Centre of Excellence for Decarbonising Roads

JEROL COMPOSITE SIGN POST

Live Trial Evaluation

Abstract

The trial assessed Jerol composite signposts as an alternative to steel on the A73. Results indicate that composite posts offer practical and operational advantages, with promising potential for future use in highways infrastructure.

Department for Transport
ADEPT LIVE LABS 2 Decarbonising Local Roads
North Lanarkshire Council
Transport for West Midlands
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Executive Summary

This report documents and evaluates the live trial of Mallatite Jerol composite signposts on the A73 Stirling Road, North Lanarkshire (January 2025). The trial assessed installation practicality, environmental performance, safety, and operational suitability compared with galvanised steel alternatives.

Key Findings:

- **Installation & Handling:** Jerol posts (approx. 50–70% lighter than steel) significantly reduced manual handling risks. Installation was straightforward, though sleeve alignment required precision.
- **Environmental Impact:** Composite posts showed potential for carbon savings across lifecycle stages, particularly by avoiding corrosion-related replacements. However, Jerol foundations required more concrete (6.0 m³ vs. 1.5 m³ for steel), which offsets some embodied carbon benefits. A lifecycle assessment is recommended to quantify net impacts.
- **Safety:** Jerol posts are fully compliant with BS EN 12767 passive safety standards. Their lightweight nature improved site safety for operatives. Crashworthiness was validated through certification but not directly tested in this trial.
- **Operational Feedback:** Positive stakeholder feedback was received, with contractors highlighting reduced strain and quicker manoeuvrability. Minor supply chain delays (e.g., concrete delivery) affected scheduling but not product performance.
- **Scalability:** Potential barriers include production capacity, composite recycling routes, and procurement frameworks. Early cost models suggest higher upfront unit cost than steel, but reduced maintenance could deliver long-term savings.

Recommendations:

1. Implement long-term monitoring (3, 6, 12, 24, and 36 months) to measure settlement, structural integrity, and surface condition.

2. Undertake a full lifecycle carbon and cost analysis before large-scale adoption.
3. Expand trials across varied soil and climate conditions.
4. Engage suppliers on UK-based production and recycling end-of-life solutions.
5. Prepare business case guidance for local authorities, incorporating cost, carbon, and safety metrics.

Introduction

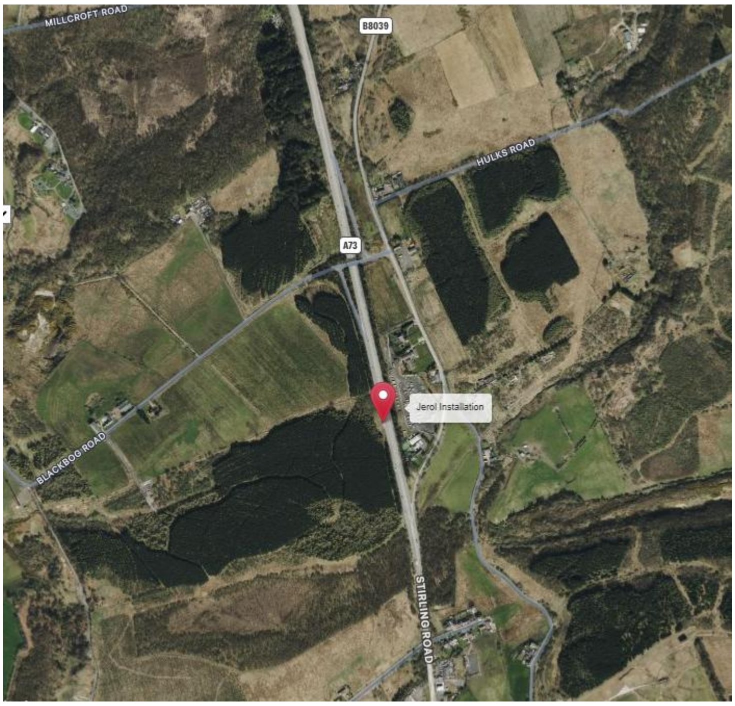
The Mallatite Jerol composite signpost trial represents a forward-thinking initiative in UK highways infrastructure, aligning with industry-wide goals for sustainability, resilience, and enhanced safety. Manufactured in Sweden using a patented process that combines a glass fibre composite core with a durable polyethylene outer skin, Jerol posts are designed to outperform traditional galvanised steel signposts in both environmental and operational metrics.

