RSS Flüssigboden®

New Technical Solutions and Market Opportunities

RAL GÜTEZEICHEN

FLÜSSIGBODEN

RSS Flüssigboden®

(Liquid Soil According to

RAL Gütezeichen 507)

O. Stolzenburg,

LOGIC Logistic Engineering GmbH

Agenda

- The Engineering Office LOGIC Logistic Engineering GmbH and Its Involvement with the Development and Application of RSS Flüssigboden®
- What Is Liquid Soil or Rather RSS Flüssigboden® – Distincition from other Temporarily Flowable Backfilling Materials
- Advantages of the Application of RSS Flüssigboden®
- Capabilities of RSS Flüssigboden® – Two Basic Trends of its Application
- Experience with Liquid Soil – State of Research and Development in the Field of Applying the RSS Flüssigboden®
- The Production of RSS Flüssigboden® – Special Features and Necessary Techniques
- Capabilities of RSS Flüssigboden® – New Solutions
- Support in Applying the RSS Flüssigboden® Process – Professional Planning and RAL Gütegemeinschaft Flüssigboden e. V.

LOGIC Logistic Engineering GmbH

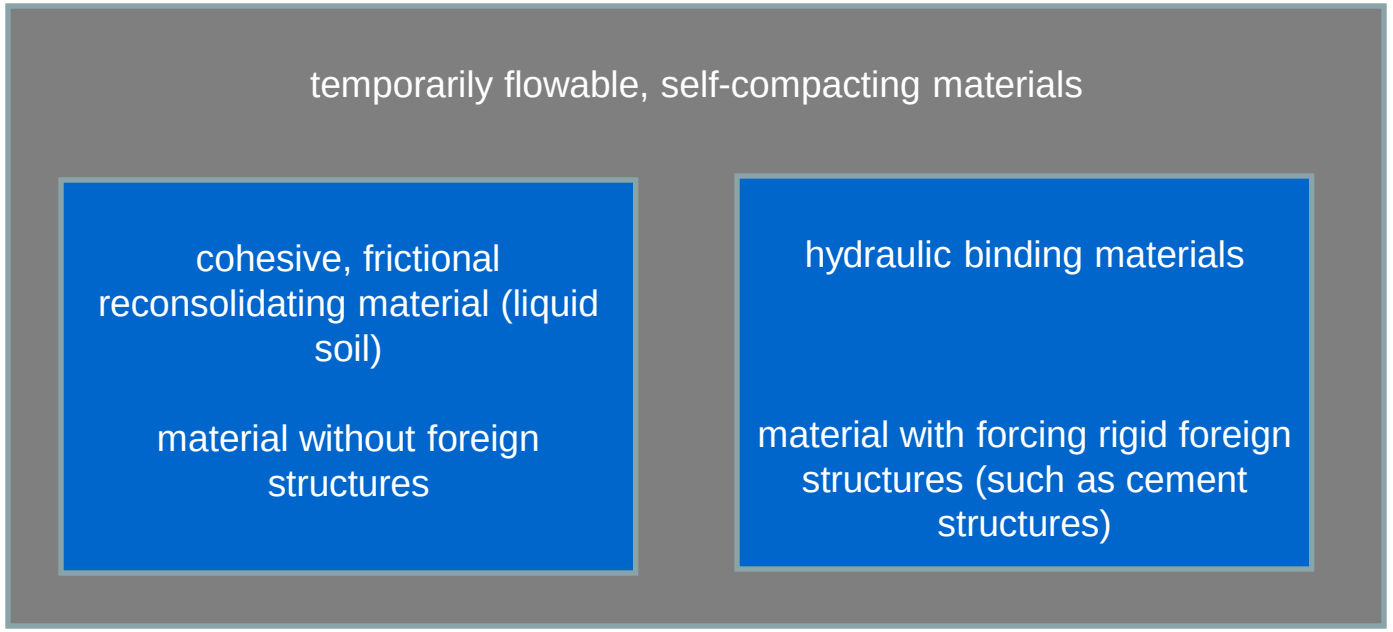
Professional Planner for the Application of RSS Flüssigboden® and Complex Subterranean Infrastructure Systems

- As an engineering office and partner of the Forschungsinstitut für Flüssigboden (research institute of liquid soil) we have developed the liquid soil process with the help of numerous research and development projects. This breakthrough was achieved in collaboration with partners from industries and universities. Now, we are constantly working on ist further development.
- As the professional planner for potential applications of this process we cooperate with project managers. In doing so, we use acquired knowledge within planning as well as quality assurance (e. g. by means of external control).
- If required, we make our knowledge available to others by offering surveillance for the application of liquid soil.
- Together with RAL Gütegemeinschaft Flüssigboden e. V. (a non-profit association ensuring the quality of RSS Flüssigboden®) we are involved in developing objective and consequently testable quality standards. In the clients' interest, these standards are effective means helping to ensure the desired quality of the filling material.
- The offers of RAL Gütegemeinschaft Flüssigboden e. V. include trainings and further education schemes for clients, planners, surveyors and construction companies, using the RSS Flüssigboden® process.

