granova®

# Reference: HEROS Aggregates for Concrete

# Aggregate for concrete

**Can Incinerator Bottom Ash Aggregate (IBAA) be used in concrete? There is a set of standards that provides the framework for all European countries that wish to use secondary aggregates in concrete or concrete products. However, the Netherlands was the first country to address IBAA in separate national guidelines.**

## EN 12620: Aggregates for concrete

The European standard EN 12620 specifies the properties of normal weight (≥ 2 t/m³) aggregates and filler aggregates for use in concrete according to EN 206. It covers aggregates obtained by processing natural, manufactured or recycled materials and mixtures of these. Thus, it also applies to industrial by-products such as IBAA. EN 13055 for lightweight aggregates does not apply to IBAA.

EN 206 provides information concerning the specification, performance, production and conformity of concrete. It is amended with complementary national standards and guidelines. EN 206 applies for structural concrete in situ (ready mixed), for precast structures and structural precast products for buildings and civil engineering works. The standard is not mandatory for concrete products.

Production of concrete paving slabs

Table 1: Overview of relevant technical regulation

| Type of regulation | Name | Title |
|---|---|---|
| European Standards | EN 12620<br>EN 206 | Aggregates for concrete<br>Concrete: Specification, performance, production and conformity |
| National Standards (examples) | Great Britain: BS 8500-1 and 8500-2<br>Germany: DIN 1045-1 and 1045-2<br>Netherlands: NEN 8005 and NEN 5905 | Complementary national standards to EN 206 |
| National Guidance on Secondary Aggregates (examples) | Great Britain: PD 6682-1<br>Germany: DAfStB Regulations for recycled aggregates<br>Netherlands: CUR aanbeveling 116<br>Netherlands: BRL 2507 | Guidance on the use of BS EN 12620<br>Concrete in accordance with DIN EN 206 and DIN 1045-2 with recycled aggregates according to DIN EN 12620<br>IBAA granulate as aggregate for concrete<br>Evaluation guidelines for the KOMO® certificate for IBAA as additive for concrete |
| European Standards for Concrete Products (examples) | EN 1338<br>EN 1339<br>EN 1340<br>EN 771-3<br>EN 13383 | Concrete paving blocks<br>Concrete paving flags<br>Concrete kerb units<br>Aggregate concrete masonry units<br>Armour stones |

## Specification of concrete

The requirements pertaining to the concrete mix design and its constituents are dependent on the concrete's specification. For concrete designed in accordance with EN 206, for example, this includes parameters such as concrete strength and exposure to environment. The strength class is a measure for the compressive bearing capacity of concrete. An excerpt from EN 206 with some common strength classes is given in Table 2.

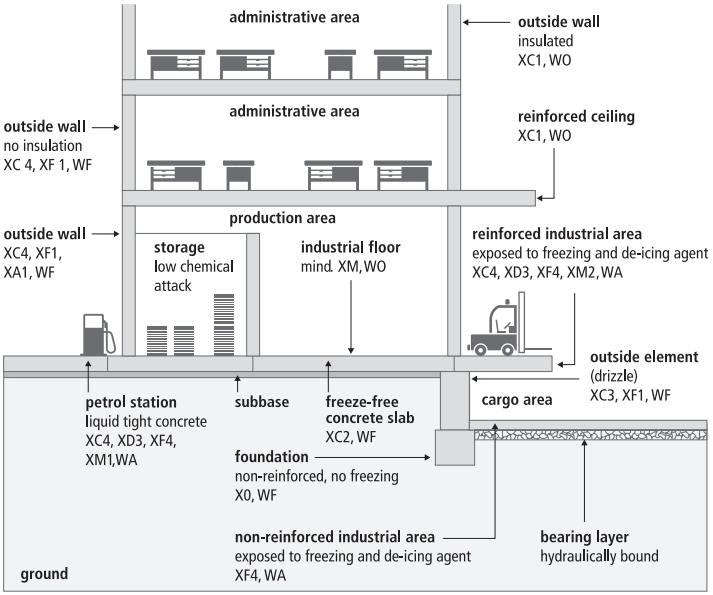
Table 2: Example of strength classes according to EN 206

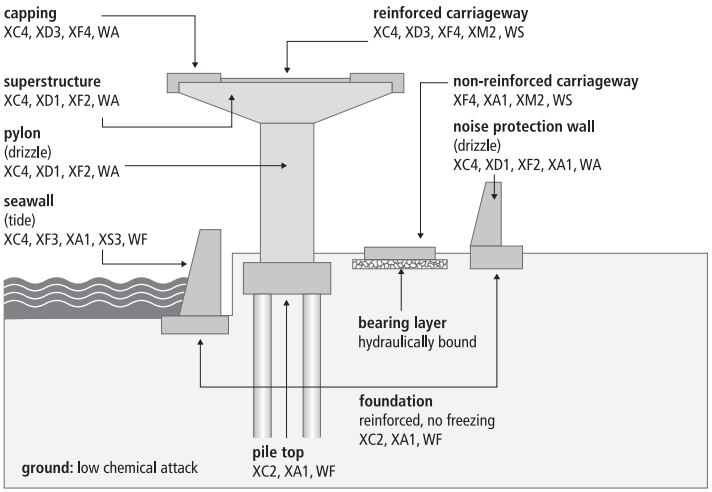
| Compressive strength class | Minumum characteristic cylinder strength [N/mm²] | Minumum characteristic cube strength [N/mm²] |
|---|---|---|
| C 8/10 | 8 | 10 |
| C12/15 | 12 | 15 |
| C16/20 | 16 | 20 |
| C20/25 | 20 | 25 |
| C25/30 | 25 | 30 |
| C30/37 | 30 | 37 |

The exposure class is a measure of the exposure of concrete to attacks such as rain, freeze / thaw and chemicals. The standard distinguishes six main groups (see table 3); in Germany, the XM classes for wear resistance and the W classes with regard to alkali-silica reaction have to be considered additionally. What this means in practice can be seen in the diagrams to the right.

