

RSS Flüssigboden® mix design for the backfilling of district heating pipes (plastic sheath pipes)

Mix design development

The requirements for RSS Flüssigboden® mix designs for the backfilling of district heating pipes are usually higher than for normal RSS Flüssigboden®. Durable and defined frictional forces of the backfill material need to be guaranteed. Also in case of temperature fluctuations, no annular gaps (and tunnel effects) may occur between the plastic sheath pipe and the surrounding soil. The material may not shrink.

The backfill material has to fulfil four tasks:

- optimum bedding of the plastic sheath pipes
- ensure defined frictional forces (max. and min.)
- ensure that no settlement occurs, so structures on top are safe
- protect the plastic sheath pipes from dynamic loads

The backfill material has to meet high demands:

- good flowability and volume constancy when placed
- high load bearing capacity and good load distribution
- high relaxation ability to achieve the given range of frictional forces required for the pipes
- prevention of annular gap formation, also with temperature changes
- high durability and good resistance against ageing
- solubility/removability comparable to the surrounding soil

Generally, a mix design for RSS Flüssigboden® FW is developed in our lab as follows:

We obtain a sufficient quantity of source material (depending on the desired application at least 50 litres, with protocol of sample collection) and the cement to be used (CEM I R). Additionally, the customer provides the desired nominal values of the mix design properties. For this purpose, we use the form "Mix design Specification". In addition to the nominal values stated by the customer, the nominal values required for the RSS Flüssigboden® from our perspective are also relevant. The mix design is approved when the required surface friction values are reliably achieved. The suitability of RSS Flüssigboden® was verified in experiments conducted by the association Fernwärme-Forschungsinstitut (district heating research institute) in Hannover e. V. (FFI), the Regensburg University of Applied Sciences, the University of Leipzig, and the AGFW (German business association for operators of combined power and heat stations and district heating grids), and with the help of numerous field studies. For each construction project and each source material, usually the required frictional forces are proven by measurements as part of the mix design development. We produce RSS Flüssigboden® in the soil laboratory, check the processability, and test the test specimens we produced. If the results meet the requirements, you get a preliminary mix design in hard copy. An employee of our company adjusts the mix design at your company/site. There may be deviations to the laboratory conditions during the adjustment. Therefore, again, test specimens are taken and tested for relevant deviations. If the results of the mix design adjustment are as required, you get an adjusted mix design. The functionality / quality of the mix design / production is ensured by initial testing / self-monitoring / external monitoring.



District heating pipe

Advantages

- Mix design adjustment on site
- Testing institute accredited by RAL
- External monitoring person accredited by RAL
- Developer of RSS Flüssigboden® FW
- Successful application of RSS Flüssigboden® FW on numerous construction sites

Data

- Costs basic mix design: €1092
- + 3 x samples surface friction each €270
- + 2 x samples settlement rate each €74,03, additional costs possible
- Validity of mix design: 1 year
- typical q_u value after 28 d: 0.08–0.3 N/mm²
- typical EV2 value after 28 d: > 45 MN/m²
- shear stress t_{PUR} , adm of 0.04 MPa according to AGFW, FW 401, part 3, p.11 after 28 d
- max shear stress is pipe dimension and recipe-dependent



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