

Approval & Reception Procedure

CA – Coordenação E Assessoria									
Vibration Stone Columns	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="padding: 2px;">Document no.</td> <td style="text-align: right; padding: 2px;">ARP/CA/01</td> </tr> <tr> <td style="padding: 2px;">Rev. no.</td> <td style="padding: 2px;"></td> </tr> <tr> <td style="padding: 2px;">Date:</td> <td style="text-align: right; padding: 2px;">17.11.2008</td> </tr> <tr> <td style="padding: 2px;">Page no.</td> <td style="text-align: right; padding: 2px;">1 of 5</td> </tr> </table>	Document no.	ARP/CA/01	Rev. no.		Date:	17.11.2008	Page no.	1 of 5
Document no.	ARP/CA/01								
Rev. no.									
Date:	17.11.2008								
Page no.	1 of 5								

1 Reference standard

- Technical specification for design and construction of stone columns composite foundation JTJ 246-2004
- Technical code for ground treatment of building JGJ 79-2002
- Code for investigation of harbour engineering JTJ 240-97
- Code for foundation of harbour engineering JTJ 250-98
- Technical specification of prototype observation for water transport engineering hydrostructure JTJ 218-2005

2 Information to be submitted

- Geotechnical information (site investigation)
- Site condition (including size, site boundaries, topography, slope, access, temporary drainage system)
- Design drawings and technical specifications for the project
- Catalogue of vibro-replacement installation equipment used in the project
- Method statement of construction
- Construction Record:
 - Stone column reference number
 - Elevation of top and bottom of each stone column
 - Number of buckets of stone backfill in each stone column
 - Vibrator power consumption and ampere during penetration of vibrator,
 - Vibrator power consumption and ampere during compaction of stone column.
 - Time to open each stone column
 - Time to form each stone column
 - Details of obstructions, delays and any unusual ground conditions.
- Location of adjacent structures (e.g. building, road, bridges, channel, utilities or service)
- Environmental evaluation report
- Monitoring data during construction

Prepared:	Verified:	Approved: Date: / /
-----------	-----------	--------------------------------

Approval & Reception Procedure

CA – Coordenação E Assessoria	
Vibration Stone Columns	Document no. ARP/CA/01
	Rev. no.
	Date: 17.11.2008
	Page no. 2 of 5

3 Materials

3.1 Lot

A lot is any quantity limited to 5000m³ of materials of the same type and origin used for Stone Column.

3.2 Stone

The crushed stone (or gravel) for column backfill shall be clean, hard, unweathered stone, free from organics, trash, or other deleterious materials. Visual inspection must be permanently made. Laboratory test must be made for each lot

For crush stone samples, the following laboratory tests shall be performed (1 test per lot)

- Particle Size Distribution Test (ASTM C136)
- Specific Gravity Test (ASTM C127, C128)
- Los Angeles test (ASTM C131, C 535)

3.3 Sand

The sand used for the temporary working platform shall be hard, natural or manufactured sand free from organics, trash or other deleterious materials. The sand should be well-graded.

For sand samples, the minimum mass of the sample for testing shall be 30 kg, the following laboratory tests to be performed (1 test per lot)

- Particle Size Distribution Test (ASTM D422)
- Maximum index density (Vibratory Table) (ASTM D4253)
- Direct Shear Test (ASTM D3080)

3.4 Water

Fresh, brackish, or sea water or any combination, free of all substances deleterious to the work may be used.

3.5 Acceptance criteria

Crushed stone should comply with technical specification.

For crushed stone, clay content must be <5%.

Prepared:	Verified:	Approved: Date: / /
-----------	-----------	----------------------------------

Approval & Reception Procedure

CA – Coordenação E Assessoria	
Vibration Stone Columns	Document no. ARP/CA/01
	Rev. no.
	Date: 17.11.2008
	Page no. 3 of 5

The maximum diameter must be less than 200mm. Grade of crushed stone shall be compatible with the vibroplant used and the type of soil of the foundation.

