

REINFORCEMENT AND EROSION CONTROL USING CONCERTAINERS

J.W. Heselden

Hesco Bastion Ltd., Unit 37, Knowsthorpe Gate, Cross Green Industrial Estate, Leeds, LS9 0NP, UK

The Concertainer Bastion was invented in 1989 as the ultimate Blast Wall and Modular Land Reinforcement system. It has grown to be one of the most effective and versatile products available to today's Military and Civil Engineers. The Concertainer Bastion is manufactured from the highest quality products. The welded wire mesh panels can be either heavily galvanised or Bezinal coated. Bezinal is a zinc alloy applied to wire to improve its corrosion resistance by up to three times that of traditional zinc coated wire for the same coat weights. The mesh panels are connected by helical spirals to create the folding modular system. Units are easily joined by pushing the spirals together and inserting a joining pin.

The name "Concertainer", which is a registered trade mark, refers to the unique way that the units fold flat concertina style. This ensures very efficient packaging, handling and erection.

The System

The strength of the system is based on the simplicity of the design and the use of high quality products, the end result being a highly effective, inherently strong and versatile system, whose basic strengths include:

- * Utilisation of a wide variety of infill materials
- * Fast and effective erection and installation
- * Strong, versatile construction
- * The unlimited potential for enduse

The system was first used for coastal erosion protection on the East Coast of England. This stretch of coastline has one of the worst erosion problems in Europe yet even in its infancy the system has proven to be highly successful. This success and the publicity it created was seen by the British Ministry of Defence in the UK and they immediately recognised its potential as a blast wall for protection of troops and equipment. Units were successfully deployed in the Gulf during Operation Desert Shield in 1990/1991.

During this time there has been extensive testing on the units for blast protection properties by the U.S., British and Dutch Armed Forces. These tests have proven that the Concertainer Bastion system is the ultimate in modern, mobile blast wall protection.

During the past eight years the system has also been marketed in civil markets throughout the world.

It can be used as a highly efficient and strong alternative to the traditional wire gabions for land reinforcement or retaining wall systems with or without the geotextile liner, a rapidly installed flood protection barrier, as an efficient noise abatement system, for sea defences, landfills or landscaping.

Projects

Recent projects include beach stabilisation in Bermuda, bridge abutments in the Philippines, airfield protection in Antarctica, coastal reinforcement in the USA and numerous other applications around the world.

Conclusion

The potential for the system is enormous as either a permanent or temporary barrier, for example as a rapidly deployed emergency flood protection barrier, for oil spill clean up operations, agricultural systems and sewage recycling plants. In summary, the Concertainer Bastion System offers a modern, flexible, yet extremely strong solution to today's engineering problems.

The use of wire mesh gabions for land reinforcement can be traced back to the time of The Pharaohs of Egypt who built dykes along the Nile using gabion-type structures. Since Roman times, cage units, originally of woven plant fibres, have been used for a wide range of applications from coffer dams to fortifications. Although effective they remain an antiquated and labour intensive solution to today's land reinforcement problems.

The Concertainer Bastion is the first new product to address these shortcomings. Originally designed for prevention of coastal erosion the product was quickly adapted by the military as a rapidly erected yet extremely strong blast wall. These characteristics have now been introduced to many other civil markets. The result is a product that is easily transported, erected in minutes and is by design inherently strong.

THE PRODUCTS

Concertainer Bastion

The Concertainer Bastion is basically a series of hinged welded wire mesh panels which are joined together by helical coil hinges to create a folding modular system. The mesh itself is usually 3" square in 3mm, 4mm or 5mm wire. The size of the panel varies from 2' x 2' to 7' x 7' and is available in heavily galvanised, Beznal coated and PVC coated finishes. The panels are lined with a durable non woven geotextile membrane. The name "Concertainer" which is a registered trade mark refers to the unique way that the units fold flat concertina style. This ensures very efficient packaging, handling and erection. The Concertainer's stability is created by infilling with almost any material; sand, ballast, earth, stone, concrete and even snow depending on the availability or requirement.

All units are fully collapsible for ease of transport and storage. One kilometre of Concertainer Wall can be transported in a single 20' container.

Units are quickly and easily joined on site by the unique yet very strong joining pin system. The finish can be further enhanced by spraying Gunit, a concrete based rendering, after installation. The use of Gunit increases resistance to abrasive action and also gives a uniform and pleasing visual effect.

More recent introductions to the range are Concertainer Bastion with Inserts and Concertainer Gabions.

Concertainer Bastions with Inserts: These are based on the standard Concertainer unit but an additional welded mesh panel is built in. This allows the use of on-site material in the back of the unit and traditional gabion stone wall effect on the front. The advantages of this system are; a) rapid assembly and strength synonymous with the Concertainer, b) The use of inexpensive local fill in the majority of the unit. c) only approximately 25% of the stone required in traditional gabions.

