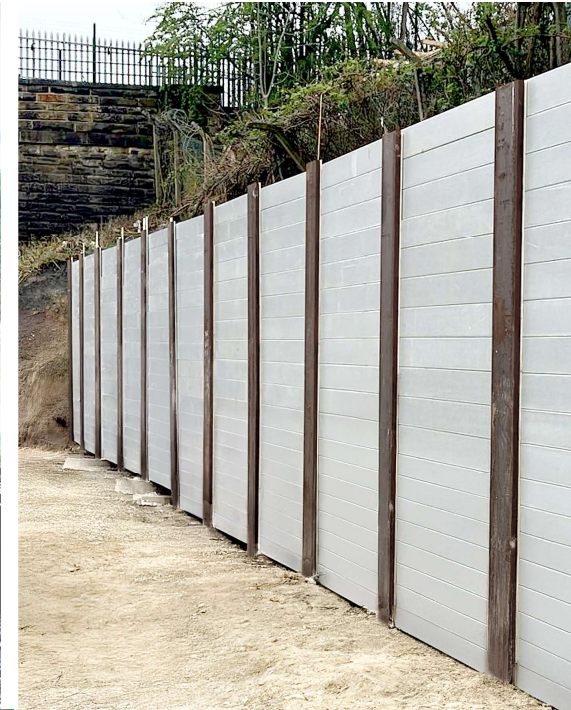




INFRASTRUCTURE UNDER PRESSURE: DESIGNING FOR DURABILITY & ADAPTABILITY

Presented by: Richard McTavish, David Mason & Thomas Matthews



ABOUT ASSET INTERNATIONAL STRUCTURES LTD

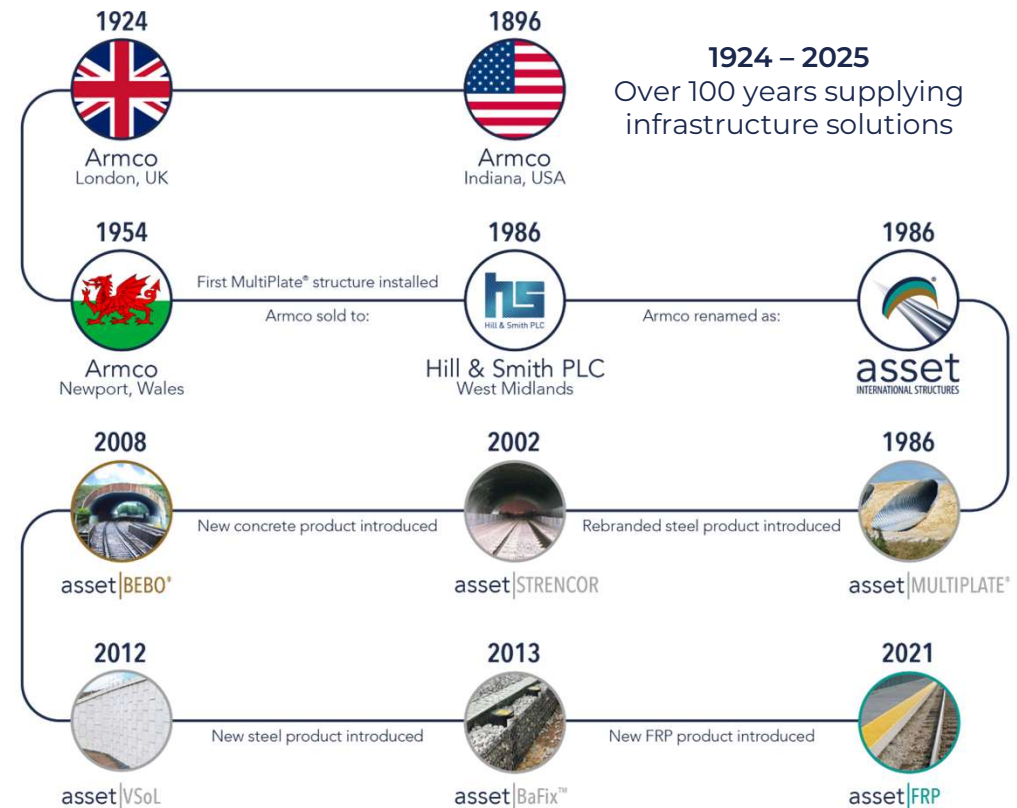
Rising to the Challenge



asset BaFix™ - Black Bridge Machynlleth

asset International Structures Ltd are the leading design and supply consultants for the road, rail, renewables and utilities sectors. As an SME, we are a member of Hill & Smith PLC within UK Engineered Solutions.

Company Registration Number: 15082506



ACCREDITATION, MEMBERSHIPS & SUSTAINABILITY



Public procurement organisation number (PPON): PCXW-6957-GRZT

PRESENTATION OVERVIEW



asset BaFix™

Fast Track to Innovation

How the System Works

Approvals & Credentials

Exploration of Technical Solutions

Benefits to the Rail Industry

Rising to the Challenge – Case Studies



Slides 5-6

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asset MULTIPLATE®

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asset BEBO® Arch

Designed for Durability

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asset FRP

Infrastructure under Pressure

Future Innovations – AFA Bridge

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FAST TRACK TO INNOVATION

asset BaFix™ Ballast Retention System



Folkestone Warren – Ballast Loss & Damaged Cable Trough

Initial Background & Project Requirements

- AIS approached by Network Rail in 2015.
- Requirement for a ballast retention system for use at Folkestone Warren. The site lies on top of a large active landslip, resulting in loss of the ballast shoulder.



