

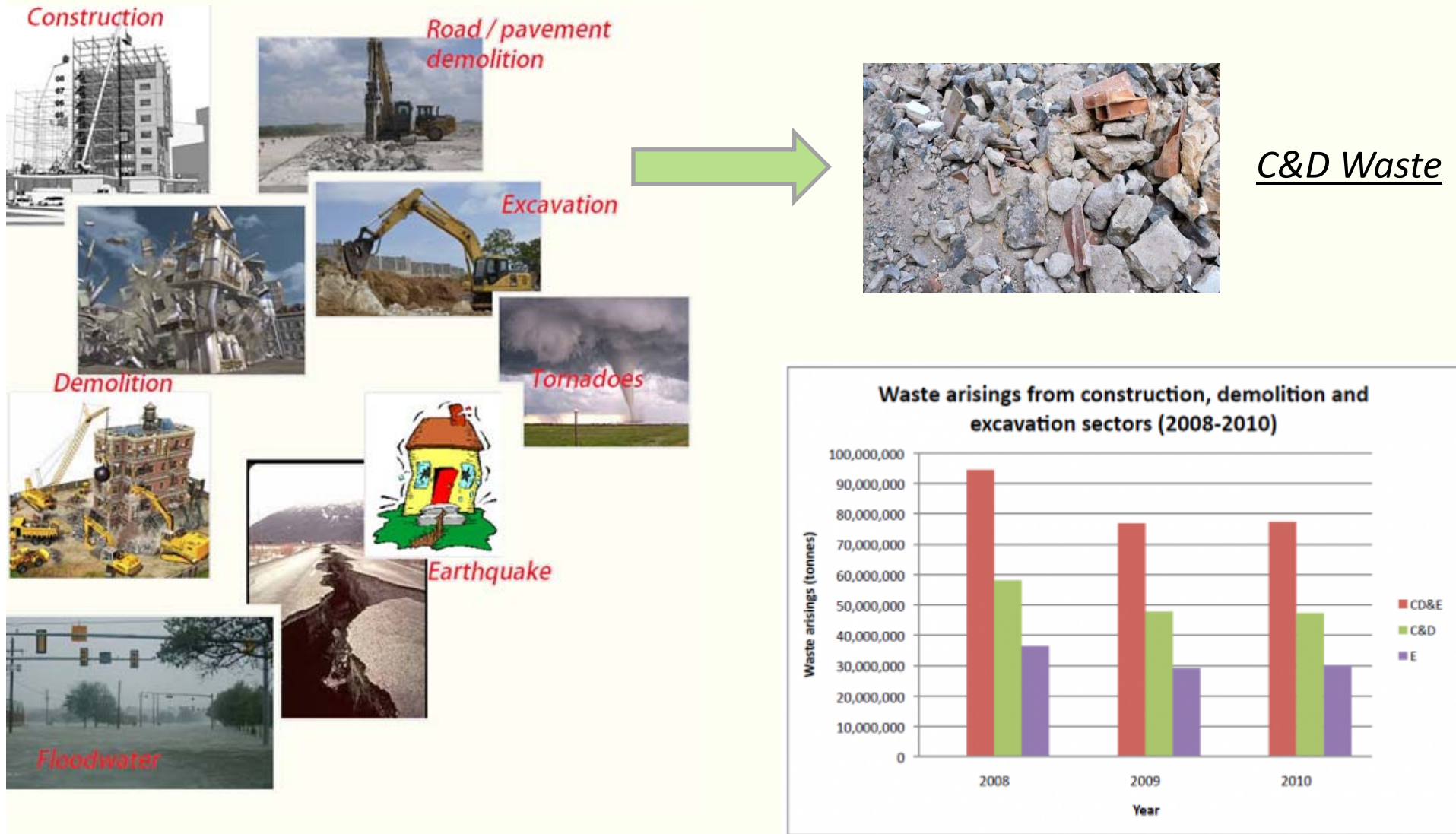


**6th International Conference
On
Sustainable Solid Waste
Management**

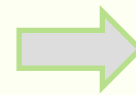
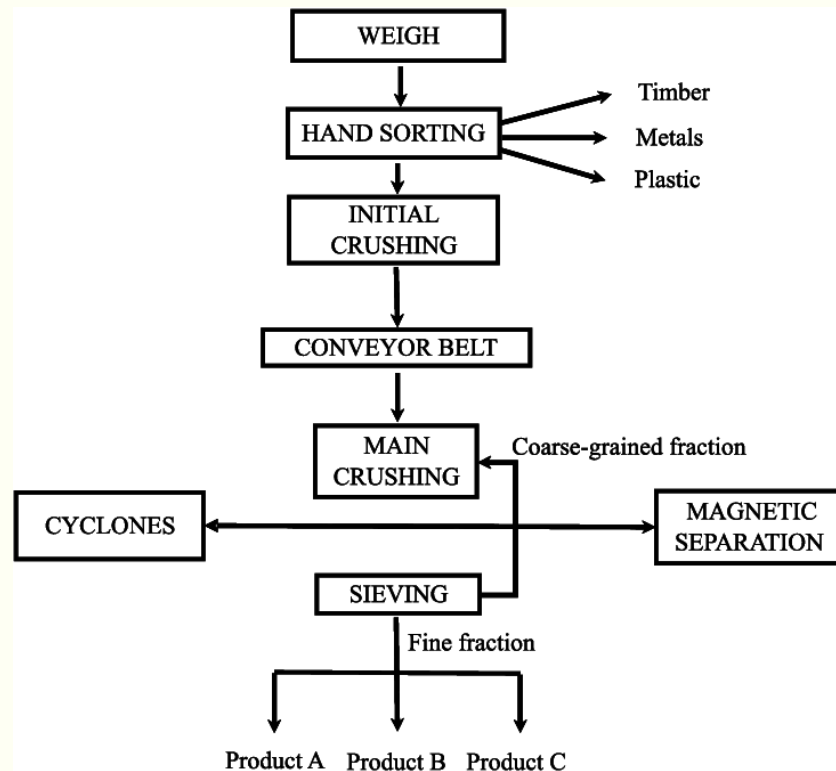
**Chloride Penetration and Strength
of
Recycled Aggregate Concrete**

Anna A. Tsoumani, PhD

Construction and Demolition (C&D) Waste (I)



Construction and Demolition (C&D) Waste (II)



recycled aggregates (RA)

production plant - mechanical sorting process



A. A. Tsoumani, N.-M. Barkoula, T.E. Matikas

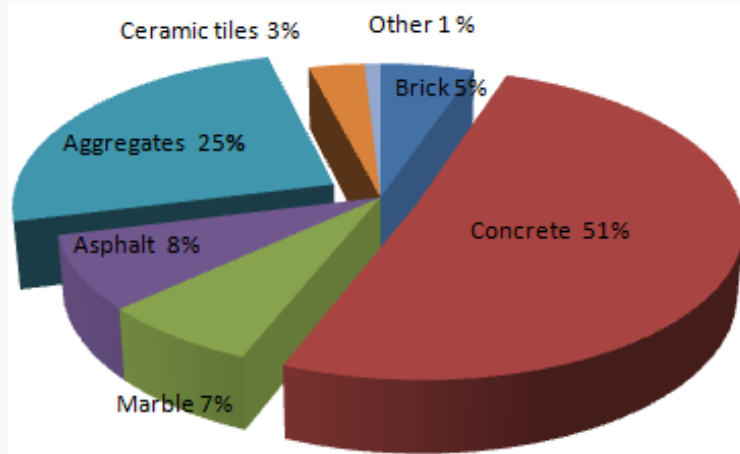
Concrete Mixtures

- ❖ C25/30 concrete quality
- ❖ concrete mixes designed using the absolute volume method (ACI 211.1)
- ❖ effective w/c ratio: 0.5

two concrete mixes: 0% RA – 100% RA

