PROJECT EXCELLENCE AWARDS 2006

ENTRY FORM

Project Name	Monk Bretton Bank Erosion Protection	
Project Details *(Brief description of works or appraisal / location / value)*	Construction of a brushwood mattress silt trap to repair severe river bank erosion. Located at the Monk Bretton A259 road bridge on the tidal River Rother, Rye (Kent Area). Cost of construction works: £280k Development of solution on other schemes including Rother Tidal Walls, Rye and Dartford Creek.	
Nominees/ Team Members	Name	Company
	Adam Schofield Miles Pickering Simon Cain Richard Hull Tim Connell	Halcrow Group Ltd Halcrow Group Ltd Cain Consultancy Environment Agency (Worthing NCPMS) Environment Agency Operations (Leigh)

AWARD CATEGORY

***Please indicate the Project Excellence Award your Application relates to**
(Projects may be entered for one or more of the categories)

Project Management		Innovation and technical merit	
Managing health and safety / environmental risk		Sustainable construction / environmental enhancement	Yes

PROJECT SUMMARY

Severe erosion to the tidal river bank adjacent to the Monk Bretton Bridge at Rye threatened to breach the flood embankment, thus exposing a junior school and 151 residential properties to life threatening tidal flooding 2m deep.

Normal hard engineering solutions had been considered for a number of years as the problem developed. However, tidal flows at the site are particularly high, and access for undertaking the works was extremely difficult. Project risk from both a technical and health and safety perspective were high. Further risk was added on identification of two Unexploded Ordnance known to be in the immediate area from WWII UXB records.

Brushwood mattresses were traditionally used for many years as a method of silt entrapment to provide bank protection as well as foundations for structures on soft marsh ground. Working with Cain Bio-Engineering Ltd a brushwood mattress was developed by Halcrow Group Ltd to provide a soft solution.

The mattress was installed by Environment Agency Operations workforce to widen their experience of the technique. The project cost was estimated to be 40% of the cost of a hard engineering solution (sheet piling and rock revetment). Health and safety risk was reduced by the development of a new tool for the project, which negated the requirement for access in the river for plant or labour.

Within 6 months of completion the mattress had accreted by approximately two-thirds, and the tidal embankment is no longer at risk of scour and collapse.

The scheme was recognised by the ICE South-East Region with the Brassey 2005 Environment Award.

Monk Bretton Bank Erosion Repair Scheme

Background:

The tidal River Rother at Rye has the largest tidal variation along the south coast of England. The river is tidal for approximately 6km, and as a result the flow rate each tide is particularly high. With high fluvial flows the discharging flow can be significant.

The A259 coast road crosses the River Rother at Rye – known as Monk Bretton Bridge. The nature of the bridge piers and river profile at the site has given rise to severe erosion process on the downstream side of the bridge, as indicated on Photograph 1. The site forms a small part of the extensive flood defence on the east bank of the tidal river Rother with the flood defence comprises a grass-covered embankment with a public footpath on the crest. The river is navigable, forming part of the Harbour of Rye and the locally important Fishmarket Quay lies on the opposite (west bank) of the river.

The area lies in the northern tip of the Camber Sands and Rye Saltings SSSI. Walland Marsh SSSI, designated for freshwater grazing marsh and associated fauna and flora, lies a short distance behind the embankment. Immediately to the rear of the embankment lie 151 residential properties and a school, approximately 2m below the level of a 1% annual probability tidal flood event.

The Problem:

Photo 1: Monk Bretton Bridge

Photo 2: Scour hole at low tide

The bridge was constructed in the early 1950s with two supporting abutments placed in such a fashion as to cause a low-level narrowing of the channel by approximately 50% of its natural width. Flows are guided through this constriction, up and downstream of the abutments, by means of piled wing walls.

The bridge abutments are aligned in such a way that concentrated high velocity flows are directed through the constriction and against the face of the downstream embankment, causing a major scour hole and loss of the riverward face of the embankment extending to approximately 50% loss of the crest width. The scour hole was approximately 60m in length, and up to 4m deep. In conjunction with the scour process a scour hole in the bed of the river was recorded at approximately 10m depth below the crest of the embankment.

Photograph 3: Scour hole, with 2m vertical face

Photo 4: Deconstructing bank margin

If left unchecked it was clear that the scour process would continue, with erosion of the embankment. Given the nature of the erosion process a sudden dramatic geotechnical failure of the remainder of the embankment could not be ruled out, exposing the property to major risk of life- threatening flooding.

In addition to the erosion issues a UXB survey was commissioned for Rye as part of the wider tidal improvement scheme works. This identified that 2 abandoned UXBs were located immediately downstream of the bridge, dropped in 1941 probably due to the presence of a Motor Torpedo Boat squadron based at what is now the Rye Fish Market Quay on the opposite bank. The 2 bombs had not detonated or been recovered due to the location in the river bed. The exact location of where the bombs had stopped moving through the river bed silts was not known.