What is Liquid Soil?

Definition of RSS Flüssigboden® by RAL Gütegemeinschaft Flüssigboden e. V.

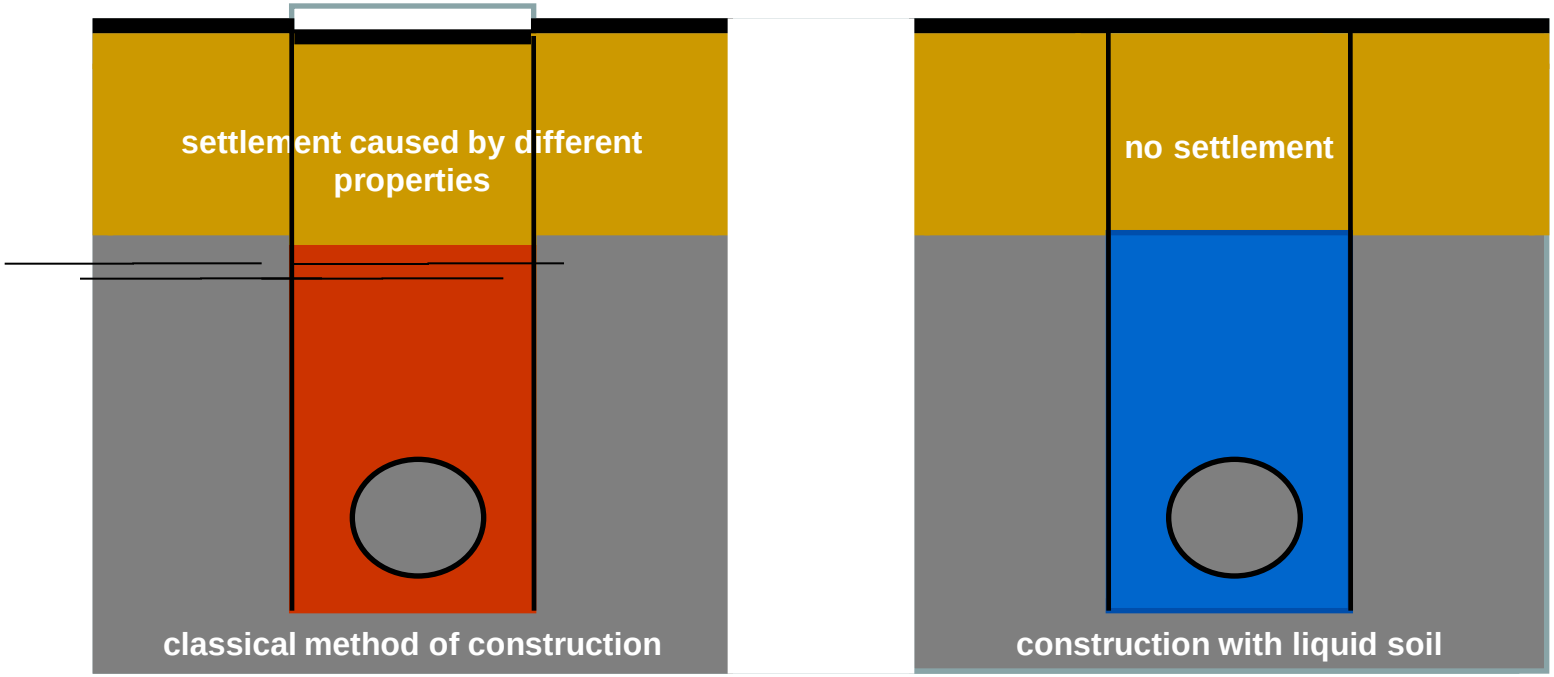
- categorized as temporarily flowable filling material
- must retain typical properties of soil without forming rigid structures of hydraulic binding agents such as cement.
- the above mentioned category consists of the following two subgroups:



Source: Wikipedia - Flüssigboden

Why Applying Liquid Soil?
To Avoid Settlement, Pipe- and Road Damages

What is the difference between these two subgroups of temporarily flowable filling materials? What are the effects on areas filled with these substances?