Mix	Replacement Percentage (%)	Cement	Water	Superplasticizer	Aggregate				
					Fine	Coarse			
						Natural	Recycled	Natural	Recycled
						nominal size (mm)			
						9,5	11	25	25
M1	0,0	280	178	1,70	931	293	-	675	-
M2	100,0	280	211	1,70	931	-	279	-	620

Recycled Aggregates



ONLY coarse recycled aggregates were used



Concrete properties

concrete mixer



steel moulds



slump test apparatus



vibration table



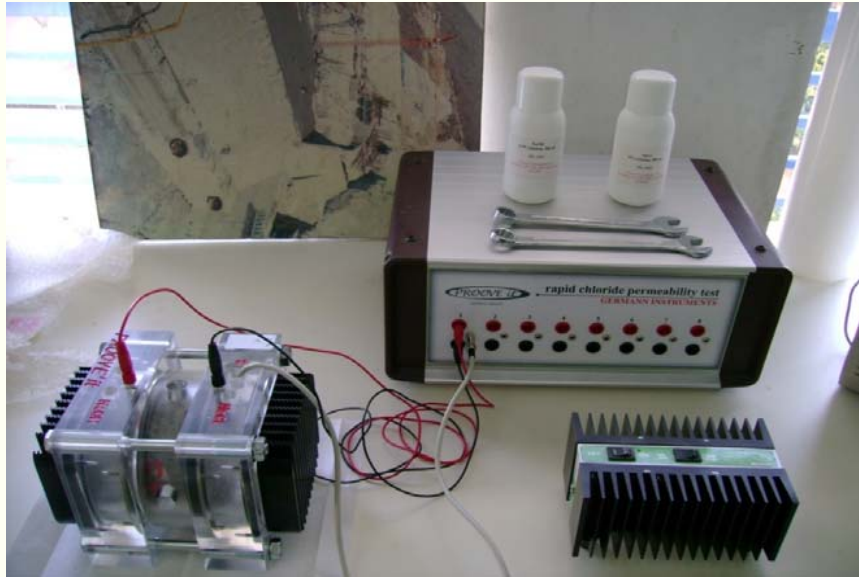
compression machine



compression test



Rapid Chloride Permeability Test



PROOVE'it© device

chloride permeability



test operation

Charge passed (Coulombs)	Chloride Permeability
>4000	High
2000 – 4000	Moderate
1000 – 2000	Low
100-1000	Very Low
<100	Negligible