Folkestone Warren Ballast Retention

ELR	XTD
Track ID	1100 & 2100
Site Mileage	72mm 000y – 72m 380y
National Grid Ref (mid-point)	TR 250 850
Track Category	3
Line Speed	75mph
ESR (pre April 2015)	20mph

Folkestone Warren – Site Details

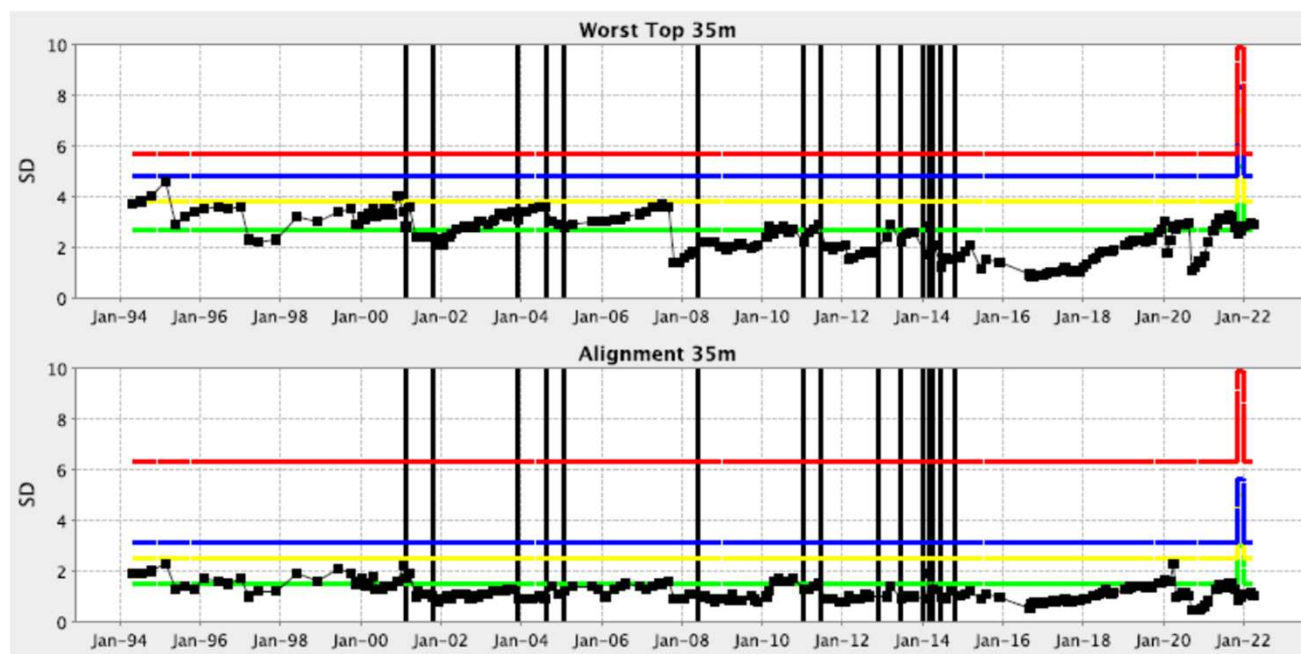
Innovative Solution to a Difficult Challenge

- Network Rail began the process for a fast-track approval and a solution was provided by AIS.
- asset BaFix™ 70 was adopted by Network Rail to retain ballast on soft ground.



FAST TRACK TO INNOVATION – PROVEN RESULTS

asset BaFix™ Ballast Retention System



Folkstone Warren – CCQ Chart Information

As you can see from the chart (left), the adoption of asset BaFix™ at Folkstone Warren has been very positive.

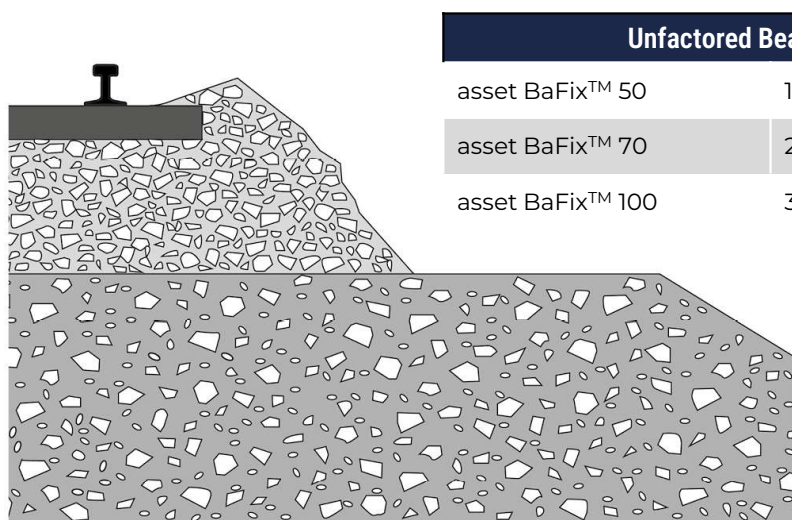
On the 2100, the 35m top and line has been very good since the installation, showing large improvement in deterioration rates, suggesting the product has stabilised the TQ problems caused by loss of the ballast shoulder.

