Post-Grouting Systems for Micropiles

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Post-Grouting Procedure

1. Install Micropile or Anchor with *Post Grouting Tubes and Valves*
2. Fill Borehole with Primary Grout
3. Let Primary Grout Cure
4. *Fracture* Primary Grout with Pressure
5. *Re-Inject Fresh Grout at Pressure*
Increased Load Performance with *POST-GROUTING*:

- Subjects Surrounding Ground to Radial Stresses
- Stiffens / Consolidates the Soil In-Situ
- Increases Effective Borehole Diameter
Empirical Relationship between *Ultimate Bond Stress* and Limit Pressure from Pressuremeter or SPT (N Value) for Silty Clay

*after Bustamante et al*
Post Grouting Systems:

• Looped Tube Systems *(IGU)*

• Staggered Multiple Tubes

• Tube-á-Manchette, TAM or TMD, *(IRS)*
Looped Tube System *(IGU)*
Permanent GEWI Micro piles (with Double Corrosion Protection)

Post-Grouted (Looped Tube System)
Basement Slab Uplift Resistance

Permanent GEWI 63.5mm Micropiles (with Double Corrosion Protection)

Post-Grouted (Looped Tube System)
Staggered Tube System

- 2 or 3 Tubes per Borehole
- 2-4 Valves per Tube
- Valves placed at differing depths (stages)
Close Up of Valve

(Staggered Tube System)

Laid alongside Micropile

(Micropile shown with Double Corrosion Protection, DCP)
Tube-á-Manchette System (TAM) **IRS**
*(shown installed between strands: temporary strand anchor)*
Double Packer Injection Tool

Un-Inflated

Inflated
Post Grouting Equipment – (IGU System shown)

- Grout Mixing Unit
- High Pressure Grout Pump
- Pressure Line
- Post Grouting Pipework / System (IGU)
Staggered Tube System

(Staged Tubes with twin valves)
Tube-á- Manchette System (TAM)
Double Packer Inflation Pressure (40 Bar)
Fracture Pressure (up to 70 Bar)
Micropiles in Restricted Access Locations

Post-Grouting is the ideal technique for increasing load capacity in difficult ground
Projects Using Post-Grouted Micropiles

Clif Kettle
Typical TMD Installation Sequence
Fort George Power Station

Drilling by DTH Hammer
Fort George Power Station

Head of micropile

centraliser
Maurice Power Station

sleeves
Détail des systèmes de reprise d'effort en attente avant exécution du radier
Rue Raynouard - Paris 16ème - Foundation Remediation with Micropiles
Typical section indicating the complexity of the existing foundations
Rue Raynouard - Paris 16ème - Area of Failed Foundation

PLAN DE SITUATION

Immeubles rue Raynouard

D. Wall

Fouilles prof. 20 m
DETAIL AU DROIT DE LA PAROI EXISTANTE APRES SINISTRE
Section through building

COUPE SUR EXISTANT
AVEC CONFORTEMENT PAR MICROPIEUX

F.F au moment du sinistre

15 m

Paroi Existante
Tirants Existants
Micropieux créer
Quantity 442 no.

Capacity 55t capacity

Length 38 - 45 m

Bond length 15 m

Central reinforcement tube 69 / 89 (MPV 80)

Free length PVC slip tube anti-friction

Tube reinforcement 157 / 178
Installation of 220mm dia. 40t capacity flat-jacks
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Steel Cradle and Micropiles

System of load transfer
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Installation of Piles

Gravity grouted tube pile section

Post grouted gewi bar reinforced section

Steel tube micropile extended by TAM post grouting and Dywidag reinforcement
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Pile Installation Sequence
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- Installation of Piles

Drilling from trench prior to micropile installation
VIADUC DE GOURNAY – Steel Tube Base Section of Micropile

Micropile tubes with full strength conical thread
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- Placement of Reinforcement and Tube-á-Manchette

Installing bar cage reinforcement within the tube pile
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Steel TMD Tube-á-Manchette within bar cluster
VIADUC DE GOURNAY – Installed Micropiles

View showing the installed micropiles at cut off level
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Coring of Pier Walls

Coring $\phi$ 700mm in the piers to prior to the installation of load transfer beams
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Core Drilling of pier

Extraction of core barrel with brickwork core intact
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Core Drilling of pier

Interier view of core hole in brick pier
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Installation of Load Transfer Beam
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Installation of the lower steel section of the load transfer cradle onto the micropiles
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- Pile Installation

Installation of the upper section of the load transfer cradle
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- Pile Installation

Completed installation of the load transfer mechanism
Completed assembly after positioning and connection to structure
VIADUC DE GOURNAY - Pile Installation

Preparatory works prior to casting a protective concrete cover around the completed assembly
VIADUC DE GOURNAY – Completed Works