

SCI

CONCRETUS



31 MAY 10 • MICA (P) No. 186/09/2009

Vol 1 No 2

SINGAPORE CONCRETE INSTITUTE

SCI CONCRETUS • Vol 1 No 2

31 MAY 10 • MICA (P) No. 186/09/2009



SINGAPORE
CONCRETE
INSTITUTE

Samwoh Eco-Green Building - A Key Milestone Towards Sustainable Development



By Dr Ho Nyok Yong, Dr Kelvin Lee Yang Pin and Mr Lim Wee Fong
(contact : drho33@samwoh.com.sg)

Samwoh Corporation Pte Ltd (Samwoh) was founded in the early 1970s as a transport and logistics company. Over the years, Samwoh has morphed into a leading integrated construction company and green construction materials supplier. In an effort to meet the stringent demands of the construction market of today, the company has invested in relevant leading-edge technologies and focused on research and development of green products in the past years. To be in line with the government's directive towards sustainable development, Samwoh has also invested heavily on recycling facilities to process construction and demolition waste, asphalt pavement waste and other industrial by-products for re-utilization in the construction industry. One of the recent developments is the Samwoh Eco-Green Park.

Samwoh Eco-Green Building

Samwoh Eco-Green Building has marked a significant milestone in sustainable development in Singapore. It is part of the Samwoh Eco-Green Park that was officially opened on 22 March 2010 by Ms. Grace Fu, Senior Minister of State for National Development and Education. The park is opened to the public for education purposes. It comprises three green premises which were constructed after extensive research and development works, namely:

- Samwoh Eco-Green Building - the first building in this region to be constructed using concrete with up to 100% of recycled concrete aggregate (RCA) derived

from construction and demolition waste;

- Asphalt recycling plant - which employs state-of-the-art technology to recycle asphalt pavement waste; and
- Ready mixed concrete plant - which is equipped with recycling capabilities to produce eco-concrete that contains recycled materials and to recycle fresh waste concrete into aggregate and sand.



Samwoh Eco-Green Park



Samwoh C&D Waste Recycling Plant

Close-up view of RCA

Research Project

Samwoh Eco-Green Building was constructed as part of a research project which is partially funded by the MND (Ministry of National Development of Singapore) research grant. The project was undertaken by Samwoh, Building and Construction Authority (BCA) and Nanyang Technological University (NTU). The objective of this project is to evaluate the feasibility of using recycled concrete aggregate (RCA), produced from construction and demolition waste, in structural concrete. The study involves two stages:

Stage 1 – Extensive laboratory evaluation of the performance of concrete with RCA

Stage 2 – Construction and structural monitoring of a three-storey building constructed using concrete containing RCA

About two million tonnes of construction and demolition (C&D) waste is produced annually in Singapore. The disposal of the waste posed a major environmental problem due to limited land space. The C&D waste can be properly processed to produce RCA. The RCA used in this building was produced from the company's own recycling plant located at Sarimbun Recycling Park. The process includes crushing, removal of ferrous metals and foreign materials such as bricks, wood and plastics as well as screening into different particle sizes. The detailed description of the production process of RCA is given in Ho et al. (2008).

Quality tests were carried out on the RCA to ensure that it is compliant with SS EN 12620 in accordance with BCA requirements so as to safeguard the quality of final products. Some of the tests include water absorption, flakiness index, Los Angeles abrasion test,

impurities content, sulphate content, chloride content, petrographic test etc.

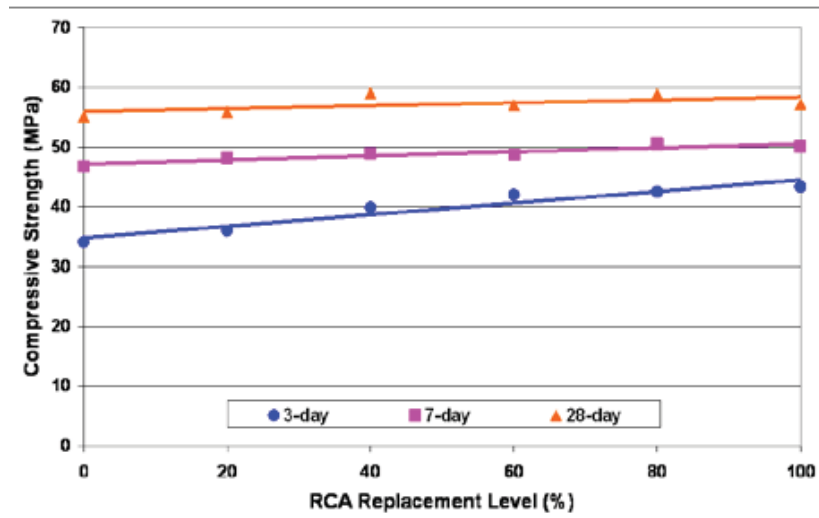
Stage 1 of the project also includes an in-depth study of the engineering properties of RCA and the concrete containing RCA. A rational mix design method is used for designing concrete in this study as proposed by Ho et al. (2009). The method is able to evaluate the effects of RCA on the properties of hardened concrete.

The test results have shown that the compressive strength of concrete with RCA were comparable to that of concrete with granite. Other engineering properties also showed good performance. Hence it is feasible to produce concrete with up to 100% RCA using the proposed rational method of mix design.

