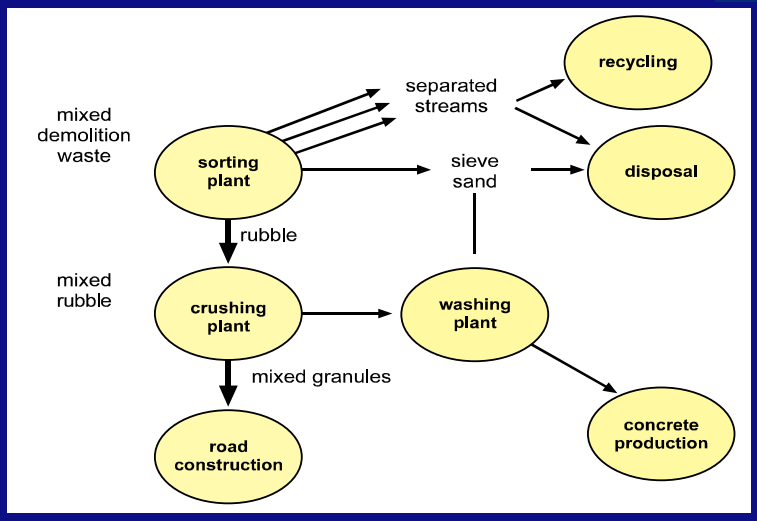
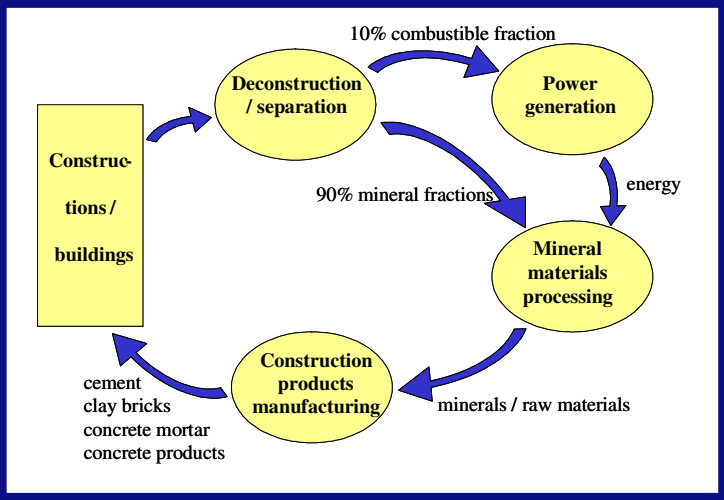
Outline of the presentation

- The Closed Cycle Construction concept
- Thermal treatment of concrete rubble
- Thermal treatment of masonry debris
- Separation of mixed C&D waste streams
- Benefits of ‘Closed Cycle Construction’

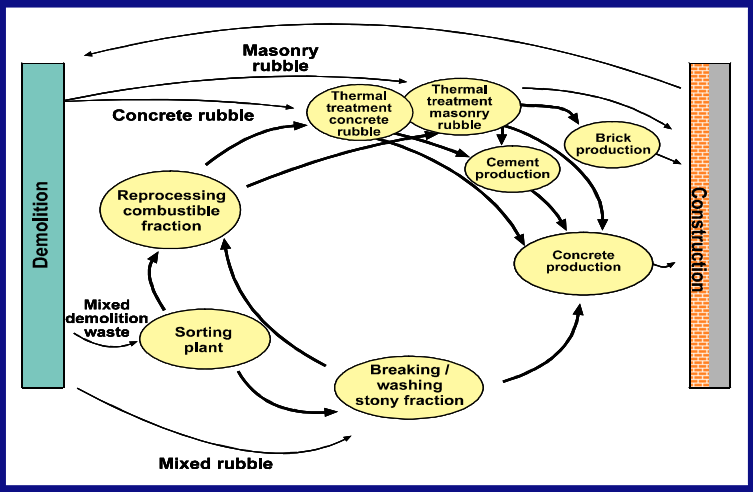
Current processing of C&D waste in the Netherlands



The Closed Cycle Construction concept - 1



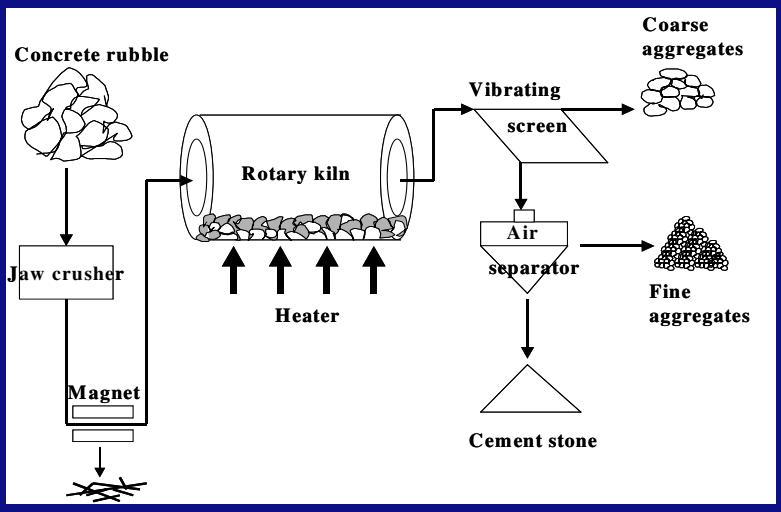
The Closed Cycle Construction concept - 2