This trial, conducted under the Live Labs 2 programme, seeks to evaluate the suitability of Jerol signposts for widespread deployment on local roads across the UK, with a particular focus on North Lanarkshire. The project aims to measure the environmental benefits—such as reduced carbon emissions and improved durability - as well as operational advantages like easier installation and enhanced safety for road workers.

By benchmarking Jerol composite signposts against conventional steel alternatives, the trial will provide valuable insights into lifecycle costs, technical resilience, and real-world performance. The findings will inform future procurement and specification decisions, supporting the transition to more sustainable and cost-effective road signage solutions.

A73, Windyridge, Wattston, North Lanarkshire, Scotland, ML6 7WH

Easting: 276355, Northing: 670754.



Methodology

To ensure a comprehensive and objective evaluation of Jerol composite signposts, the trial adopted a multi-stage approach combining theoretical design analysis, physical installation, and ongoing performance monitoring.

Comparative Design Assessment

- Sign assemblies modelled with both Jerol and steel posts using industry software (SignLoad Professional 3.81; KeySign/KeyPost).

Site Selection

- Installation on the A73 Stirling Road, monitored under real-world conditions.

Baseline Comparison

- Jerol signposts are benchmarked against steel signposts with a view to matching parameters.

Stakeholder Feedback

- Qualitative feedback from operatives, inspectors and engineers.

Long-Term Monitoring

- Post-trial evaluation will continue over a three-year period to benchmark the performance of Jerol signposts, ensuring that both short-term and long-term outcomes are captured.

Limitations

While the Live Labs 2 trial of Mallatite Jerol signposts provides valuable insights into their feasibility for UK roads, several limitations should be considered:

- **Short-Term Data Collection Window:** Although the trial includes a three-year monitoring period, immediate findings may not capture long-term durability issues, gradual wear, or unforeseen maintenance challenges beyond the evaluation timeframe.
- **Operational Subjectivity:** The trial incorporates subjective feedback from road inspectors, engineers, and operational teams. While this insight is crucial, perceptions can vary, and personal biases may influence the conclusions drawn. Future trials could benefit from more standardized feedback mechanisms.
- **Limited Geographic Scope:** The trial is focused on North Lanarkshire, meaning results may not fully represent performance across different UK regions with varying road conditions, climate, or traffic patterns. Broader trials in diverse locations are recommended to validate findings.
- **Baseline Comparisons:** As the trial did not install a baseline comparison sign on galvanised steel posts, Jerol signposts will be compared with traditional galvanised steel posts are compared to traditional galvanised steel posts, but external variables such as installation procedures, maintenance practices, and local authority policies may affect the comparison results. These factors should be carefully considered when interpreting outcomes.
- **Scaling Considerations:** While the trial aims to inform broader adoption, actual scalability depends on supplier production capabilities, local authority budgets, and acceptance within the wider industry, which the trial alone cannot fully determine.

These limitations highlight the need for careful interpretation of the trial data and consideration of broader real-world applications before full-scale implementation.

Conditions During Installation

The installation of Jerol composite signposts follows manufacturer-recommended procedures to ensure optimal performance and safety. Foundations should be excavated so that the top of the foundation is at least 100mm below ground level. The steel socket is positioned and levelled in the excavation, then backfilled with either excavated or higher-quality material (Type 1 sub-base recommended). For installations requiring electrical connections, appropriate ducting and chambers should be installed as per the supplier's guidance. Posts are aligned vertically using supplied plastic wedges, and the foundation is filled with sharp grit to within 100mm of the top, capped with mortar. The ground is then reinstated to 100mm above the foundation. For mass concrete foundations, the same alignment and backfilling principles apply. These steps ensure a stable, compliant installation and facilitate future maintenance or replacement if required.

The following data has been taken from site reports:

Parameter	Value / Notes
Date & Time	29–30 Jan 2025, 08:00am – 16:00pm
Weather	29 Jan – Wet 30 Jan – Dry, ~8–10°C
Wind speed / Direction	Light, variable
Lighting	No external lighting was required due to daytime working with variable cloud cover.
Existing carriageway condition	Sound; Chapter 8 compliant
Ground conditions	Clay / embankment, excavated to depth 1.15m
Traffic management	Lane closure with sequential lamps, cones, TM wagon & IPV present

Observational Feedback

The installation of Jerol composite signposts on the A73 Stirling Road was carefully managed and documented. Site preparation included embankment clearance and excavation of two pits, with barriers and signage deployed to Chapter 8 standards. During installation, Jerol sleeves were accurately placed, concrete was poured and consolidated using poker vibration, and protective measures ensured proper curing. The final assembly featured twin Jerol posts supporting the sign face, with the verge reinstated and the site cleared.