Improvement Works

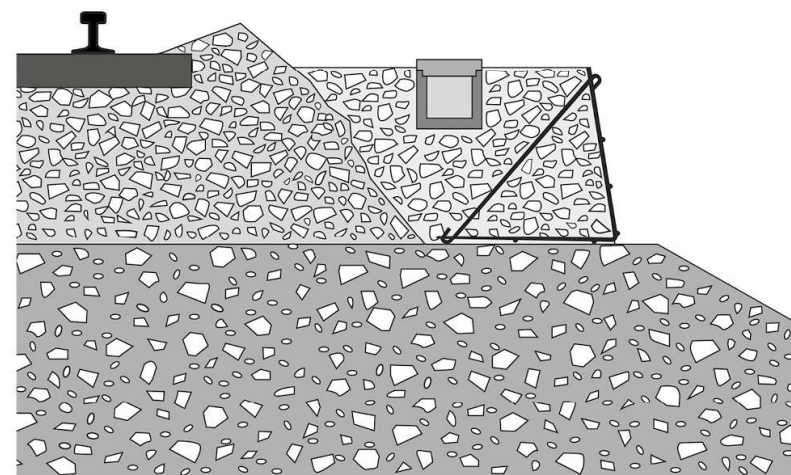


HOW THE SYSTEM WORKS

asset BaFix™ Ballast Retention System



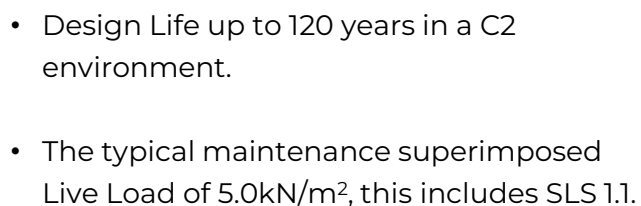
Unfactored Bearing Values	
asset BaFix™ 50	17.209 kN/m ²
asset BaFix™ 70	20.662 kN/m ²
asset BaFix™ 100	31.967 kN/m ²



asset BaFix™ provides an innovative track ballast shoulder retention system for the rail industry.

- asset BaFix™ offers future improvements such as raising track levels if required.
- Can be used in the National Electrification programme OLE (retaining ballast around cantilever masts).
- Enables cable troughs / ducts to be installed and maintained within the system.
- Palisade fencing post or key clamp system anchored within the supported asset BaFix™ structures.

asset BaFix™ Ballast Retention System



Max Live Load 5.0kN/m²

Dim B

Dim A

125

685 (H_f)

40°

θ

600 (b)