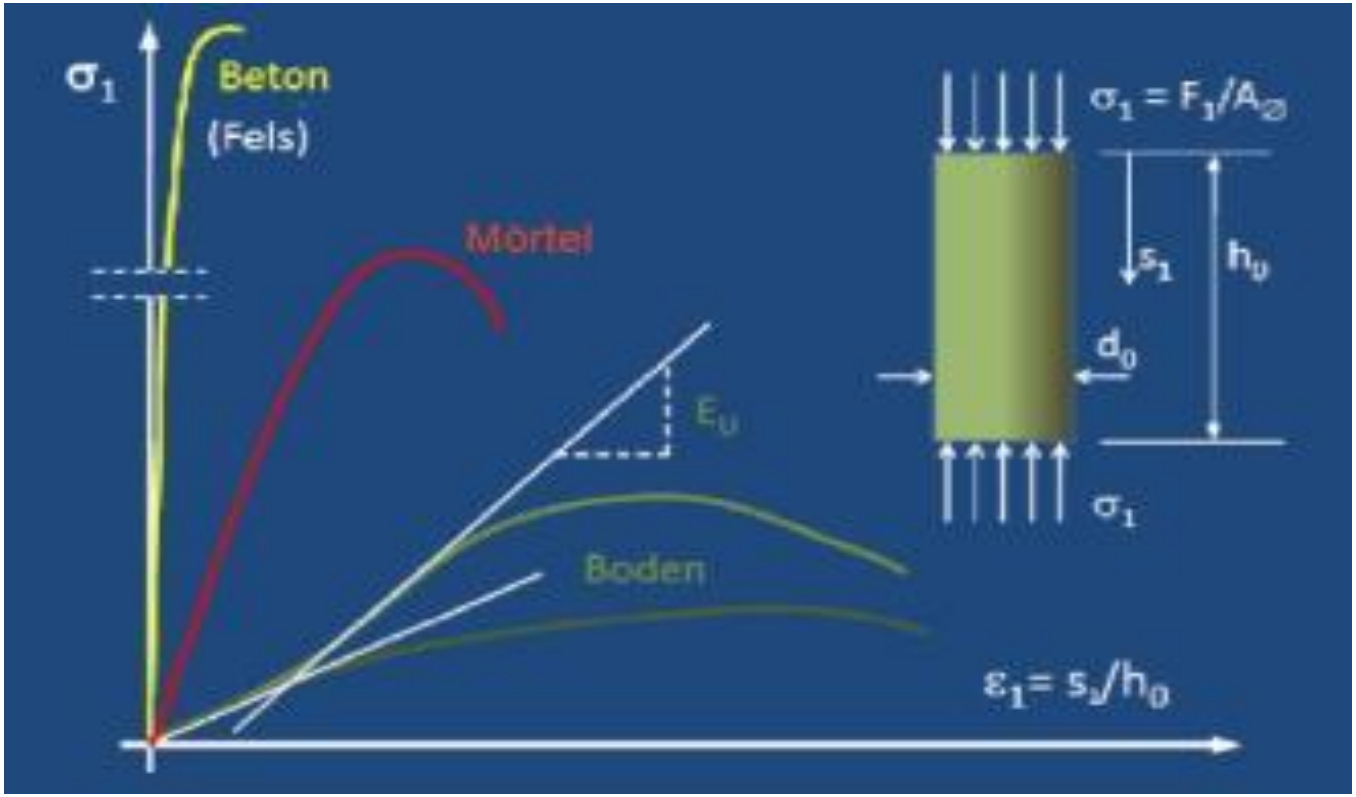
excavation area with:
soil-unlike behaviour
filled with compacting or hydraulic binding material

excavation area with:
soil-like behaviour
filled with liquid soil

Source: Wikipedia - Flüssigboden

Is the Quality of Liquid Soil Testable?

These differences in material are measureable objectively through observing specific behaviour caused by different degrees of elasticity, compaction, soil humidity, etc. In this way, road damages caused by foreign bodies can be avoided.