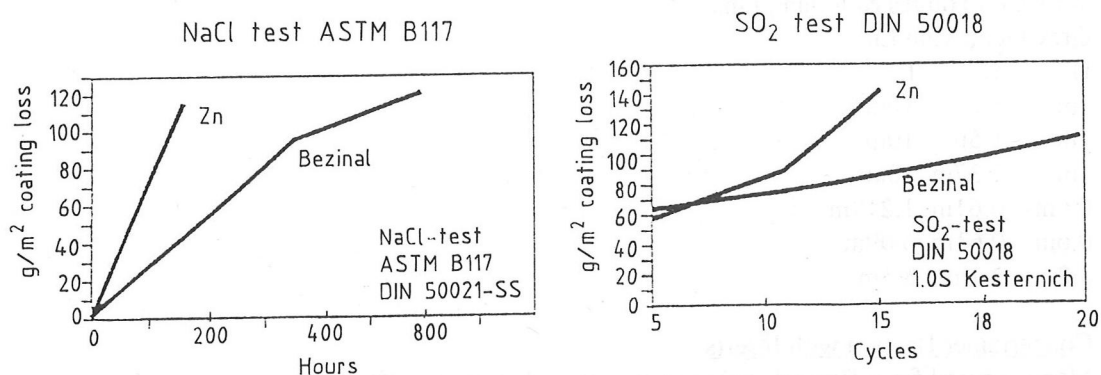
Concertainer Gabion: Where traditional stone filled gabions are required, the Concertainer Gabion is the gabion for the 21st century. The units are unlined, fully collapsible, with lids and bases, available in lengths of up to 10 metres, inherently strong and rapidly installed. One of the other advantages over the traditional gabion is a vast reduction in the amount of lacing required on site.

There have been no compromises in the construction of the Concertainer which is manufactured from the highest quality components. This has been further improved by the introduction of Bezinal coatings on the wire and welded mesh used in its construction.

BEZINAL

Bezinal or the Galfan process is a zinc alloy coating, (95% zinc, 5% aluminium) applied to wire to improve its corrosion resistance by up to three times that of traditional zinc coated, (galvanised) wire for the same coat weights. The coating weight of minimum 240g/m² is applied to the wire prior to fabrication of the mesh.

Extensive research into the improved corrosion protection afforded by this coating in rural, industrial and marine environments has been undertaken both by the International Lead Zinc Research Organisation and by the manufacturers, the findings of which are outlined below.



To appreciate the improved corrosion resistance, the corrosion mechanism should be understood. Galfan solidifies into a lamellar micro-structure consisting of alternating very thin (< 1 μ m) Al-rich and Zn-rich plates. In this type of structure the more active zinc will corrode leaving an aluminium enrichment which continues with exposure, i.e. therefore the longer the exposure the more corrosion resistant the coating becomes. Hence the loss of coating weight is not linear as with galvanising but parabolic.

Advantages of Bezinal Coated Wire

- * A more homogenous, ductile and smoother coating than pure zinc coating.
- * Better corrosion protection:- up to three times better than zinc coating in salt spray tests and to two or more times better in SO₂ atmosphere.
- * Better sacrificial protection to traditional galvanising especially at the welded areas.

Longevity of Bezinal Coated Wire and Galvanised Coated Wire in Different Environments,

Environment	ZINC COATED WIRE			BEZINAL COATED WIRE		
	to Red Rust	Useful Life	Coating Weight	to Red Rust	Useful Life	Coating Weight
Rural	22	31	240g/m ²	>45*	>50*	140g/m ²
Industrial	12	16	240g/m ²	>45*	>50*	175g/m ²
Marine	9	12	240g/m ²	40*	44*	240g/m ²

* Extrapolated Results

Bezinal coated units are now being used in situations where traditionally PVC coated units would have been used, thereby providing a durable and cost effective unit that is available in a much greater range of wire diameters to suit the requirements of the application.

Sizes: Concertainer Bastions and Gabions are available in a vast range of sizes made to order. Standard sizes are:

Concertainer Bastion:

Manufactured from Bezinal coated or heavily galvanised to BS 729.

75mm x 75mm x 4.00mm Weldmesh.

4mm Coil Hinges & Joining Pins.

Grey Geotextile Liner

H	W	L
1m	1m	10m
1m	1.5m	10m
1m	1.37m	10m
0.6m	0.61m	1.219m
0.6m	0.61m	6.09m
2.2m	2.1m	8.5m

Concertainer Bastion with Inserts:

Manufactured from Bezinal coated or heavily galvanised to BS 729.