Dim C

1 in 30 Fall

G44 Concrete Sleeper

200 Ballast

250 Ballast

300 Ballast

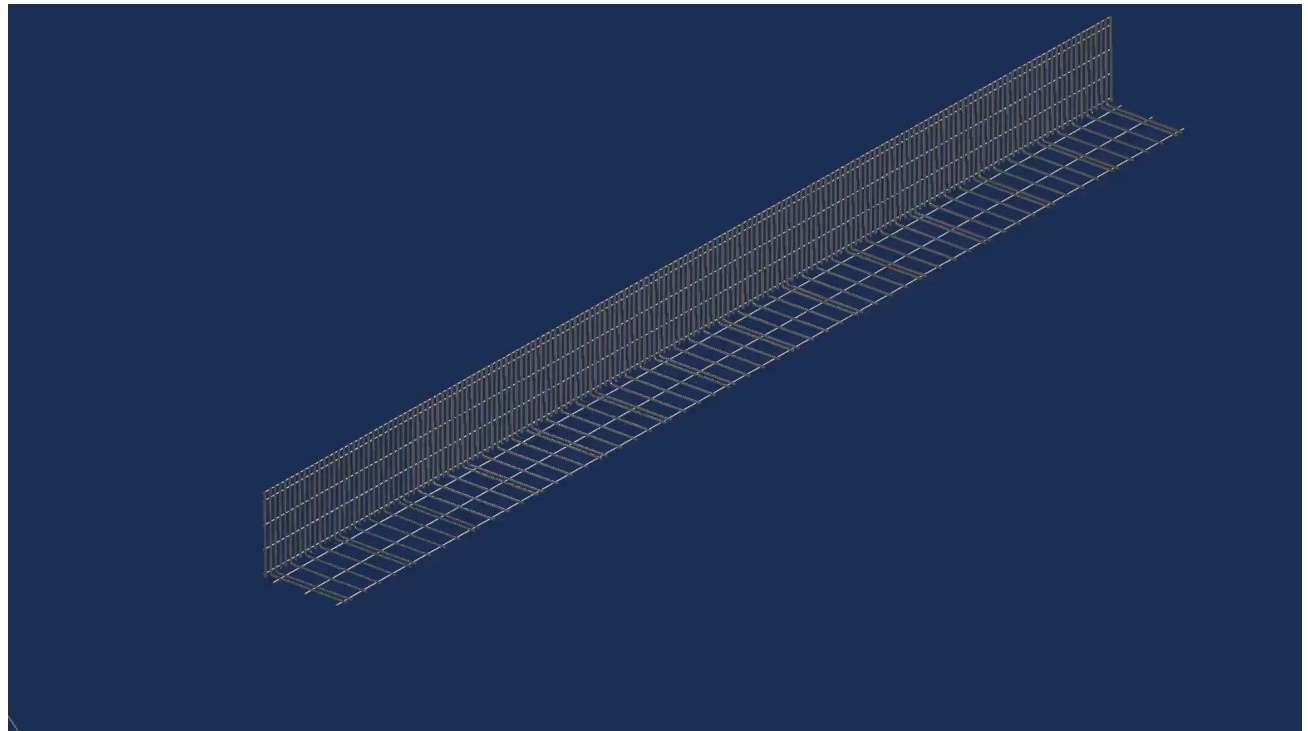
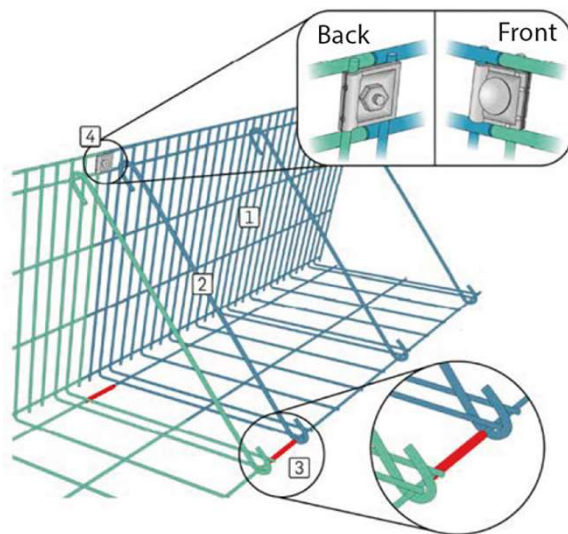
Base Width (b)	0.600 m	Formation Soil	
Vert. bar dia. (d_v)	5 mm	Angle of Friction	36 de
Horiz. bar dia. (d_h)	8 mm	Variable Surcharge	5 kPa

HOW THE SYSTEM WORKS - INSTALLATION & MAINTENANCE

asset BaFix™ Ballast Retention System



Steel Panels are placed and anchored into the ground using 10 number per 6m length U-Staples 200x6mm.



APPROVALS AND CREDENTIALS

asset BaFix™ Ballast Retention System



Certificate of Acceptance
OFFICIAL
PA05/06325

Manufacturer: Asset International Structures Ltd **Issue:** 4
Valid From: 21/08/2024

BaFix Ballast Retention System

Product Description

Collapsible wire mesh, ballast retention system.

Product Image

Scope of Acceptance

Full Acceptance

For use in the retention of railway track ballast.

Network Rail Acceptance Panel (NRAP) hereby authorises the product above for use and trial use on railway infrastructure for which Network Rail is the Infrastructure Manager under the ROGS regulations.

Amir Malik
Product Acceptance Coordinator

David Webb
Network Technical Head Track

Please contact pa05@railinfra.co.uk
 Network Rail Infrastructure Ltd Registered Office: Watlington General Offices, London SE1 8SW. Registered in England and Wales No: 2064557 www.networkrail.co.uk
 Version 6.1 May 2024.

Network Rail Certificate of Acceptance

Comparison Table between asset BaFix™ & Ballast Boards						
Product	Retention Height	Length of Retention	No of Items	Weight of Items (kg)	Carbon Equivalent (CO ² eq)	Transport (0.10kgCO ² eq/mt-km)
asset BaFix™ 50	500mm	120m	20	780	2,191.8	23.4
Ballast Board	500mm	120m	48	5,280	4,224	158.4
Difference	-	-	140%	576.92%	92.72%	576.92%

asset BaFix™ - GWP A1-A3 of 2,810kg CO² eq/1000kg

Authorised for use by
London Underground
 Reg No:3082

Approved for use by:
Iarnród Éireann
Irish Rail

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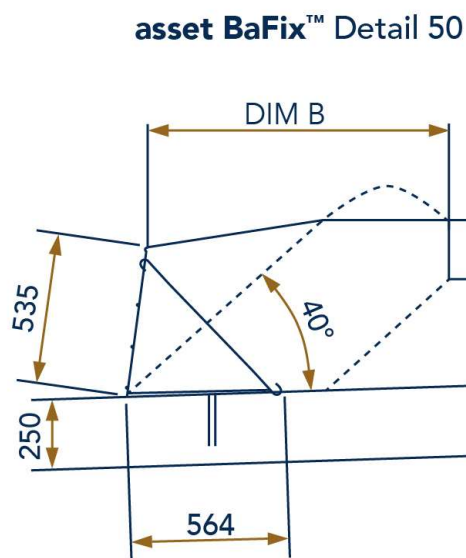
EXPLORATION OF TECHNICAL SOLUTIONS

