Holcim Netherlands and recycling

Agenda

- Holcim Netherlands
- Why use of secondary materials
- Zero waste in RMC production
- Requirements for recycled concrete
- Requirements for concrete with recycled materials
- Experience in RMC and concrete products
- Types of recycled materials for concrete
- Price consequences
- General conclusions

Holcim Betonmortel

Alphen

quius

Concrete 300.000 m³

600.000 ton / aggregates

Krimpen

Oudenbosch

Holcim Betonmortel

- Strength class C25 – C65
- High strength
- Light /heavy weight
- Colored
- Fiber reinforced
- Liquid impermeable
- Low shrinkage
- Self compacting
- Aggressive resistance etc.
- 100 years of durability

Holcim Concrete Products

Alphen

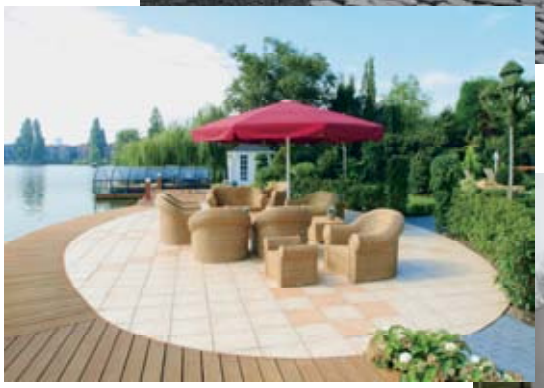
Oudenbosch

Groot Ammers

Concrete 375.000 m³

750.000 ton / aggregates

Concrete products



Road construction

Pavement and sewage pipes

Hydrolic projects

basaltonstones, waterwall elements.

Environmental products

tiles for tankstations and industry

Garden products

pavementstones. tiles, circles, etc.

Prefab construction elements

walls , precast construction elements.

Recycling

The Netherlands

16.5 mio. Inhabitants

500 inhabitants/km²

89% of the people live in towns and cities

Objectives

1. To protect the landscape from effects of the production of aggregates
2. To decrease the use of primary aggregates
3. To prevent the dumping of demolition waste
4. To promote recycling

Guideline treating Recycling

Following the Ladder of Lansink
(Member of the Dutch parliament) 1979

Priorities

1. Prevention
2. Reuse of the product
3. Reuse of the material
   (as much as possible)
4. Burn the waste and regain the used energy
   (as little by-products as possible)
5. Dumping

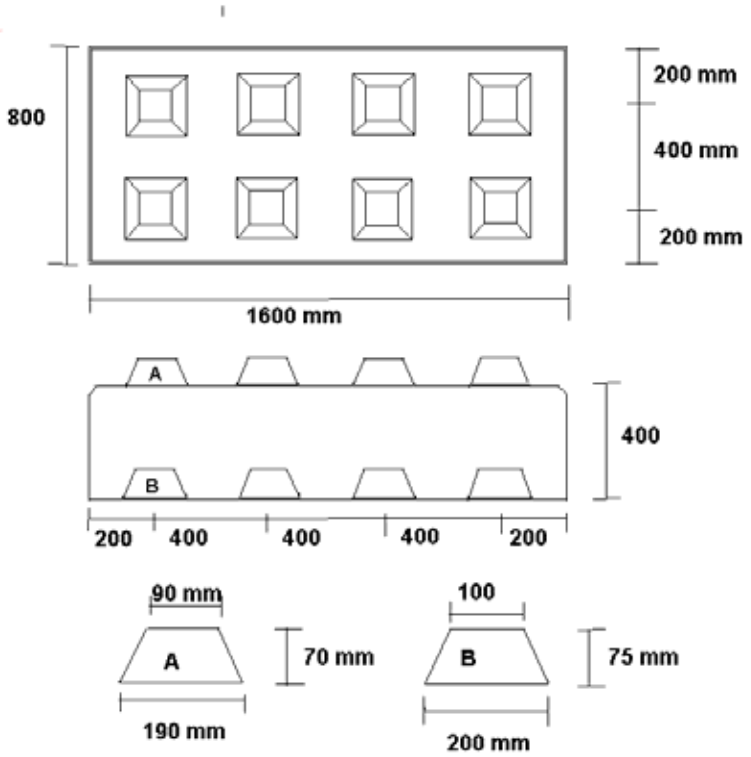
Concrete industry CUR B 29 (1979)