Visual inspections confirmed neat, stable excavations with no collapse or water ingress, even in wet conditions. Sleeves were positioned according to specifications and fixed with ST3 concrete. Posts were aligned and secured, showing no signs of cracking, surface damage, or settlement post-installation.

Stakeholder feedback was positive: operatives found the posts significantly lighter than steel, improving handling and reducing manual strain. The installation procedure was straightforward, and Contractors praised the site setup. Minor delays in concrete delivery highlighted the importance of supply chain coordination, but no issues were reported with the Jerol product itself.

Material performance was robust, with the composite construction resisting chipping and corrosion—key advantages over steel, especially in environments exposed to water and road salt. The lightweight nature of the posts facilitated easier handling without compromising strength. Installation crews noted that positioning the posts was simpler than with steel equivalents, though sleeve alignment required careful attention. Once installed, the posts remained secure and upright, and the process reduced manual strain and health risks.

However, some challenges were noted. Precise sleeve alignment demanded extra care, potentially extending installation time during early adoption. Wet ground conditions emphasized the need for complete concrete curing before loading the posts.

Environmental & Safety

Jerol Composite Signposts:

Jerol posts are constructed from glass-fibre reinforced polyester (GRP) with a polyethylene outer coating. This composite material is non-hazardous, non-toxic, and highly durable, offering significant resistance to corrosion, chipping, and UV degradation. Their lightweight nature also reduces manual handling risks and associated health and safety concerns for operatives during installation and removal. The jerol composite has a service life which is estimated to be greater than 60 years resulting in less frequent replacement and maintenance. The posts are considered environmentally safe, with no known hazardous effects, and can be disposed of at approved waste sites at end-of-life. It is worth noting that Jerol posts are not currently part of a widespread composite recycling stream within the UK.

Galvanized Steel Signposts:

Steel, when exposed to atmospheric or harsh environments, is prone to corrosion—a process that is both costly and carbon-intensive to address. To mitigate this, galvanised steel is coated with zinc, creating a robust barrier that protects against rust and environmental degradation. This combination leverages the inherent strength of steel and the corrosion resistance of zinc. However, it is important to note that steel production is energy-intensive and results in higher embodied carbon compared to composite alternatives. Galvanised steel is well-suited to circular economy principles, as it can be readily reused, remanufactured, or recovered. The hot-dip galvanising process provides exceptional corrosion protection, enabling steel components to achieve their full design life with minimal maintenance. The zinc coating can endure multiple cycles of reuse, and steel can be regalvanised to further extend its service life. At the end of its lifecycle, both steel and zinc are efficiently recycled together through established processes, supporting sustainability and resource efficiency.

Design Evaluation

This evaluation considers a range of factors, including structural performance, compliance with safety standards, installation requirements, durability, maintenance needs, and environmental impact. By benchmarking Jerol composite posts against galvanized steel alternatives, this analysis aims to provide a comprehensive understanding of the technical, operational, and sustainability advantages and limitations of each system.

Jerol Trial Design

Jerol posts are fully compliant with BS EN 12767 and EN40, having undergone extensive third-party crash testing. They are classified as either NE (No Energy) or HE (High Energy) for passive safety. NE posts are designed to shear or break away on impact, minimizing vehicle deceleration and risk to occupants, making them ideal for high-speed roads. HE posts are engineered to arrest vehicles more significantly, suitable for urban or pedestrian-heavy environments. Both types are CE marked and meet wind load and deflection criteria within BS EN 12899. Service life is estimated to exceed 60 years, with minimal maintenance required due to corrosion resistance and robust construction. Installation is simplified by the use of foundation sockets and the posts' lightweight nature, allowing for shallower foundations and easier site works.

A sign & foundation design was completed by Mallatite using SignLoad Professional 3.81 on 07/11/2024.