asset BaFix™ Ballast Retention System



ASSET BAFIX™ 50 KIT

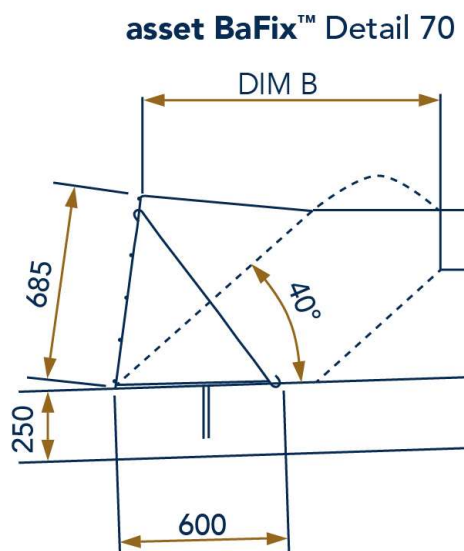
PART NO: 0057/072456



Total Kit Weight: **39kg**

ASSET BAFIX™ 70 KIT

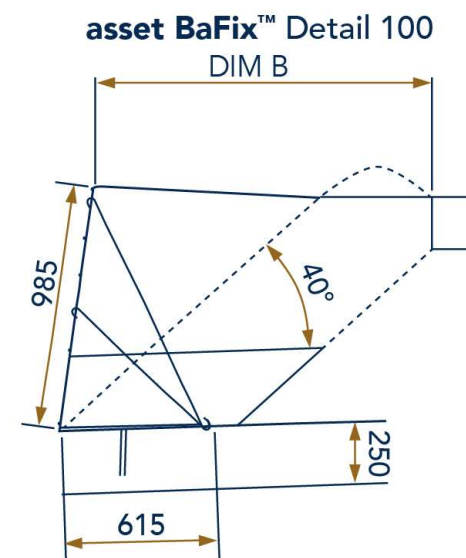
PART NO: 0057/072457



Total Kit Weight: **46kg**

ASSET BAFIX™ 100 KIT

PART NO: 0057/072458



Total Kit Weight: **61kg**

EXPLORATION OF TECHNICAL SOLUTIONS

Sleeve-It



Tested Pre-Engineered Fence Post Anchoring System

When using the asset BaFix™, there could be a requirement to protect important trackside equipment. Sleeve-It is a pre-engineered fence post anchoring system that can be used as an accessory to the rail approved asset BaFix™.

Sleeve-It can be utilised as a solution for resisting various loading configurations, as stated in BS1722 Part 14. Sleeve-It is suitable for integrating either handrail, key clamp barriers or fencing systems, providing a stable fence footing.

asset BaFix™ featuring Sleeve-It

3 step Sleeve-It installation in conjunction with asset BaFix™:

1. Create at least a 50mm gap at the top of the unit to the front face of the asset BaFix™.
2. Backfill material to comply with the rail authority's ballast standards.
3. The unit shall be filled with C8/10 or ST2 concrete conforming to BS 8500 -1 and BS 8500 – 2.



BENEFITS TO THE RAIL INDUSTRY

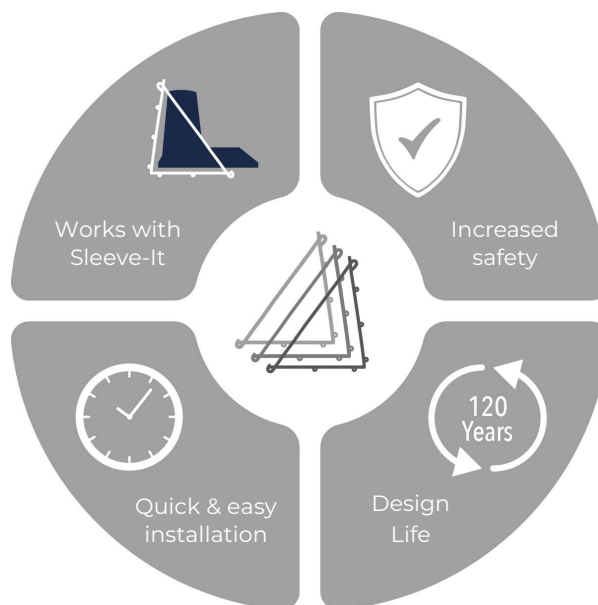
asset BaFix™ Ballast Retention System



asset BaFix™ & Sleeve-It System

- Reduces levels of required maintenance.
- Provides lateral stability caused by ballast tamping.
- Maintains track speed on a national basis.

asset BaFix™ System Benefits

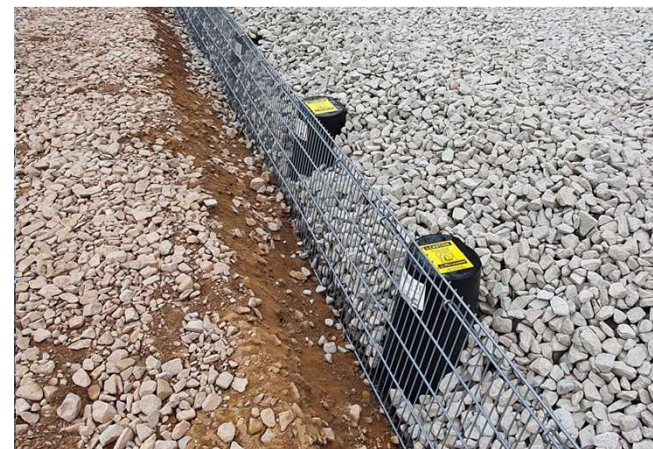


asset BaFix™ – Torre Station

- Reduces the loss of track-side ballast.
- Improving cess levels of safety and maintains alignment and line speed.
- Handrailing provides position of safety.

