

European Codes

Structural Eurocodes: group of standards for the structural and geotechnical design of buildings and of civil engineering works

European Committee on Standard - CEN

- **CEN/TC 250 / SC 7 - Geotechnical Design**
- **CEN/TC 288 – Execution of Special Geotechnical Works**
- **CEN/TC XYZ – Geotechnical Investigations & Testing**
- **ISO/TC182 – Geotechnical Engineering: Classification & Presentation**

www.cenorm.be/sectors/construction/eurocode/htm

Formal processing

- Work on Draft Document
- Enquiry (national response)
- Formal vote
- Accepted as national standard (national application document – NAD)
- 2 & 5 year review period

CEN/TC 250/SC 7- Geotechnical Design (ENV)

- ENV 1997 - Part 1: General Rules (most recent revision: 2000-04-18) final version for voting: 2002
- ENV 1997 - Part 2: Design assisted by laboratory testing
- ENV 1997 - Part 3: Design assisted by field testing

CEN/TC 288 – Execution of Special Geotechnical Works – Voted

Deal only with execution aspects

- EN 1536: Bored Piles
- EN 1537: Anchors
- EN 1538: Slurry Walls
- EN 12063: Sheet Piles
- EN 12699: Displacement Piles
- EN 12715: Injection/Grouting
- EN 12716: Jet Grouting

CEN/TC 288 – Execution of Special Geotechnical Works – Formal Vote

- WG 8: Micropiles (Formal vote: 2002)
- WG 9 - TG 1: Soil Nailing (Formal vote: 2002)
- WG 9 - TG 2: Reinforcement of fills (Formal vote: 2002)
- **WG 10: Deep Soil Mixing (Formal vote: 2004)**
- WG 11: Vertical Drains (Formal vote: 2004)
- WG 12: Deep Vibration (Formal vote: 2004)

www.geoforum.com/wg10





Deep Soil Mixing – WG 10

Dry and wet mixing methods

Main Document & Annexes

- Experts from 9 countries
- National Mirror Groups
- Communication preferably by Internet
- Drafting of document: Web platform
- 7 Meetings (2000: 2, 2001: 3, 2002: ?)
- Final draft in English, translated to French and German

CEN / TC 288 - Members WG 10

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English version

Execution of special geotechnical works - Deep mixing

Exécution des travaux géotechniques spéciaux - Colonnes
de sol traité

Ausführung von besonderen geotechnischen Arbeiten
(Spezialtiefbau) - Tiefreichende Bodenstabilisierung

This European Standard was approved by CEN on 26 February 2005.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Central Secretariat has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.



EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

Contents

1. Scope
2. Normative References
3. Definitions & Terms
4. Information Needed for the Execution of the Work
5. Geotechnical Investigation
6. Materials and Products
7. Considerations related to Design
8. Execution
9. Supervision, Monitoring & Testing
10. Records
11. Special Requirements