Sign parameters are as follows:

Sign: 2940mm (W) x 3665 (H)

Sign Area 10.78m2

Wind Velocity: 25.5 m/s

Altitude 250m

Wind Pressure 1080 N/m2

Post parameters are as follows:

Number of Supports: 2

Support Type: Mallatite Jerol 273 Post

Support length: 7265mm

Passive Safety to: BS EN 12767

Foundation parameters are as follows:

Soil Type: Poor or unknown

Depth of soil fill above foundations: 100mm

Dimensions: 1150 (D) x 1000 (W) x 2500 (L)

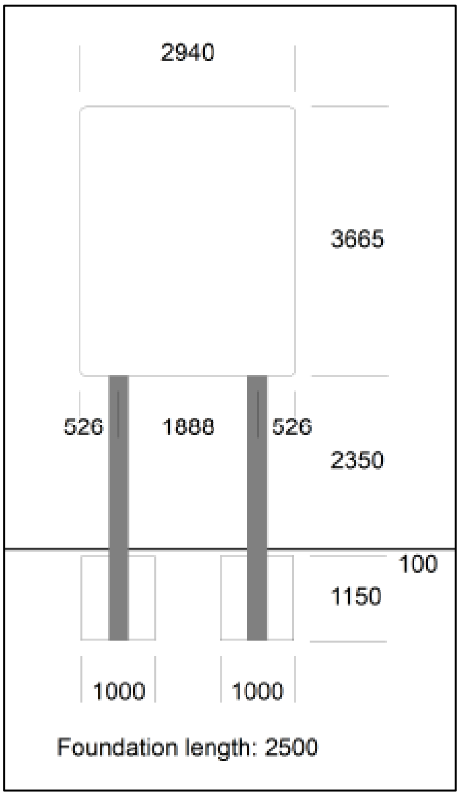


Figure 1 – Trial Design

Galvanised Steel Hypothetical Design

Steel posts are the industry standard and also meet structural and wind load requirements. However, they require deeper, cast-in-situ concrete foundations due to their weight and structural properties. This increases installation time, cost, and manual handling risks. Steel posts are not inherently passively safe and may require additional design considerations or products to meet passive safety standards. They are more susceptible to corrosion and surface damage, leading to higher maintenance demands and reduced service life in aggressive environments.

A sign & foundation design was completed using Key Sign & Key Post on 21/10/2025. Parameters were matched as closely as the design software would allow to ensure a comparable Jerol trial vs galvanised steel traditional design. The only main difference to observe is the foundation requirements for installation. KeyPost cannot determine a solution for a galvanised steel post solution with shallow foundations and is required to have deep foundations as detailed below.

Sign parameters are as follows:

Sign Width: 2818mm (W) x 3665 (H)

Sign Area 10.31m2

Wind Velocity: 25.25 m/s

Altitude 250m

Wind Pressure 1180 N/m2

Post parameters are as follows:

Number of Supports: 2

Support Type: Galvanised Steel

Support Section: 273mm x 6.3mm (S355)

Support length: 8115mm

Foundation parameters are as follows:

Soil Type: Poor or unknown

Depth of soil fill above foundations: 150mm

Dimensions: 2100 (D) x 550 (W) x 550 (L)

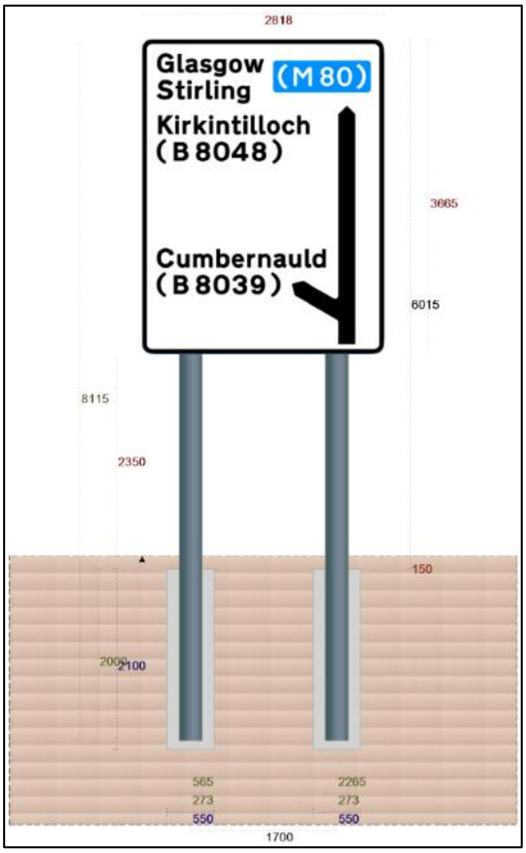


Figure 2 – Baseline Mock Design

Comparison

This section compares the performance, design, and operational characteristics of Jerol composite signposts with traditional galvanised steel signposts, based on the live trial conducted on the A73 Stirling Road.

