CUMBRIA FLOODS

Cumbria gets stuck

Delicate repair job for Workington's 'condemned' Calva bridge

By Declan Lynch

Engineers were this week carrying out final preparations for the start of repairs to flood-hit Workington's Calva Bridge.

The Grade II listed, three span 47.5m long masonry bridge was so severely damaged in last November's floods that it was initially condemned.

It is now to be rebuilt, but there remains a 50/50 chance that the repair work could cause the bridge to collapse.

The main task is to underpin and repair the bridge's central pier using mass concrete and masonry. The pier was partially washed away in the floods causing the bridge deck to drop by up to 230mm.

Repairs are now considered possible after an extensive structural analysis was carried out by Scotland Transerv, a Balfour Beatty/Mouchel joint venture.

It is actually responsible for managing roads in north west Scotland but did the work on behalf of Connect Roads, the Balfour Beatty-led highway maintenance firm that is responsible for the bridge.

The analysis concluded that the bridge can be repaired sufficiently to take full highway loading.

Key to the change of approach was the discovery of remedial works carried out by the Highways Agency in 2003 to prevent water leaking into the structure from the deck.

The Agency had initially been responsible for maintaining the bridge until it was taken out of the national trunk road network.

The 2003 work had stripped the bridge down to its skeleton structure exposing two masonry diaphragm walls which follow the shape of the arches. Nine more diaphraghm walls running across the structure were also exposed. The Agency had filled the voids between these walls, forming a concrete saddle beneath the deck.

This discovery meant that the structure had a lot more strength than was previously thought.

"We discovered video footage that showed a concrete saddle being installed on the bridge deck to prevent water leakage," said Scotland Transerv bridges manager Calum Galloway.

"This opened up the possibility of salvaging the bridge."

The floods caused the foundations of one of the piers to be eroded on its upstream side, causing the 1,000t dead loads imposed on it to be unevenly distributed.

As result the bridge is twisted out of shape. The roadway on the upstream side has sunk by 230mm while the deck on the downstream side has dropped by 90mm.

This made structural analysis tricky. "I've never assessed a bridge with only two thirds of a middle pier," added Galloway.

"It's a combination of design and analysis."

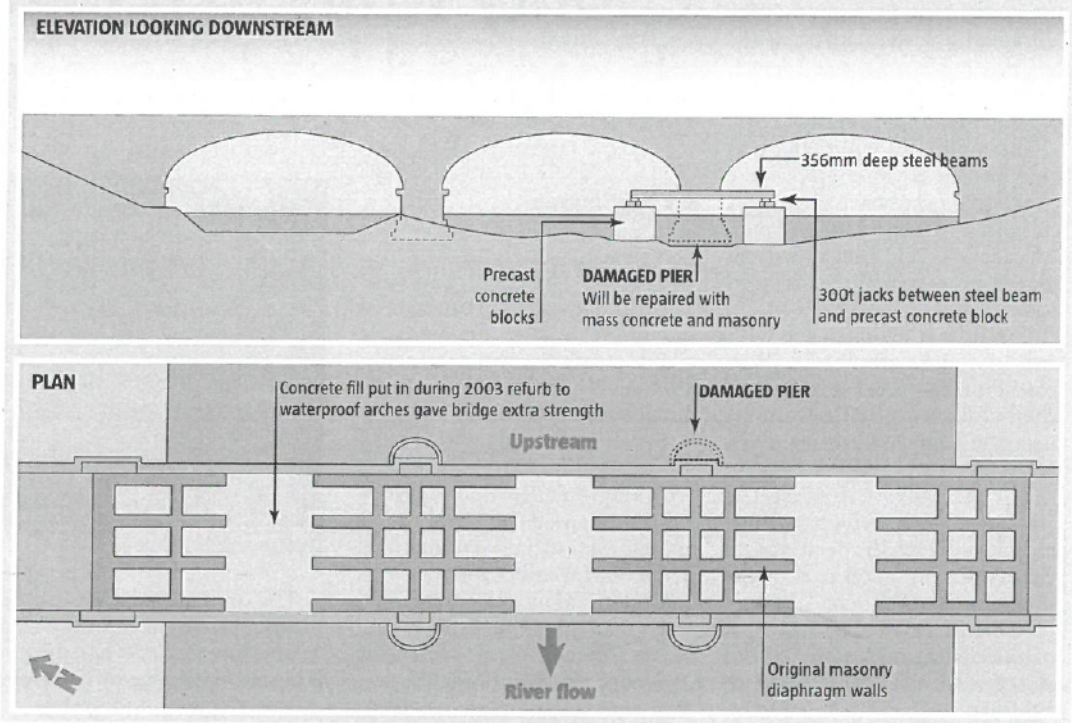
Engineers carried out a remote topographic survey of the bridge and this data was fed into software which determined that the bridge could withstand normal traffic loading but not abnormal loads.

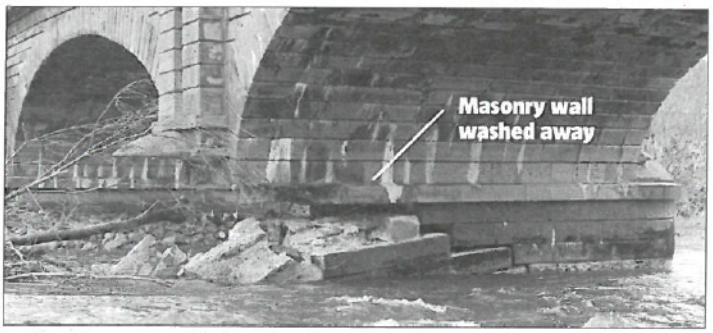
The analysis is conservative because the concrete fill, which is believed to add strength to the structure, is technically considered to be dead load with no strengthening properties.

