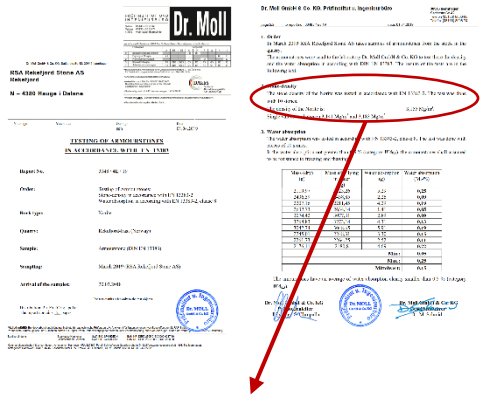
REKEFJORD STONE AS
BENEFITS OF HIGH-DENSITY ROCK IN COASTAL & OFFSHORE

Rekefjord (East) Quarry, Norway
Supply of Norit High-Density Rock
Density > 3100 kg/m^3


Dr. Moll

TESTING OF ARMOUR UNITS IN ACCORDANCE WITH EN 13383

2. Stone-density

The stone-density of the Norite was tested in accordance with EN 13383-2. The test was done with 10 stones.

The density of the Norite is: 3,155 Mg/m^3.

Design of Rock Structures in Coastal and Offshore Structures:

Rock Density ρ_r is Key Parameter

Under Water, use (Relative) Submerged Density: $\Delta = \frac{\rho_r}{\rho_w} - 1$

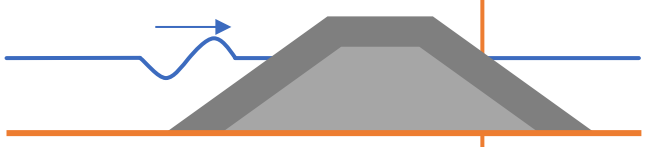
Strong Effect: increase Density from 2650 to 3100 kg/m^3 (+17%) → Δ increases 28%

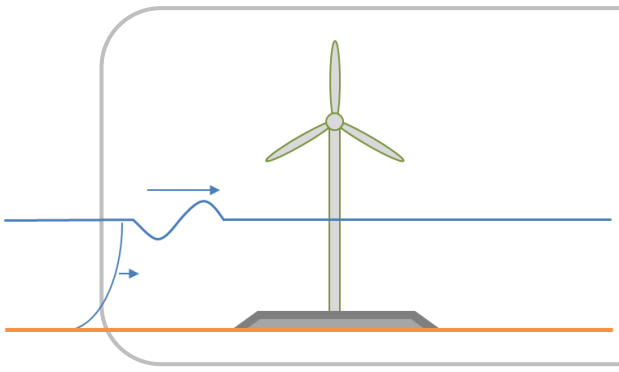
Breakwaters, Coastal Defences

Design: all stability equations take the shape: $\frac{H_s}{\Delta \cdot D} = X$

Direct relationship Rock Size $D \leftrightarrow \Delta$. As $M \sim D^3$: strong effect on rock mass.

With rock density up 17%, median rock mass reduces with 44%.





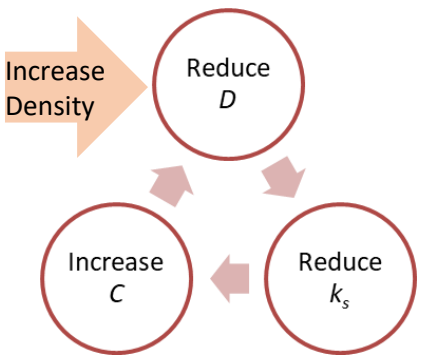
Offshore Rock Berms, Scour Protection

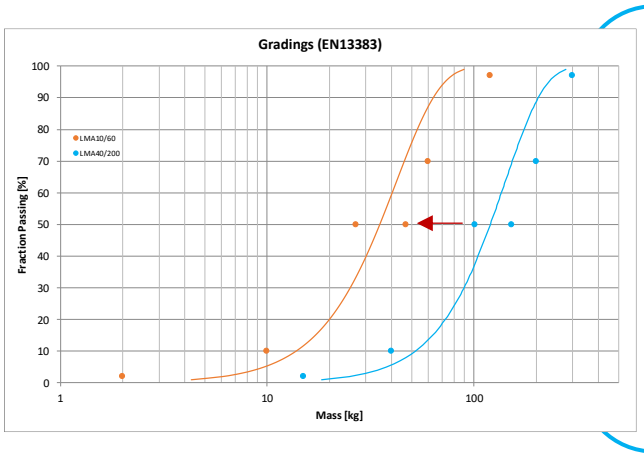
Design: use Shields equation: $\Psi = \frac{\tau}{(\rho_r - \rho_w) \cdot g \cdot D}$

Through shear stress: beneficial iteration loop

Reduction of median rock mass up to 75%

Use much lighter rock gradings





Benefits of High-Density Rock over Normal-Density Rock

- While maintaining the same level of design safety:
  - Reduce required median rock mass by 44% to 75% (depending on situation)
  - Reduce total amount of rock by 8% to 30% (depending on situation)
- Easier execution:
  - Use lighter cranes (breakwaters, coastal defences)
  - Use fallpipe vessels (scour protection)
- Handle smaller masses, safer project execution

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