durcrete

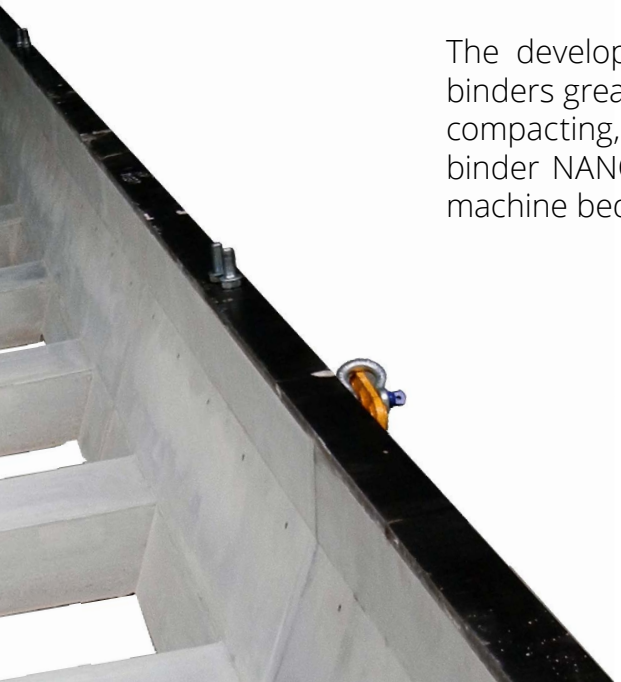
Solid machine beds made
from NANODUR©-concrete

TECHNOLOGY
PARTNER
DYCKERHOFF
NANODUR®

Advantages of solid machine components

Solid machine beds are required, where high-speed machining is combined with the utmost of precision. Due to its nature of high damping characteristics, polymer concrete and natural stone are the preferred materials for high-quality milling, cutting, turning, and grinding machines. Using these materials will increase stiffness and natural frequency while reducing noise and tool wear.

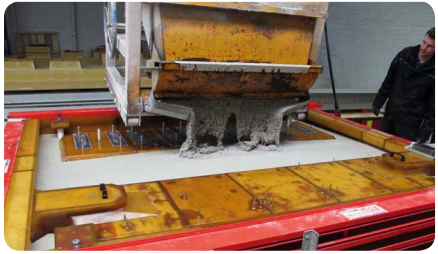
The development of new high-tech and nano-based cementitious binders greatly simplifies the manufacture of machine parts with self-compacting, solvent-free, cementitious concrete. Durcrete uses the binder NANODUR© from the Dyckerhoff GmbH in order to produce machine beds made of UHPC (Ultra High Performance Concrete).



Production

The UHPC concrete is mixed from aggregates, special cement and water which is then filled into negative moulds in specialized facilities. Depending on the requirements, the moulds are made of wood, plastic or steel. Threaded sleeves, steel bars, pipes, conduits, lifting anchors, pneumatic lines etc. are embedded within the machine frame.

The solvent-free mixture hardens under ambient conditions. After one day, the component is removed from the mold and coated after special treatment steps. Cementitious concrete is dimensionally stable even at high temperatures, it also does not burn and is recycleable as construction debris.



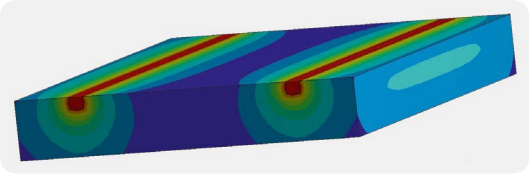
Precision

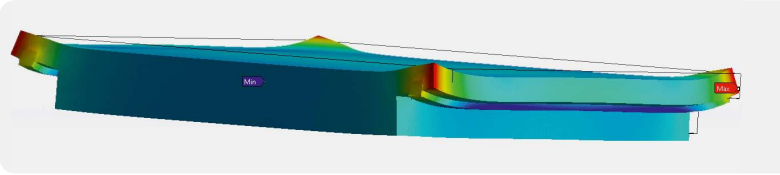
A straightness, flatness and parallelism of 0.1 mm can be achieved directly out of the mold. Accuracies of up to 0.005 mm can be achieved by grinding the concrete surface, alternatively by milling and drilling embedded steel plates. Especially for manufacturing series components, the casting of precision surfaces using gauges and epoxy resins are very cost-efficient.