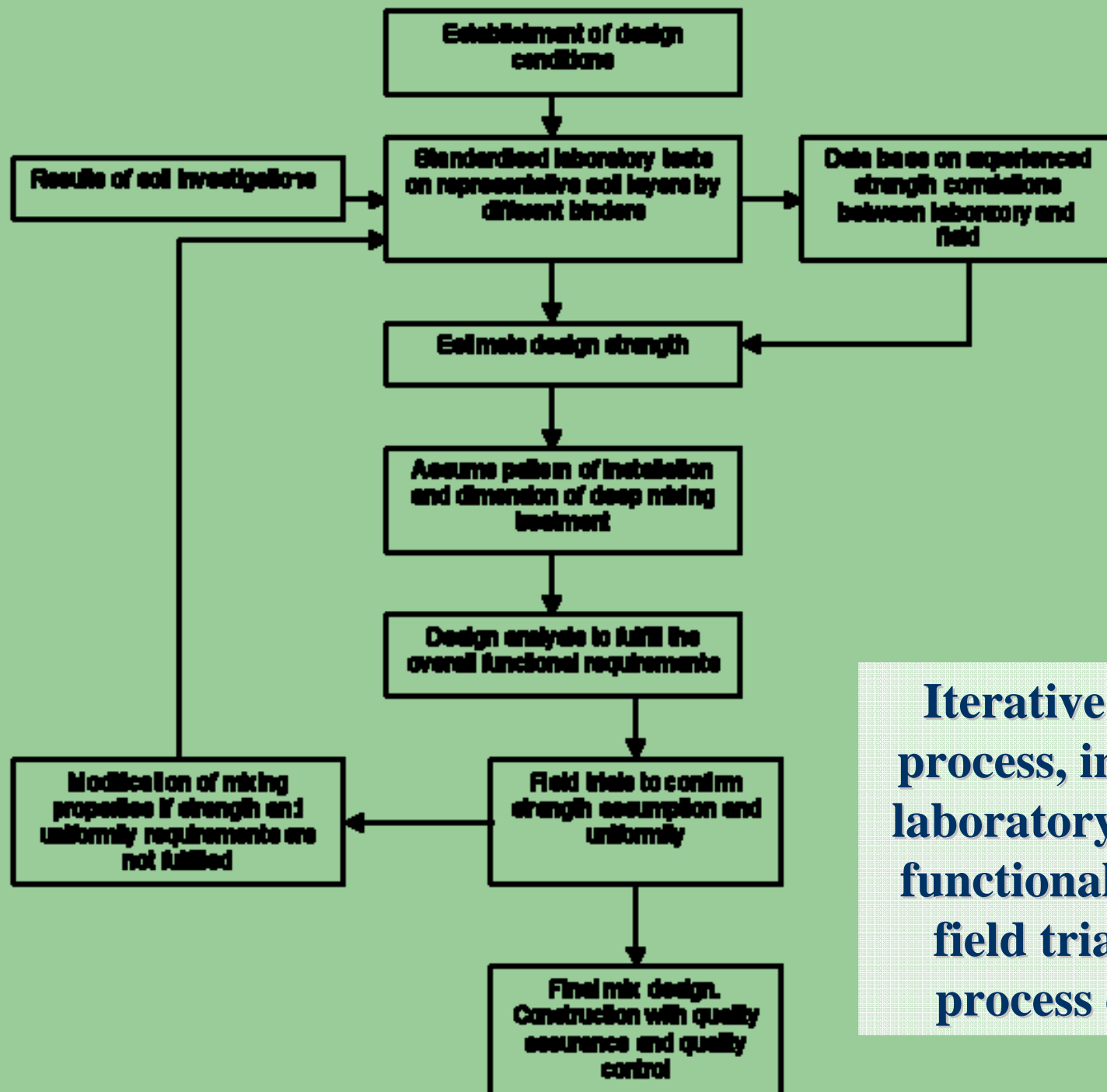
Annexes

Annex A - PRACTICAL ASPECTS

- Dry Mixing
- Wet Mixing
- Patterns of Installation
- Methods of Testing

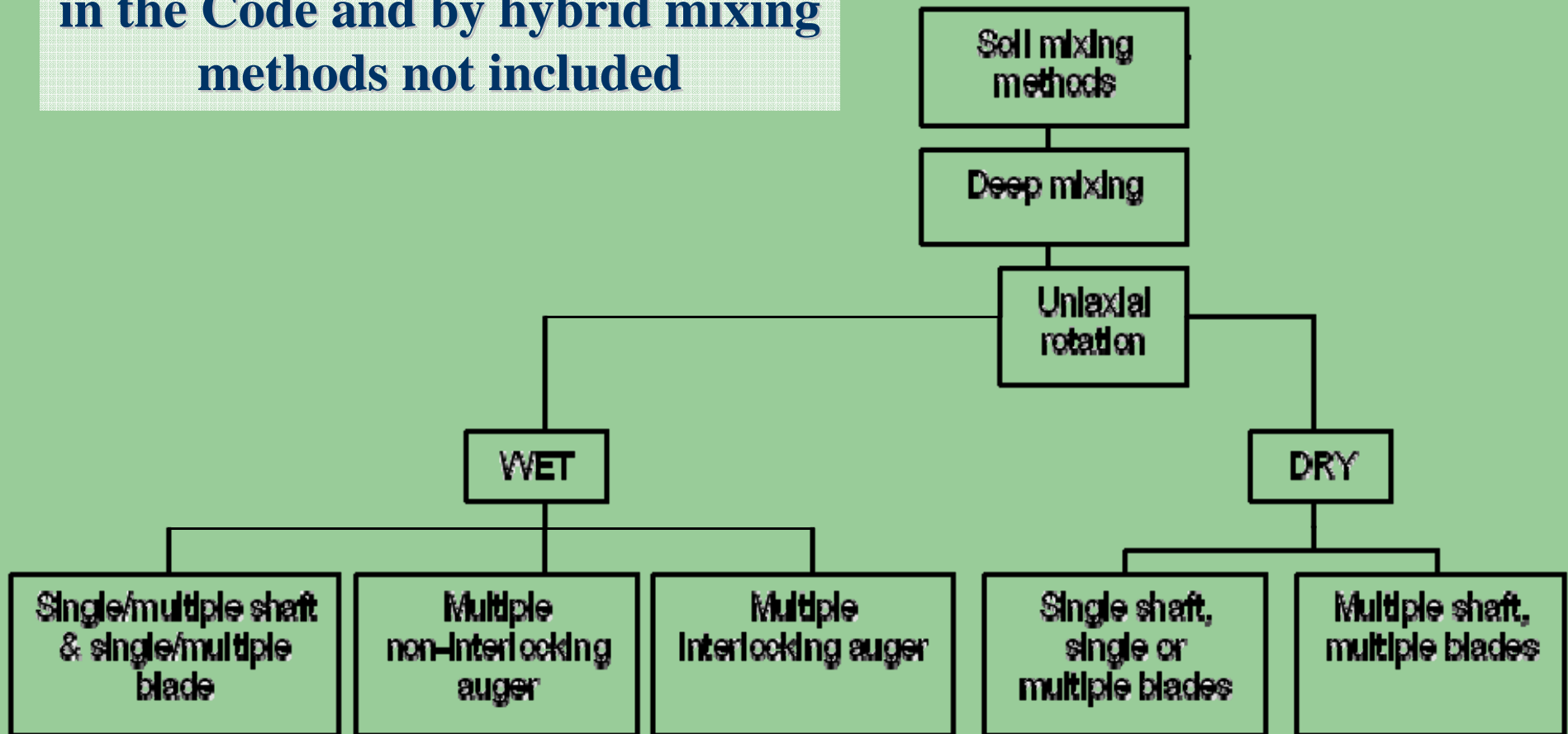
ANNEX B—ASPECTS OF DESIGN

- Ultimate Limit State Design
- Serviceability Limit State Design

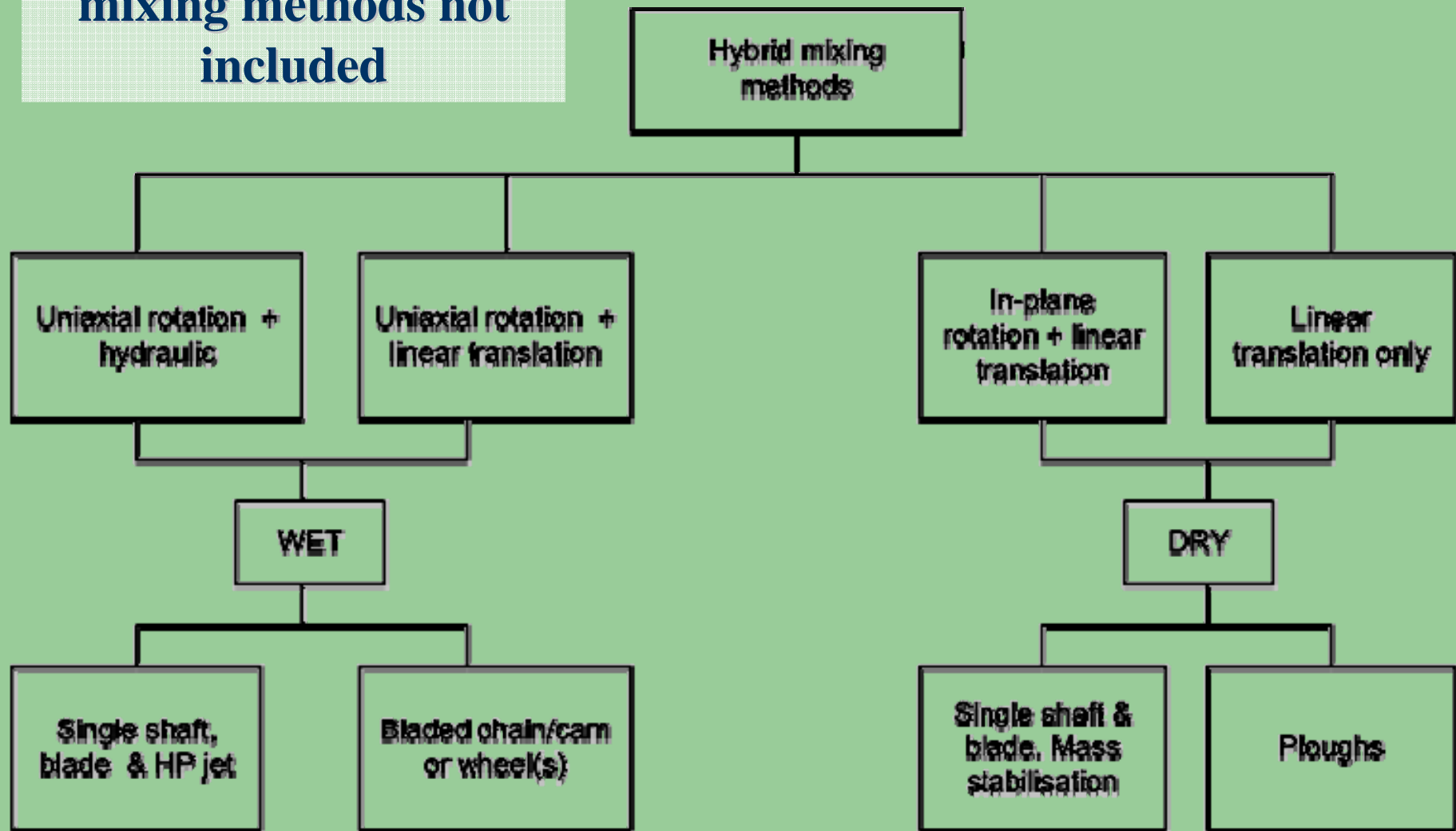


Iterative design process, including laboratory testing, functional design, field trials and process design

**Classification of deep mixing
equipment included
in the Code and by hybrid mixing
methods not included**



Classification of hybrid mixing methods not included



Application of Deep Mixing Methods

Temporary

Underground strut
Increase of lateral resistance of piles
Prevention of bottom heave
Slope stabilisation
Retaining walls
Stabilisation of excavation

Permanent

On-land operations

River embankments
Road and rail embankments
Bridge piers
Retaining walls
Building foundation
Immobilisation of contaminants
Slope stabilisation
Vibration mitigation

Marine operations

Man-made islands
Sea walls
Breakwaters

Functional Requirements
(Stability, settlements,
hydraulic perviousness, etc.)