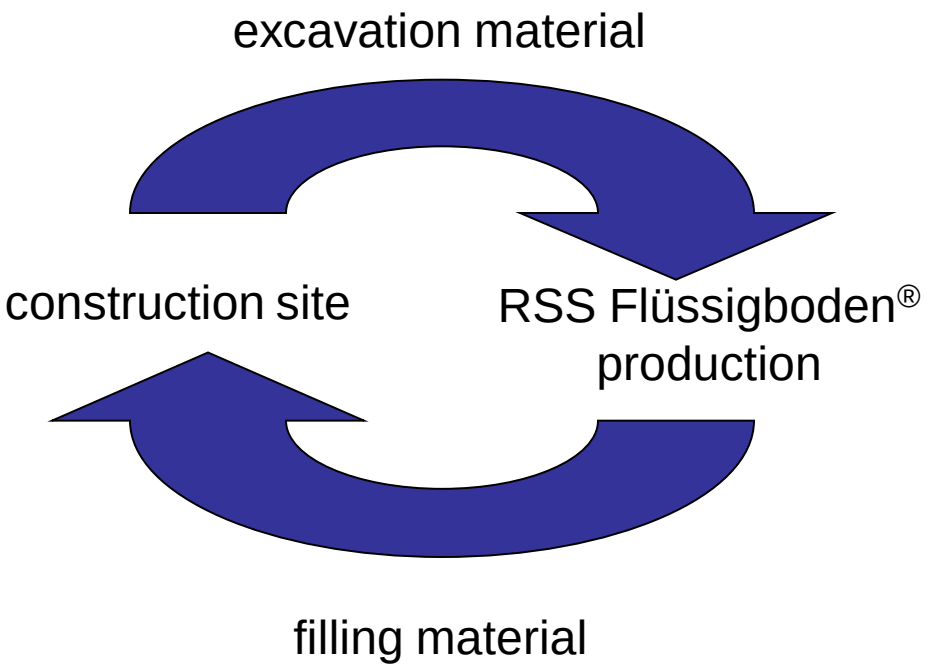
This example illustrates the behaviour affected by load.

Source: Prof. Dr. Thomas Neidhart, Hochschule Regensburg

What is RSS Flüssigboden®?

A cyclic process comprising
soil – liquid – soil

The RSS Method of Construction:



Preserve the environment and benefit from it!

O. Stolzenburg,
LOGIC Logistic Engineering GmbH

Liquid Soil and its Important Advantages

1. save building costs
2. save operating costs and follow-up costs
3. relieve public financial resources
4. reduce construction time
5. reduce the space required for construction
6. reduce emission during production => environment-friendly
8. use resident-friendly methods
9. meet all legal demands for soil and ground water protection

   => environment-friendly

   => reduce costs for waste disposal, soil replacement and possible fines
8. avoid classical dangers of building
9. reduce transport routes
10. new technological opportunities because of new material characteristics

Capabilities of the Liquid Soil Process

Two Ways of Application of RSS Flüssigboden®

a construction site's excavation

-production of RSS Flüssigboden® on-site
(a trend meeting the legal requirements)

-or at another central place
(often still necessary because of
individual technical state of equipment)

filling material keeping the excavation material's relevant properties for construction

backfilling at the construction site by using specific properties of liquid soil

filling material with systematically changed relevant physical properties of the excavation material

O. Stolzenburg,
LOGIC Logistic Engineering GmbH

Experience With Liquid Soil

- more than 12 years of experience drawn from both development and practical use

- state-of-the-art technology for more than ten years

- RSS Flüssigboden® is being applied in Germany, as well as in numerous European countries (e.g. Switzerland, Austria, Sweden, Poland and England)

- a growing number of specialists throughout Europe who have been trained according to the guidelines of the RAL Gütegemeinschaft Flüssigboden e. V.

- the collaboration of the professional planning office LOGIC Logistic Engineering GmbH with both domestic and foreign planners leads to many new technical solutions

-Example: Schwimmende Verlegung (“swimming laying”) (on these grounds building is very difficult and expensive with conventional methods)

Experience With Liquid Soil

Effects and Opportunities of Applying Cohesive, Frictional Reconsolidating Material

- securing an optimal 180° bedding of the pipe by a vibration-free fitting of RSS Flüssigboden® in one step
- protecting the surface of the highly sensitive GIL-pipes

Experience With Liquid Soil

Effects and Opportunities of Applying Cohesive, Frictional Reconsolidating Material

Material does not shrink after filling!

