



Reusing Steel Sheet Piles for Sustainable Highway Construction

Location: M4 Smart Motorway Junctions 10-12

Client: SMP Alliance

Designer: WSP & Jacobs

DAWSON-WAM and the Smart Motorway Project Alliance (SMP Alliance) have collaborated to achieve the First-Ever Reuse of Steel Sheet Piles for Permanent Work in a National Highways project.

A pioneering effort that not only contributes to sustainable construction practices but also enhances the quality and cost-efficiency of highway infrastructure.

Reusing Steel Sheet Piles for Sustainable Highway Construction



What was achieved?

The first ever reuse of sheet piles on a permanent structure on a National Highways project.

Wall B10 on the M4 Smart Motorway J10-12 was installed in November 2024.

It required over 6 months of collaboration effort to achieve a departure from standard for the use of these piles.

The use of second hand sheet piles did not change the installation value of the works but did save **£7,265.06** from the procurement cost, equivalent to **11%**.

The key outcome of this departure from standard was the saving of purchase of **62,885kg** of new steel, and in doing so this saved an impressive **173,562.60kg CO₂e**.



Original Requirement					Second Hand Piles Used					Enhanced Capacity		
Pile Section	No. Pairs	Length (m)	kg/m	Quantity (t)	Pile Section	No. Pairs	Length (m)	kg/m	Quantity (t)	Steel thickness	Structural Capacity	
AZ24-700	27	7	191.4	36.175	AZ28-700	27	8.3	220.1	49.324	+2.0mm	14%	
AZ24-700	8	9.5	191.4	14.546	AZ28-700	8	9.6	220.1	16.904	+2.0mm	14%	
AZ14-770	18	2.75	159	7.871	AZ14-770 10/10	18	3	165.8	8.953	+0.5mm	4%	
AZ14-770	9	3	159	4.293	AZ14-770 10/10	9	3	165.8	4.477	+0.5mm	4%	
				62.885					79.658			

	Tonnage	eCO2 per t*	Total Carbon
Original Requirement - New Prime Steel	62.885	2.76	173.561
Second Hand Piles Used	79.658	0.00	0.000
		Saving	173.561

* carbon factor used from the National Highways Carbon Toolkit V2.6.1

	Tonnage	Cost per Tonne	Total Cost
Original Requirement - New Prime Steel	62.885	£1,050.00	£66,028.73
Second Hand Piles Used	79.658	£737.70	£58,763.67
		Saving	£7,265.06

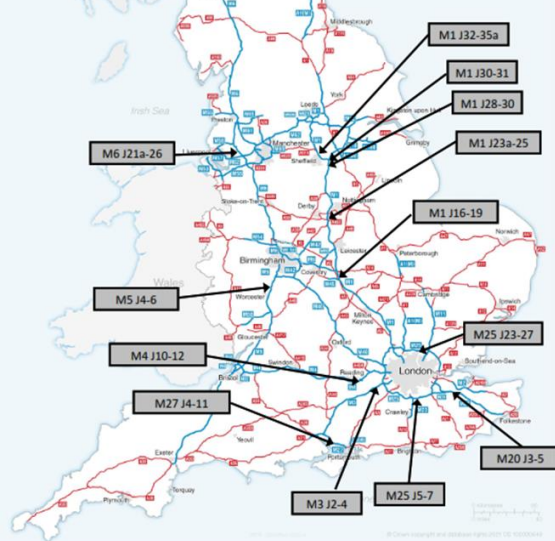
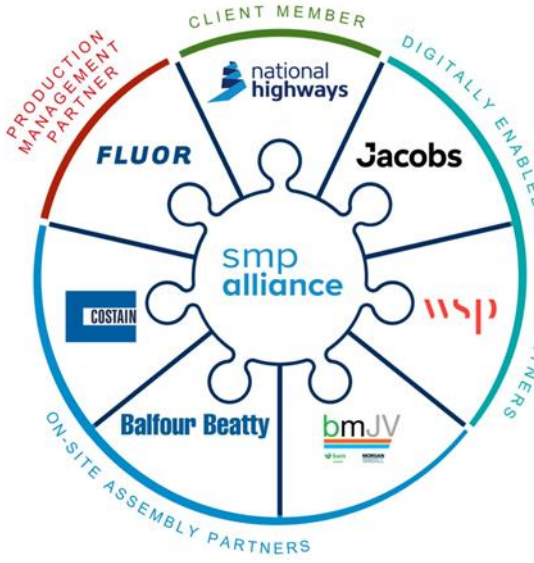
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The SMP Alliance is a collaborative enterprise formed in April 2020 by National Highways to deliver upgrades and safety enhancements across England's strategic road network. The works comprise of the delivery of over 150 additional emergency areas on sections of all lane running (ALR) motorway.