Re-use of construction waste

- Analysing of the type and quantity of construction waste
- Study on technical aspects in demolition and recycling
- Research in the use of recycled concrete in concrete
- Research in economical aspects
- Requirements for recycled concrete

(CUR 4 - 5 and VBT 1986 NEN 5950)

Zero waste in RMC production



Lego - block

Zero waste in RMC production

Recycling installatie

- Gravel 4 - 32 mm.
- Sand 0 - 4 mm.
- Cement slurry

Zero waste in RMC production

Slurry mixture: water + cement + filler + fine sand

- Homogenious mix
- Daily control content of materials
- Max 1% raw material in slurry/m³ beton (± 20 kg)

Zero waste in RMC production

Recycling of hardened concrete.

Requirements

BRBS
brancheverenging
recycling
breken en sorteren

Vereniging van Ondernemingen van
Betonmortelfabrikanten in Nederland

VOBN

PRODUCTWAARDEN BETONGRANULAAT 4/32

Inleiding

Dit productinformatieblad bevat de door BRBS en VOBN gezamenlijk opgestelde kwaliteitseisen voor betongranulaat als grindvervanger in beton. De eisen zijn tevens conform CUR-Aanbeveling 112 en NEN 5905. Het productinformatieblad dient derhalve ook als CE-markering. Ten opzichte van de verplichte CE-markering wordt aan de volgende aanvullende eisen voldaan:

Aanvullende eisen:

Gehalte aan beton conform NEN 5942	> 90 % m/m
Gehalte overig steenachtig conform NEN 5942	< 10 % m/m
Andere niet steenachtige bestanddelen NEN 5942	< 0,5 % m/m
Lichte niet-steenachtige bestanddelen conform EN 1744-1 par. 14.2	< 0,1 % v/v

Bij toepassing in schoonbeton

Vlekvormende bestanddelen conform EN 1744-1 par. 14.1	Voldoet
Lichte bestanddelen conform EN 1744-1 par. 14.2	< 0,1 % v/v

Requirements

BETONGRANULAAT 4/32
Toeslagmateriaal voor beton

4.3 Korrelgradering

zeef volgens ISO 565:1990 R 20	grenswaarden voor doorval volgens NEN-EN 12620			90% van de bepalingen voldoet aan onderstaande grenswaarden voor de doorval
	algemeen	gemiddelde	grens t.o.v. gemiddelde	
63	100	100		100
45	98 - 100	99		99 - 100
31,5	90 - 99	95		91 - 99
16	25 - 70	60	42,5 - 77,5	28 - 56
4	0 - 15	11		2 - 9
2	0 – 5	5		0 - 3

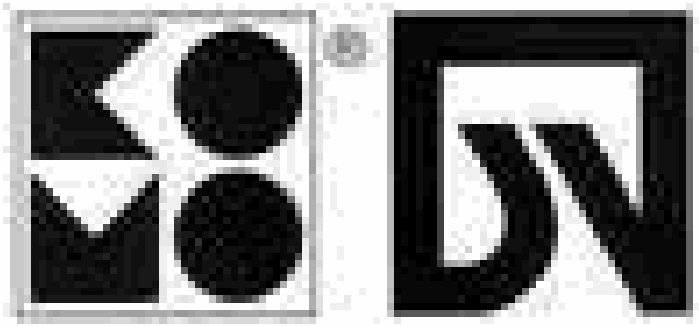
4.3	Categorie	G_C 90/15 G_T17,5
4.4	Korrelvorm	FI_{20}
4.5	Schelpgehalte	SC_{10}
4.6	Hoeveelheid fijne deeltjes < 63 µm	f_4 (< 3 %)
4.7	Kwaliteit van fijne deeltjes	Onderzoek zwellende klei : Voldoet
5.2	Los Angeles	LA_{40}
5.4.1	PSV	PSV_{NPD}
5.5	Deeltjesdichtheid	≥ 2200 kg/m³
5.5	Waterabsorptie	1,5 %WA
5.7.1	Vorst/dooi bestandheid	F_{NPD}
5.7.2	Krimp door uitdrogen	WS_{NPD}
5.7.3	ASR gevoeligheid	*ASR* (CUR aanbeveling 89 is van toepassing)
6.2	Chloride gehalte	≤ 0,1 %Cl
6.3.1	In water oplosbaar	$AS_{0,8}$
6.3.2	Totaal zwavelgehalte	≤ 1,0 %S
6.4.1	Bindings- en verhardingsvertraging	Voldoet