Fresh concrete properties

Property	Substitution level	
	0%	100%
workability (cm)	8,0	7,7
air content (%)	1,9	2,1
density (Kg/m ³)	2420	2140
compressive strength 28 days (MPa)	45,0	33,0
electric charge passed (Cb)	3140	3810
chloride permeability	moderate	moderate

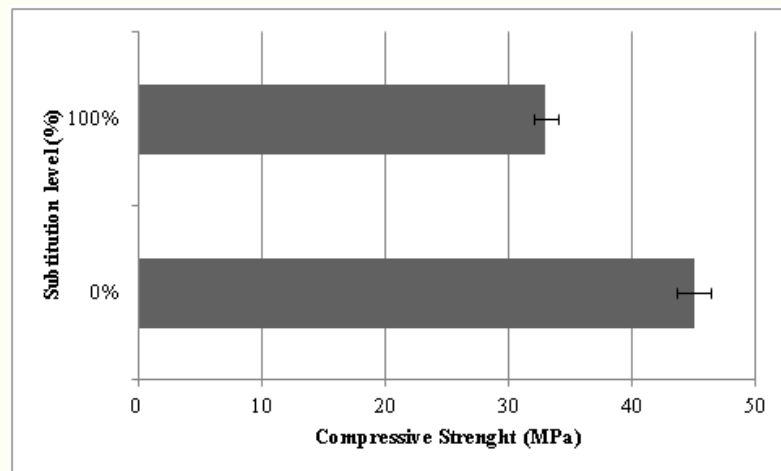
workability ↓

RA → air content ↑

density ↓

Compressive Strength

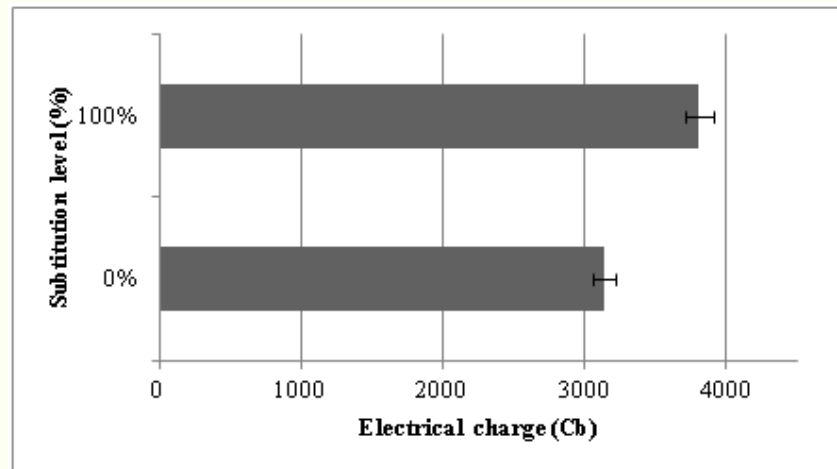
Property	Substitution level	
	0%	100%
workability (cm)	8,0	7,7
air content (%)	1,9	2,1
density (Kg/m ³)	2420	2140
compressive strength 28 days (MPa)	45,0	33,0
electric charge passed (Cb)	3140	3810
chloride permeability	moderate	moderate



25% reduction

Chloride Permeability

Property	Substitution level	
	0%	100%
workability (cm)	8,0	7,7
air content (%)	1,9	2,1
density (Kg/m ³)	2420	2140
compressive strength 28 days (MPa)	45,0	33,0
electric charge passed (Cb)	3140	3810
chloride permeability	moderate	moderate



20% increase

moderate permeability

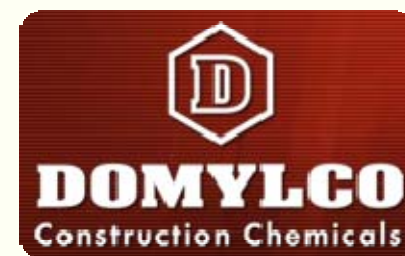
Conclusions

RA use :

- negligible effect on fresh concrete properties
- decrease on compressive strength
- increase on chloride permeability

Recycled aggregates obtained from the C&D waste sorting facility have potential to be used as concrete aggregates in producing C25/30 quality and moderate permeability concrete.

Acknowledgements





**6th International Conference
On
Sustainable Solid Waste
Management**

**Chloride Penetration and Strength
of
Recycled Aggregate Concrete**

Anna A. Tsoumani, PhD