- enables a permanent embedding of pipes of high quality
- result: load relief of the pipe
- this is the basis for a long-lasting damage-free usage of the pipe

Experience With Liquid Soil

Effects and Opportunities of Applying Cohesive, Frictional Reconsolidating Material

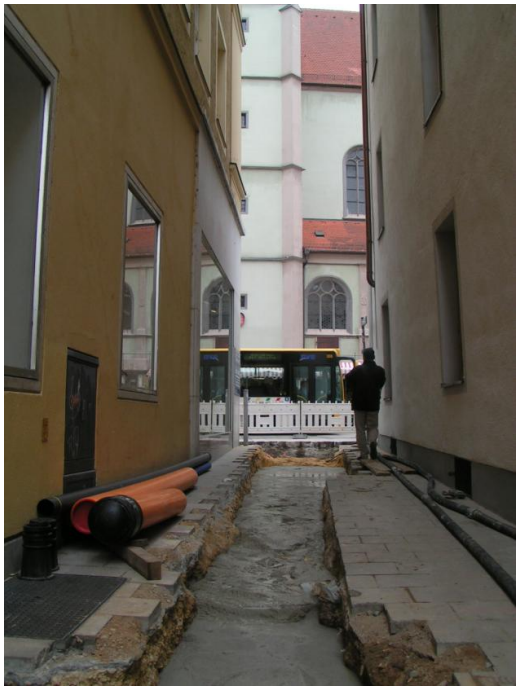
Einzelwerte	f < 10 Hz		f = 10..50 Hz		f = 50..100 Hz	
Grenzwert	*5 mm/s*		*5 ... 15 mm/s*		*15 ... 20 mm/s*	
Messdatum	24.11.03	01.12.03	24.11.03	01.12.03	24.11.03	01.12.03
X-Achse	1,62 mm/s	0,04 mm/s	5,23 mm/s	0,15 mm/s	1,41 mm/s	0,14 mm/s
Y-Achse	1,50 mm/s	0,09 mm/s	4,80 mm/s	1,02 mm/s	1,82 mm/s	0,47 mm/s
Z-Achse	1,58 mm/s	0,05 mm/s	7,21 mm/s	1,07 mm/s	2,31 mm/s	0,26 mm/s
Maximalwert auf Achse:	X	Y	Z	Z	Y	Y
mit Wert	1,62 mm/s	0,09 mm/s	7,21 mm/s	1,07 mm/s	2,31 mm/s	0,47 mm/s
Abstand zum Erreger	2,0 m	2,0 m	2,0 m	2,0 m	2,0 m	2,0 m

Messung am 24.11.03 ohne eingeordneten Flüssigboden
Messung am 01.12.03 mit eingeordneten Flüssigboden

- vibration absorbing property of RSS Flüssigboden®
- leads to a high protection of pipes and buildings against dynamic loads of the traffic

Experience With Liquid Soil

Effects and Opportunities of Applying Cohesive, Frictional Reconsolidating Material



Securing heritage-protected historic monuments with the help of RSS Flüssigboden®

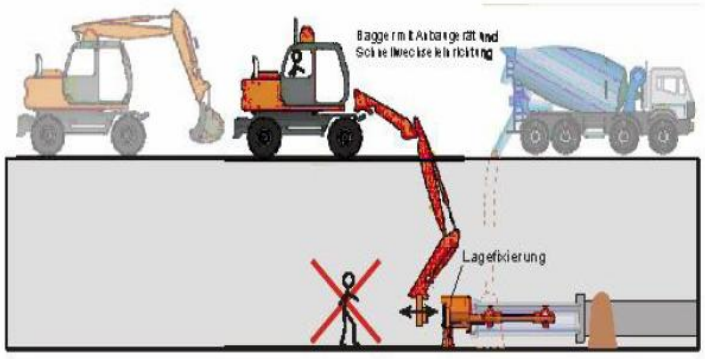
O. Stolzenburg,

LOGIC Logistic Engineering GmbH

Experience With Liquid Soil

Effects and Opportunities of Applying Cohesive, Frictional Reconsolidating Material

RSS Flüssigboden® allows a changeover from sheet piling to trench boxes



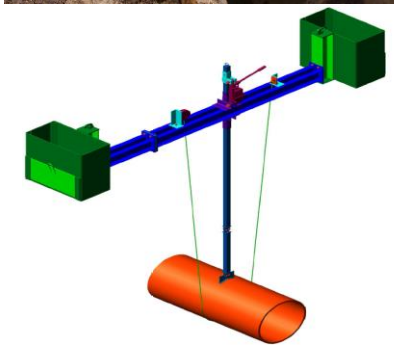
new technological opportunities offer both economic efficiency and highest quality

Experience With Liquid Soil

Effects and Opportunities of Applying Cohesive, Frictional Reconsolidating Material

sequenced technology as basis for high performance

1. excavation
2. inserting the trench boxes
3. placing the pipe with help of assembly kit
4. placing in the bulkhead
5. filling in RSS Flüssigboden® up to lower edge of road foundation
7. transferring the trench box, bulkhead and assembly kit



this combination of RSS Flüssigboden® and a suction excavator ensures the successful progress despite crossings and subterranean obstacles