RIISING TO THE CHALLENGE OF FLOOD RESILIENCE

Case Study



asset BaFix™ – Black Bridge, Machynlleth

Black bridge has been closed 30 times in the last decade, and ten times in 2020 alone, for emergency repairs caused by flood water. Following 30 flood closures in the last decade, the £3.6m project required 400 metres of asset BaFix™ to help retain future ballast loss. Network Rail worked in collaboration with Natural Resources Wales to protect the sensitive local environment.

“It’s important to acknowledge the true team spirit that has been part of this intense scheme from start to finish...” Andy Crowley – Operations Director (Wales & Western) AmcoGiffen

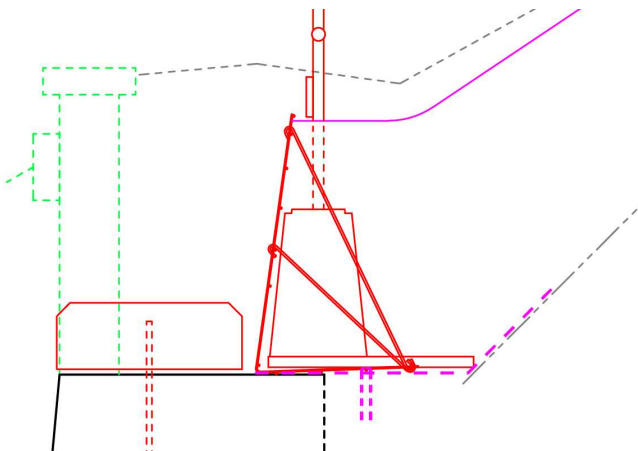
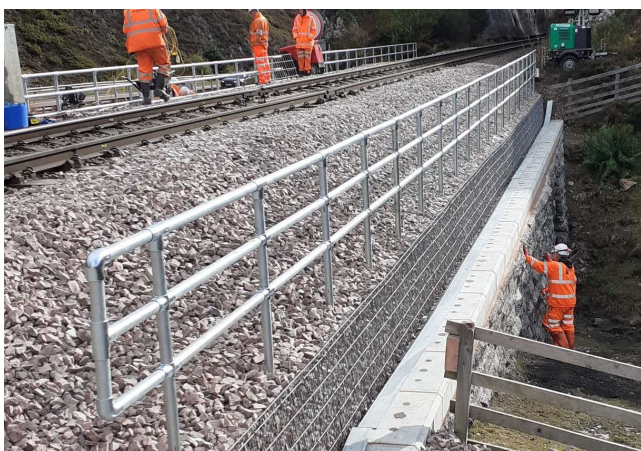
Improvement Works



[Network Rail Video](#)

RELIEVING OVERLOADING

Case Study



asset BaFix™ Overload Bridge Parapet – Sputan Dubha, Scotland

60 metres of asset BaFix™ was used to help retain future ballast loss within the project, and provide CPOS whilst relieving the overloading of the original bridge parapet. The bridge is situated over a watercourse near Slochd Summit (toward Inverness), which had temporary support put in place prior to asset providing our asset BaFix™ ballast retention system.

BaFix Potential – This could be considered for improving safety and access across the network.

Improvement Works



BRIDGE REHABILITATION

Case Study



asset BaFix™ – River Ancholme, Lincolnshire

60 metres of asset BaFix™ was used to help retain future ballast loss within the run in and run off approaches of this rail bridge rehabilitation project over the Ancholme river, and provide CPOS at all access points. Both 3.1m approach arches were deteriorating, taking longitudinal thrust from the main 26.4m span. The spandrel/parapet walls were also suffering as a result.

The chosen solution was a combination of bearing and drainage replacement of the main span. asset MultiPlate® was utilised to reline both approach arches, along with the repointing of spandrel/parapet walls and new asset BaFix™ revetments.

Improvement Works



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ACCESS SUPPORT & CESS RETENTION

Case Study



asset BaFix™ – Princess Risborough, England

Atkins approached AIS as they were designing a new track access staircase with post foundations on 450mm square pads, which had left sections of cess unsupported. As a result, ballast shoulder retention was required without further intervention and regrade works.

6 metres of asset BaFix™ was used along with Sleeve-It units to help retain ballast, giving effective anchorage for handrail posts, and maintain the ballast shoulder in a constrained cess. This provided suitable formation to allow better access via a new stairwell and deck for crossing point.