Geotechnical Design
Soil conditions (strength,
stress/strain characteristics,
permeability)

Technique Selection
Dry mixing, wet mixing, hybrid
other alternatives

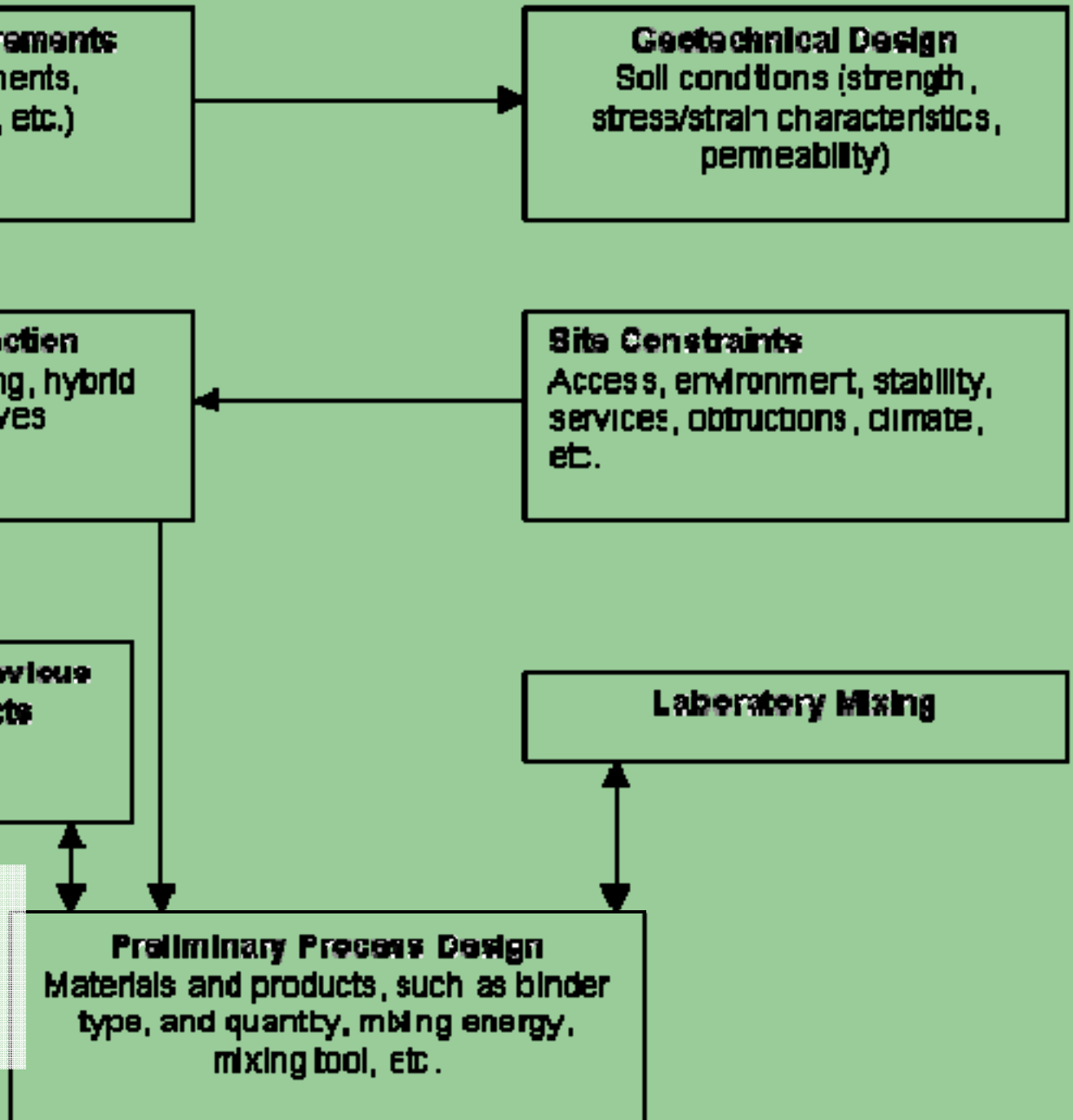
Site Constraints
Access, environment, stability,
services, obstructions, climate,
etc.