The Solution:

During investigation of the site the channel upstream of the Monk Bretton Bridge was inspected. The channel is unusual in that the left hand bank features a completely smooth and stable profile, whilst the opposite bank is actively undergoing slump and deconstruction. Closer inspection revealed that the bank profile has been achieved via the accretion of a pre-formed brushwood sediment trap.

Photograph 5-7: Ancient hazel faggot bank revetment upstream of Monk Bretton Bridge

The age of the installation of the brushwood could not be identified readily, but since no knowledge of its existence was known by any local EA staff, it has been presumed to be at least 50-60 years old, and probably far older.

This solution was developed by Halcrow Group and Cain Bio-Engineering to identify a brushwood design for the downstream site. The concept of the solution is that the matrix of the brushwood mattress slows the

velocity of the water such that the suspended sediment is deposited, and the mattress quickly accretes with silt and clay fines to form a natural profile, ultimately which at the top fringe can vegetate with natural saline species already found in the area at the adjacent saltings.

This solution avoided the need for a hard engineering option using sheet piling and rock revetment. Such a solution would not only have been particularly expensive, but also involved a high safety risk level due to access requirement for piling from the river in severe tidal flows and variation, plus the UXB potential for a severe incident.

To maximize the gain for the local Environment Agency Operations team, it was elected that they would undertake management of the construction, with Cain Bio-Engineering Construction undertaking the mattress construction as key supplier and Halcrow Group providing supervision and further design advice.

Material for the brushwood mattress was obtained from renewable sources in Southern England, providing regeneration of coppiced woodland for hazel (faggots) and chestnut (stakes). The benefits of coppiced woodland are widely promoted by English Nature.

Following a near-surface UXB survey (cheaper than a deep penetrative UXB survey required for sheet piling) the construction of a stake matrix was initiated. To avoid the need for labourers to undertake this manually within the tidal river silts, a special tool was used fabricated by the machine plant supplier to pick and place the stakes using a long-arm reach machine. This was planned during design discussions as part of the Designer's Risk Assessment by the team.


Photograph 8-9: Placement of the timber stakes using placing tool

In addition to reduced H&S risks associated with working in the river, there were also significant economic benefits from adopting this more rapid method of construction. The stake matrix was completed and hazel faggots then installed. These were delivered in 300mm to 400mm tied bundles, up to 4m in length. Placement of the faggots was undertaken using a combination of hand and machine to achieve the required design profile.


Photographs 10-11: Completion of stake matrix and placement of faggots with temporary step access

The faggots are bound together in-situ to form the mattress. Once the faggot mattress is placed to required profile, the timber stakes are trimmed, and the mattress is held to the timber stakes by installation of rock netting over the top.


Photograph 12-13: Mattress with netting installation

Conclusion:

The brushwood mattress has accreted as predicted – even during construction it was found that the toe of the mattress was soon invisible following completion. Lessons that have been learnt over the past year during monitoring of the mattress are:

- Once accreted the mattress settles, thus exposing the top of the stakes and netting at the top level of the design profile. At the appropriate time either the stakes and mesh needs to be lowered or removed such that it does not become a maintenance liability.

- The accretion rate up to 500mm of MHWS level (top of design level) was quick at this site (about 6 months). However since the suspended sediment load at the top of the tide is lower (slower speed) the final accretion to design level is a much more gradual process, and it may be that artificial placement to the design level would improve aesthetics and then assist natural vegetation process to achieve the final desired natural effect.

The solution has been developed at other locations in Rye as part of the Rother Tidal Walls Improvement Scheme, and also at other sites such as Dartford Creek. At Rye the financial savings are estimated to be in excess of £1.5m compared to a hard engineering sheet piled solution.

The scheme was recognised by the ICE South-East Region with the Brassey 2005 Environment Award.


Photograph 14: Mattress at end of construction


Photograph 15: 12 months post completion

Report Courtesy of Adam Schofield – Halcrow Group Ltd.
Photography – Simon Cain - Cain Bio-engineering Ltd

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Postscript:

NCPMS COMMUNIQUE
Project Excellence Awards 2006
'The short-listing panel picked out the Monk Bretton Bank Protection scheme, undertaken within Southern Region as deserving a special mention. This scheme was completed several months before the period of eligibility for the 2006 Project Excellence Awards and could not therefore be short-listed for consideration by the final judging panel. It would however have been a strong contender in the sustainable construction / environmental enhancement category and the panel have recommended that other opportunities be explored to promote the techniques used on this scheme.'

Miles Jordan
Head of NCPMS