Aspect	Jerol Composite Signposts	Galvanised Steel Signposts
Design & Materials	Glass fibre composite core with polyethylene outer skin; manufactured by Mallatite Jerol	S355 grade steel, circular hollow section (CHS); industry standard
Support Details	Circular Hollow Glass Reinforced Polyester 273mm Outer Diameter 11mm Composite Thickness Density Length 7265 mm 2 x Jerol 273 posts	Circular Hollow Steel 273mm Outer Diameter 6.3mm Wall Thickness Steel Density: 7850 kg/m3 Length 8115mm 2 x CHS 273 x 6.3 (S355) posts
Weight	Weight per metre: ~23.5kg	Weight per metre: ~41kg
Foundation Details	Spread footings: 1000 mm (width) x 2500 mm (length) x 1150 mm (height); shallow foundation. 6m3 total concrete required.	Cast-in-situ concrete: 550 mm (width) x 2100 mm (height); deep foundation. 1.5m3 total concrete required.
Service Life	60+ Years	30-40 Years
Passive Safety	Improved safety margins for operatives; passive safety to BS EN 12767 for road users.	None - VRS requirements on higher speed roads.
Maintenance	Low Requirements unless struck by errant vehicle.	Medium Requirements unless struck by errant vehicle (regalvanising, repainting etc).
Carbon Emissions	Refer to individual carbon report for Jerol	

Cost Per Metre	In the region of £450. Costs will vary depending on Local Authority and individual procurement framework routes.	In the region of £630. Costs will vary depending on Local Authority and individual procurement framework routes.
Performance	Meets wind load and stability requirements (EN1991-1-4, BS EN 12899-1:2007)	Meets wind load and stability requirements; higher foundation depth required
Deflection & Stability	Temporary wind load deflection: 21.1 mm/m (PASS, limit 25 mm/m)	Temporary wind load deflection: 21.3 mm/m (PASS, limit 25 mm/m)

Conclusions & Recommendations

The live trial of Mallatite Jerol composite signposts on the A73 Stirling Road has provided valuable insights into the practical, operational, and environmental performance of composite signposts compared to traditional galvanised steel alternatives. The trial demonstrated that Jerol posts are significantly lighter than steel, which not only reduces manual handling risks but also enables quicker and more straightforward installation. This improvement in handling directly enhances site safety for operatives and reduces the likelihood of musculoskeletal injuries.

Early indications from the trial are positive regarding both durability and safety. The Jerol posts fully comply with BS EN 12767 passive safety standards, and their lightweight nature contributed to improved site safety. While crashworthiness was validated through certification, it was not directly tested in this trial; however, no adverse outcomes were observed during installation or initial use.

From an environmental perspective, the composite posts show promising potential for reducing carbon emissions over their lifecycle, particularly by avoiding corrosion-related replacements that are common with steel. However, it is important to note that the Jerol foundations required a greater volume of concrete (6.0 m^3 versus 1.5 m^3 for steel), which partially offsets the embodied carbon savings of the composite material. A full lifecycle assessment is therefore recommended to accurately quantify the net environmental impact.

Stakeholder feedback was overwhelmingly positive, with contractors and operatives highlighting the reduced strain, improved manoeuvrability, and overall confidence in the product's operational use. Minor supply chain delays, such as concrete delivery, were noted but did not impact the performance of the Jerol posts themselves.

Potential barriers to wider adoption include production capacity, the development of composite recycling routes, and the need for procurement frameworks that accommodate innovative materials. While early cost models suggest a higher upfront unit cost for Jerol posts compared to steel, the potential for reduced maintenance and longer service life could deliver significant long-term savings.