**Experience from previous
or similar projects**

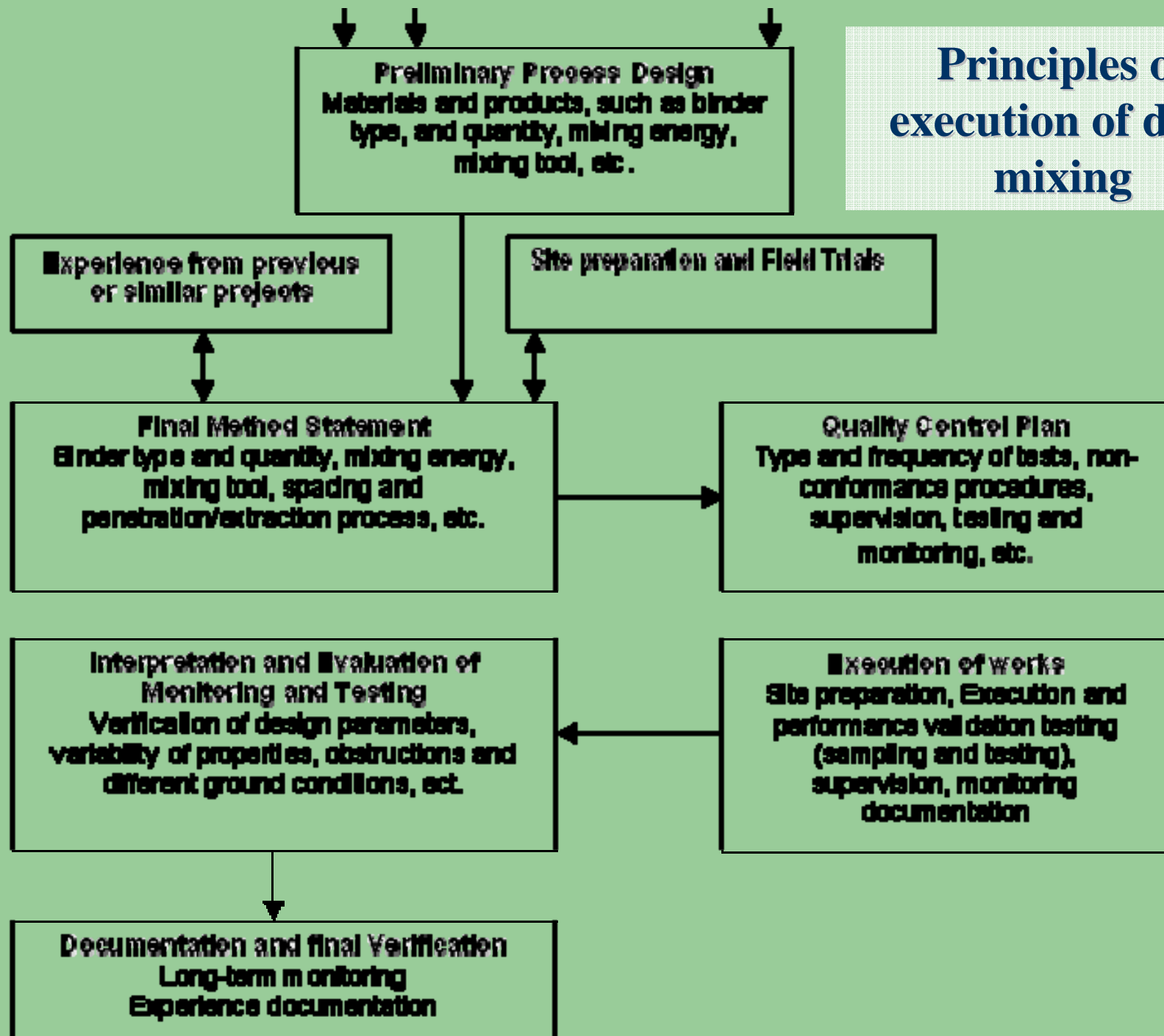
Laboratory Mixing

Principles of execution of deep mixing

