JJ Mac Ltd

JJMac Ground Stabilisation

The Role of Soil Improvement, Modification, and Stabilisation in Adopted Highway Works

Citation ISO Certification Quality management ISO 9001: 2015 REGISTERED
Certificate No:334152019

Acclaim Accreditation

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CL:AIRE Principal Member

wamitab

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JJ Mac Ltd

Who are we?

- We are highly experienced contractors in the provision of successful geotechnical and ground engineering solutions for earthworks and roadwork projects
- 15+ years' experience in soil stabilisation and bulk earthworks across highways, commercial, and infrastructure schemes
- An independently resourced business able to provide all its own plant, equipment and personnel.
- A fully equipped laboratory and qualified staff, undertaking in-house testing
- Advanced capability in Rolling Dynamic Compaction (RDC) for pre-treatment consolidation
- Repeat contractor to Tier 1 infrastructure clients and Highways England projects

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Plant and Equipment

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THE TRADITIONAL APPROACH CHALLENGE

Traditional highway formation design often relies on:

- Mass excavation and removal of unsuitable or marginal soils from site
- Importation of suitable bulk fill, capping materials and of course Type 1 sub-base
- The associated HGV traffic, time, and cost involved with such approach:

  - Has a high embodied carbon footprint
  - Is environmentally disruptive
  - Often proves uneconomical in large or soft ground situations
  - Does not always deliver improved geotechnical performance
  - Rarely delivers additional structural stability and or stiffness, over and above that expected for normal typical design

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THE SOIL IMPROVEMENT/STABILISATION ALTERNATIVE

Soil improvement/stabilisation involves the in-situ or ex-situ improvement of native, site-won, or imported soils using Lime, Cement, GGBS or blended binders to improve strength, durability, and bearing capacity.
It enables the reuse of clays, silts, and even some U1A-classified materials.

- Dry modification – to reduce moisture and improve handling/compaction
- Improvement – to achieve required strength (typically >5% CBR, 95% Compaction or >65kPa by hand shear vane)
- Stabilisation (Capping) – to achieve required strength (typically >15% CBR, 95% Compaction, or >100kPa by hand shear vane)
- Stabilisation (Type 1 Replacement) – to achieve required strength (typically >30% CBR, 95% Compaction, or >135kPa by hand shear vane, non-frost susceptible material)
- Enhanced uniformity and resilience

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NATIONAL GUIDANCE & COMPLIANCE

Soil improvement and stabilisation is fully supported by UK standards:

- MCHW Series 600 (Clauses 617, 618, 619)
- MCHW Series 800 (clause 810) for capping and sub-base layers
- CD 225 (Rev 1) and CD 226 for pavement foundations
- HA74/07 – *Treatment of Fill Materials using either Lime or Cement*
- Britpave Guidance – *Stabilisation and Soil Modification Techniques*
- BS EN 14227 – Hydraulically Bound Mixtures

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Typical Test Process

1. **Desk Top analysis**

- Site Investigation – soil description matched to MCHW classification
- Site Investigation – Water Tables, Sulphates et.al.
- Earthworks Specification – Improvement recommendations

2. Site Samples collected and sent to lab

3. Mix Design derived from Lab Mix testing and site requirement i.e. required CBR/kPa

4. Site progress testing in accordance with IPT. Typically MCV, Pulverisation, CBR and Air Voids

Pre-Start & Construction Phase Testing

JJMac 3203 - (Issue - 001)

Earthworks (cut/Fill) Vol:	0 m3	Bulk Treatment Vol:	- m3		
Cut Area:	cart to fill area	Building Area:	0 m2	N/A	In-situ Base Treatment 300mm
Fill Base Area:	0 m2	Capping Area :	0 m2	R'd Edge + 1m each side	Bulk Fill to
Treatment Surface Areas:	0 m2	Road Length:	0 m		Capping Layer to achieve > 30% CBR = 0 m3
Estimated Layers (Avg)	5 Layers @ 300mm	1	No: Subgrade Surface	300.00 mm / Layer	
Construction Period:	2 Wks		CAPPING	300.00 mm / Layer	