Based on the findings of this trial, the following recommendations are made to support the future adoption and optimisation of Jerol composite signposts:

1. **Long-Term Monitoring:** Implement a structured monitoring programme at 3, 6, 12, 24, and 36 months post-installation to assess settlement, structural integrity, and surface condition. This will provide robust data on long-term durability and performance under real-world conditions.
2. **Lifecycle Assessment and Cost-Benefit Analysis:** Undertake a comprehensive lifecycle carbon and cost analysis to fully understand the environmental and economic implications of large-scale adoption. This should include both embodied and operational carbon, as well as maintenance and end-of-life considerations.
3. **Broader Trials:** Expand live trials to other regions across the UK, encompassing a variety of soil types and climatic conditions. This will help validate the findings from North Lanarkshire and ensure the solution is robust and adaptable to different environments.
4. **Supplier Engagement and End-of-Life Solutions:** Work closely with suppliers to develop UK-based production capabilities and establish viable recycling or end-of-life solutions for composite materials. Addressing these challenges will be critical for scaling up adoption and aligning with circular economy principles.
5. **Business Case Development:** Prepare a procurement business case template for local authorities, incorporating cost, carbon, and safety metrics. This will support informed decision-making and facilitate the integration of composite signposts into standard procurement frameworks.
6. **Stakeholder Communication:** Continue to engage with contractors, operatives, and local authorities to gather feedback and share best practices. Their insights will be invaluable for refining installation procedures, addressing operational challenges, and building confidence in the new technology.

By following these recommendations, the highways sector can make informed decisions about the adoption of composite signposts, balancing innovation with safety, sustainability, and operational efficiency.

Appendix A

Excavation

Sleeve Installation

Concrete Pour

Post & Sign Face Erection

Finished Install

Appendix B

KeyPost Data

Loading and Stability Report
for Proposal "LL2 Jerol Trial"

Proposal created on: **21 Oct 2025** by: **AW** as part of Scheme: **(None specified)**

This version: **1** modified on: **21 Oct 2025** by: **AW**
Status: **Draft**
Report generated on: **21 Oct 2025 09:49**

This report was generated using KeyPOST version 5.0.3.0

The Design Life of the proposal is 25 years.

General Assumptions

All lengths and positions are given in mm, masses in kg, forces in kN unless otherwise stated.

Gravity is taken to be 9.81 m/s^2

Assembly maximum allowed overall width = 15 m, maximum allowed overall height = 9 m.
Where appropriate, partial action factors are chosen from Design Approach DA1 and PAF1 for ULS structural tests.
Foundations are sized using methodologies from Eurocode 7 and (for 'planted' foundations) CD 354 §12.
Signs with channels have temporary deflections tested to TDB4 (25 mm/m).
Signs without channels are not tested.
Support bending deflections tested to TDB4.
Support torsion deflections tested to TDT4.
KeyPOST does not verify the strength and suitability of flanges, bolts or other fixings.

The ground and structure in this proposal have been classed as Geotechnical Category 1

Environs

This proposal is situated in the general Environs "LL2 Jerol Trial" whose details are given below.

Location	Scottish Mainland
Description	
Terrain Class	II (Country)
General Altitude	250 m
Exposure	Normal
Orography	Not significant

Local Site

Within this Environs, the assembly is to be constructed on an area whose Local Site details are as follows:

Altitude	250 m
Exposure	Normal
Orography	Not significant
Distance to Shore-line	> 5 km

Structure and Sign Assembly

Component objects Signs: 1 Posts: 2 Foundations: 2

Max height above ground	6015 mm	
Mounting height	2350 mm	(minimum vertical carriageway clearance 900 mm)
Bearing from North	000 °	Orientation from carriageway 090 °

Electrical Housings None

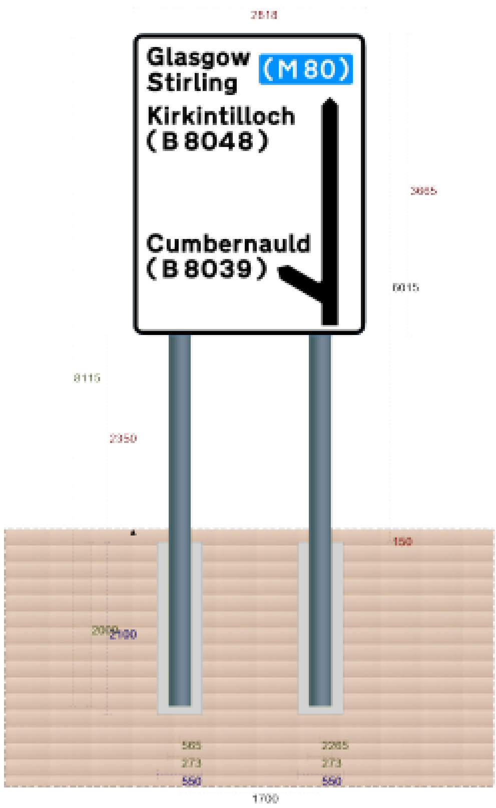
Passive Safety

This structure was not tested for passive safety.