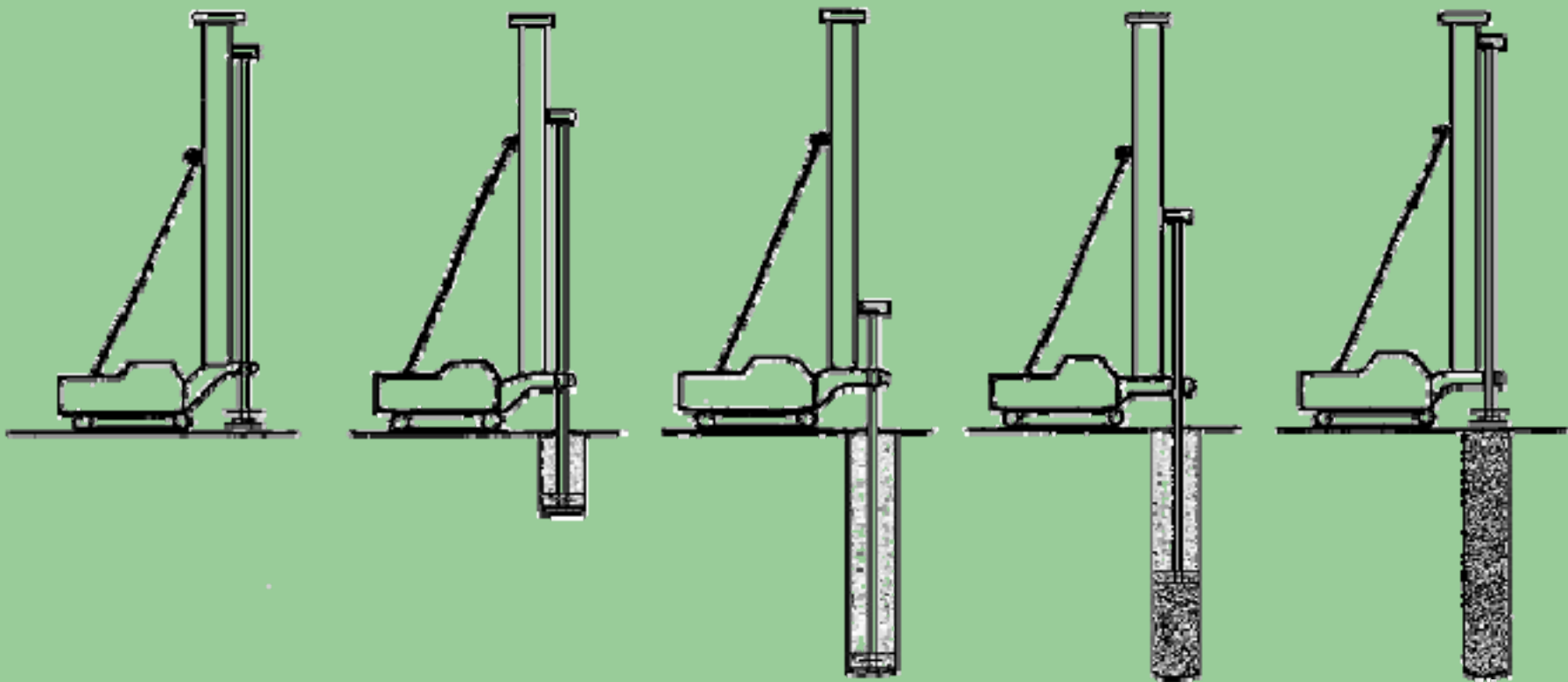
Preliminary Process Design
Materials and products, such as binder
type, and quantity, mixing energy,
mixing tool, etc.



