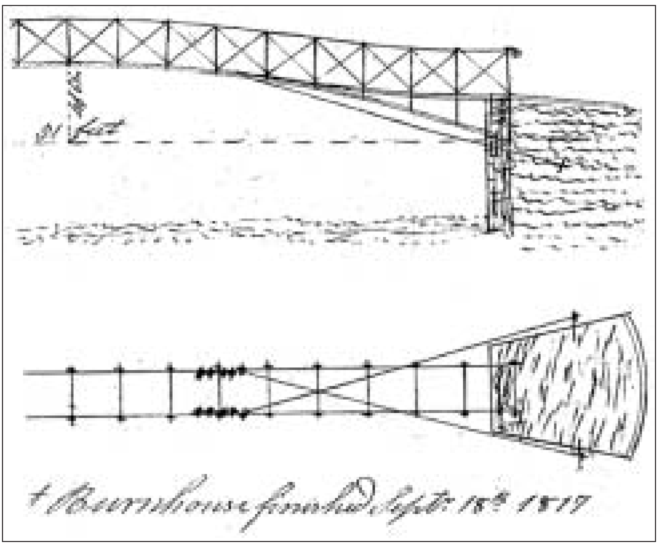
bank of the river. It was no doubt also used by others as the former Edinburgh–Hawick road was then on the west bank of the Gala Water. Today the bridge comes under the jurisdiction of the Community Council. By the late 1990s the condition of its land arch had deteriorated to such an extent that action was taken in 2001 to prevent its collapse and preserve the original stonework at the cost in appearance of an unsightly steel reinforced lime concrete supporting arch. [3]

## 5. Burnhouse Footbridge, Fountainhall

**NT 4395 4895**

A typical – for its date – iron lattice girder span bridge of 40 ft over the Gala Water made by R. Peddie & Co., Tynecastle, Edinburgh (ca.1900). The site is of greater interest for being that of one of Scotland's earliest iron bridges, designed and erected by Andrew Hislop (1774–1855) blacksmith, Fountainhall, in September 1817.

The deck of Hislop's 51 ft span bridge was carried on a pair of low rise $2\frac{1}{4} \times \frac{3}{4}$ in. segmental arch ribs attached to trussed side railings 3 ft high. From the quarter points the deck was carried by $1\frac{1}{4} \times \frac{1}{2}$ in. deck bearers directly to each abutment, with intermediate struts. The railings were of $\frac{1}{2}$ in. square bars and the sway bracing was of $\frac{1}{2}$ in.



Royal Highland & Agricultural Society of Scotland

Burnhouse Bridge drawing, 1817

diameter rods. A model of the bridge made by Hislop exists in the Royal Museum of Scotland, Edinburgh.

Another iron footbridge (NT 3380 6750) by Hislop, of similar date and span, was erected over the North Esk at Gibraltar, Dalkeith, about 100 yards upstream of Cow Bridge, but it no longer exists.

## 6. Ashestiel or Low Peel Bridge

**HEW 309**
**NT 4386 3507**

This road bridge crosses the Tweed in a single graceful semi-elliptical arch of 131½ ft with a rise of 26 ft. It is one of the world's largest rubble masonry spans and the closing bridge achievement of J. & T. Smith of Darnick.

The present structure, dating from 1847–48, represents the second attempt to build this bridge. It was reported that when the temporary timber centring supporting the arch of the first bridge during its construction was removed 'the keystone shot up into the air and the whole bridge collapsed'. The bridge was rebuilt at the Smith brothers' expense, but the original contract price of £1200 proved insufficient to meet the cost of both bridges and they 'failed in business'. The use of a semi-elliptical arch, in addition to maximising the waterway, is perhaps indicative of their understanding that this shape being flatter at

Ashestiel Bridge

Steve Hawkin

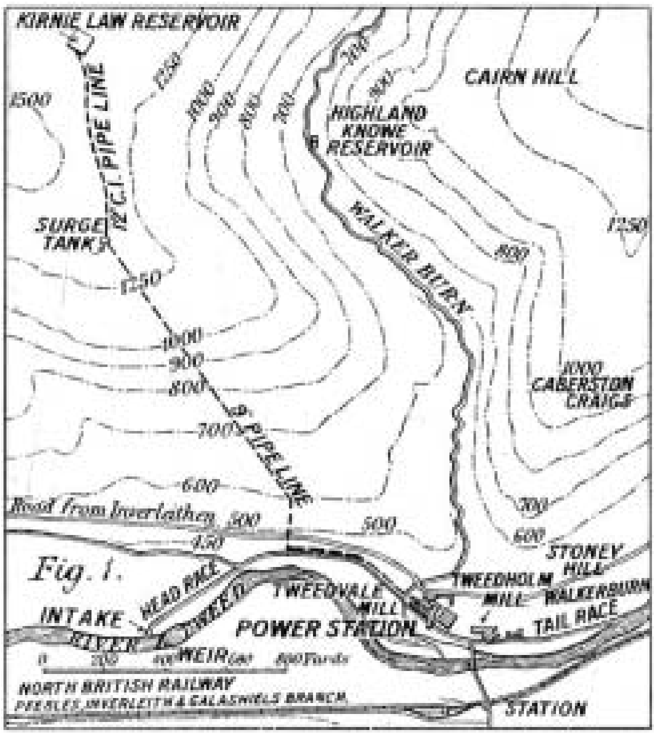
the crown was less likely to fail through the crown being forced upwards.

A reinforced concrete slab, spanning over two external and two internal spandrel walls, was cast in the early 1950s, the bridge remaining open while this work was done. The parapets and spandrel faces were taken down and rebuilt in the early 1980s. [4]

## 7. Walkerburn Pumped Storage Hydro-Electric Scheme

**HEW 2404**
**NT 3484 3869**

Two large textile mills were established at Walkerburn in 1854, worked by waterwheels powered by intakes from the Tweed. Each operated under a head of about 5 ft. In 1918 the mills came under single ownership and the new owner adopted a hydro-electric scheme developed by consultants Boving & Co. Ltd of London. The waterwheels




Walkerburn Hydro-Electric Scheme map [5] were replaced by a single power plant using low-pressure turbines worked by the water from a reservoir on a neighbouring hill. In order to meet the peak demand, water stored in a new reservoir on Kirnie Law, about 1000 ft above the mills, was used to operate a Pelton Wheel.

Kirnie Law reservoir, now empty, consists of a reinforced concrete tank 15 ft 6 in. deep and 192 ft square with a capacity of 3.5m gallons. It was constructed with the aid of a cable railway. During off-peak hours the low pressure turbines pumped water into the reservoir through a 9 in. diameter pressure pipeline. A surge tank was provided at the midpoint of the main to absorb pressure fluctuations. When extra power was required the flow of water in the pipeline was reversed to operate the Pelton Wheel.

This early pumped storage hydro-electric scheme, a precursor of the huge Cruachan and Foyers schemes of the 1960s and 1970s, quadrupled the original waterwheel power supply and gave efficient and satisfactory service until the mills closed in 1988. [5, 6]

## 8. Tweed Bridge, Innerleithen

**HEW 2408**
**NT 3336 3597**

A four-span road bridge with slightly bowed steel lattice trusses on masonry piers, erected over the Tweed in 1886 by the Peeblesshire Road Trustees. The spans, which are nearly 70 ft, are not quite equal in length. The engineer was R. S. Anderson and the contractors, Robertson & Co., Workington. ‘W.B. 1830’ is carved on an abutment, built for the multi-span timber bridge designed by James Jardine which preceded it. [7]

## 9. Cardrona Viaduct

**NT 2987 3905**

A five-span wrought-iron riveted plate bow girder bridge over the Tweed. Its girders, which rest on stone piers, have clear spans of about 60 ft, a clear width of about 12 ft (3.7 m) and are about 15 ft above the river. This former railway bridge, now used by golfers, other pedestrians, and for local access, was erected in 1863–64 by the North British Railway. It is a good example of its type and similar to others at Peebles (demolished) and one of six spans at Haughhead, Innerleithen.