The National Emergency Retrofit Scheme (NEAR) was done for a fixed cost, with an extremely tight programme by March 2025, and with significant social and sustainability commitments.

The SMP Alliance is built on two core sustainability goals - Production Excellence and Enhanced Environments. We're committed to reliability, waste reduction, and reducing carbon emissions by at least 10%. These objectives align directly with broader UN Societal Outcomes, making our work globally relevant.



Build resilient infrastructure, promote inclusive and sustainable industrialisation and foster innovation.



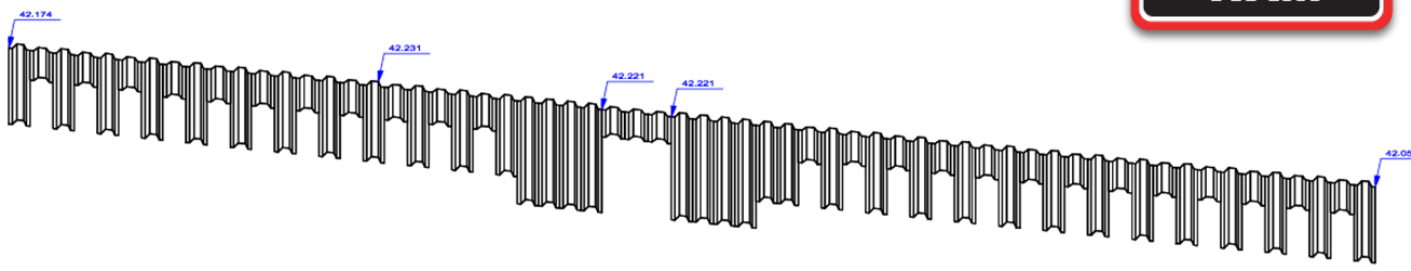
Ensure sustainable consumption and production patterns.



Take urgent action to combat climate change and its impacts.

The key contributors for this achievement were Balfour Beatty, Jacobs, WSP, DAWSON-WAM and National Highways.

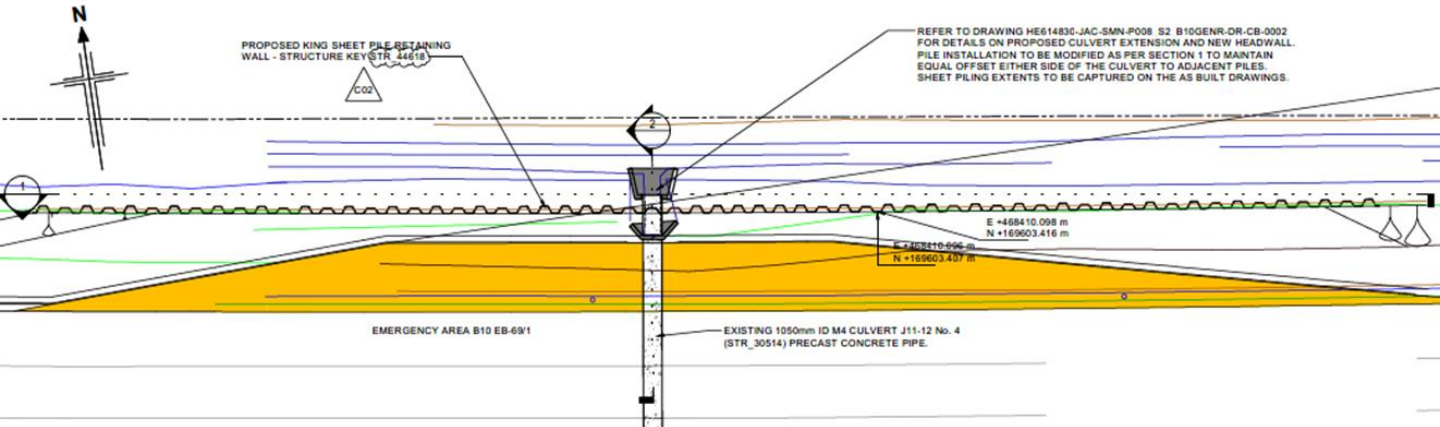
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Wall B10 at chainage 69/1B is a King Sheet Pile™ steel sheet piling retaining wall on a motorway embankment which also crosses a drainage culvert.