UHPC has a high thermal capacity. Moreover, it has a thermal expansion coefficient similar to steel. Therefore thermal influences on the machine bed are reduced. Single UHPC components may be glued together with epoxy resins.

Material data

Characteristic	Nanodur© concrete E45	Design value concrete E45	Nanodur© concrete E80	Design value concrete E80
Compressive strength f_{cm}	> 125 MPa	σ_{adm} = 40 MPa	> 150 MPa	σ_{adm} = 40 MPa
Flexural tensile strength f_{ctm}	15 MPa	σ_{adm} = 5 MPa	20 MPa	σ_{adm} = 5 MPa
Centric tensile strength	-	σ_{adm} = 3 MPa	-	σ_{adm} = 3 MPa
Static modulus of elasticity E_c	46,500 MPa	45,000 MPa	84,500 MPa	80,000 MPa
Dyn. modulus of elasticity E	55,600 MPa	-	89,600 MPa	-
Poisson's ratio μ	0.19 [-]	0.20 [-]	-	0.20 [-]
Density hardened concrete ρ_c	2,480 kg/m³	2.5 tons/m³	2,790 kg/m³	2.8 tons/m³
Specific thermal capacity c_p	1.2 J/gK	1.2 J/gK	0.85 J/gK	0.85 J/gK
Thermal conductivity λ	3.0 W/mK	3.0 W/mK	6.0 W/mK	6.0 W/mK
Thermal expansion α_T	$12.0 \cdot 10^{-6}$ [1/K]	$12.0 \cdot 10^{-6}$ [1/K]	$7.0 \cdot 10^{-6}$ [1/K]	$7.0 \cdot 10^{-6}$ [1/K]



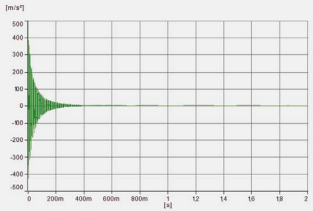


Vibration damping

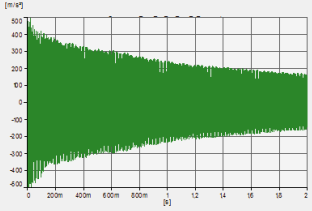
Material	Log. damping decrement Λ	Damping ratio D [%]
Nanodur concrete E45	0.030	0.50
Nanodur concrete E80	0.021	0.33
durfill	0.035	0.56
Cast iron GG	0.003	0.05
Steel S235	0.001	0.02

Results depend on the specimen's geometry and the procedure of testing.

nanodur concrete E45



aluminium



Our service

In cooperation with manufacturing plants and precision processing companies, durcrete GmbH delivers finished and coated machine beds and bases made of NANODUR©-concrete. We support you in terms of design and structural analysis of the components.
Durcrete GmbH does the application consultancy for the binder NANODUR© Compound 5941 on behalf of Dyckerhoff GmbH. If you are planning on building an own fabrication, we will give you advice regarding the selection of primary materials, the development of recipes, plant engineering and quality assurance plans.

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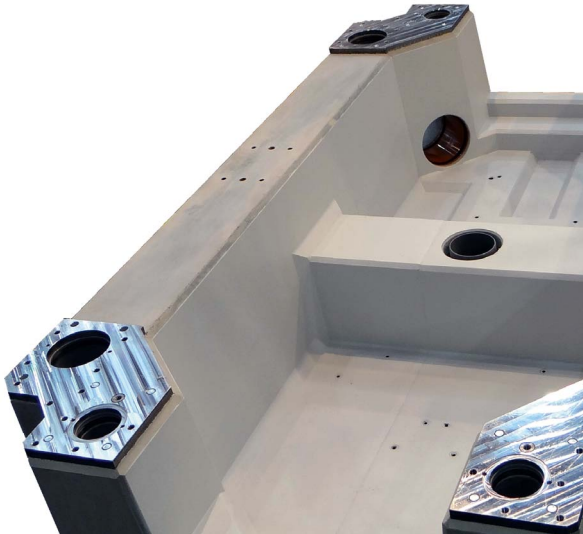

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