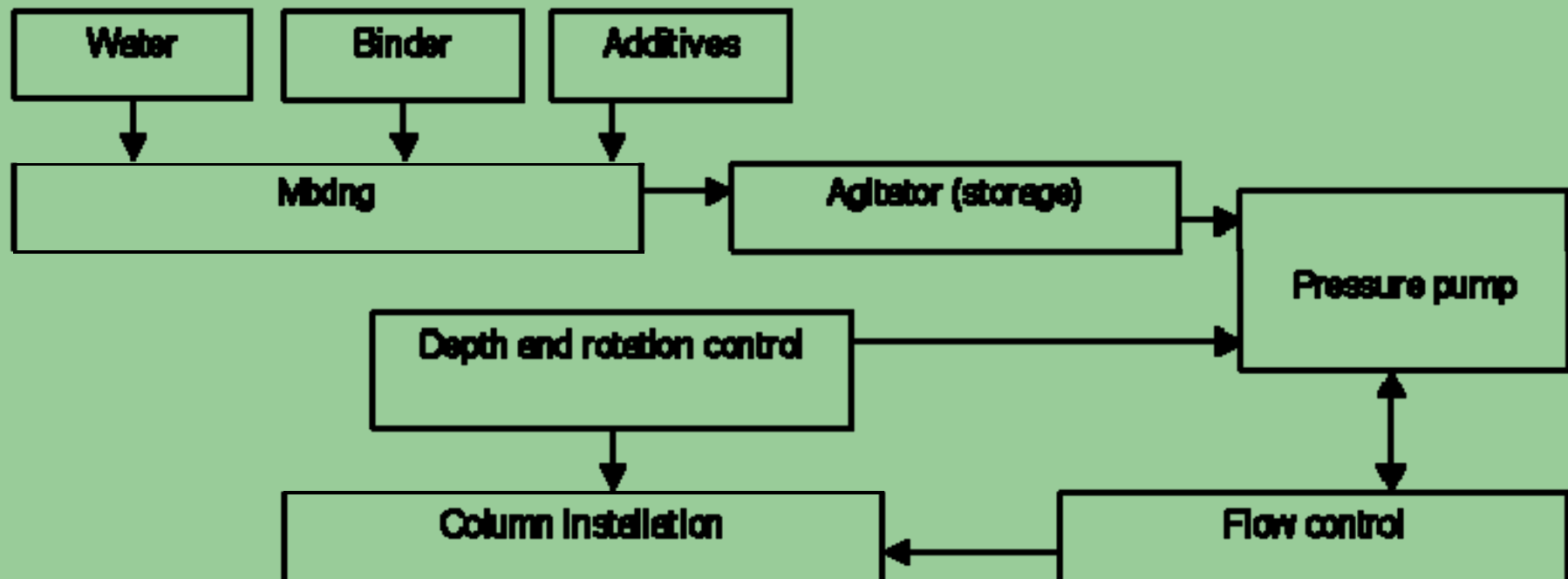
Principles of execution of deep mixing



Sequence of installation



Flow chart for the execution of wet mixing



Major capacity and execution of European and Japanese wet mixing techniques

Details	On land, Europe	On land, Japan	Marine, Japan
Number of mixing rods	1–3	1–4	2–8
Diameter of mixing tool	0,4 m to 0,9 m	1,0 m to 1,6 m	1,0 m to 1,6 m
Maximum depth of treatment	25 m	48 m	70 m below sea level
Position of binder outlet	Red	Red and blade	Red and blade
Injection pressure	500 kPa to 1 000 kPa	300 kPa to 600 kPa	300 kPa to 800 kPa
Amount of slurry storage	3 m ³ to 6 m ³	3 m ³	3 m ³ to 20 m ³

Examples of treatment patterns in wet mixing on land