Safety Factors

Destabilising (model) γs;d	1.25	(Default)
Overturning	1.50	(Default)
Sliding	1.50	(Default)
Additional Factor	1.00	(Default)
Slope Stability Factor	1.50	(Default)

Front Elevation



Side Elevation

Wind

Wind Load Method		EN 1991-1-4 (Eurocode 1)		
Based on a wind return period of		25	years	
1-year wind return factor		0.611		
Wind velocity based on location	$v_{b,map}$	25.254	m / s	
Altitude factor	c_{alt}	1.250		
Fundamental Basic Wind Velocity	$v_{b,0}$	31.568	m / s	$= v_{b,map} \times c_{alt}$
Design life exceedence probability factor	c_{prob}	0.960		
Seasonal factor	c_{season}	1.000		
Air density in storm	ρ	1.226	kg / m³	

Wind Force on Signs

Height from Ground to centroid		4182.5	mm	
Plane XY				
Orography factor	c_o	1.000		
Basic Wind Velocity	v_b	30.295	m / s	
Mean Basic Velocity Pressure	q_b	562.597	kN / m²	
Exposure factor	c_e	1.986		
Peak Velocity pressure	q_p	1.117	kN / m²	
Basic Wind Load (Pressure)	w_b	1.117	kN / m²	(Above WL5)
Sign# 001				
Area of Sign	A_{ref}	10.308	m²	
Wind Force				
Effective slenderness ratio	λ	1.301		
Force coefficient	c_f	1.280		(By BS EN 12899-1 NA.2)
Wind Design Pressure (ULS)	$w_{e,d}$ (ULS)	1.930	kN / m²	
Wind Design Pressure (SLS)	$w_{e,d}$ (SLS)	1.430	kN / m²	
Total Design Wind Force (ULS)	$F_{w,d}$ (ULS)	19.937	kN	
Total Design Wind Force (SLS)	$F_{w,d}$ (SLS)	14.768	kN	
Design Wind Force (SLS) 1-year Return	$F_{w,d}$ (1 yr)	9.020	kN	

Partial Action Factors for Loads

Ultimate Limit State (ULS)	γ_{fl}	1.350
Servicability Limit State (SLS)	γ_{fl}	1.000
Additional Factor	γ_{f3}	1.000

Ground

Grid Ref point			GB: (271924.0, 668275.0)
Slope		0.0º	(XY)
Depth to solid layer		1	m
Ground Category			Cohesive soils (Soft clays and silts)
Soil Quality (for planted foundations)			Unknown (Overridden from Default Of: Poor)
Friction Coeff		0.506	
Presumed Allowable Bearing Pressure		50.0	kN / m²
Unit Weight		17.00	kN / m³
Angle of Internal Friction	φ	0	°
Cohesion	cu	20	Tested Undrained
Ground Water			Well below foundations

Signs

Sign	Ref	Type	Shape	Zpos	W	H	D	Mass	Face	Substrate	X	Y	Area
					mm	mm	mm	kg			mm	mm	m²
001			Rec	Front	2818	3665	4.00	111.33		Generic Aluminium	0	2350	10.31

Posts

Support	Ref	Type	X	Y	H	Orient	Cap	BPlt	Doors	Mass	Flange	Mount	Anchorage	Foundation
			mm	mm	mm					kg				
001		ST-A	565	-2150	8115	000°	N	N	0	336	N	Embeddded	none	001
002		ST-A	2265	-2150	8115	000°	N	N	0	336	N	Embeddded	none	002

Support Types

Type	Manufacturer	Model	Section	Width	Breadth	Wall	Base	Material
				mm	mm	mm	mm	
ST-A	(Unspecified)	GenericS355CHS	CHS	273.0	-	6.3	N/A	Steel/S355

Type	Mass/m	VMax	$MuMax_x$	$MuMax_y$	TuMax	EI_x	EI_y	JG	Passive Safety
	kg / m	kN	kN m	kN m	kN m	kN m²	kN m²	kN m²	
ST-A	41.38	688.75	146.55	146.55	141.02	9626.438	9626.438	7419.401	Class 0

Note: Use of Passively Safe post types and those deemed Passively Safe under EN 12767 imply restrictions on mounting height sign array size And post separation.The relevant standard And manufacturer's data should be checked to confirm that their us is appropriate.

