The re use of Construction and Demolition Waste as a factor of sustainability of the construction sector

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«Circular economy and valorization/recycling: a potential way to reduce dependence on raw material and energy»
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EU: CDW

- All Waste generated under NACE code F (construction sector) and Chapter 17 of 2000/532/EC (List of Wastes)
  - Concrete, bricks, tiles, ceramic and gypsum
  - Wood, Glass, Plastic
  - Asphalt and related products
  - Dredging spoil
  - Insulation materials
- Hazardous waste and naturally occurring material (Code 17 05 04) are excluded

GREECE: ECDW

- All Waste generated under NACE code F (construction sector) plus
  - Excavation material
  - Hazardous waste and naturally occurring material (Code 17 05 04) are excluded
Waste per economic activity

EU (28 countries)

Construction 33%
Manufacturing 11%
Mining and quarrying 29%
Wholesale of waste and scrap 4%
Services 2%
Water collection 1%
Electricity, gas, steam and air conditioning supply 4%
Agriculture, forestry and fishing 2%
Households 8%

Greece

C: 821.160.000 t
Construction 1%
Mining and quarrying 66%
Agriculture, forestry and fishing 0%
Households 7%
Wholesale of waste and scrap 0%
Waste collection 1%
Water collection 0%
Electricity, gas, steam and air conditioning supply 17%
Services 2%

C: 815.000 t

Source: Eurostat- Extraction 20.11.2016 Reference year 2012
Greece: CDW management data

- Data reported based on estimations
- CDW generation estimated to be 6-10 times higher than the figures reported to Eurostat
- 2012: 2,700 of 815,000 t of CDW recovered (133 t backfilling & 2,567 recovered by ECDW management systems)
- 812,300 t landfilled legally or illegally
- Non-existing landfills for inert CDW
- 54 approved treatment facilities in Greece covering 60% of the population
- No solid figures on the total CDW treatment capacity

SOURCE: Construction and Demolition, Waste Management in Greece V2–September 2015 REPORT data
CDW: Level of Recycling in EC

CDW: Material recovery & backfilling (2011)

70% target
50% target

ECDW systems

- 9 ECDW systems
- 54 ECDW treatment facilities

2013
53,000 t processed
600,000 t produced (est.)

GREEK NATIONAL WASTE MANAGEMENT PLAN

TARGETS

- 50% Re-use/Re-cycle/Re-cover by end of 2015!
- 70% Re-use/Re-cycle/Re-cover by end of 2020 through
  - National coverage of CDW treatment plants
  - CDW sorting on site by applying selective demolition techniques
  - A minimum amount of recycled aggregates to be reused in public technical works in context of the Green public procurement requirements
  - Landfill tax (35€/t up to 60 €/t)

Source: FEK 2706/B`/15.12.2015
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CDW Production

- cement
- Natural aggregates
- Water
- Admixtures

Concrete Production > Construction Building > Construction Use > Construction Demolition > Landfill

upcycling

- Recycling as gravel replacement
- Concrete granules
- Landfill

Cement

Concrete additive

Building construction = Processing

Lifetime of building

Dismantling
Purpose of study

- Outline the differences between Recycled Aggregates (RA) and Natural Aggregates in Greece
- Evaluate coarse RA’s possible influence in concrete performance.
Greece: ECDW

Natural Aggregates

Recycled Aggregates

Purpose of study

- Classification of RA
- Chemical, Mineralogical Composition of all aggregates by X Ray Fluorescence and X Ray Diffractometry
- Chemical & Physical Properties
- Concrete Performance by direct replacing the natural coarse aggregates by 25%, 50% and 75%, with RA
Results: RA Properties

- Significant variation among the CDW plants attributed to different origin and/or different production process

- Increased Si, Al, and K/Na oxides that originate from quartz and minor quantities of aluminosilicate materials especially in fine fractions (<4mm)
- Higher water absorption (2-10 times) due to the old mortar attached to their particles
- Water soluble ions content similar to natural aggregates (max 0.01%)
Results: RCA Compressive strength

- CEM IV32.5
- CEM IV42.5

Compressive Strength (MPa)

Fck = 25MPa
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**Saving in primary resources**

FU = 2-floor structure - 200m³ concrete

Natural Aggregates (kg)

% Replacement by RA

42,000 kg primary aggregates
Recycled Aggregates (coarse fraction) have the potential to replace natural aggregate in technical aspect.

The economic costs and environmental impacts of the use of RA in concrete needs to be assessed **locally** regarding:

- Necessary cement content to satisfy specified needs
- Transport distances of RA to the construction site

Thank you for your attention