Cardrona Viaduct

Roland Paxton

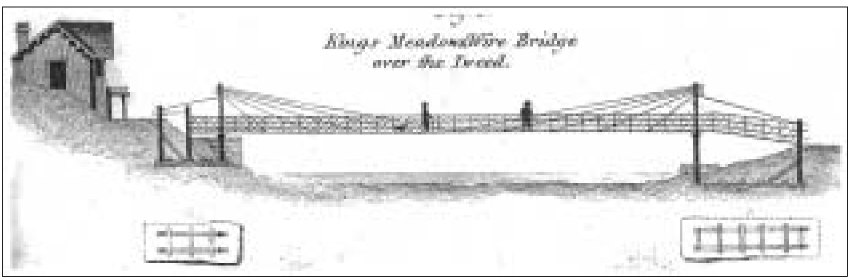
The engineer was Charles Jopp and the contractor, Trowsdale & Son. [8]

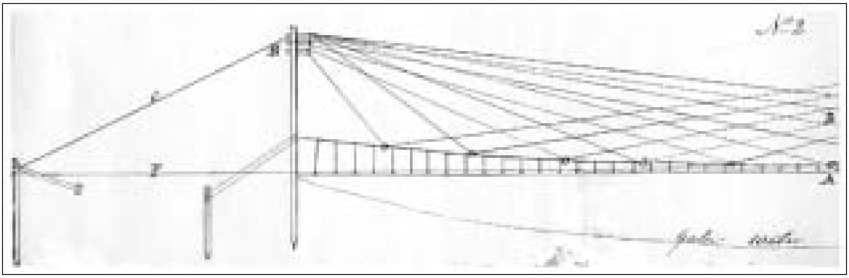
## 10. Kingsmeadows Bridge Site (Private)

**NT 2681 3999**

An abutment at Wire Bridge Cottage, a mile east of Peebles on the A72, is all that now remains of J. S. Brown's innovative 4 ft wide and 110 ft span bridge erected over the Tweed for Sir John Hay in 1817. It was one of the world's earliest wire bridges and had 0.3 in. diameter wire suspension stays radiating from cast iron tubular side supports. Adjustable screw-bolts enabled the stays to be tensioned. The bridge was modified by Redpath Brown in 1923 and lasted until destroyed in a flood on 29 October 1954.

Kingsmeadows Wire Bridge [R. Stevenson, Bridges of Suspension, *Edin. Phil. J.*, Edinburgh, **V**, 1821. pl.]






RHASS

Galashiels Wire Bridge (Lees)

Brown's bridge was more workmanlike in engineering terms than that of the same span erected by Richard Lees, Galashiels mill owner, over the Gala Water in 1816, of which Brown was almost certainly aware, and may be a development of it. Lees' bridge lasted only a few decades.

Although both designs had little influence on suspension bridge development generally, they are noteworthy as indigenous examples of the new bridge genre stemming from practice in the USA, Telford's iron-stay bridge proposals published from 1811 and his 50 ft span wire, load-tested, model suspension bridge at Runcorn in 1814, and Capt. S. Brown's well publicised bar-chain bridge of ca.1814 at his Isle of Dogs works. [9, 10]

## 11. Priorsford Bridge, Peebles

**HEW 2413**
**NT 2535 4019**

A picturesque late-Victorian style suspension bridge with lattice towers and parapets erected over the Tweed in 1905. Its deck has a main span of 97 ft suspended from two 1 in. diameter twisted steel strand cables passing over

Priorsford Bridge

Roland Paxton

lattice tower supports. It was designed by an engineer, R. J. M. Inglis, of 'Tantah', Peebles, and the contractor was Somervail of Dalmuir. [11]

## 12. Tweed Bridge, Peebles

**HEW 2402**
**NT 2504 4030**

This bridge over the Tweed appears to be a typical ca.1900 masonry structure, with its five arch spans of about 38 ft and parapets surmounted with decorative cast-iron dolphin lamps cast in Glasgow. But, on close inspection of the underside, arches of earlier construction can still be seen. In 1799 one or two arches were added at the south end. These were replaced by the railway overbridge in ca.1863.

The 15th century bridge may have been built by a master mason known as 'John of Peebles' and was in the course of

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Tweed Bridge

erection or undergoing improvement in 1465. It had a clear width of only 8 ft and was widened on both sides in 1834 to 21 ft and again in 1899–1900 to 40 ft, by taking down and rebuilding the east (downstream) façade. The engineers for this last work, which is still in service, were M'Taggart, Cowan & Barker, Glasgow. The contractor was a local firm, Dickson & Clyde and the cost about £8000. The cast-iron dolphin lamp standards on the parapets are particularly eye-catching. [11, 12]

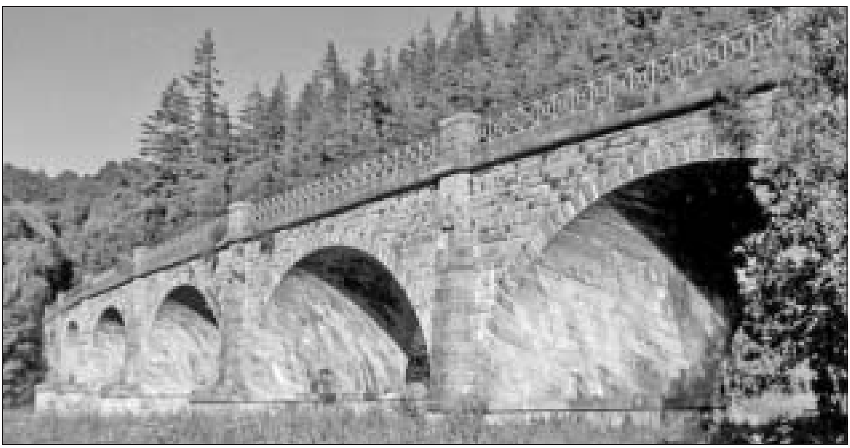
Another probably 15th/16th century bridge of similar width and character in the Borders, which has survived in a more original state, is Canongate Bridge, Jedburgh. It has three segmental arches of 28½ ft span, each supported on four ribs and its use is now restricted to pedestrians.

## 13. Neidpath Viaduct and Tunnel, Peebles

**HEW 2403**
**NT 2328 4019**

Sometimes known as The Queen's Bridge, this magnificent viaduct built over the Tweed in 1863 on the former Symington, Biggar & Broughton Railway (from 1866 the Caledonian Railway) is one of the finest examples of skewed-arch construction in Scotland. It has eight arches on a curve of 20 chains (1320 ft) and is 15 ft wide.

Opened in February 1864, the single track viaduct and tunnel were designed in 1861 by Bruce & Cunningham, Edinburgh consulting engineers. The contractor was


Neidpath Viaduct

Roland Paxton

William Scott, Kilmarnock. The intricate and detailed calculations made early in 1863 for the skewed freestone masonry and the erection of the viaduct have survived. They were made by resident engineer Robert Murray at the Damdale site office, Peebles.

The tunnel is 537 yards long of which all but 8 yards is lined in 18 in. brickwork. It has ashlar façades, is 18 ft high and $17\frac{1}{4}$ ft wide. Excavation in whinstone and sand cost 7/6d per cubic yard and the price per lineal yard of tunnel with brickwork was charged at £231 4s, and for 18 in. ashlar at £50 2s 4d, making £14 431 6s 8d in total.

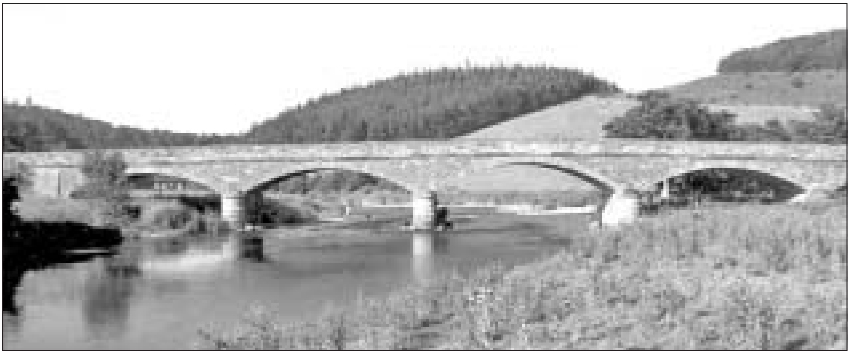
The railway was closed in 1954 and the viaduct is now part of a heritage trail. [11, 13]

## 14. Old Manor Brig or Roman Bridge, Peebles

**HEW 2409**
**NT 2311 3939**

This structure is a fine example of a largely rubble-stone arch bridge of 1702. It spans the Manor Water on a steep byroad to Peebles which, until the building of Manor Bridge, offered an alternative route to the use of the nearby Tweed Ford. Its span is 38 ft and width $9\frac{1}{2}$ ft. The bridge is now subject to a 7.5 t weight limit. An old tablet informs the reader that 'William Duke of Queensberry designed this work and William Earl of March his second sone built the same Anno 1702'. [11]

Old Manor Brig [postcard 1905]



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## 15. Manor Bridge, Peebles