	(A) Pre-Start/Pre-Pacement Testing	TESTING RATE	ITEM	SAMPLE RATE/SET	TESTS TOTAL (No)	COST / TEST	COST (£)	NOTES	ACCEPTANCE CRITERIA LIMITS NOTE	LOWER	UPPER
	Volume = 0 m3	MATERIAL CLASSIFCATION CHECKS (7E)							NOTE	LOWER	UPPER
1	Grading (U)/PSD/Classification - (2A/2B)	1,000	per m3	1	0	-	£0.00	Selected samples from whole of stockpile	Subject to Engineers Review		
2	PI - Atterbergs Tests - (2A/2B)	1,000	per m3	1	0	-	£0.00	Selected samples from whole of stockpile	Subject to Engineers Review		
3	MC - (2A/2B)	1,000	per m3	1	0	-	£0.00	Selected samples from whole of stockpile	Subject to Engineers Review		
4	Sulphate Checks as per MCHW (TRL Suite) - (2A/2B)	1,000	per m3	1	0	-	£0.00	Selected samples from whole of stockpile	BS EN 1744.1 clause 10.	-	1400 mg/l as SO4
5	Organic Matter - (2A/2B)	1,000	per m3	1	0	-	£0.00	Selected samples from whole of stockpile	Subject to Engineers Review		
	Length = 80 m	SUBGRADE - IN-SITU Testing after TOPSOIL/STOCKPILE Removal							NOTE	LOWER	UPPER
6	Hand Shear Vanes - Subgrade - (Pre-impovement)	20	METRE	4	0	-	£0.00	Test Depths @ Suface + 0.5m + 1.0m + 1.5m	STIFFNESS	75kPa	-
7	Mexi-probe - Subgrade - (Pre-impovement)	20	METRE	4	0	-	£0.00	Test Depth @ Surface	CBR	>3%	-
	MIX DESIGN CHECKS - BULKFILL to Class 2A/2B (Lime Only) & CAPPING to Class 9D (Lime Only) or Class 9E (Lime+ Cement)								NOTE	LOWER	UPPER
	6R- Mix-1 @ 1% Cement	1	/ source	0	0		£0.00	1 @ 7 days as standard soaked test	CBR	>15%	-
	6R- Mix-1 @ 1% Cement	1	/ source	0	0		£0.00	1 @ 28 days as standard soaked test	CBR	>15%	-
	MCV Determination - 6R Material	1	/ source	0	0		£0.00	On mixed materials prior to placing in moulds	MCV	9	11
	Mositure Content - 6R Material	1	/ source	0	0		£0.00	On mixed materials prior to placing in moulds	OMC	-2%	+2%
	MDD - 2.5kg - 6R Material	1	sample	0	0		£0.00	for Class 2A/2B only - for each mix	Subject to Final Review		
					TOTAL		£0.00				

	(B) CONSTRUCTION TESTING - JJ MAC Ltd	TESTING RATE	ITEM	TEST No / Item-Rate	TESTS TOTAL (No)	RATE / TEST	COST (£)	NOTES	ACCEPTANCE CRITERIA LIMITS NOTE	LOWER	UPPER
	GENERAL TESTING Cont'd										
1	MDD - 2.5kg - Check Bunds	500	m3	0	0		£0.00	To be undertaken on Modified Fills	Value to be used in detemination of Density		
	SUB-FORMATION (Prior to Fill or Capping Treatment)										
2	Sub-Formation - HSV - Hand Shear Vane	250	m2	0	0		£0.00	By appointed UKAS Accredited Test House	HSV	75kPa	-
3	600mm dia - Plate Tests - (after insitu improvement)	250	m2	0	0		£0.00	Test Depth @ Surface	CBR	>15%	-
4	600mm dia - Plate Tests - (after insitu improvement)	250	m2				£0.00	Test Depth @ Surface	Bearing	>75kN/m2	-
	BULK FILL (IN-SITU)										
5	MCV test to check Moisture Condition	1	DAILY	1	15		£0.00	@ the point of compaction	MCV (assumed)	9	12
6	Layer tests - HSV - Hand Shear Vane	500	m3	1	0		£0.00		HSV	75kPa	-
7	Capping tests - CBR - 300mm Plate @ FCL	1,000	m3	1	0		£0.00		CBR	>15%	-
8	Moisture Content	1,000	m3	1	0		£0.00		OMC	-2%	2%
9	15% CAPPING LAYER (Assumed below frost zone)										
10	MCV test to check Moisture Condition	1	DAILY	0	0		£0.00	@ the point of compaction	MCV (assumed)	9	11
11	Capping -Field Dry Density (NDM)	250	m3	0	0		£0.00		Density	95%	-
12	Capping tests - CBR - 300mm Plate @ FCL	250	m3	0	0		£0.00		CBR	>15%	-
13	Pulverisation	250	m3	0	0		£0.00		Pulverisation	30%	-
14	GENERAL CHECKS										
15	Binder Spread Rate	500	m3	1	0		£0.00	By JJ Mac Site Team (Lime / Cement)	Record Only	To Meet % Application	
16	Supplier QA Data Sheet (Lime + Cement Source)	1	WEEKLY	1	0		£0.00	By Supplier	Record Only	To Meet Cement Spec:	
17	Attendance on site - Half Days	1	TECH's	1	0		£0.00				
18	Attendance on site - Full Days	1	TECH's	0	0		£0.00				
					TOTAL		£0.00				