At just over 90m in length, it was the last of 4 sheet piles walls installed on the M4 Jct 10-12 Smart Motorway, and the last of all the 24 permanent piled retaining walls to be installed on the NEAR Programme.

Deemed as a low risk structure by the design team, and being so late in the programme, it became the ideal candidate to progress the sheet pile reuse.





Why had this not been done before and what we have done to make this easy to replicate.

The current standards require that new sheet piles are used as per the extract of the specification below.

Volume 1
Specification for Highway Works

Series 1600
Piling and Embedded Retaining Walls

Steel reinforcement

6 (11/03) Steel reinforcement shall be in accordance with sub-Clause 1611.9 and as described in Appendix 16/14.

Placing and compacting concrete

General

1615 Steel Sheet Piles

General

1 Only new piles shall be used for permanent works. Piles shall be carefully examined by the Contractor at the time of delivery and damaged piles repaired or replaced. The records of testing of the steel used in the piles shall be made available.

The biggest technical challenge was thought to be getting National Highways Safety Engineering and Standards (SES) onboard, around the process for technical approval process.

National Highways have challenging carbon targets to meet, and the current standards and specification do not take this into account.

When engaged SES were eager to support the departure from standard, accepting that the selection of reused sheet piles at construction stage, formed part of the material approvals process.

Agreed with SES a standard departure could be adopted for the proposal, supplemented by a standardised proforma on a location specific basis, to speed up departure submissions for this and future use