Improvement Works



EMBANKMENT STABILISATION

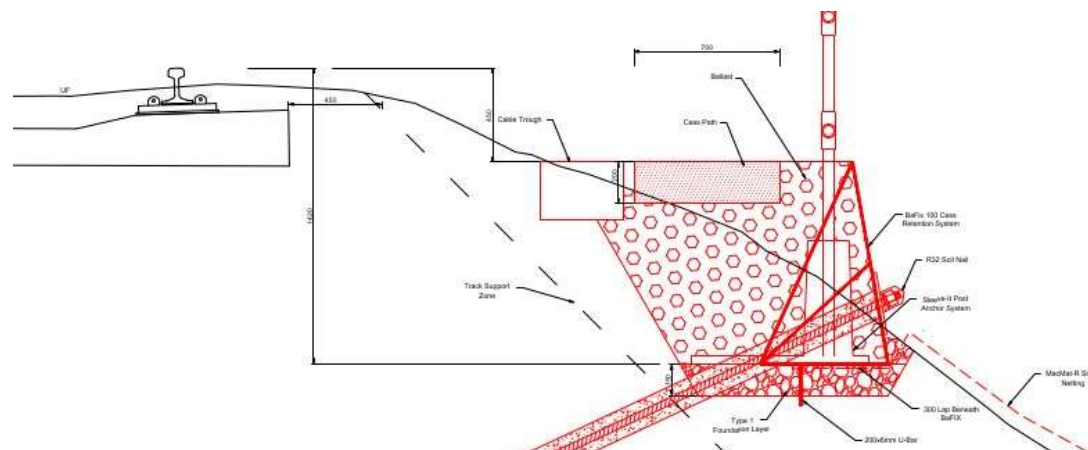
Case Study



asset BaFix™ – Hook Embankment, Wessex

The Southern Renewals Enterprise reached out to AIS to assist in the feasibility of various options using soil nails. The final solution included soil nails of the existing embankment, along with cess retention supported by 300 metres of asset BaFix™ 100 (along with the Sleeve-It units to provide robust cess retention, giving effective anchorage for handrail posts).

There was also extensive slope stabilisation with upper and lower soil nails including MacMat R to prevent burrowing. The asset BaFix™ worked very well with the upper R32 self drilling hollow soil nails.

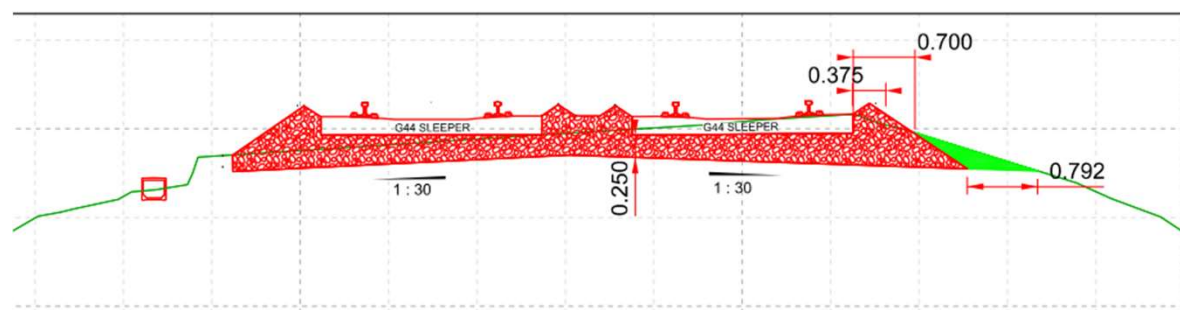


Improvement Works



EMBANKMENT STABILISATION

Current Project



Potential asset BaFix™ Application – Saxmundham Junction, East Suffolk Line

In order to construct the new nuclear power station, significant quantities of bulk materials are required to be transported to the construction site. To keep heavy traffic off local roads, it is proposed that the majority of the bulk materials are delivered by rail through utilisation of the Sizewell Branch Line (ELR: SIZ).

To facilitate this upgrade, asset BaFix is being considered at various locations.

Improvement Works



EMBANKMENT STABILISATION

Current Project – Saxmundam Junction



	Bulk density	Undrained shear strength (cu)	Drained cohesion (c')	Constant volume friction angle (ϕ'_{cv})	Peak effective friction angle (ϕ'_{pk})	Drained Young's Modulus	Undrained Young's Modulus
	kN/m ²	kPa	kPa	(°)	(°)	MPa	MPa
Made Ground - Cohesive (Embankment Fill)	19	15+3.5z	2	24	26	4	9+2.1z

Table 1: Embankment parameters - reproduced from extract from Saxmundham GIR

Saxmundham Junction (part of SZC railway improvements) spans between CH147+040 to CH147+360, but it is not anticipated that the ballast support would be required along the entire section.

The design team currently considers providing the asset BaFix system in areas where the proposed ballast shoulder is within 150mm of the crest of the slope, or where the need for a handrail dictates for this.