HEW 2410
NT 2292 3948

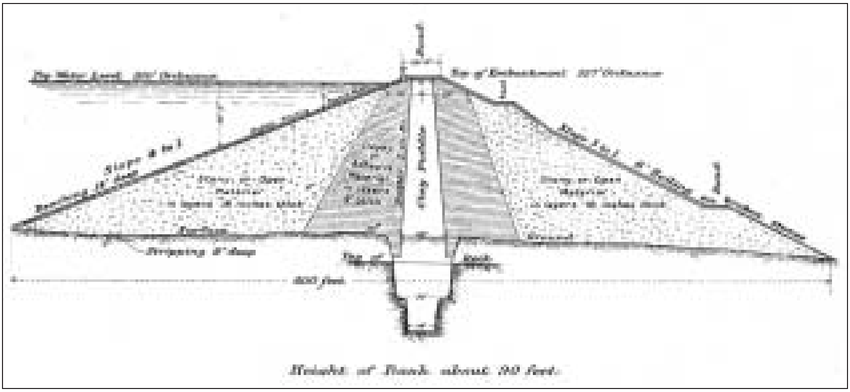
An elegant five-span low-rise segmental arch masonry bridge with a central span of 45 ft built over the Tweed in 1883 to replace a ford. Its arch rings are of squared sandstone and the spandrels of snecked rubble. The bridge, presumably designed by or for Peeblesshire Road Trustees reputedly has a part paid in its creation by David Kidd, inventor of the modern envelope, whose sisters contributed substantially towards its cost out of their inheritance from him. [11]

Top: Manor Bridge

## Edinburgh Water Supply – Talla Scheme

HEW 2397

Towards the end of the 19th century the City of Edinburgh had largely utilised the water reserves of the valleys of the Pentland and Moorfoot Hills and looked further afield for an increased supply. Three sites in the valley of the Tweed were investigated before the Talla Water south of Broughton was chosen. This offered, among other advantages, potential for future extension from the development of neighbouring tributaries. After seven years of rain-gauging and flow measurement, the yield of the 6180 acre catchment area was assessed at 14.5 million gallons/day, of which one-third was to be released as compensation water. [14]



## 16. Talla Reservoir

**HEW 2397/01**
**NT 1200 2140**

Top: Talla Dam cross-section [14]

This reservoir is formed by an earth dam 1050 ft long and of maximum height 80 ft impounding up to 2800 million gallons of water. The top water level is 950 ft above Ordnance Datum and the dam side slopes are 1 in 4 upstream and 1 in 3 downstream. Water is conveyed 35 miles to Alnwickhill, Edinburgh by the Talla Aqueduct.

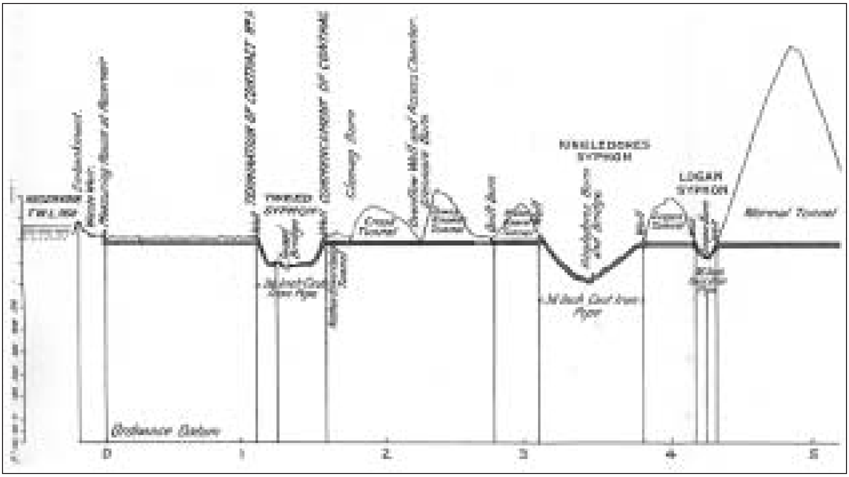
A 10 mile long standard gauge temporary railway was constructed from the Caledonian Railway at Broughton for the conveyance of materials. Much of the formation level of this railway and its iron truss bridges of 100 ft span over the Tweed, which also carried the aqueduct, and of 60 ft span over the Biggar Water, can still be seen. The line had a ruling gradient of 1 in 50.

The engineers were J. & A. Leslie & Reid of Edinburgh. Construction was let in about 50 separate contracts, but the greater part of the works were carried out by James Young & Sons and John Best, both of Edinburgh, and Robert McAlpine & Sons of Glasgow. The total cost from 1895 to completion in 1905 was £1.25m. In the 1950s and 1960s the tributaries Menzion and Fruid were developed to augment the supply. [14]

## 17. Talla Aqueduct

**HEW 2397/02**
**NT 1050 2505**

The aqueduct between the reservoir measuring-house and Alnwickhill filters in Edinburgh is approximately 35 miles long, including nine miles of tunnel and 12 miles of




Talla Aqueduct south end – longitudinal section [14]

cut-and-cover work, the remainder being bridges or cast-iron pipes in the open. There are altogether 21 lengths of tunnel, the shortest being 399 ft and the longest some 1.33 miles. The longitudinal section shows the positions of some of the tunnels and other works in the first five miles. The tunnels are either concrete, or of four-ring brickwork in heavy ground.

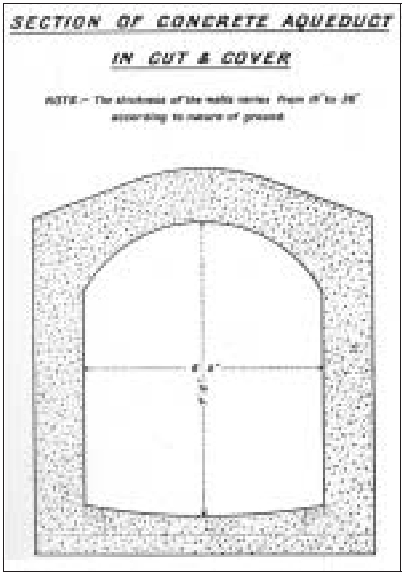
The aqueduct is laid on a gradient, mainly of 1 in 4000, and was made sufficiently large when constructed in 1901–05 to carry not only the water from Talla, but also from the adjoining watershed of Fruid–Menzion, developed in the 1950s and 1960s. The least dimension inside the aqueduct tunnels is 6 ft wide by 7 ft 6 in. high.

Some of the valleys on the route are crossed by inverted siphons for which cast-iron pipes, varying in diameter from 27 in. to 36 in., were used. Only one line of pipes was required for the original supply from Talla, but provision was made for duplication of the pipes in later years should this be required. The passage of time and the development of the Fruid–Menzion scheme has shown the far-sightedness of this decision. [14]

## 18. Talla Observatory, West Linton

**HEW 2397/03**
**NT 1803 5468**

The setting out of the line and level of the Talla Aqueduct was done with great precision from observatories, the

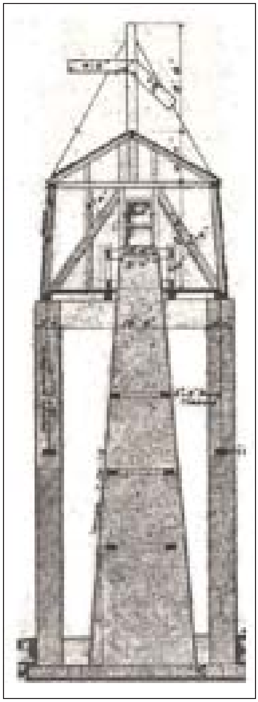



Talla Aqueduct cross-section [14]

concrete pillars, a number of which still survive, including one on a steep hillside near Tweedsmuir (NT 106 260) and this one, about a mile south of six others, within a masonry tower near West Linton. The drawing shows its long gone timber superstructure. The brass transit instrument with

Talla Observatory – West Linton

Lothian Regional Council Water and Drainage



Lothian Regional Council Water and Drainage

Talla Observatory – West Linton

30-inch telescope used in setting out the aqueduct is now in the ICE Museum at Heriot-Watt University.