Re-use of steel sheet piles for M4 Bays B08 and B10
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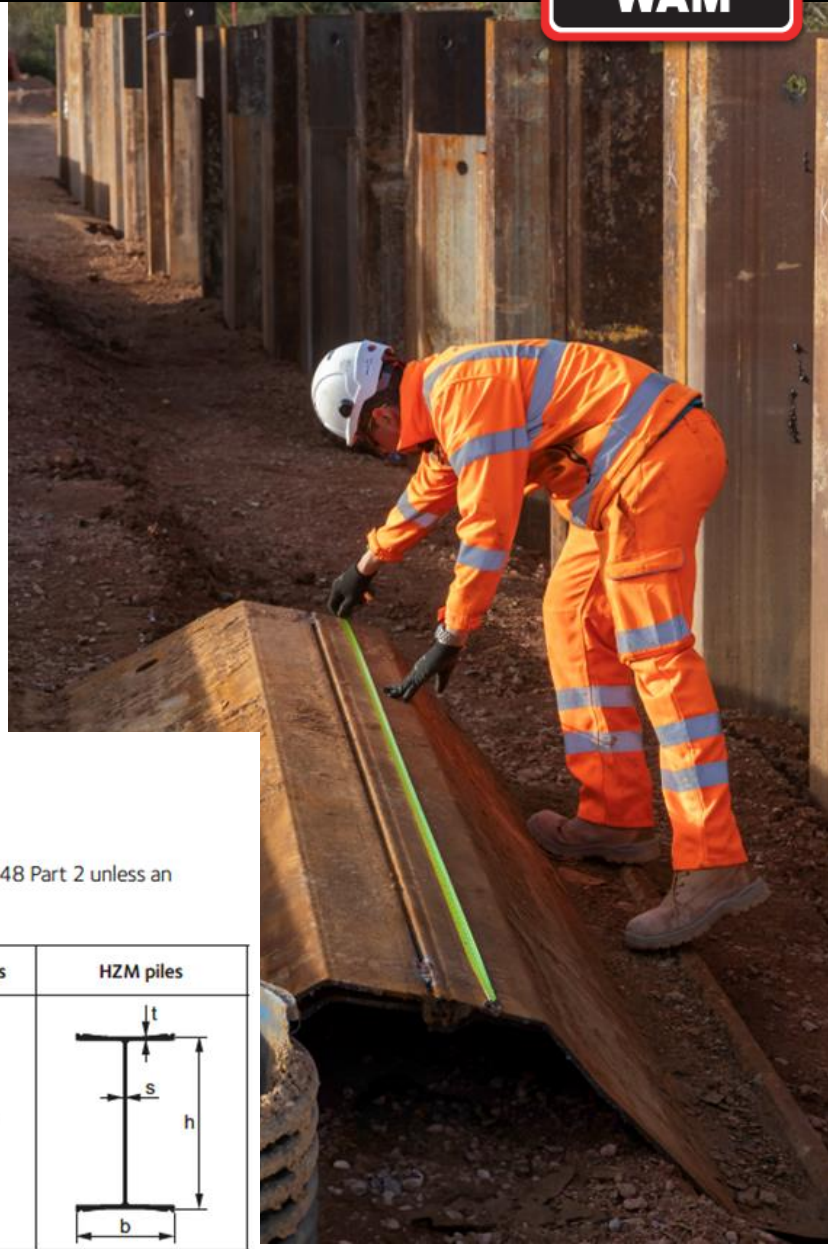
Question	Response
<p>Project RFI-TQ-M4J3-12</p> <p>Subject Re-use of steel sheet piles for M4 Bays B08 and B10</p> <p>Question As discussed in meetings with DED, Dawson Wam have identified an opportunity to use second-hand sheet piles previously used in a Temporary Works application in the permanent works retaining walls, with associated cot and Carbon savings. As time has passed since this was first suggested, the installation programme now shows two locations on the NEAR M4 J10-12 that could work, depending on the time required for Technical approvals.</p> <p>Bay 08 - due to commence 30 September Bay 10 - due to commence 14 October. The proposed second-hand sheet piles are available immediately from stock and new piles for these bays are on 2-week lead time.</p> <p>Dawson Wam have proposed that the next size up of sheet piles from the design is used, to provide additional capacity. (see attached schedule).</p> <p>Can the DED please provide acceptance of the proposed use of second-hand sheet piles, which we understand will require a Departure from the Specification to not use new piles.</p> <p>Attachments M4 - Wall Comparrrison B8 B10.pdf (25.25 KB)</p>	<p>Response We are happy to accept the proposal to use used piles at retaining walls B8 and B10 subject to the departure approval by SES and any conditions of approval.</p>

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Ensuring Quality and Compliance

Each sheet pile used was thoroughly checked to ensure compliance with the original manufacturer's tolerances.

Piles were also checked for corrosion, damage or other visual indications that would hinder performance. This process ensured that although previously used, these second hand piles will meet the requirements of new piles.



Piling Handbook, 9th edition (2016)

1.8. Product tolerances

Hot rolled sheet piling products are supplied to EN 10248 Part 2 unless an alternative standard (e.g. ASTM) is specified.