JJ Mac Ltd

Standards

Standards for Highway Design Manuals for Roads and Bridges

HA74/07 – Vol 4 section 1

Placticity Optimum 26%

Moisture Optimum 18 – 22

MCVs Optimum 8 – 12%

May 2007

Constituent	Process	Application	Initial Class	Primary purposes of constituent	Resultant Class
Lime	Improvement	General granular fill	Class U1A	Reduction in mc (or increase in MCV)	Class 1A Class 1B Class 1C
Lime	Improvement	General cohesive fill	Class U1A	Increase in MCV (or reduction in mc); reduction in PI	Class 2A Class 2B Class 2C Class 2D Class 2E
Lime	Improvement	General chalk fill	Class U1A	Reduction in mc	Class 3
Lime	Stabilisation	Selected cohesive fill – capping	Class 7E	Increase in MCV (or reduction in mc); increase in bearing ratio; reduction in PI	Class 9D
Cement	Stabilisation	Selected granular fill – capping	Class 6E	Increase in bearing ratio	Class 9A
Cement	Stabilisation	Selected cohesive fill – capping	Class 7F Class 7G	Increase in bearing ratio	Class 9B Class 9C
Lime and cement	Stabilisation	Selected cohesive material – capping	Class 7I	Increase in MCV (or reduction in mc); increase in bearing ratio; reduction in PI	Class 9E
Lime and cement	Stabilisation	Selected granular fill – capping	Class 6R	Reduction in mc (or increase in MCV); increase in bearing ratio	Class 9F

Note: 1. Improvement – rendering unacceptable material acceptable
2. Stabilisation – change in use of acceptable material
3. mc = moisture content
4. MCV = Moisture Condition Value
5. PI = Plasticity Index
6. Bearing ratio = California Bearing Ratio

Table 2/1 Applications of Lime and Cement Treatment for General Fill and Capping

Part 6 HA 74/07

Applicati

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Site Testing

MCV – Moisture Condition Value

CBR – California Bearing Ratio

LWD – Ligthweight Deflectometer

Tray Weights – Binder Addition

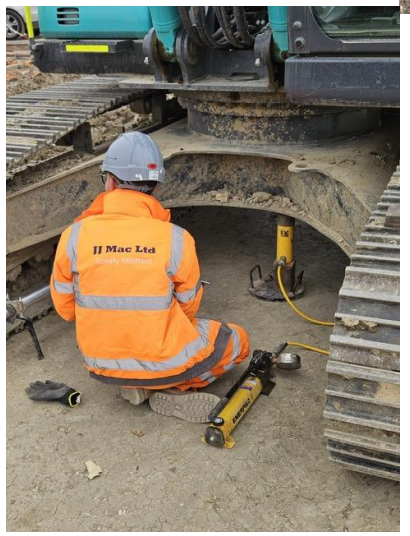
HSV – Hand Shear Vane

NDM – Nuclear Density Gauge – Air Voids

Core Cutter - Air Voids

Sand Replacement – Density Test

Clegg Test – Compaction Test



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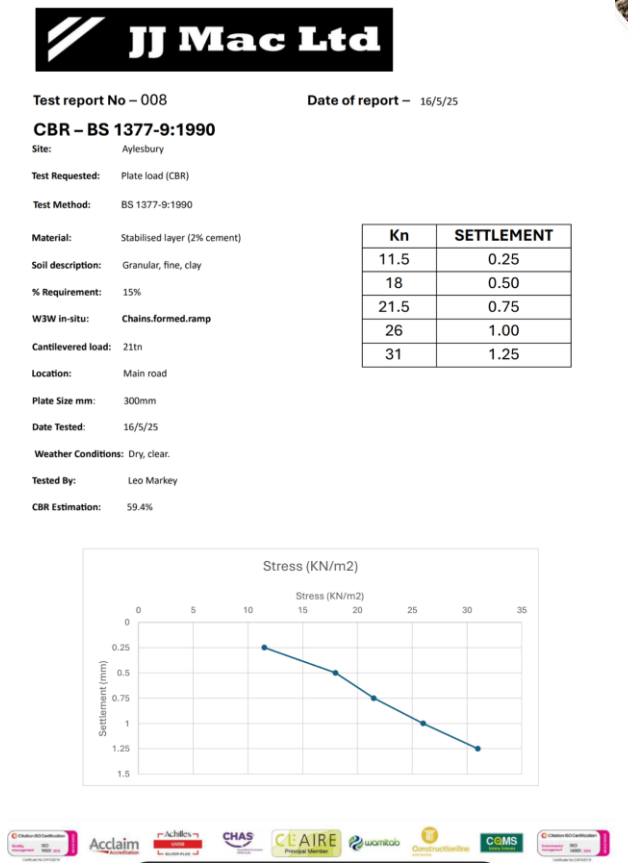
ENGINEERING BENEFITS