The engineers for the aqueduct were J. & A. Leslie & Reid of Edinburgh and the main contractors were John Best of Edinburgh and Robert McAlpine & Sons, Glasgow. [14, 15]

## 19. Gattonside Bridge, Melrose

**HEW 0409**
**NT 5452 3459**

This iron suspension footbridge over the Tweed was erected in 1825–26 for use by pedestrians and horses. The work was undertaken by public subscription and the contractors were Redpath & Brown, Edinburgh. John S. Brown was the partner involved and he probably designed the ironwork. The masonry work was carried out by J. and T. Smith of Darnick for £600. Masonry towers on each bank, rising 38 ft above low-water level, support four suspension chains (two on each side) over a span of 296 ft. Their sag–span ratio is 1 : 17.5 which was bold for

Gattonside Bridge before strengthening

Roland Paxton

its time. The tower saddles were rigidly fixed so that any temperature effects on the chains were accommodated by a small rise or fall of the deck. The chains consist of 10 ft × $1\frac{3}{4}$ in. diameter eye-bar links connected by 7 in. long conventional links.

The 4 ft wide timber deck with its associated handcrafted ironwork was of light construction and for 167 years exhibited quite lively oscillations in strong winds. Concern for public safety by Borders Regional Council eventually led

Gattonside Bridge after strengthening, being inspected by the late C. E. Peterson, conservationist

Roland Paxton

to the bridge being ingeniously strengthened in 1991–92, but with significant loss of its original ironwork and character. This involved replacing the original railings with substantial steel trusses, new hangers, saddles and anchorages. It also involved the provision of an additional steel-bar main chain on each side of the bridge to the same curvature, which involved widening the spacing of the original lines of chains forming each pair.

The engineers for this work were Travers Morgan. Examples of the original hand-crafted ironwork, including hangers and fixings, railings, saddle and a ship's rudder (which was loaded with stones as an anchorage) are now preserved and interpreted in the ICE Museum at Heriot-Watt University, Edinburgh. [3, 16]

## 20. Old Tweed Bridge, Ettrickfoot

**HEW 2406**
**NT 4881 3223**

A three-arch masonry bridge over the Tweed erected by the enterprising J. & T. Smith of Darnick who had also carried out building work at Abbotsford for Sir Walter Scott. It was opened on 11 April 1831, its foundation stone having previously been laid by Scott who probably influenced the adoption of the alternate pink and yellow arch stones and raised Tudor shields in the spandrels. Scott wrote in his diary of the 'romantic scene' at the opening.

The bridge, which is now restricted to pedestrian and cycle use, carried the A7 trunk road for many years until bypassed by the present bridge in 1974. Windean Bridge (NT 4850 3140) nearby, with two arched spans of 52 ft and one of 26 ft, was also probably built by J. & T. Smith at about the same time.

## 21. Waverley Castle Hotel, Darnick

**HEW 2398**
**NT 5330 3465**

The Waverley Hydropathic Institution, as it was known when built in 1871, is believed to be the first major concrete structure in Scotland, erected five years before Robert McAlpine's first building in concrete.

In plan the 130 bedroom hotel forms a square of about 140 ft sides with a court in the centre and cost about £24 000 to build. The front elevation is relieved by a tower 75 ft high and all the walls, staircases and steps are in unreinforced concrete. The concept is said to have been

Waverley Castle Hotel

Roland Paxton

that of a Mr Tall of London who patented a concrete system but had difficulty in marketing it. 'It won handsome praise from Dr Munro, the hydropathist, who said it compared very favourably with the ordinary methods of stone or lime or brick building.' The concrete mix was 'two bags of cement to one square yard of crushed stone'. [17]

## 22. Darnlee, Lowood or 'Bottle' Bridge, Melrose

**HEW 2405**
**NT 5283 3485**

A substantial two-arch sandstone masonry bridge with two 80 ft spans erected over the Tweed from 1754–62 of which little is now known. This river crossing was of major significance at the beginning of the turnpike era in Scotland; the only other carriage bridge crossing of the Tweed between Berwick and Peebles 50 miles inland having just been completed at Kelso in ca.1755. The bridge now carries the B6360 road. The 'Bottle' name may stem from a belief that broken glass was used as aggregate in the foundations or from having a bottle being built into a parapet (demolished by a tank in the early 1940s), perhaps symbolic of the use of glass aggregate.

This bridge may have superseded the medieval footbridge at nearby Bridgend, described by Sir Walter Scott in *The Monastery*, the foundations of which, although now gone, were visible in the 19th century. A bridge existed at Melrose in the 15th century but its site and form are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Darnlee Bridge

not known. According to Scott this bridge had a stone pier in the middle of the current with counter-weighted draw bridges on each side attended by 'Peter of the Brig', who had difficulty exacting his toll from the monks of St Mary's Abbey, Melrose. [4, 18]

## 23. Leaderfoot Viaduct, nr Melrose

**HEW 1263**
**NT 5737 3474**

An impressively slender former railway viaduct of 19 arches crossing the Tweed at a height of 126 ft and opened in 1865. Its arches, each of 43 ft span, are of brick-work and the abutments, piers and walls are of rustic-faced red sandstone. Some later strengthening of the abutment and pier at the south end is evident.

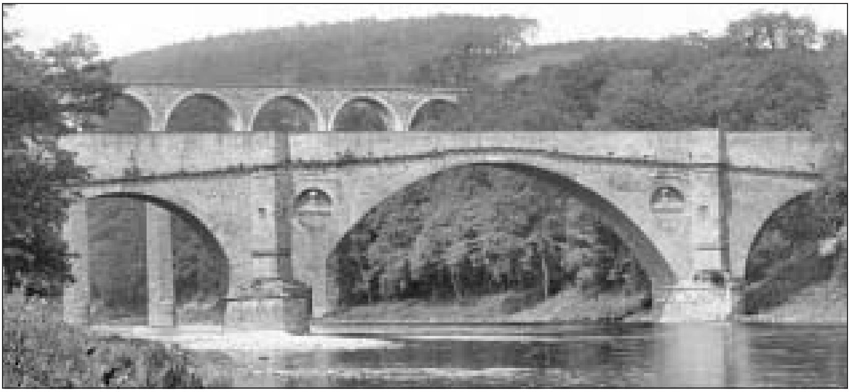
The viaduct used to carry the Berwickshire Railway branch line from the Edinburgh to Hawick 'Waverley Route' to Duns and Reston. Its engineers were Charles Jopp and Wylie & Peddie.

The line was severed in the 1948 floods and closed in 1965. The structure is in good condition having been extensively renovated by Historic Scotland in 1992–95. It is not generally open to the public, but is visited by arrangement for viewing the Roman fort site to the west. [3]

## 24. Drygrange Bridges

**HEW 0531**
**NT 5753 3466**

These bridges over the Tweed, together with nearby Leaderfoot Viaduct, provide an instructive example of the development of bridge engineering over two centuries.



Drygrange Bridge and Leaderfoot Viaduct [postcard 1925]

Drygrange, or 'Fly Boat' Bridge as it used to be known referring to an earlier ferry, is a masonry arch bridge constructed as a turnpike road improvement in 1779–80 with a central span of 105 ft and two side spans of 55 ft. The rise of the main arch is 34 ft and its arch ring is only $2\frac{1}{2}$ ft thick at the crown.

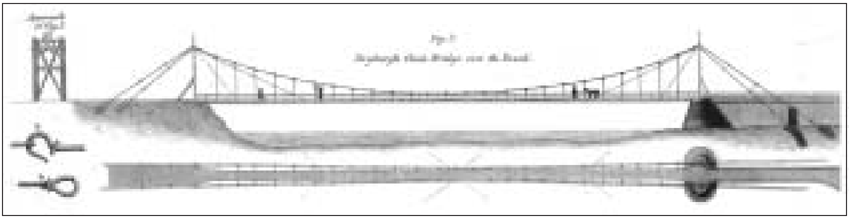
The bridge was designed and constructed by Stevens, who applied state-of-the-art practice, including three longitudinal cavities in each spandrel to reduce weight. Its pier foundations are of large hewn stones joined by iron cramps and laid on rock. The cutwaters are of the curved and pointed shape preferred by French engineers but very new to Britain in 1780. The bridge is believed to have been Stevens' most daring design. For many years, until bypassed in 1974, it carried the A68 trunk road.