Table 3: Environmental exposure classes in accordance with EN 206

| Type of exposure | Exposure class |
|---|---|
| 1 – No risk of corrosion or attack | X0 |
| 2 – Corrosion induced by carbonation | XC 1, XC 2, XC 3, XC 4 |
| 3 – Corrosion induced by chlorides other than from sea water | XD 1, XD 2, XD 3 |
| 4 – Corrosion induced by sea water | XS 1, XS 2, XS 3 |
| 5 – Freeze / thaw attack with or without de-icing agent | XF 1, XF 2, XF 3, XF 4 |
| 6 – Chemical attack | XA 1, XA 2, XA 3 |

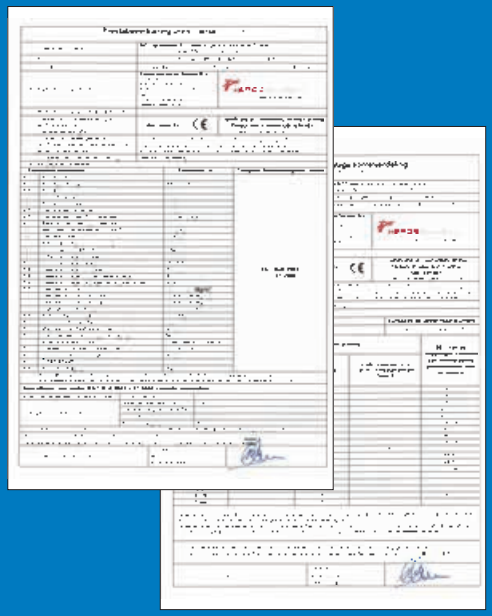



Examples of exposure classes: Industrial construction (top) and civil engineering works (bottom)

## Facts at a glance:
## granova® for concrete in the Netherlands

- The REMEX subsidiary HEROS Sluiskil B.V. is the Dutch market leader for processing incinerator bottom ash.
- Production of around 500,000 tonnes of IBAA for use as secondary aggregate.
- granova® aggregate for concrete is produced in accordance with the new Dutch guideline "CUR aanbeveling 116", and "BRL 2507".
- granova® suitability for concrete is demonstrated with a KOMO® certificate.
- Main concrete applications of granova® include concrete products such as blocks or paving stones.
- The replacement of 20 to 50 % of total sand / gravel is possible.



# The Dutch are setting standards

## CUR aanbeveling 116 and BRL 2507

CUR aanbeveling 116 is a Dutch guideline that came into force in October 2012 and treats the subject of IBAA specifically. It defines the use of IBAA as normal weight aggregate in reinforced and non-reinforced concrete structures. The application in pre-stressed concrete is excluded. The guideline allows for the replacement of natural sand and / or gravel in the following quantities:

- up to 20 Vol.-% in reinforced concrete and
- up to 50 Vol.-% in non-reinforced concrete and non-structural concrete products.

In accordance with this guideline, IBAA can be used in strength classes from C 12/15 up to C 30/37. Also, IBAA is permitted in reinforced concrete of all exposure classes excluding XA2 and XA3. For use in exposure class XF, the replacement percentage is limited to 20 Vol.-%. The use of cement types CEM III/B and CEM II/B-V is mandatory for the environmental classes XD and XS.

For non-reinforced concrete and concrete products, the CUR aanbeveling 116 permits the use of IBAA in all strength and environmental exposure classes. The matching BRL 2507 „Evaluation guidelines for the KOMO® product certificate AEC granulate as additive for concrete" was introduced in October 2013. This regulation allows the production of standardised concrete and concrete products with IBAA under the KOMO® certification.

## Innovation made by granova®

The first in the Netherlands to market IBAA for the high quality application of concrete is the REMEX subsidiary HEROS Sluiskil B.V. The plant processes around 700,000 tonnes of MSWI bottom ash per year. Due to significant research and development efforts and relevant investments into plant technology the ash is turned into a high quality building material that complies with the new Dutch regulation.

The final material is produced and delivered with the according CE marking and KOMO® certification and marketed under the brand name granova®.

granova® is not only the sustainable and financially attractive alternative to primary aggregates – it also offers a real competitive edge to concrete producers.

The REMEX Dutch processing facility, operated by its subsidiary HEROS Sluiskil B.V

# granova®

REMEX is a waste management company with expertise in mineral waste, demolition and remediation services, stabilisation and backfilling of disused mines, landfill site operation and production of secondary construction material.

The REMEX Group consists of over 60 business locations and around 650 employees. Its network of around 20 construction waste treatment facilities produce approximately 2.3 million tonnes of high quality recycled aggregates, sold under the remexit® brand name. Additionally, REMEX produces around 1.3 million tonnes of quality assured secondary aggregates from waste incineration slag and ash which is marketed under granova®.

REMEX is part of the REMONDIS Group, one of the world's largest recycling, service and water companies.

www.granova.eu