- Allows reuse of on-site cohesive soils to meet structural fill requirements
- Delivers long-term strength (UCS >1.5MPa or CBR >5%)
- Reduced differential settlement
- Compatible with RDC pre-treatment to enhance formation support
- Reduced water sensitivity and shrink/swell potential
- Enhanced stiffness and freeze-thaw durability



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Test report No – 008 Date of report – 16/5/25

CBR – BS 1377-9:1990

Site: Aylesbury
Test Requested: Plate load (CBR)
Test Method: BS 1377-9:1990
Material: Stabilised layer (2% cement)
Soil description: Granular, fine, clay
% Requirement: 15%
W3W in-situ: Chains.formed.ramp
Cantilevered load: 21tn
Location: Main road
Plate Size mm: 300mm
Date Tested: 16/5/25
Weather Conditions: Dry, clear.
Tested By: Leo Markey
CBR Estimation: 59.4%

Kn	SETTLEMENT
11.5	0.25
18	0.50
21.5	0.75
26	1.00
31	1.25

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ENVIRONMENTAL & SUSTAINABILITY BENEFITS

- Reduction in imported aggregates (up to 70%)
- Reduction in off-site disposal of arising's
- Reduction in Works Programme
- Decreased construction traffic movements – lower NOx, CO_2, PM emissions
- Lower whole-life carbon footprint – aligns with PAS 2080
- Natural capital retention and circular economy compliance

JJ Mac Ltd

COST & PRODUCTIVITY BENEFITS

- Lower material import/export and haulage costs
- Fewer working days required
- Reduced need for temporary works, dewatering, and over-excavation
- Predictable performance based on in-house lab and on-site testing
- Optimised programme with early access for follow-on trades

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HEIC High Energy Impact Compaction and RDC Rapid Dynamic Compaction

Our ability to undertake Rolling Dynamic Compaction (RDC) in combination with stabilisation allows:

- Pre-treatment of loose fills and organic strata
- Greater densification of loose granular layers
- Verification of formation stiffness prior to binder treatment
- Equipment: Sinoway SWIC320 (HIEC) impact roller

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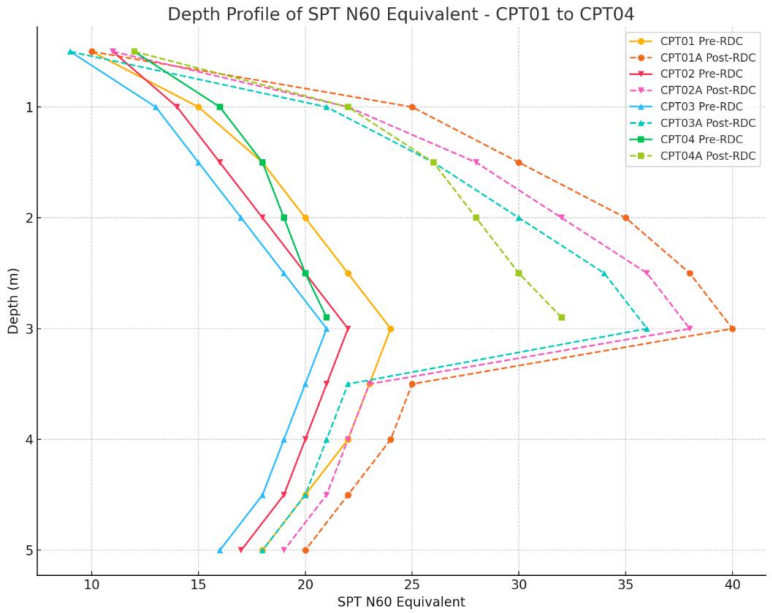

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