The present bridge is a modern composite steel box girder and concrete deck bridge. It was designed by Sir Alexander Gibb & Partners and built in 1971–73 by Miller Construction (Northern) Ltd with steelwork by Clarke Chapman Ltd. It has a main river span of 187 ft with subsidiary spans giving a total length of 640 ft. The twin box girders are 12 ft × 5 ft at the piers reducing to 5 ft × 5 ft at midspan, to give a curved soffit profile. The girders were assembled on site using high strength friction grip bolts. [3, 19, 20]

## 25. Dryburgh Abbey Footbridge

**HEW 2396**
**NT 5885 3209**

A steel wire cable suspension bridge erected over the Tweed near the Abbey in 1911 with a span of about 260 ft



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Dryburgh Abbey Footbridge [31]

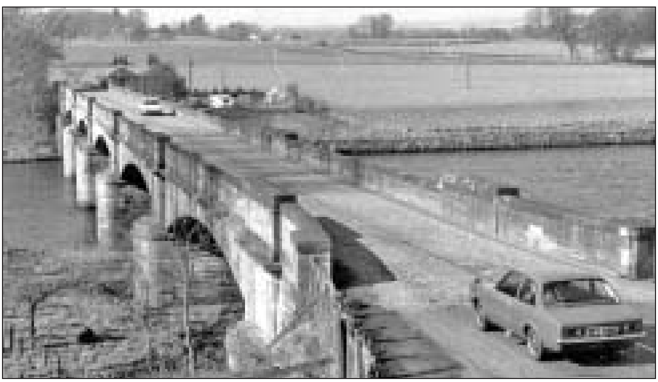
and steel-lattice tower supports. It was refurbished, including re-decking, in the early 1990s, having replaced the wrought-iron chain-link suspension footbridge of similar span of 1818. It too had replaced a pioneering bridge of the suspension and chain-rod stay type, August 1817, which had collapsed in a storm from chain failure at its rod ends (as shown). Both were designed, made and erected by J. & T. Smith of Darnick for the Earl of Buchan. [3, 21]

## 26. Mertoun Bridge, St Boswells

**HEW 1373**
**NT 6098 3205**

Mertoun Bridge to the east of St Boswells, a five-arched brown sandstone structure, carries the B6404 road over the Tweed. Each arch is of 70 ft span that, with a rise of only 6 ft, presents a remarkably shallow curvature. The arch ring joints radiate to the parapet stringer course.

As originally constructed in 1839–41 by William Smith of Montrose there were three timber rib-beams made up from five laminations of 12 in. × 6 in. timber bound with iron straps. This appears to have been adopted as a medium



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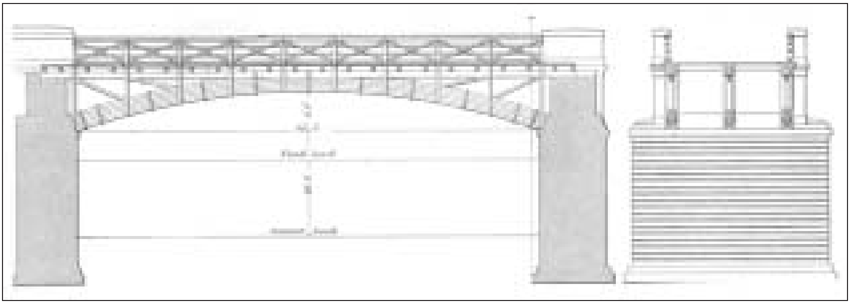
Mertoun Bridge



Mertoun Bridge – Slight's timber arches [22]

term measure by the ingenious James Slight of Edinburgh who allowed in his substructure details for the present masonry arches to be built when required. It is not known whether the original timber arches were utilised as falsework. [3, 22]

## 27. Kalemouth Suspension Bridge

**HEW 0410**
**NT 7084 2745**

This is a rare operational example of an early wrought-iron chain-bar suspension bridge. It was made and erected over the Teviot in ca.1835 by chain manufacturer Capt. S. Brown, RN. The span is 186 ft and the timber deck almost 9 ft wide at the suspension pillars. The bridge has double chains at each side of the deck consisting of 10 ft × 2 in.

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Kalemouth Suspension Bridge

diameter rods with hand-forged eyes and short interconnecting links. The chains are suspended from pairs of ashlar pylons at each end of the bridge.

With a sag–span ratio of about 1:14 the chains have a more efficient curvature in terms of their load bearing capacity than Brown adopted at Union Bridge in 1820. A comparison between Union and Kalemouth bridges demonstrates the evolution of Brown's practice. Other improvements on Union Bridge at Kalemouth were the cross bolting of each pair of chains and the provision against oscillation by means of robust timber lattice parapets. The masonry of the bridge was the work of William Mather, Kalemouth. In 1845 the toll for a pedestrian was a halfpenny, for a horse and cart three pence, and for a chaise one shilling.

In 1987 the bridge was tastefully reconditioned by Borders Regional Council. The timber was renewed, the pylons were refurbished and the pins and short interconnecting main chain links were replaced using spheroidal graphite iron. In 1990 new cable anchorages were installed. [3]

## 28. Roxburgh or Teviot Viaduct

**HEW 1046**
**NT 7020 3041**

This structure is fine example of a large masonry viaduct constructed on a curve with skewed spans. It crosses the Teviot at a height of about 70 ft and was built in 1849–50 by the North British Railway to connect the Edinburgh Waverley line at St Boswells with Kelso.

The viaduct's 14 segmental arches include six skewed spans of about 46 ft 9 in. (measured on the square) built



Teviot Viaduct

in coursed rusticated stonework with framed ashlar pilasters. These skew arches are flanked by four 30 ft straight approach spans built of coursed rubble. The engineer was John Miller and the resident engineer, G. Glennie.

On the north side of the viaduct four piers are extended at a low level above the river to support an iron truss footbridge with three clear spans varying from 49 ft to 52 ft. Each span is simply supported by 4 ft deep bowstring trusses at each side of the deck. The upper chord of the truss is a 5 in. $\times$ 1 in. thick flat bar and the tension member is a $1\frac{1}{2}$ in. diameter wrought-iron rod. The rod was tensioned by tightening its end nut against the bulbous flat bar end through which it passes. This footbridge also dates from ca.1850 and was almost certainly made and erected by C. D. Young & Co.

The railway began operation on 17 June 1850 and was closed in 1968. The viaduct has been recently refurbished and now forms part of The Borders Abbeys Pedestrian Way from Kelso to Jedburgh. [3, 23]

## 29. Teviot Bridge, Kelso

**HEW 2401**
**NT 7189 3354**

Alexander Stevens submitted designs and estimates for this bridge in 1784 and 1788 and although the actual builder in 1794–95 was William Elliot of Kelso, the form and ornament suggest very strongly that it was built to Stevens' design. It has some points of similarity with his Bridge of Dun design.

The twin columns over each pier, which are ornamental and without structural significance, were first introduced by Robert Mylne at Blackfriars Bridge, London, in 1760–69 and gave rise to the mocking rhyme:

> 'I stand, I stand, twin column dear,
> But tell me now, – what do we here?'

John Rennie, when visiting Kelso in 1798, was critical of the architecture of Teviot Bridge and of its position at a river bend. However, he seemed to have second thoughts about twin columns as he incorporated them with a more generous entablature into Kelso Bridge and Waterloo Bridge, London.

Teviot Bridge is founded on rock and its arches are segmental with a centre span of 64 ft and side spans of

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Teviot Bridge

53 ft. The clear width between parapets is 21 ft 6 in. The cutwaters are both curved and pointed like those of the Drygrange Bridge. The cost of construction was about £2000. [3, 19]

## 30. Kelso Cauld or Weir

**HEW 2400**
**NT 7240 3413**

This weir across the Tweed at Kelso is believed to date from ca.1250 and may have been constructed by the monks of Kelso Abbey. It is built of sandstone masonry,

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Kelso Cauld

about 1300 ft long and 5 ft high, and crosses the river at an angle for the purpose of diverting water into the mill lade. The downstream face is a varying slope meeting an apron of stones held in a framework of timber baulks which is accessible at its east end only through Hogarth's Mill. The cauld is best seen from Chalkheugh Terrace. A dramatic 17th century view of it was drawn by Slezer. Part of the medieval mill can be seen spanning the lade at the rear of Hogarth's mill. [24]

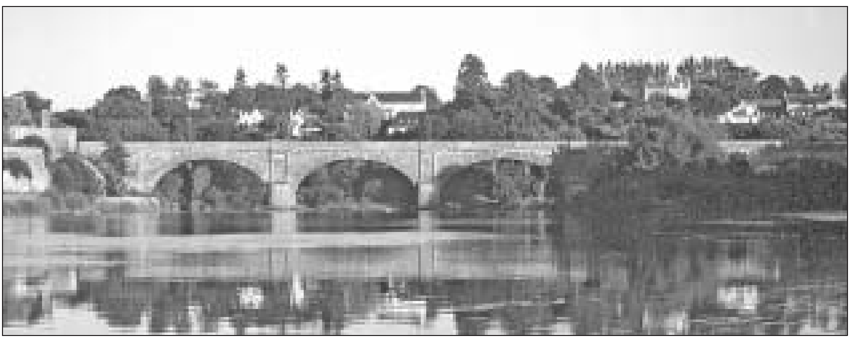
## 31. Kelso Bridge

**HEW 0308**
**NT 7278 3361**

This bridge over the Tweed is one of John Rennie's finest and a precursor to his magnificent Waterloo and New London Bridge over the Thames. He designed it in 1799 for the local road trustees to replace a six-arch bridge, built a short way upstream in ca.1755, that had partially collapsed in 1797 because of scour to its shallow foundations.