Experience With Liquid Soil

Effects and Opportunities of Applying Cohesive, Frictional Reconsolidating Material



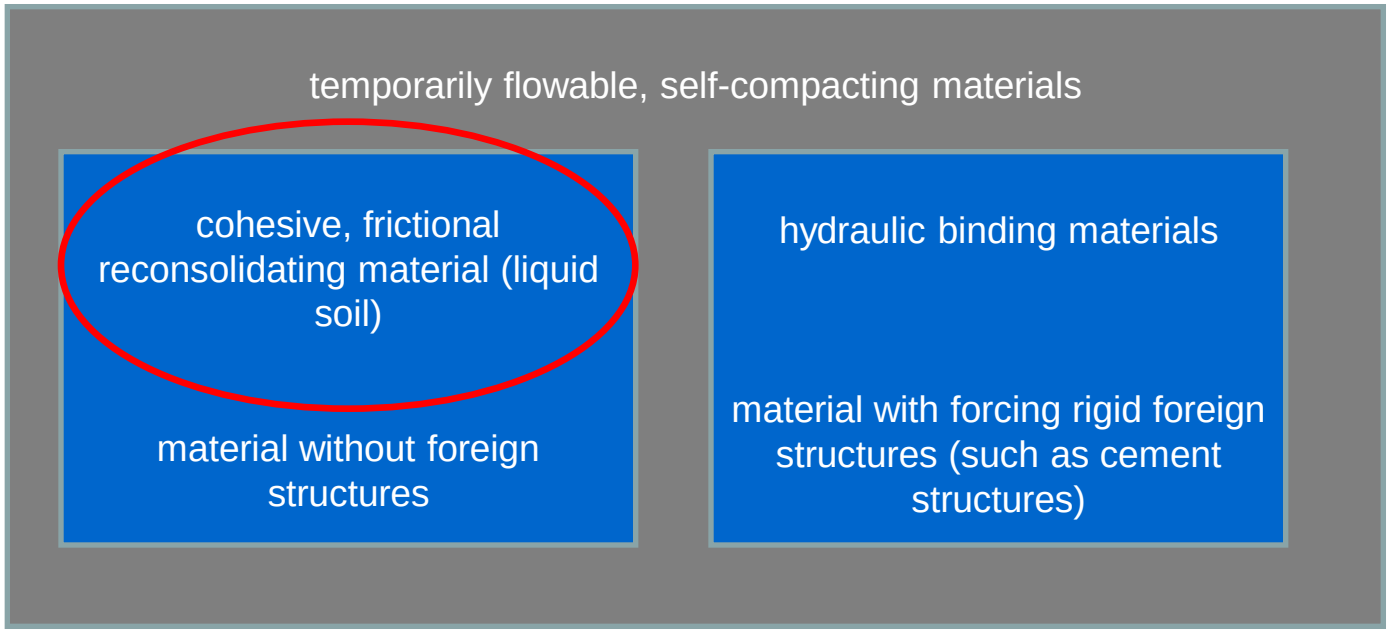
From left to right: strongly humic soil, London clay and deep-water clay as basis for RSS Flüssigboden®

Reuse of all common types of soil in the production of RSS Flüssigboden® as an opportunity to meet legal environmental standards

Producing RSS Flüssigboden®
(Liquid Soil According To RAL Gütezeichen 507)

RSS Flüssigboden® - a cohesive, frictional consolidating material

What does this mean for its production?



Source: Wikipedia - Flüssigboden

Special Aspects to be Considered During Production Process

conventional materials (e.g. concrete)

- stable and defined recipe
- simple controlling unit is enough for production of recipe
- when finished, product always keeps static and defined characteristics
- despite changes of characteristic of the surrounding area

liquid soil (e.g. RSS Flüssigboden®)

- adapts changing characteristics of the soil on-site
- recipes must change and adopt permanently

=>requires a sophisticated, dynamic controlling unit for confection of recipes

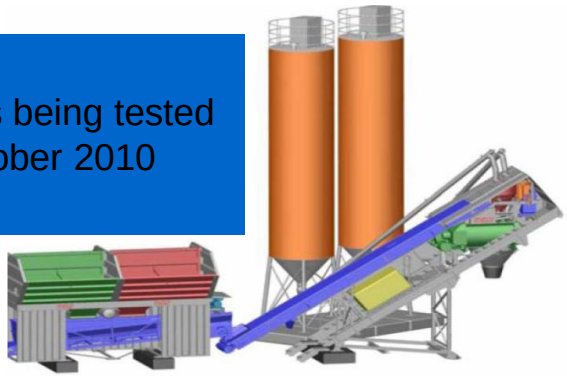
=>is essential to avoid quality problems