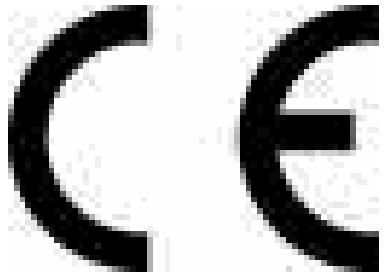
Ondergetekende verklaart op grond van artikel 9 van de Richtlijn Bouwproducten (89/106/EEG) namens Voorbeeldbedrijf gevestig
Korrelweg 3 te PUININGEN dat het in dit productspecificatieblad genoemde product, afkomstig van haar brekerinstallatie Grindwe
BETONDORP, voldoet aan de eisen van NEN-EN 12620 voor de eigenschappen genoemd in Tabel ZA.1a van bijlage ZA van deze norm.

Concrete granulate

Requirements and certification

NEN EN 206-1	NEN 6720
NEN EN 12620	NEN 8005
NEN 5905	EN 1744-1
NEN 5942	CUR-Aanbeveling 112





Requirements for concrete

Requirements for Concrete Technology

NEN-EN 206-01 >< NEN 8005 >< Cur 112

- **Replacement max. 20% (50% cur 112) of the content (V/V) of nat. aggregates without consequents for the stability of the construction .**
- **Meets the requirements of: Strength class**
  Exposure class
  Workability class etc.

Be careful by architectural concrete

Experience in concrete technology

- Properties of recycled concrete gran. - nat. gravel
- Mix-design of concrete
- Effects on water demand
- Workability of concrete
- Influence on compr. Strength
- Influence on durability

Concrete granulate

Recycled crushed concrete < >natural gravel

- Shape (100% broken)
- Water absorption 5 - 10%
- Spec. weight ± 2300 kg/m³
- Fluctuation in quality
- Pollution