Thermal treatment of concrete rubble

- The original ingredients of concrete (gravel, sand and cement stone) are set free by input of a combination of thermal and mechanical energy
- The process was developed, based on the experiences of TNO, KEMA and Mitsubishi
- The process temperature is approximately 700 ^{o}C
- Required energy can be obtained from the combustible fraction of C&D waste; no fossil fuel is required

Thermal treatment of concrete rubble



Thermal treatment of concrete rubble

- In laboratory experiments, coarse concrete rubble yielded:
  - 45% gravel (> 4 mm)
  - 35% sand (< 4 mm)
  - 13% cement stone (< 150 microns)
  - 1% reinforcement steel
  - 6% vaporised hydration water
- Verification experiments on a pilot scale are planned for next month

Thermal treatment of masonry rubble

- The clay-brick recovery process, at ± 500 °C, is based on a difference in linear expansion coefficient between mortar and brick (for cement based mortars)
- For mortars with high lime content a higher temperature is required to disintegrate the mortar; high % breakage; mechanical pre treatment required
- Clay-brick parts and mortar parts are separated
- The clay-brick parts are broken to < 2 mm, in order to recycle the granulate in the brick-making process, in ratio's up to 50%

Thermal treatment of masonry rubble

Thermal treatment of masonry rubble

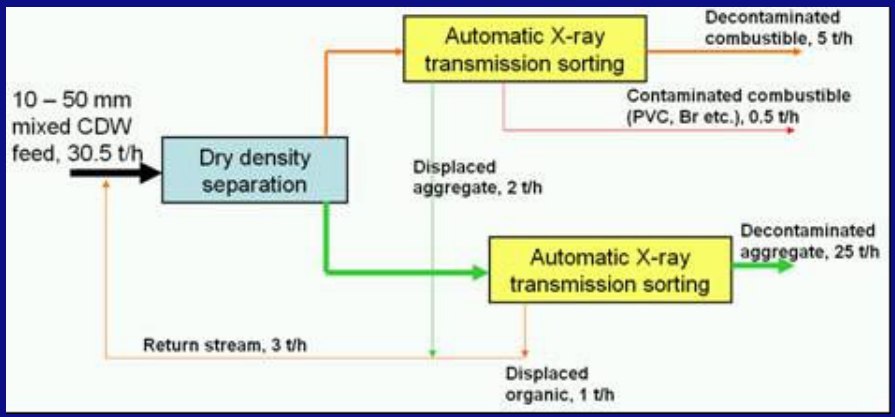
Thermal treatment of masonry rubble

Thermal treatment of masonry rubble

- After lab-research a pilot-scale experiment was carried out to recover whole clay-bricks:
- The experiment yielded: 900 kg whole bricks, 1100 kg brick parts and 500 kg mortar
- The recovery rate was up to 36% of the total input, and 60% of the ingoing whole bricks
- This process only requires 25% of the energy that is needed for the production of new bricks
- The new bricks have good technical, environmental and aesthetical properties

Separation of mixed C&D waste

A combination of dry density pre concentration techniques and automatic sorting techniques

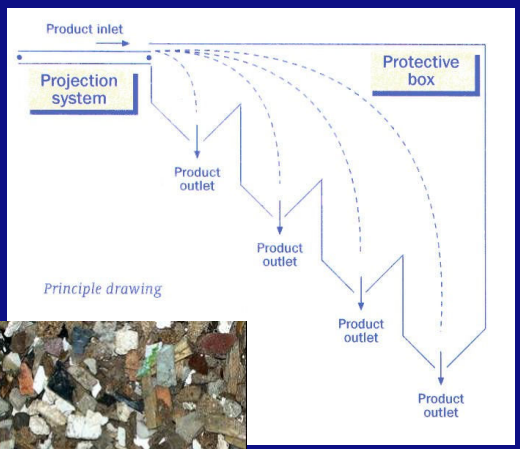


Separation of mixed C&D waste
Dry density pre concentration techniques

Dry density separation techniques that were investigated for pre separation in a heavy and a light fraction:

- Dry sand fluidised bed: ++ for >20 mm fraction
- Air jig (in combination with air sifting): + for < 20 mm fraction
- Aster ballistic separator: + especially for high volumes, but requires prior classification
- Air table: +/- because of displacement of tiles and glass in the light fraction

Separation of mixed C&D waste



Reject

Product

Separation of mixed C&D waste
Automatic sorting techniques

Automatic sorting techniques that were investigated for cleaning up the pre concentrated fractions:

- Automatic colour sorting: + for coloured bricks, tiles, glass and gypsum
- Electromagnetic sensors: + for some components, - for others
- Sorting based on Dual-energy X-ray transmission: + for a number of materials, like gypsum, wood and glass

A second step (with another technology) is required to get saleable by product (e.g. gypsum and glass)

Separation of mixed C&D waste

Benefits of Closed Cycle Construction

- Closing the material cycles for masonry and concrete; thus fulfilling objectives of the government (sustainable developments) and of industry (producer's responsibility and long term raw material supply)
- Recovery of high grade raw materials; thus reducing the need of excavating natural raw materials
- Utilization of the combustible fraction of C&D waste; at the same time reducing the amount of waste to be disposed of in landfill
- The integrated character of the process implies a reduction in transport kilometres and costs
- Several environmental benefits

Benefits of Closed Cycle Construction