Realizing the Special Aspects of the Production Process with the According Technology

types of production

permanent production in a centralized plant with high capacity

a pilot plant is being tested since October 2010



mobile production in a compact system with a lower capacity

advantages:
- applicable at large construction sites
- once installed, remarkably short set-up times
- low investment on-site
- comfortable transportation due to compact system
- joint development with partners in practice
- output up to and over 100 m^3/h (depending on the soil)

advantages:
- cost-efficiency even for small construction sites
- extremely short set-up times as well as flexible application
- very low investment on-site
- very easy and fast transportation
- profound expert knowledge after years of practical experience
- output up to and over 50 m^3/h (depending on the soil)

Source: -PROV- Produktions- und Vertriebsgesellschaft mbH -

Realizing the Special Aspects of the Production Process with the According Technology

types of production

stationary production in centralized plant

fields of application:

- central production in cities and communities
- following the idea of circle of materials
- production at large construction sites
- covering the emerging demand of the whole region
- optimized logistics at the construction site
- quality assurance by trained experts
- optimized through permanent location of technology and staff
- permanently reduced pollution
- optimized material flow/minimized transportation
- particularly suited for cities/communities with ecological and economic concerns

mobile production in a compact system

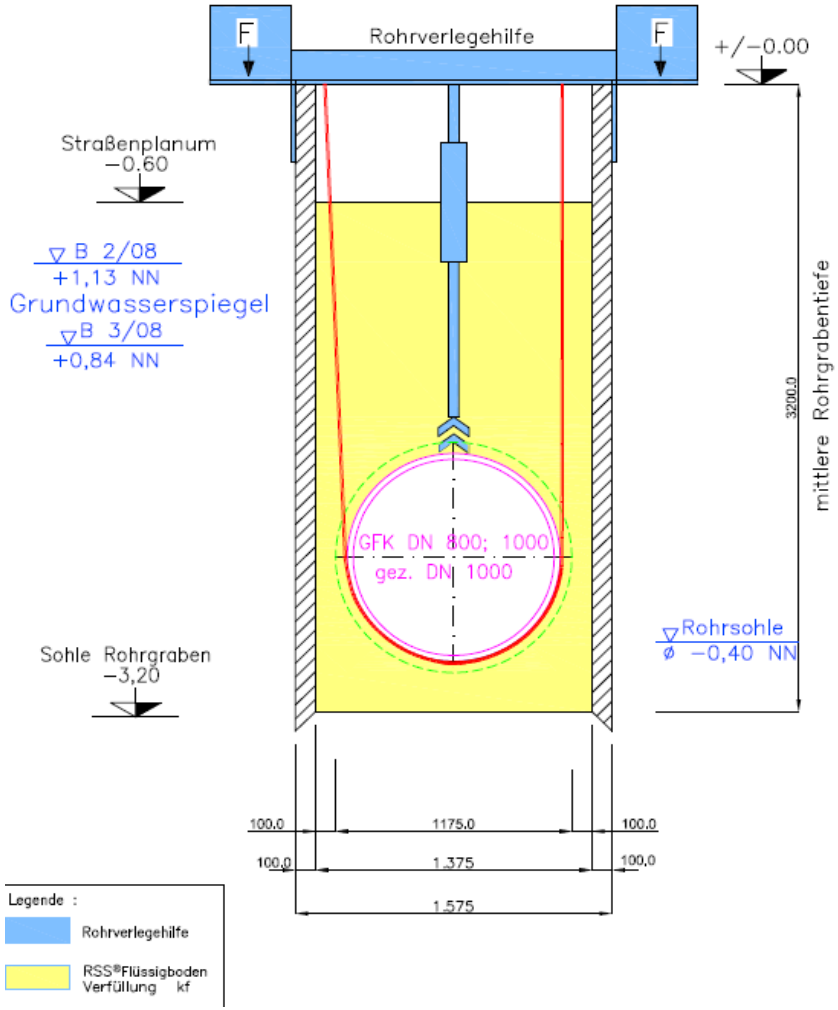
fields of application:

- mobile production at construction sites
- following the idea of circle of materials
- opportunity to produce at numerous construction sites
- meeting the construction site´s demand
- optimized the logistics at the construction site
- quality assurance by trained experts on-site
- optimal application of technology and staff for construction site
- reduced pollution at the construction site
- optimized material flow/ optimized transportation
- adaptable to sites with difficult access or less demand
- optimized flexibility due to special controlling unit (useful for changing soil types and special liquid soil properties)

Capabilities of the Liquid Soil Process – New Solutions

large application spectrum:

- canal and pipeline construction
- backfilling
- soil stabilization
- soil improvement
- immobilization of contaminants
- building protection against vibrations and water
- constructing on instable surfaces (e.g. clay, peat and sludge)
- canal constructions above and below water without dewatering or watertight shoring
- tunneling
- cooling system for high voltage cables
- piping systems for district heating
- hydraulic engineering
- flood protection



O. Stolzenburg,
LOGIC Logistic Engineering GmbH

Support for the Application of the Liquid Soil Process

1. support from professional planning for clients and construction firms while applying this process

2. support from certified experts as quality assurance representatives for the liquid soil process (a growing number of trained experts in Germany, Austria, Switzerland, Russia, Poland and France)

3. support from RAL Gütegemeinschaft Flüssigboden e. V. (by providing transparent as well as objective standards of quality assurance based on more than ten years of experiences)

4. support from further education schemes offered by RAL Güte-gemeinschaft Flüssigboden e. V. at Regensburg university (e.g. a two-day-seminar)

Certification for Quality Assurance of Liquid Soil According to RAL Gütezeichen 507 – an Example

09.00 – 09.40	**welcoming** **"Introduction to the history of the liquid soil process"** speaker: Dipl.-Ing. (TU) Olaf Stolzenburg chairman of RAL Gütegemeinschaft Flüssigboden e. V.
09.40 – 10.00	**coffee break**
10.00 – 10.40	**„Soil mechanical basics"** speaker: Prof. Dr.-Ing. Thomas Neidhart Regensburg university – civil engineering department
10.40 – 11.20	**"Requirements for the use of liquid soil based on the needs of canal construction"** speaker: Prof. Dipl.-Ing. Andreas Ottl Regensburg university – civil engineering department
11.20 – 12.00	**"Mineralogical basics of the liquid soil process and their need of quality assurance"** speaker: Prof. Dr. rer. Nat. habil. Ing. Dipl.-Chem. Reinhard Frey University of Technology and Civil Engineering
12.00 – 13.00	**lunch**
13.00 – 13.45	**"Current environmental law/Need of approval for processes and production methods"** speaker: Dr.-Ing. Bernd Märtner M&S Umweltprojekt GmbH, expert
13.45 – 15.15	**"The liquid soil process: from production to installation"** speaker: Dipl.-Ing. Andreas Pischetsrieder professional planner of system application
15.15 – 16.15	**"Practical realization of quality assurance"** speaker: Dipl.-Ing. Andreas Pischetsrieder professional planner of system application
16.15 – 16.40	**coffee break**
16.40 – 18.30	**Quality assurance part 1** **"Quality and test regulations of RAL Gütegeminschaft Flüssigboden e. V. "** speaker: Dr.-Ing. Steffen Weber/LOGIC Logistic Engineering GmbH, professional planner for liquid soil
09.00 – 11.00	**quality assurance part 2 and 3** **"Company standards and application guidelines of the developer of this process"** speaker: Dipl.-Ing. Andreas Pischetsrieder professional planner of system application
11.00 – 11.20	**coffee break**
11.20 – 12.00	**"Specific features in testing the liquid soil"** speaker: Dipl.-Ing. (TU) Olaf Stolzenburg chairman of RAL Gütegemeinschaft Flüssigboden e. V
12.00 – 13.00	**lunch**
13.00 – 13.45	**"Proper labeling with RAL quality mark 507/Equality of liquid soil and its verification"** speaker: Denise Töpfer, lawyer DOHRMANN lawyers
13.45 – 14.30	**"Awarding according to the requirements of § 25, Abs. 3 of VOB, part a (awarding)"** speaker: Prof. Dr. jur. Thomas Ax, lawyer Ax, Schneider und Kollegen
14.30 – 14.45	**coffee break**
14.45 – 16.15	**written examination** - certificate as officially recognized quality assurance representative of liquid soil according RAL quality mark 507
16.15 – 18.00	**Analysis of test questions and ending the certification**

Thank you very much for your attention!

Dipl.-Ing. (TU) Olaf Stolzenburg

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Example for underwater application of RSS Flüssigboden®
Source: Ing. Büro LOGIC Logistic Engineering GmbH