The bridge, built from 1801 to 1804, has five semi-elliptical arches of 72 ft span and 10 ft rise that provided a greater waterway than its predecessor. The foundations are all sunk at least 7 ft into bedrock and were built in cofferdams that were pumped dry by a waterwheel in a mill-race on the south bank. The width between the parapets is 24 ft. The contractors were Murray & Lees and the cost was £12 876.

The architectural details are correct and bold, with a wide projecting cornice, columns and entablatures perfectly proportioned, and rusticated cutwaters. The steep rise of the ground at the south end required a high



Kelso Bridge

Steve Hawkin

bridge and the choice of a horizontal line of road and parapets to give a symmetrical elevation necessitated an embankment at the north end.

A serious accident during construction nearly deprived the nation of Kelso-born, Sir William Fairbairn. When 14 years old and working as a labourer at the bridge, a stone he was carrying proved too heavy and his leg sustained a 'fearful gash' which threatened to make him a cripple. Fortunately he recovered to fulfil a destiny which included experimentally developing and making iron girder bridges, culminating in the 460 ft spans of the Menai tubular bridge by 1850, more than six times greater than those of Kelso!

Masonry re-pointing and some bridge strengthening took place in 1921. A small width increase was proposed in 1956 but the Fine Art Commission objected strongly because the required cantilevering would affect the architecture of the elevations. It was not implemented. In 1981 the parapets were rebuilt with much new stone being used. [3, 25, 26]

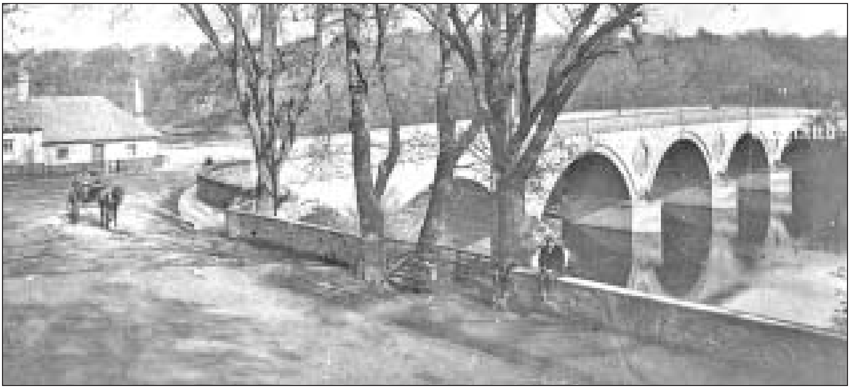
## 32. Coldstream Bridge

**HEW 0158**
**NT 8488 4013**

The earliest of three large masonry bridges designed and built under John Smeaton's direction. It was erected across the Tweed from 1762–67 and has five segmental arches with three different spans built to the same radius so that the centring could be reused. This practice resulted in spans from the sides to the centre of 58 ft, 60 ft 5 in. and 68 ft 8 in. producing an attractive elevation and acceptable road gradients.

The decorative circles in the spandrels, that suggest transverse cavities to lighten the load on the piers, originally concealed a cavity in the direction of the road filled with loose material. By 1828 the spandrel walls had become cracked and off-plumb and they were reconstructed with arched cavities between on Sir John Rennie's advice.

The foundations are protected from scour by surrounds known as 'starlings', originally of rubble stone but now of concrete. As a further precaution the cauld, or dam, downstream was built in 1785 to provide a stilling pool at the piers. The major flood levels and their dates are recorded on the north abutment.



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Coldstream Bridge

In 1960 the arches were strengthened with reinforced concrete below the roadway which was widened over the spandrel walls by the addition of cantilevered footways. The view dates from ca.1930. [3, 27, 28]

## 33. Norham Bridge

**NT 8900 4729**

This bridge, with its four segmental masonry arches, was erected over the Tweed from 1885–87 by G. Meakin and J. W. Dean to a design of Thomas Codrington. It has two 90 ft central spans flanked by 85 ft spans, all of hollow-spandrel construction, and is 16 ft wide. The bridge replaced a bold laminated timber segmental arch-truss bridge with two 190 ft spans designed by J. Blackmore and erected in 1838. [29, 30]

## 34. Union Bridge, nr Paxton

**HEW 0143**
**NT 9339 5102**

Although projected after Telford's Menai Bridge, which was on a much larger scale, Union Bridge erected over the Tweed four miles west of Berwick in 1819–20 by Capt. Samuel Brown RN was completed first. It has an 18 ft wide deck and for five years was the largest wrought-iron span suspension bridge in the world carrying vehicular traffic, which it still does. It is believed to be the oldest suspension bridge still carrying vehicles and is now subject to a two ton weight limit.

The bridge was a triumph of the newly-emerging technology made practicable by Cort's improvements in iron

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Union Bridge

manufacture. Brown used his patent wrought-iron chains to achieve a clear span of 361 ft (437 ft between supports), a span several times greater than was practicable by means of a stone arch. The main ironwork consists of individual chains formed of 15 ft × 2 in. diameter eye-bar links in three pairs, one above the other, at each side of the deck, with a dip of about 26 ft. The bridge has a supporting tower only on the north bank, being anchored into the rock face at its south end.

Brown's expertise was in chain manufacture rather than bridge design and his original proposals for the 60 ft tall tower and abutments were considerably improved on the advice of John Rennie. Nevertheless, this application of his eye-bar chains, and its development by Telford at Menai Bridge, undoubtedly exercised an important influence in suspension bridge practice. The bridge was erected in the remarkably short time of 12 months and cost approximately £7700 which was compared at the time with the sum of at least £20 000 for a multi-span masonry arch bridge.

Knowledge of Brown's achievement and of other innovative Scottish wrought-iron suspension bridges was widely spread by Robert Stevenson in his authoritative *Edinburgh Philosophical Journal* article in 1821, notable for its early description of deck undulation. By 1824 translations of Stevenson's article had appeared in German, French and Polish publications.

In 1903 the bridge was strengthened by the addition above the chains at each side of a single steel cable and hangers which will only come into play and support the deck if an original chain fails. In 1974 the bridge was reconditioned including the replacement, in spheroidal graphite iron, of defective short interconnecting links between the original main eye-bars which were retained in service. An original worn link has been preserved in the ICE Museum at Heriot-Watt University, Edinburgh.

Shirley-Smith states in his book that the bridge was blown down six months after its erection but this is untrue and he may have been confusing it with the fate of the first Dryburgh suspension bridge. Although not as influential as Menai Bridge, Union Bridge nevertheless represents a landmark in the development of long span bridges and its custodians through the years are to be congratulated for its tasteful preservation and maintenance. [3, 21, 30–34]

## Berwick-upon-Tweed Bridges

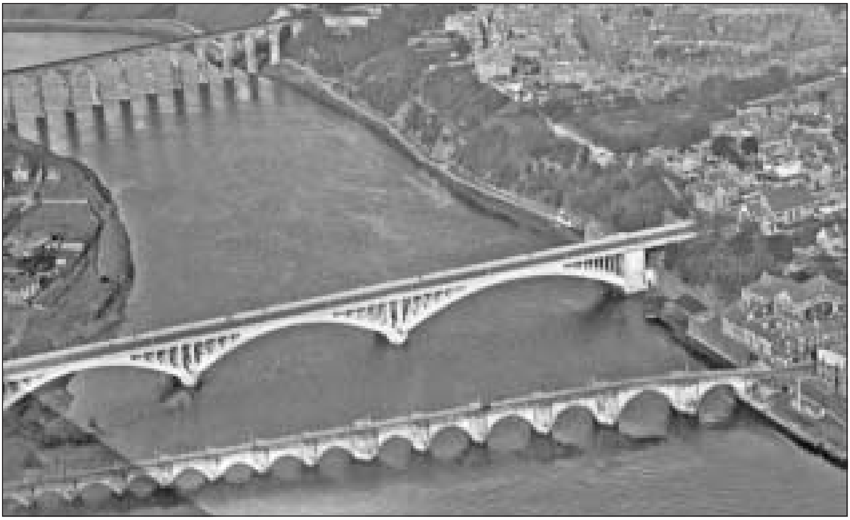
## 35. Royal Border Bridge

**HEW 0020**
**NT 9924 5319**

Together with the crossing of the Tyne at Newcastle, the Royal Border Bridge over the Tweed removed the last major obstacle in completing the East Coast Main Line railway from London to Edinburgh.