Experience in concrete technology

Mix-design

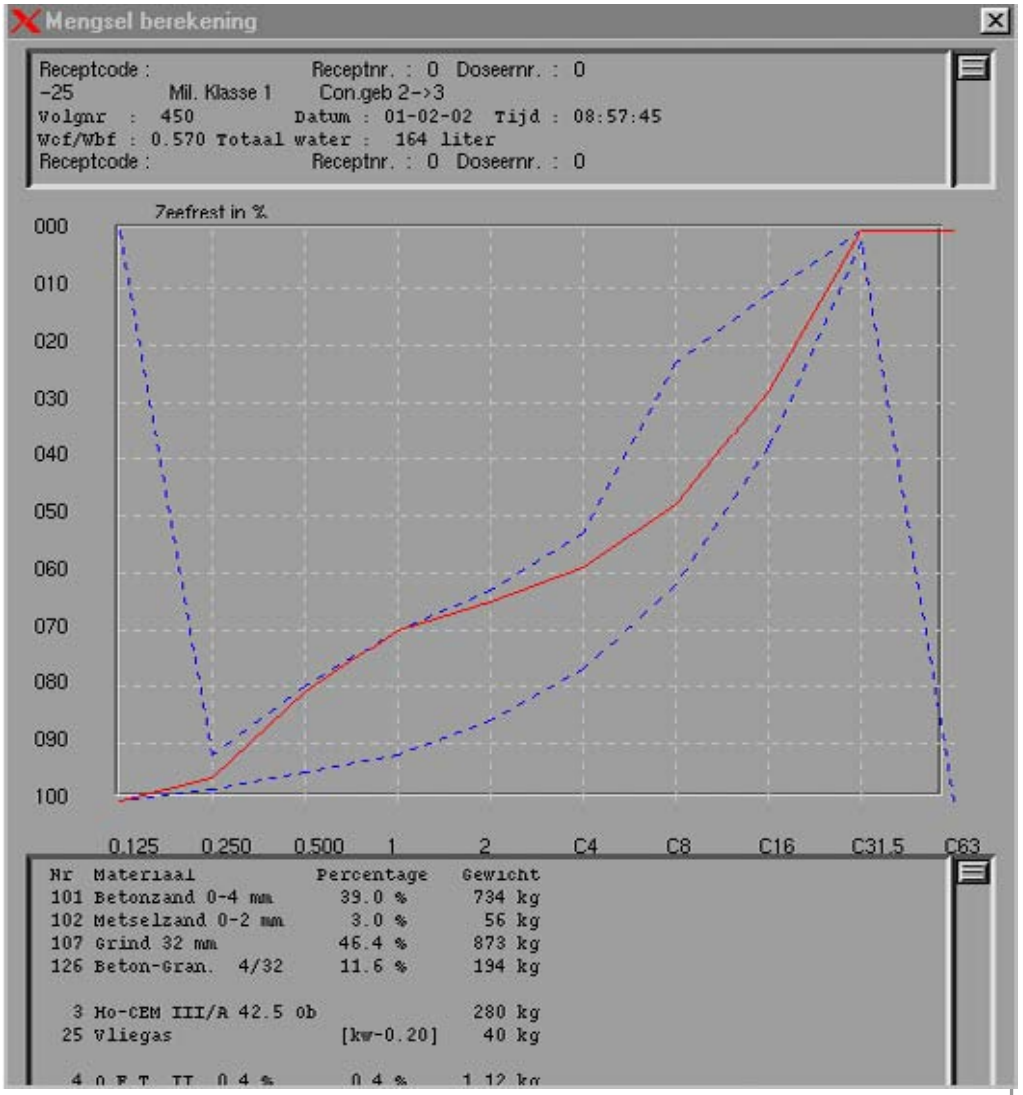
C20/25 XC2 S3

CemIII/A	280 kg/m³
Fly-ash	40 kg/m³
Workability	2>3 (s.plast.)
W.c.r.	0.57

Gravel 58% = 413 dm³

20% = 83 dm³ . 2.35 =

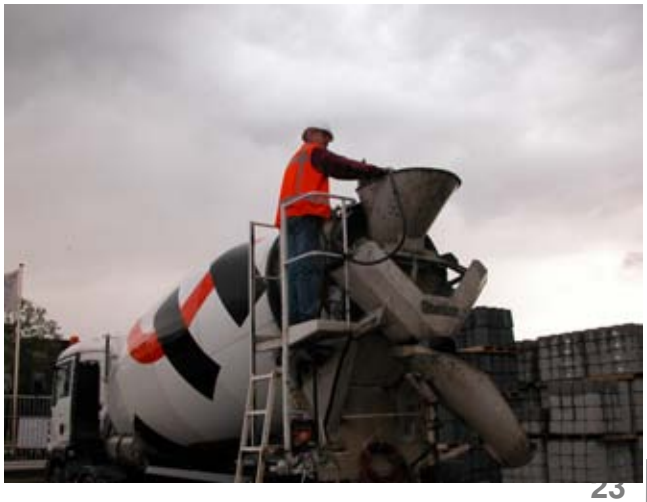
194 kg/m³ R.C.Gr.



Experience in concrete technology

Water demand

- No extra water by 20 % replacement
- > 20 % replacement extra water because of the broken shape
- Dry material: extra water for absorption
  less effect of the additive



Experience in concrete technology

Workability

- No problems if 20 % replacement
- Reduction of workability in case of absorption
- More than 20 % replacement decreasing of flow and more difficult by pumping