Foundations

Fnd	Shape	X	Y	W	L	H	Concrete/Material	Density	Type	Vol	Mass	Wgt
		mm	mm	mm	mm	mm		kg/m³		m³	tonnes	kN
001	Cir	290	-2250	550	550	2100	Designed C40/50; S3; C40/50	2300.00	Cast-in-situ	0.50	1.15	11.26
002	Cir	1990	-2250	550	550	2100	Designed C40/50; S3; C40/50	2300.00	Cast-in-situ	0.50	1.15	11.26

Results

Total Mass of Stucture	2.913 tonnes
Total Weight of Structure	28.572 kN
Total Volume of added Concrete	0.998 m³

Plane: XY

Signs

Deflections, where shown, are the approximate maximum across the sign. Wind Loads are distributed.
Only signs with a sign thickness <= 10 mm and with channels are included in deflections.

Sign# 001

Deflection

(This Sign has no Channels so deflection is not considered)

Supports

For shear and bending, ULS wind force is applied. For temporary deflections, SLS (1 year) wind force is applied.

Max Temp. Deflection Class 25.0 mm / m (TDB4)

Only the results for the Post with the greatest bending moment (Post #001) are shown.

Post# 001

Ground Cover	150.000 mm		
Partial Material Factor	1.050		
Wind Load Applied (ULS)	10.011 kN	Wind Load Applied (SLS 1-yr)	4.529 kN

Ultimate Effects

Shear

Max Shear	P_v	688.750 kN
Partial Material Factor	γ_m	1.050
Ultimate Shear Capacity	P_v / γ_m	655.952 kN

		Point Load		Wind Load
Basic Load	F_k	0.500 kN	(PL3)	7.416 kN
Partial Action Factor	γ_F	1.35		1.35
Applied Load	F_d	0.675 kN		10.011 kN
Ultimate Design Shear	V_d	0.675 kN		10.011 kN
Shear Capacity used		0.1 %	PASS	1.5 % PASS

Bending

Max Bending Moment	M_c	146.551 kN m
Partial Material Factor	γ_m	1.050
Ultimate Bending Capacity	M_c / γ_m	139.572 kN m

			Point Load		Wind Load	Dead Load
Basic Load		F_k	0.500 kN	(PL3)	7.416 kN	0.548 kN
Partial Action Factor		γ_F	1.35		1.35	1.20
Applied Load		F_d	0.675 kN		10.011 kN	0.658 kN
Total Bending Moment (inc. Dead Load)						
	V.	M	-0.186 kN m			-0.091 kN m
	H.	M	-4.253 kN m		-43.465 kN m	
Bending Capacity used	V.	Λ	0.1 %	PASS		0.1 % PASS
	H.	Λ	3.0 %	PASS	31.1 % PASS	

Foundations and Stability

Foundation# 001 (Individual,Planted)

Destabilising (Planted: CD 354 §12)

Unfactored Design Load		7.416	kN	
Ground Factor	G	230.000	kN / m² / m	(Table 12.12: 'Unknown' - taken as Poor)
Minimum Diameter of Post	D	273	mm	
Planting Depth of Post	P	2150	mm	
Ground Resistance Moment	M_g	62.403	kN m	
Destabilising Moment	M_{DS}	-43.216	kN m	
Safety (Model) Factor	$\gamma_{s;d}$	1.250		
$\gamma_{s;d} \times M_{DS}$		-54.020	kN m	
Capacity used		86.6	%	PASS

Concrete reinforcement is not tested for planted, non-concrete or proprietary foundations.

Foundation# 002 (Individual,Planted)

Destabilising (Planted: CD 354 §12)

Unfactored Design Load		7.353	kN	
Ground Factor	G	230.000	kN / m² / m	(Table 12.12: 'Unknown' - taken as Poor)
Minimum Diameter of Post	D	273	mm	
Planting Depth of Post	P	2150	mm	
Ground Resistance Moment	M_g	62.403	kN m	

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Destabilising Moment	M_{DS}	-42.849	kN m	
Safety (Model) Factor	$\gamma_{s;d}$	1.250		
$\gamma_{s;d} \times M_{DS}$		-53.561	kN m	
Capacity used		85.8	%	PASS

Appendix C

Relevant supplier information (datasheets etc.)