Thickness of ballast 'excavate and replace' beneath BaFix unit (m)		0.25	0.50
Minimum width of ballast required beneath BaFix (m)		0.85	1.10
Imposed design bearing pressure DA1-1 (kPa)		17.4	13.3
Imposed design bearing pressure DA1-2 (kPa)		14.2	10.7
Slope Angle 18°	Design bearing resistance DA1-1 (kPa) *	32.9	56.9
	Design bearing resistance DA1-2 (kPa) *	15.2	28
Slope Angle 20°	Design bearing resistance DA1-1 (kPa) *	29.0	50.3
	Design bearing resistance DA1-2 (kPa) *	13.3	24.7
Slope Angle 22°	Design bearing resistance DA1-1 (kPa) *	25.2	43.9
	Design bearing resistance DA1-2 (kPa) *	11.5	21.5
Slope Angle 24°	Design bearing resistance DA1-1 (kPa) *	21.6	37.7
	Design bearing resistance DA1-2 (kPa) *	9.8	18.4
Slope Angle 26°	Design bearing resistance DA1-1 (kPa) *	18.2	31.8
	Design bearing resistance DA1-2 (kPa) *	8.2	15.4

* Note: Design bearing resistance provided assumes an increased base width, accounting for the load spread, as well as applying the load at a depth below ground level equivalent to the underside of ballast.

Table 3: Excavate and replace, estimated applied pressure for various thickness of excavate and replace beneath BaFix 70 unit.

ASSET MULTIPLATE® MP200

Innovation in Materials



asset MultiPlate® (200mm x 55mm) corrugation is manufactured in a wide range of steel thicknesses and plate sizes.

SUITABLE APPLICATIONS: Culverts, re-lining existing bridges, vehicle underpasses, pedestrian underpasses, livestock underpasses, railway and service tunnels, ecological crossings and portal structures.

asset MultiPlate® Underpass Relining – Greatham Beck Nature Reserve, Hartlepool

The asset MultiPlate® CSBS underpass relining based in Hartlepool has a design life of 120 years, and has been designed to the standards LM71 and Derailment under 7m of cover. Additional design details were considered due to the structure being situated within a tidal estuary containing brackish water.

The new relined structure was designed in an aggressive environment with invert protection.



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ASSET BEBO® PRECAST CONCRETE ARCH SYSTEM

Designed for Durability



asset BEBO® Arch System features the world's most significant precast concrete arch structures, offering spans from 3.7m up to 35m.

SUITABLE APPLICATIONS: Road bridges, rail tunnels, pedestrian underpasses/overbridges, livestock or vehicle underpasses, wildlife bridges, viaducts, stream culverts, sewage outfalls and floodplains.

asset BEBO® Arch & VSoL Walls – Nansledan Village, Cornwall

We were approached by Network Rail to provide a solution to accommodate a road over a railway line situated in Cornwall, which would enable site access to a new sustainable village called Nansledan.

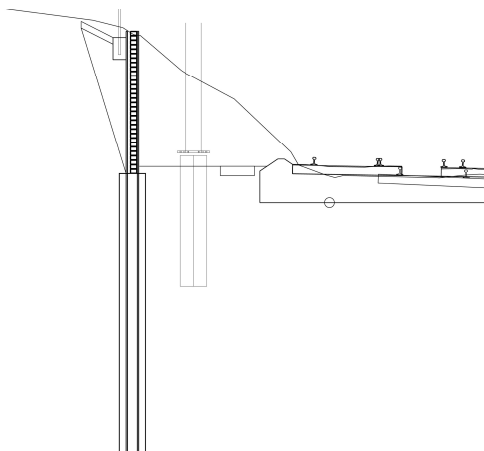
Constructed over two night possessions, the chosen structure for the project was an E72 asset BEBO Arch, square ended (22.6m span, 8.5m rise, 13.27m length), with VSoL walls.



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ASSET FRP KING POST WALLS

Infrastructure under Pressure



asset FRP King Post Walls – Overview:

asset FRP King Post Retaining Walls are a lightweight, cost-effective system, providing permanent or temporary retention. There are a number of ESG benefits to installing an asset FRP King Post Wall, including carbon reduction, maximising health & safety and reducing carbon emissions through less road loads required to site.

asset FRP King Post Wall – TRU, Huddersfield

In conjunction with the TransPennine Route Upgrade (TRU), we were approached to provide a solution for a retained wall situated alongside an active rail line, based in Huddersfield. The main driver for the project was carbon efficiency, and a series of concrete panels was initially considered for the project.

asset FRP was the chosen solution due to its lightweight, durable material, which reduces installation times along with carbon emissions by achieving less energy consumption.



ASSET FRP AFA BRIDGE

Future Innovations – Access For All Bridge



Benefits of asset FRP AFA Bridges:

- Fiber Reinforced Polymer construction. Lightweight and corrosion resistant.
 - 50% reduction in embodied carbon from traditional steel bridges, supporting sustainability goals.
 - Its modular design enables rapid assembly, reducing construction time and community disruption.
- Costs: Competitive Vs Steel.
 - Lightweight: Individual modules weigh less than 2 tonnes, reducing heavy plant requirements.
 - 120-year design life with minimal maintenance, ensuring long term cost efficiency.

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OUR PRODUCT MANAGERS



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WE LOOK FORWARD TO YOUR QUESTIONS...

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