The 2152 ft long viaduct is built on a curve and consists of 28 semicircular arches of 61 ft 6 in. span, with a stop pier in the middle as a safeguard against progressive collapse. Its greatest height over the bed of the river is 126 ft. Nasmyth’s steam piledriver was used extensively to drive bearing piles into the river bed. The machine is said to have operated at 60 or 70 strokes a minute, in some cases causing the pile heads to burst into flame. American elm was used for many of the piles, some being 100 ft long. Each bearing pile was calculated to carry a load of 70 tons.

The superstructure is mainly ashlar masonry with a hearting of grouted rubble masonry and with brickwork in the piers, arch haunches and arch rings. There are, it is said, 1 437 684 cu ft of masonry in the structure and 1 710 000 bricks in the arches. The greatest numbers of men and horses employed were 2738 and 180 respectively.



Berwick-upon-Tweed bridges [postcard 1936]

The engineers were Robert Stephenson and his assistant T. E. Harrison. The resident engineer was (Sir) George B. Bruce, founder of the firm of Sir Bruce White, Wolfe Barry & Partners, whose wife laid the foundation stone on 15 May 1847 and placed the keystone in the last arch on 26 March 1850 using a brass mallet. The contractors were James Mackay and J. Blackstock and the work sadly led to Mackay's bankruptcy.

This landmark structure cost the North Eastern Railway Company over £253 000, took three years, three months, three weeks and one day to build and was opened by Queen Victoria on 29 August 1850. [3, 35, 36]

## 36. Royal Tweed Bridge

**HEW 0695**
**NT 9951 5278**

This imposing reinforced concrete bridge is seen to advantage from the adjoining bridges. It illustrates the charm of irregular spans arising from the fact that the bridge is on a gradient of 1 in 51, giving rise to the largest arch at the north end of 361 ft 6 in., the longest concrete arch in Britain at the time. Other spans are 285 ft, 248 ft and 167 ft at the south end.

The whole structure, including the four main parallel ribs of rectangular cross-section, was erected in timber staging mounted on timber piles. It was cast in situ using

Royal Tweed Bridge under construction [postcard 1927]

concrete from mixing plants on both sides of the river. An unusual feature is the lack of interruption of the open spandrels columns sequence by any feature at the three piers.

The bridge was designed by L. G. Mouchel & Partners and built by Holloway Bros. (London) Ltd. It was opened on 16 May 1928. The amount of reinforcing steel used in the concrete was 1015 tons and the average labour force on site was 170 men. The cost of the bridge was £160 000. [3, 37, 38]

## 37. Berwick Bridge

**HEW 0694**
**NT 9956 5272**

There are records of the destruction of several early wooden bridges over the Tweed at or near this site either by man or nature from 1198 onwards. On 15 February 1607 ice, carried by a strong current, demolished the last timber bridge and a grant was made from the Privy Council to build a new bridge of stone.

The bridge, one of Britain's largest and more important, is 1164 ft long of 15 arches, and 17 ft wide between parapets. It was begun in 1610 and took 24 years to complete. The master mason at first was James Burrell who was granted an allowance of 2/6d per day for directing and overseeing. By 1620, seven arches were completed and a contract was entered into with Lancelot, Branxton & Burrell to complete the work within two years. There was serious flood damage in 1621, made worse by the collapse of the old timber bridge, and the contract was cancelled. Work recommenced in 1622 under day labour and eventually the bridge was completed on 24 October 1634 at a total cost of £14 960 1s 6d.

The nearly semicircular, slightly pointed, arches vary in span, the largest being 74 ft. The bridge is asymmetrical in elevation being higher at the Berwick end. It was built to a high standard with flourishes of ornamentation on some elevations. The piers are founded on oak piles 'properly bound with iron' and each pier is protected against scour by starlings 'or surrounds' 3 ft to 6 ft in width. The bridge now carries local traffic. [3, 36, 39]

## 38. Hutton Mill Bridge

**HEW 2407**
**NT 9211 5458**

This bridge, with three spans of 55 ft over the Whitadder Water, was erected in 1837 to a state-of-the art design of James Jardine with iron tension-rod truss spans supported on 50 ft tall, elegant, stone piers. In 1878 the trusses and deck were replaced by the iron-lattice girders and deck (shown in the second illustration) made and erected by Oliver & Arrol. The engineers were D. & T. Stevenson.

In 1985 this superstructure was in turn replaced by a steel beam and reinforced concrete slab deck under the direction of consulting engineers Babtie, Shaw & Morton.

Hutton Mill Bridge

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RCAHMS, John Hume

Hutton Mill Bridge girders 1878–1985

The original piers and abutments were retained. One 1878 iron bridge plaque was re-erected on site in 1985 and the other can be seen at the Institution of Civil Engineers Museum, Heriot-Watt University. [3]

## 39. Allanton Bridge

**HEW 2394**
**NT 8649 5460**

An imposing masonry structure designed by Robert Stevenson & Sons for Mr Balfour of Balsillie and now carrying the B6437 road over the Whitadder Water. It was built from 1840–42 and has two segmental spans each of 75 ft with a low rise of 11½ ft. The resident engineer was J. T. Syme.

The elevation, with its rectangular pilasters, imparts boldness to the bridge's appearance and offsets the duality of the twin spans. The masonry is of broached ashlar, except for the pilasters, frieze, cornice, impost courses, and the base and coping of the parapet. The stone is generally local soft red sandstone except that for the springing courses which was from Daleky (Dalachy) Quarry, Fife. The arch stones are 3 ft deep at the haunches and 2 ft 6 in. at the crown with their joints radiating across the spandrel facing.


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Allanton Bridge

The smaller Blackadder Bridge nearby, with two elliptical arch spans, was built in 1851. [40]

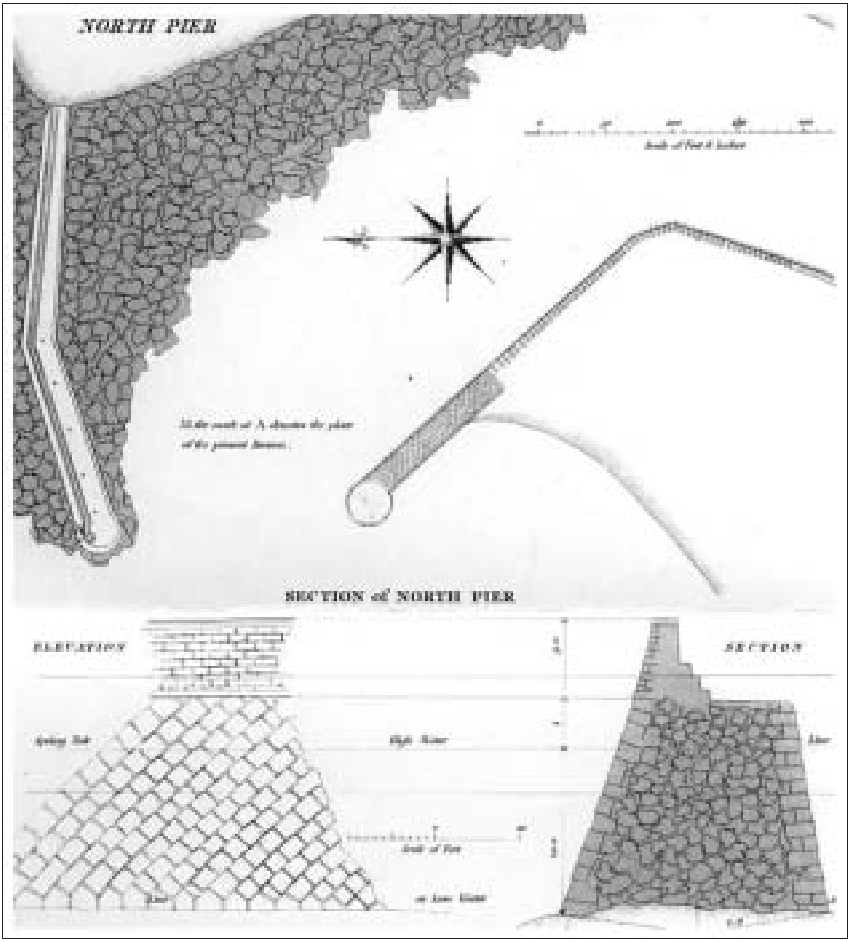
## 40. Eyemouth Harbour

**HEW 2399**
**NT 9454 6411**

Early records show proposals for a harbour at the entrance to the Eye Water at Eyemouth as early as 1660. Silting was a problem and in 1747 what is now known as the Old Pier was constructed by William Crow to channel the river. This effected an improvement but the harbour was badly damaged by the sea in 1767 and further damaged by a severe flood in 1794.