The sand shall be well-graded, contain less than 5 percent passing through ASTM sieve No.200, and have a mean diameter of at least 0.2mm.

4 Construction Control

Stone column installation will be performed in accordance with the provisions of section 5 of JTJ 246-2004 and the technical specifications of the design.

It is necessary to undertake construction trial so as to determine the relevant construction parameters namely:

- duration of vibration in each defined depths;
- parameters of electrical current;
- the surplus coefficient of stone column – ratio of apparent volume of measured stones / theoretical volume of the column.

Large-scale stone column construction will not commence until the construction method and construction parameter is approved by owner and designer.

The contractor shall provide competent and qualified personnel to continuously observe and furnish to the engineer recorded logs during column installation, on tables of Appendix C of JTJ 246-2004.

Geometric construction tolerances are as specified in the following:

Plan location tolerance:

Stone column shall be installed within 150mm of the position shown on the contract layout drawing for the vibro works

Verticality tolerance

Stone column shall be constructed as near vertical as possible. The axis of the stone column shall not be inclined from the vertical by more than 50mm in 3m ($\tan\alpha=0.01667$, $\alpha=1$ degree) as indicated by the tilt of vibrator and follower tubes.

Depth

Prepared:	Verified:	Approved: Date: / /
-----------	-----------	--------------------------------

Approval & Reception Procedure

CA – Coordenação E Assessoria	
Vibration Stone Columns	Document no. ARP/CA/01
	Rev. no.
	Date: 17.11.2008
	Page no. 4 of 5

The bottom tip of stone columns should reach the designed elevation indicated in the design. Any variations in depth of stone columns due to site conditions not foreseen in the design shall be immediately reported to the Designer who shall advice on any action to be taken.

5 Construction Monitoring

Monitoring during construction shall be as specified in clause 6.2 of JTJ 246-2004. Details and frequencies shall be as specified in section 4 & section 5 of JTJ218-2005 and technical specification.

6 Supervision and control

During the construction of stone columns, supervision and control shall be as defined in clause 5.4 of JTJ246-2004.

7 Testing

The following field tests shall be performed.

7.1 Compactness of stone columns

Select randomly 1% of stone columns in normal condition; in any case, a minimum number of 3 stone columns will be selected for test - Heavy Dynamic Penetration Test (JTJ 240-97). For stone columns installed in sand or in silt foundation, the test shall be carried out at least one day after construction.

For stone columns installed in clay foundation, the test shall be carried out at least 10 days after construction.

7.2 Bearing capacity of composite foundation

Composite Foundation Bearing Capacity Test (JTJ 246-2004)

The amount of selected samples for test shall be more than 0.5% of total stone columns; a minimum number of 3 tests will be undertaken.

For sand foundation, 7 days is required for interval period between test and construction.

For silt foundation, 14 day is required. For clay foundation 28 day is required.

Prepared:	Verified:	Approved:
		Date: / /

Approval & Reception Procedure

CA – Coordenação E Assessoria	
Vibration Stone Columns	Document no. ARP/CA/01
	Rev. no.
	Date: 17.11.2008
	Page no. 5 of 5

7.3 Single column bearing capacity

Static load test for single column will be performed in accordance with Approval & Reception Procedure ARP/DG/13: "Pile Bearing Resistance Verification Procedure A – Pile Static Loading Test"

The amount of selected samples for test shall be more than 0.5% of total stone columns; a minimum number of 3 columns will be selected for test.

7.4 Verification test for treatment effect on soil between stone columns

Suitable tests shall be carried out to verify the treatment effect (e.g. CPT, SPT, field vane shear test and/or laboratory soil test). For sand foundation, 7 days is required for interval period between test and construction. For silt foundation, 14 day is required. For clay foundation 28 day is required.

7.5 Acceptance criteria

Test results should comply with the requirements specified in technical specification.

Prepared:	Verified:	Approved:
		Date: / /