

## **PETROCHEMICAL AND PETROPHYSICAL CHARACTERISATION OF CONSTRUCTION AND DEMOLITION INERT MATERIALS FOR THE PREPARATION OF CERAMIC MIXES AND CONCRETE**

ALICE TOFFANO

Dipartimento di Scienze della Terra, Università di Ferrara, Via Saragat 1, 44100 Ferrara

### INTRODUCTION

Building activity is currently demanding noticeable amounts of natural inert materials, such as gravel and sand, usually provided by natural sediments. The extraction of sediments can modify river-profiles and their equilibrium as well as quarrying activities could induce environmental problems.

The use of recycled aggregates is promoted by the EU which has provided guidelines for common strategies for a correct re-use of construction and demolition (C&D as proposed by Poon *et al.*, 2001) (DG ENV E. 3, 2000). As for the Italian situation, currently the legislation (D.L. 152/06, 2006) is encouraging the re-use of C&D inert materials but the re-utilisation of these materials is hampered by the scarcity of suitable plants for processing, as a result this resource is used as a lower quality materials for low grade application (*i.e.* road sub-base). In this study, different grain-size fractions, obtained by a grain-size sorting, from a C&D processing plant in Rovigo (NE Italy), were compared with other data (Bianchini *et al.*, 2005) and investigated through chemical and physical analyses (according to UNI EN 206-1, 2001). The results indicate that, through an opportune crushing and sorting operation for C&D material, it is possible to obtain grain-size fractions with roughly homogenous chemical and mineralogical composition on each fraction. The homogeneity of the materials can be considerably improved if a careful differentiation takes place during the initial stages of C&D production (Poon, 1997; Poon *et al.*, 2001).

### DISCUSSION

Fine recycled fractions were used in high grade application as starting materials for ceramic mixes prepared and tested in collaboration with CNR-IRTEC Faenza laboratories. Preliminary results, in fact had shown that there is a real possibility to use this materials for preparing suitable ceramic mixing.

Fine recycled fractions (TA1d e TA2d sands) were used for preparing 6 different mixes (two recycled sands plus two different kind of clay) compared with 3 mixes prepared using natural sand (Colombara) plus the same clays. Clays used (Sila, Mosso, Giomo) were selected on geographical basis, quarried not far from the Fenza Daniela plant (Table 1).

Were produced:

- 3 standard mixes (Colombara plus Sila, Mosso, Giomo respectively)
- 3 mixes (TA1 plus Sila, Mosso, Giomo respectively)
- 3 mixes (TA2 plus Sila, Mosso, Giomo respectively)

All the materials used were characterized in the CNR-IRTEC of Faenza laboratories and then were also characterized all the mixes produced.

Table 1 - Ceramic mixes prepared and tested in collaboration with CNR-IRTEC Faenza laboratories.

S0		STA1		STA2	
Sila clay	85%	Sila clay	85%	Sila clay	85%
Colombara	15%	TA1d	15%	TA2d	15%
M0		MTA1		MTA2	
Mosso clay	85%	Mosso clay	85%	Mosso clay	85%
Colombara	15%	TA1d	15%	TA2d	15%
G0		GTA1		GTA2	
Giomo clay	85%	Giomo clay	85%	Giomo clay	85%
Colombara	15%	TA1d	15%	TA2d	15%

The results have shown that using the recycled sands, produced for these experimental study, it is possible to prepare ceramics mixes for bricks with the very similar characteristic when compared with mixes produced with natural materials (Marsigli & Dondi, 1997; Dondi *et al.*, 1998a, 1998b, 1998c).

Recycled sand and a medium grade fraction (0-30 mm) were used for preparation of concrete mixes in collaboration with CTG-Italcementi Group laboratories. More in detail were investigated some fractions usually produced in the plant:

- recycled sand (TA1)
- recycled fraction 0-30 mm (TA2).

Chemical-mineralogical and physical analysis have shown that the material is roughly homogenous. The homogeneity of the materials can be considerably improved if a careful differentiation takes place during the initial stages of C&D production (Poon, 1997; Poon *et al.*, 2001). This aspect is relevant for the use of this materials in the preparation of concrete mixes. Several concrete mixes were prepared using different percentage of recycled aggregate and tested. The data obtained have shown, accordingly with Limbachiya *et al.* (2006) that the introduction of 30% of inert recycled coarse fraction, substituting the natural coarse aggregate, does not affect the concrete.

## REFERENCES

- Bianchini, G., Marrocchino, E., Vaccaro, C. (2005): Recycling of construction and demolition waste materials: a chemical-mineralogical appraisal. *Waste Manag.*, **25**, 149-159.
- D.L. 152/06 (2006): Decreto Legislativo 152/06: Norme in materia ambientale, parte IV.
- DG ENV E. 3 (2000): European Commission, Directorate - General Environment. Management of construction and demolition waste. Working document No. 1, 1-26.
- Limbachiya, M.C., Marrocchino, E., Koulouris, A. (2006): Chemical-mineralogical characterisation of coarse recycled concrete aggregate. *Waste Manag.*, **27**, 201-208.
- Dondi, M., Marsigli, M., Venturi, I. (1998a): Comportamento in cottura delle argille italiane per laterizi. *Ind. Laterizi*, **54**, 382-394.
- Dondi, M., Marsigli, M., Venturi, I. (1998b): Sensibilità all'essiccamento e caratteristiche porosimetriche delle italiane per laterizi. *Ceramurgia*, **28**, 1-8.
- Dondi, M., Marsigli, M., Venturi, I. (1998c): Technological requirements of raw materials for heavy clay products (1998c) Proc. 2<sup>nd</sup> Mediterranean Clay Meeting, Aveiro, 204-207.
- Marsigli, M. & Dondi, M. (1997): Plasticità delle argille italiane per laterizi e previsione del loro comportamento in foggatura. *Ind. Laterizi*, **46**, 214-222.

- Poon, C.S. (1997): Management and recycling of demolition waste in Hong Kong. *Waste Manag. Res.*, **15**, 561-572.
- Poon, C.S., Yu, A.T.W., Ng, L.H. (2001): On-site sorting of construction and demolition waste in Hong Kong. *Resources Conserv. Recycling*, **32**, 157-172.
- UNI-EN 206-1 (2001): Calcestruzzo-parte 1: specificazione, prestazione, produzione e conformità.