Experience in concrete technology

Compressive Strength

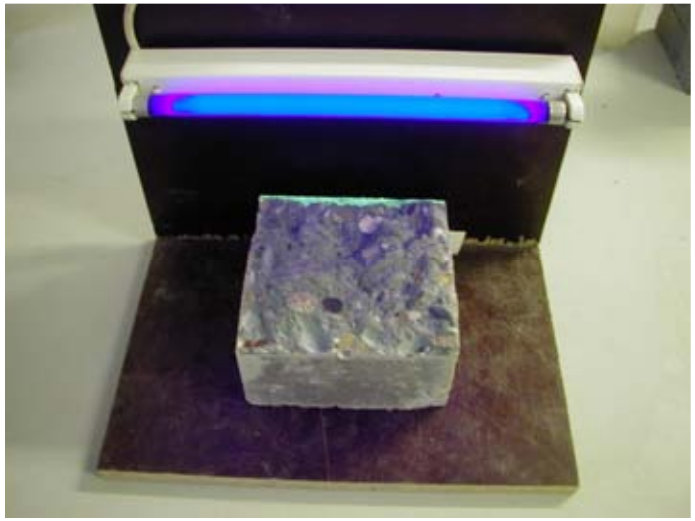
Strength-class C20/25 C28/35

- **No problems by 20 % replacement**
- **100% > 4 - 6 % less compr. strength**

Strength-class > C28/35 loss of strength depends on quantity and quality.

Experience in concrete technology

Durability



20 % replacement no different in:

- Waterinpressing (prEN 12390-8)
- Frost resistance
- Aggr. Environment
- Exposure-class. (same w.c.r.)

Environmental and social project

Cirkelstad Rotterdam

- reuse of demolution waste
- training of jobless labors

Recycling in Concrete Products.

Aggregates from concrete recycling

Granulate 0/10 mm.

100% replacement in tiles.

Recycling in Concrete Products.

Aggregates from asphalt recycling

- Filler
- Sand 0/2 mm
- Gravel 2/8 4/22

Recycling in Concrete Products.

Recycling in Concrete Products.

Properties

- compressive strenghts
- tensile strenghts
- de-ising salts frost tests
- wear resistance
- env. requirements
- ASR etc.

Source of recycled materials

Fine and corse materials

- fresh concrete
- hardened concrete (crushing proces)

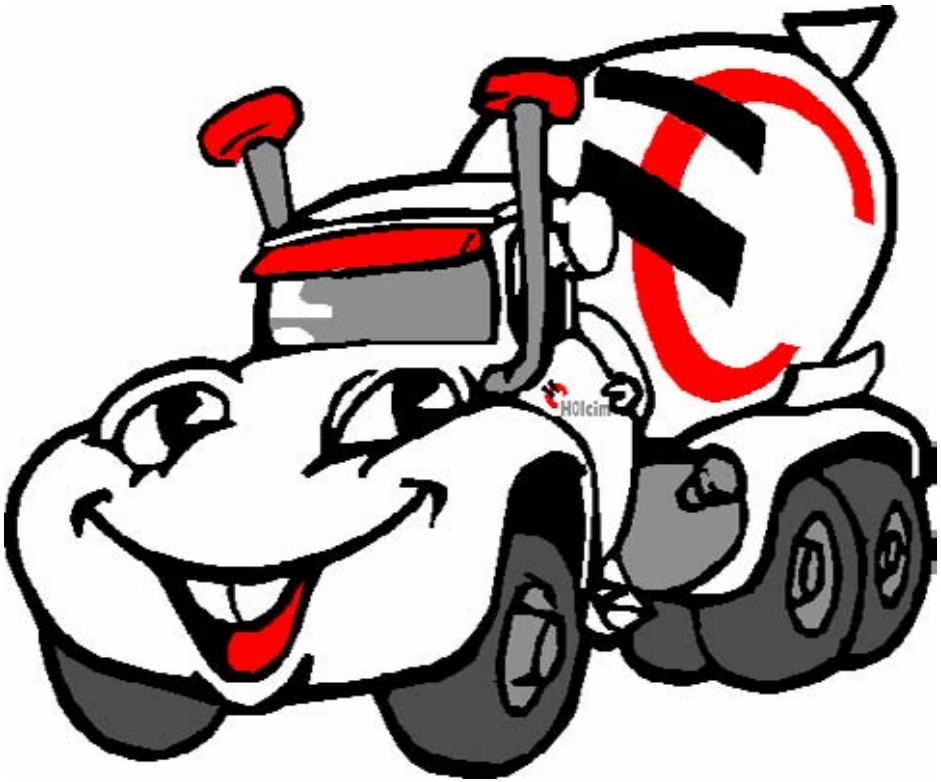
  (thermical proces kringbouw)
- asphalt recycling (eco-granulate)

What will it be ????

- Quality
- Avaibility
- Transport
- Price

- more technical support
- extra storage on site and in plant
- more cement or/and additives.
- Price / m³ concrete

Thanks for your attention



Recycling in Concrete Products.