John Smeaton made recommendations for the building of a North Pier, which was begun in 1769 and completed in 1773 to his design as shown. This gave a measure of protection for the harbour entrance. Inclined masonry courses, which Smeaton considered better for resisting wave action than the customary horizontal ones, were used in constructing the pier, some of which can still be seen.

In 1882, after the fishing fleet disaster of 1881, new plans were prepared which were carried out in 1885–87. The harbour was extended to 9.5 acres and deepened by 2 ft. The middle pier was constructed and rock cutting on the Gunsgreen side improved the river course. In 1892–93 the harbour was deepened by a further 3 ft.




Eyemouth Harbour – plan and sections [41]

Eyemouth was nearest to the most abundant of the white fishing grounds and over the years the harbour became known as 'The Hope of the Town'. In the 20th century further improvements were carried out and in 1995 the harbour was still being improved and developed. [41]

## 41. St Abbs Head Lighthouse

**NT 9142 6924**

A major light and fog horn, with a tower only 29 ft high but, being on the headland, its light is about 223 ft above

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Eyemouth Harbour Pier – inclined masonry

sea level giving a range of 29 miles. When operating, the 3 000 000 candlepower light flashes white every ten seconds.

The station was erected in 1862 under the direction of Northern Lighthouse Board engineers D. & T. Stevenson. The inclined astragals in the lantern glazing, to minimise interference with the light beam, were a feature first introduced by Alan Stevenson about two decades earlier. The first Scottish lighthouse foghorn was introduced here in 1876. It is no longer operational. [42]

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## 42. Abbey St Bathans Footbridge

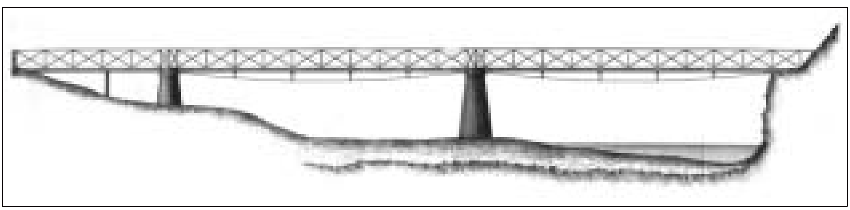
**NT 7585 6234**

Top: St Abbs Head Lighthouse and foghorn

Originally a wrought-iron footbridge with spans of 24 ft–60 ft–60 ft, erected over the Whitadder in ca.1833. It was designed by and erected under the direction of Robert Stevenson for local landowner George Turnbull. The 60 ft trusses were a development of the concept of Stevenson's Cramond Bridge, Edinburgh, proposal of 1820 and later bridges at Glasgow and Micklewood by his friend James Smith of Deanston, which envisaged the deck resting on rather than being supported from the chains of a suspension bridge.

This design developed into a standard footbridge made and widely marketed by C. D. Young & Co. from 1850 (see Teviot Viaduct 2-29). The bridge was closed in 1925. The present cable-stay suspension timber bridge, which utilises

Abbey St Bathans Footbridge ca.1833–ca.1983 [43]



some of the original side pier masonry was erected by the army in ca.1983. [43, 44]

## 43. Pease Bridge, Cockburnspath

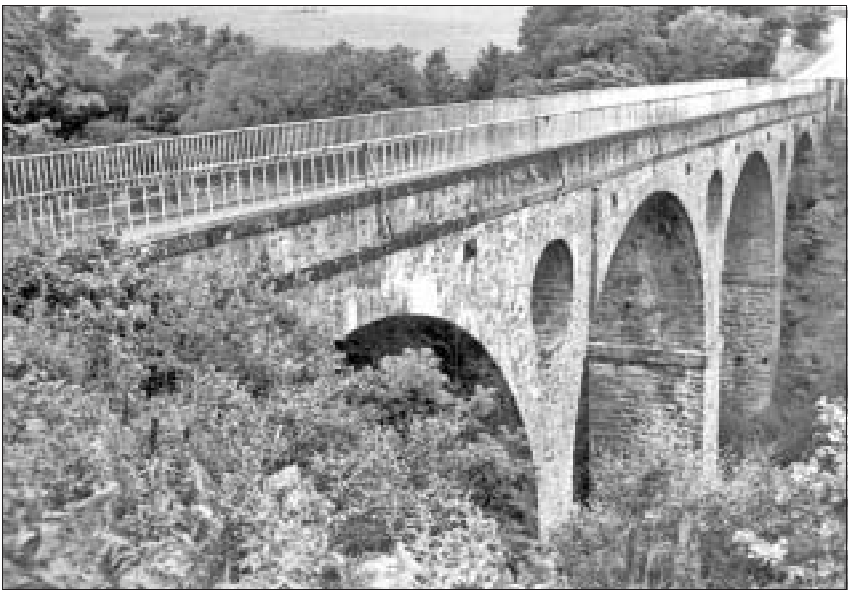
**HEW 1374**
**NT 7915 6997**

The deep gully of the Pease Burn on the former Edinburgh to Berwick turnpike road via Coldingham Moor was a formidable obstacle to travellers prior to construction of this bridge in 1783. A strong argument in favour of building the bridge is said to have come from the military on the grounds that the gorge was almost impassable for artillery!

This bridge, admired by Telford as 'bold' and presaging numerous tall structures of his own from the 1790s, comprises four semicircular masonry arches varying in span from 42 ft to 56 ft in roughly-squared red sandstone. It is notable for its height of about 117 ft above the burn, its slender piers and for the 9 ft diameter voids in the spandrels above each pier introduced to save weight.

Most of the 3 ft high cast-iron railing surmounting each masonry parapet wall is probably contemporary or nearly so. The spandrels and parapets were extensively rebuilt in 2004.

Pease Bridge



Borders Regional Council

The designer was David Henderson who may also have been the contractor. [3]

## 44. Cove Harbour

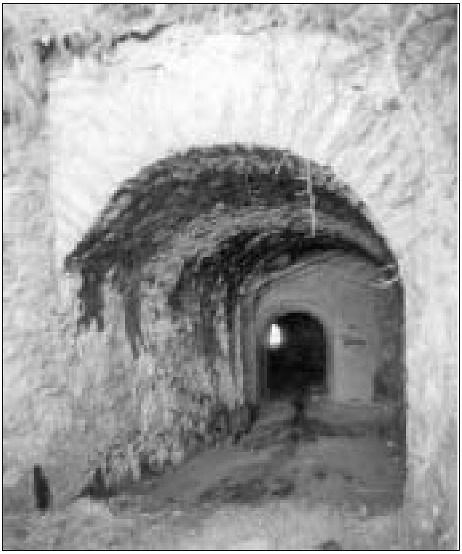
**HEW 2395**
**NT 7850 7169**

Cove Harbour, now little used, was completed in 1831. It has two masonry piers forming an entrance about 50 ft wide with the North Sea and enclosing an area of three acres. Earlier piers, vestiges of which still exist, were destroyed in storms, but a notable tunnel made through a spur of rock in ca.1752 remains, although somewhat distorted in parts by recent safeguarding measures. It was formed as part of a harbour improvement by Sir John Hall of Dunglass to give safe access to the beach.

As the road from Cove nears the harbour, a rock cutting 32 ft long on the right leads to the tunnel entrance. The tunnel is 183 ft in length and slopes down 20 ft. Its first 20 ft from the road is built in rubble masonry with an arched roof and is $8\frac{1}{4}$ ft wide and $10\frac{1}{2}$ ft high. Beyond this to the harbour, the tunnel is cut through the natural sandstone. It was originally 10 ft square at the beach end (at cliff base at left-hand edge of the view), near which it connects via an iron door with an elaborate system of disused storage cellars hewn out of the rock.

Cove Harbour

Roland Paxton



Cove Harbour Tunnel

Roland Paxton

The contractor was Stephen Redpath and the principal mason John Brown. Gunpowder was used to make the tunnel. Labourers were paid from 5d to 6d per day and excavation cost from 7s 6d to 10s per cubic fathom.

This pre-canal age tunnel, one of the earliest in Britain in a context other than mining, is indicative of the spirit of commercial enterprise stirring in Scotland at the onset of the Industrial Revolution. [45]

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