75mm x 75mm x 4.00mm Weldmesh.

4mm Coil Hinges & Joining Pins.

Grey Geotextile Liner *

H	W	L
1m	1m	10m
1m	0.5m	5m

Concertainer Gabions:

Manufactured from Beznal coated or heavily galvanised to BS 729.

75mm x 75mm x 3.00mm, 4.00mm or 5.00mm Weldmesh.

3mm or 4mm Coil Hinges & Joining Pins.

Including Lids & Bases

H	W	L
1m	1m	10m
1m	1.5m	5m
0.5m	1m	10m
0.61m	0.61m	6.09m

* Other geotextile colours available on request

The System The advantages of the Concertainer System are:

- a) It is inherently strong.
- b) It is built from the highest quality components to give long life.
- c) Fully collapsible for transportation & storage.
- d) Rapidly erected.
- e) Cost Effective.
- f) Utilises a wide variety of infill materials.
- g) Unlimited potential for end use.

Applications The use of Concertainers can be split into two markets; Military & Civil.

Military:

Concertainers were first used in the Gulf War by the British M.O.D. The United States, British and Dutch M.O.D.'s have carried out extensive live blast tests on Concertainers. The results confirm that these products are the ultimate in mobile, rapidly erected Blast Wall Force Protection. Over 200 kilometres of Mil. No. 1 units (1m x 1.37m x 10m) have been used in Bosnia alone.

One Military Concertainer is equivalent to approximately 2,500 sandbags and can be erected and filled by two men and a mechanical digger in less than twenty minutes. A conventional sandbag wall would take a platoon of men two hours to build. Concertainer walls can be built to any length and virtually any height, this being governed by the ability to raise infill material. The wall can be filled with any available material such as, sand, rubble, hardcore, soil, rocks or even snow. Concertainer walls are available in various camouflage styles to suit location.

Whilst under British M.O.D. testing, it was found that a single Concertainer, once erected and filled, would withstand attacks from 81mm mortar bombs, 120mm H.E. blasts, 30mm H.E. fired from Warrior A.F.V. and all types of small arms fire including 0.50 M/G. sustained bursts. Recent tests by the U.S. Airforce have shown that properly constructed Concertainer walls are effective against 1,000 lbs and ,2000 lbs bombs and 10,000 kgs of high explosives.

Concertainer can be used as blast wall protection for vital and vulnerable facilities such as command posts, hospitals, stores, aircraft, tanks, guns or other vulnerable weapons systems in fixed locations. Units of Concertainer can also be used for tank obstacles or emplacement for support weapons. The highly dangerous task of deploying troops from vehicles in high risk areas can be undertaken safely using Concertainer protection.

The Gulf:

Concertainer Bastions were used for an assortment of defensive tasks from protecting aircraft on the ground to keeping essential ammunition supplies intact and away from enemy fire. One of the contributing factors to rapid deployment of troops is the ability to set up effective, secure ground positions as quickly as possible. Concertainer was designed with this in mind and was used successfully during the Gulf campaign.

Aircraft played a major part in the effectiveness of this campaign and Concertainer was a key ingredient in the protection of ground crew and aircraft between operations. Dhahran airbase was one amongst many in Saudi Arabia defended in this way, along with fuel dumps and vehicle parks.

Yugoslavia:

Due to the nature of this conflict, UN Protection Forces were faced with the major problem of avoiding heavy crossfire from both sides and shrapnel from indiscriminate shelling and mortar attacks. Concertainer's portability played an important part in constructing protective blast shelters in difficult terrain. Most of the hostilities were within heavily populated areas where vulnerable facilities needed protection, these included hospitals and medical centres where protection of both civil and military personnel is crucial.

Civil:

The applications for Concertainer in civil markets are endless. The most important uses to date have been:

1. Flood Protection:

- To build a wall 1 metre high by 1 metre wide by 10 metres long;
- 10 men filling 1500 sandbags - 7 hours.
- 2 men using Concertainer - 20 minutes.

The difference is staggering. Concertainer could tip the balance between minimal flood damage or a costly and demoralising clean up operation. Time is of the essence when constructing barriers to stop flood water. Sandbags take time to fill and can be washed away. Concertainer takes a fraction of the time to pull out and fill leaving a very robust and stable barrier which could be left as a permanent feature or emptied and re-used.

Recent Projects:

The Mississippi Basin:

Concertainer was rushed out to the USA when the Mississippi flooded its banks bringing devastation to a vast area. Traditionally, levees had been built that ran for hundreds of miles enclosing areas which were prone to flooding, when flood waters threatened to breach the levees sandbag walls were constructed along their length. These temporary measures were time consuming and weak.