To repair the bridge, the upstream pier must be underpinned and repaired.

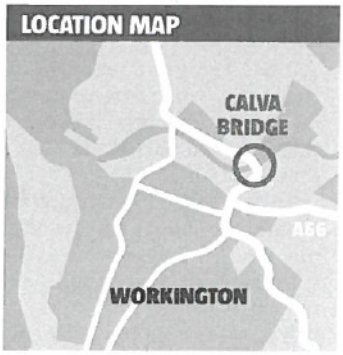
Connect Roads is using maintenance contractor Balfour Beatty

REPAIRING CALVA BRIDGE, WORKINGTON





Falling down: Two thirds of the pier collapsed



into flood repairs

to do the work.

It will first construct a causeway next to upstream edge of the bridge along two thirds of its length using local sand and gravel, and incorporating large diameter pipes to maintain river flow.

The contractor will then excavate bases for 1m deep precast concrete temporary piers either side of the existing damaged pier. Precast concrete blocks will be placed on top of the excavated bases.

Three steel beams, each with two 300t jacks attached, will be placed on the precast units and then slid into position underneath the damaged, upstream part of the pier.

The six jacks will raise the structure to carry a combined load of 300t, reducing the dead load on the remaining good part of the pier from 1,000t to 700t.

"This is most delicate part of the operation," said Balfour Beatty contracts director Keith Bowman.

"We could trigger a reaction that might cause the bridge to fail."

If the bridge remains stable, engineers will start removing masonry and debris underneath the damaged part of the pier to excavate a suitable base.

They will then form a cofferdam around the damaged part of the pier using 1t hessian bags filled with sand and gravel before dewatering it.

A new mass concrete core will be poured into the damaged section of the pier up to the underside of the steel cross beams. Steel plates and more jacks will be installed above the concrete foundation before then the load is transferred to them.

The original jacks can then be removed, leaving the new jacks in place. These will eventually be cast into the repaired pier when the new mass concrete section is connected to the damaged pier. Shuttering will then be built up around the jacks and more concrete poured to fill the remaining void.

The repaired pier will be faced with 100mm ashlar stone to match existing facade.

County waits to replace flood damaged bridges, six months on

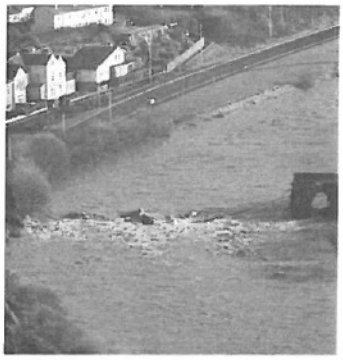
By Jo Stimpson

Nine bridges are still unrepaired six months after devastating floods struck Cumbria, the county's review of flood recovery progress said this week.

Seven road bridges still need replacing or repairing, including Workington's Northside Bridge which collapsed and Calva Bridge which was initially condemned (*NCE* 26 November 2009).

Cumbria County Council highways manager Geoff Holden said a replacement for the Northside will not be built until May 2012.

Structural damage has kept Backbarrow Bridge and Bouthray Bridge in South Lakeland closed since the floods. Backbarrow Bridge needs parapet repairs and repointing. The schedule and cost for this are unconfirmed.



Destroyed: Northside bridge

The council said it was considering replacing Bouthray Bridge at an estimated cost of £400,000. This could be done by November subject to planning approval.

Low Lorton and Little Braithwaite bridges in rural Allerdale both collapsed in floods. Replacements are at the preliminary design stage and planning applications have been submitted. The new bridges could also be built by November for £700,000.

Scarness bridge in Bassenthwaite sustained damage to its parapets and culvert. The council is working up a schedule for repairs and 31 July has been given as an estimated deadline.

Funding has been set aside for repairs to the Millers footbridge in Cockermouth and designs for a replacement of the damaged Navvies footbridge in Workington are underway.

A temporary replacement for Navvies bridge was constructed by the Royal Engineers in December (*NCE* 3 December 2009). Its permanent replacement is scheduled to be finished by the end of 2010, when the temporary bridge will be dismantled.

Workington's port still needs structural repairs. Invitations to tender for the repair work will be sent out next month.

National Trust plans for floods

By Jo Stimpson

The National Trust is considering new soft engineering measures to reduce flood risk in the Lake District after last year's floods ravaged much of its property.

The organisation has said it may use soft engineering techniques in the hills to hold back run off and reduce flooding downstream.

The measures could include planting new woodland to prevent top sediments being washed away and causing silting downstream. The Trust is also considering blocking moorland ditch drains, known as grips, to restore natural drainage patterns; encouraging moss to grow and act as a natural sponge; and creating flood storage areas on farmland to protect towns and villages downstream.

Flooded: Wordsworth's house

The solutions could also include replacing existing bridges with longer span structures with more space under them for water to pass through, preventing them becoming choke points.

The proposed measures could be controversial as they would change the National Trust's much-loved landscapes.

Some National Trust properties were hit by the 2009 floods. The gardens and historic terrace walls of Wordsworth's House in Cockermouth were destroyed, while buildings at Fell Foot Park on the shore of Lake Windermere sustained considerable flood damage. Farms, cottages, paths, footbridges and walls were also damaged.