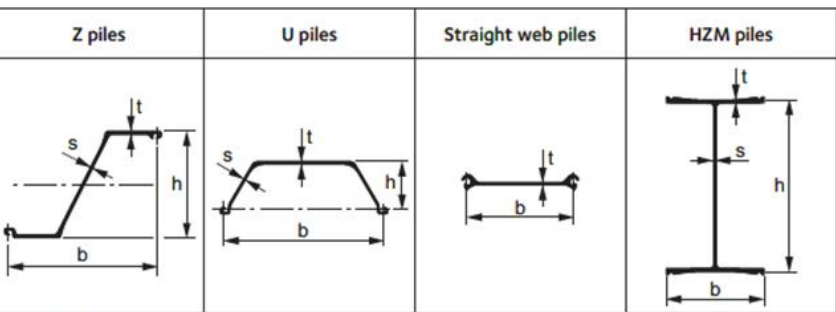


Fig. 1.17. Hot rolled steel sheet piles shapes.

Tolerances	AZ [®]	AU [™] , PU [®] , GU [®]	AS 500 [®]	HZ [®] -M
Mass ¹⁾	± 5%	± 5%	± 5%	± 5%
Length (L)	± 200 mm	± 200 mm	± 200 mm	± 200 mm
Height (h) ²⁾	h ≥ 300 mm: ± 7 mm	h ≤ 200 mm: ± 4 mm h > 200 mm: ± 5 mm	-	h ≥ 500 mm: ± 7 mm
Thicknesses (t,s)	t, s ≤ 8.5 mm: ± 0.5 mm t, s > 8.5 mm: ± 6%	t, s ≤ 8.5 mm: ± 0.5 mm t, s > 8.5 mm: ± 6%	t > 8.5 mm: ± 6%	t, s ≤ 12.5 mm: -1.0 mm / +2.0 mm t, s > 12.5 mm: -1.5 mm / +2.5 mm
Width single pile (b)	± 2% b	± 2% b	± 2% b	± 2% b
Width double pile (2b)	± 3% (2b)	± 3% (2b)	± 3% (2b)	± 3% (2b)
Straightness (a)	≤ 0.2% L	≤ 0.2% L	≤ 0.2% L	≤ 0.2% L
Ends out of square	± 2% b	± 2% b	± 2% b	± 2% b

Table 1.23. Tolerances of hot rolled steel sheet piles.

¹⁾ From the mass of the total delivery.

²⁾ Of single pile.

As a mitigation measure the sheet piles selected were upsized in capacity by between 4% and 14% to provide additional comfort to the Safety, Engineering and Standards (SES) directorate.

What is the potential for this departure from standard?

To put this into perspective, the UK imported 76,000 tonnes of sheet piles in 2022 alone. That equates to over 209 million kg of CO₂, showing a scale of the impact if even a fraction of those were reused. And with the UK no longer manufacturing sheet piles, we rely heavily on imports—from Luxembourg to China.

How can we meet the demand for previously used sheet piles?

Temporary works in HS2 and large-scale European hire markets offer a huge pool of second-hand sheet piles. These are available today. With the right policy and procurement approach, we can meet future demand without new steel.

An example of the potential – Lower Thames Crossing

A prime opportunity is the Lower Thames Crossing, a zero-carbon pathfinder project. We've already identified carbon savings of up to 18,000 tonnes of CO₂ across the North Roads, South Roads, and tunnel sections if reused sheet piles are adopted early.

Summary

One of the most compelling outcomes of this initiative is the measurable carbon saving we achieved. Using the National Highways Carbon Toolkit Version 2.6.1, we were able to quantify that by reusing the steel sheet piles from the Thames Tideway Project, we saved 173,328 kilograms of CO₂ emissions by avoided the production of 62,790 kilograms of new steel.

That's the equivalent of:

- Charging over 21 million smartphones,
- Or powering 20 average UK homes for a full year,
- Or driving nearly ½ million miles in a petrol car.

And these aren't hypothetical savings—they're realised benefits, from just one instance of reuse on one project. Imagine the impact if this approach were scaled across the wider infrastructure sector.

What made this possible was not just technical capability, but collaboration. It required alignment between procurement, design teams, contractors, and certifiers to ensure reused materials could meet all safety, performance, and documentation standards.

Also important to note: these savings go beyond carbon. We reduced transportation costs, avoided energy-intensive steel production, and shortened lead times. That's savings in time, cost, and environmental footprint, a rare triple win.