Concertainer Bastions were used in St Genevieve, 60 miles south of St. Louis to back up the levees. Concertainer walls were built behind weak spots in the levees so when flood waters seeped through, the water pressure equalised on both sides, preventing pressure from building up and consequently blasting holes in the levees. When used in this way Concertainers are stood and wrapped in polythene to make them non-water permeable. The Concertainer units used were 1.37m H x 1.06m W x 10m L.

The measures being taken at the moment are short term solutions to long term problems, Concertainer is helping to ease the immediate needs and prevent further flood damage. However, long term we must look to the future to counteract disasters before they happen. At present the existing levees, are built of hardcore, sand and gravel, this can be easily weakened and washed away. With Concertainer walling constructed along the centre of the levees, it greatly enhances their strength and effectiveness against flood water, the wire mesh and material liner are a key to a better foundation.

The Philippines: In the Philippines, Concertainer has been used to good effect. Volcanic eruptions set off flash floods which are particularly devastating during the monsoon season. The damage ranges from riverbank erosion to the destruction of bridges. This particular project involved a bridge which had been severely weakened. Concertainer was utilised with local labour and materials to build a support pontoon for the damaged bridge.

We believe there is tremendous potential for Concertainer for flood protection throughout the Indian Subcontinent.

2. Coastal Erosion:

Concertainer is used across a wide range of markets, however, it was initially designed to counteract the effects of coastal erosion. It has been successfully used throughout the world from Bermuda to Britain's North East Coast. Due to the simplicity of design and installation, it is ideally suited for shoring up sea ravaged coastal shorelines. It can be installed without specialist equipment or labour. This leads to cost effective, more practical and inexpensive operations.

Concertainer's size and weight in its packaged form also caters for those times when site access presents a problem.

Construction of the Concertainer allows ease of installation with minimal effort, which in turn leads to rapid installation, keeping job planning and costs to a minimum. In most cases, construction rubble on site can be used as infill, saving on expensive tipping costs.

3. Waterways:

For embankment stabilisation, the Concertainer has once again proved itself on the waterways, particularly where works are costly and time consuming.

Simple yet intuitive, the design of the Concertainer allows strong and durable reconstruction of riverbank and canal towpaths.

The geotextile membrane allows for the quick drying of concrete when used as an infill and quick draining when river silt and gravels are used.

4. Retaining Walls:

The Concertainer Gabion and Concertainer Bastion with Inserts are ideal products for both emergency and permanent use where landslip becomes a problem.

5. Landscaping:

Concertainer is manufactured in a range of sizes and colour schemes to suit all types of landscaping projects. The Concertainer can be used for shoring up embankments, making terraces or just decorative walling. Using the Concertainer is simplicity itself, just carry to where the wall is to be built, extend to full length and fill with sand and gravel, compost or garden soil.

The smaller Concertainers are ideal for situations where a temporary garden environment needs to be created. For events such as garden shows and exhibitions. Concertainers can be quickly and simply pulled out, filled with compost and are then ready for planting. When the event comes to an end simply pack up and move onto the next one.

Larger Concertainers are being used by construction companies and local council for landscaping projects where economical solutions are required for building projects. They provide excellent foundations to landscapes involving terraces and slopes.

6. Noise Reduction:

In a world of increasing irritations, noise has to be one of the greatest. Whether it be protecting the environment on a normal day-to-day basis or for specific purposes of testing machinery and equipment in the outdoors, the Concertainer is ideal for both permanent and temporary applications.

We are constantly exploring new markets for Concertainers. Experimentation is currently underway at a leading Agricultural College in the UK on the use of Concertainer in reed bed systems for the removal of dangerous chemicals from industrial and agricultural waste water.

The system is also being tested for pollution control. Here Concertainer has two roles to play in the campaign to lessen the effects of oil contamination. The first is as a rapidly deployed barrier which will prevent oil being washed up onto beaches or working its way up inland waterways with tidal and weather conditions. A good example of where Concertainer could be used was during the Gulf war. When oil slicks off Kuwait approached the sea water inlet valves threatening to shut-down the vital fresh water producing plants.

The second way by which Concertainer can be used is to construct holding tanks on beaches close to the affected area. Oil contaminated sea water can be pumped into these tanks and the sand used to infill the wall will then act as a filter. This allows the sea water to drain back through to the sea, leaving behind the oil for possible reprocessing and recovery or disposal.

CONCLUSIONS

Today's land reinforcement and soil erosion problems require products that are strong, long lasting, easy to install and versatile. The Concertainer meets all these criteria. It also has enormous potential as either a permanent or temporary barrier for emergency flood protection and as the ultimate mobile military blast wall.

In summary the Concertainer Bastion System offers a modern, flexible yet extremely strong solution to today's civil and military engineering problems.