Various concrete grades from Grade 20 to 60 with RCA contents ranging from 0% to 100% (by mass of coarse aggregate) were studied. The analysis was carried out with respect to a series of mechanical and durability tests which include:

Compressive strength	Creep	Initial surface absorption
Elastic modulus	Drying shrinkage	Sulphate attack
Flexural strength	Chloride ingress	Water permeability
Indirect tensile strength	Drying & wetting test	Water absorption

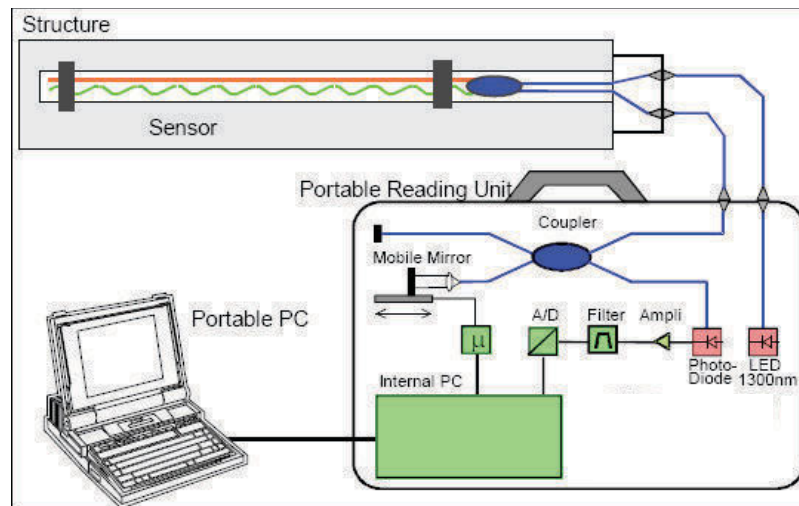
Based on the laboratory study, Grade 40 concrete with up to 100% RCA (herein-after known as RCA concrete) was used to construct the building in Stage 2 of the project. The building comprises three storeys. The RCA concrete was used for the construction of all the structural members of the building which include the beams, columns, slabs and walls. To provide an analysis of the in-situ performance of the RCA concrete, fibre-optic sensors were embedded in the columns to provide real time monitoring of the building. The sensors measure the deformation of the columns which can be used to analyse the structural behaviour of the building. The data gathered from this maiden research will help BCA to update the building code requirements to allow the use of RCA in all buildings.



Test results for concrete with various RCA contents (Ho et al., 2009)

Conclusion

The Samwoh Eco-Green Building has demonstrated the feasibility of using concrete with RCA in structural concrete. The results obtained from the study can be used to expand the existing building codes to include the use of RCA in buildings. With this showcase, it is hopeful that RCA can be used in future structural buildings which will reduce our dependence on natural aggregate and thereby, contribute towards our nation’s goal to achieve sustainable development.



Structural Health Monitoring System



Some research & development works being carried out

References

a) Ho N. Y., Lee Y. P. K., and Tan J. Y. “Beneficial Use of Recycled Concrete Aggregate for Road Construction in Singapore”. 6th International Conference on Road and Airfield Pavement Technology, Sapporo, Japan. 20 to 23 July 2008.

b) Ho N. Y., Lee Y. P. K., Lim W. F., Ting S. K., Soh Y. and Low G. L. “Efficient Utilization of Recycled Concrete Aggregate for Structural Concrete Applications”. 27th Conference of the ASEAN Federation of Engineering Organisations, Singapore. 30 Nov to 2 Dec 2009.

Samwoh is proud to receive BCA Green Mark Platinum Award 2010

Samwoh Eco-Green Park

Located at 51 Kranji Crescent Singapore 728661



SAMWOH

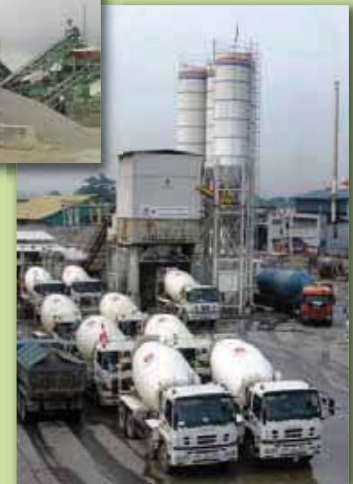
Founded in 1975, Samwoh Corporation is a leading integrated construction company. For years, the company has been investing heavily in Green business, which is inline with the government's directive towards sustainable construction.

The company's latest development is Samwoh Eco-Green Park, which consists of 3 green premises :

1. Samwoh Eco-Green building is the first in this region to be constructed using concrete with up to 100% of recycled concrete aggregate after extensive research. The building is used to house the new Samwoh R&D Centre.
2. Asphalt recycling plant which employs state-of-the-art technology to recycle asphalt pavement waste.
3. Ready mixed concrete plant which is equipped with recycling capability to produce Eco-concrete that contains recycled materials.

The park was officially opened by Guest-of-honor, Ms Grace Fu, Senior Minister of State for National Development and Education on 22 March 2010.

The successful completion of Samwoh Eco-Green Park showcases a breakthrough in construction technology that will pave the way towards greater sustainability and environmental consciousness in construction projects.



Samwoh Group Specializes in :

- ❖ Supply of Ready-Mixed Concrete & Eco-Concrete
- ❖ Civil Engineering & Infrastructure Construction
- ❖ Quarrying & Supply of Building Materials
- ❖ Blasting Services
- ❖ Recycling of Construction Wastes
- ❖ Machineries Trading & Rental Services
- ❖ Supply of Sea Sand
- ❖ Supply & Laying of Asphalt Premix
- ❖ Precast Concrete Components
- ❖ Specialised Construction Products
- ❖ Concrete Imprint Systems
- ❖ Transportation & Logistics Services
- ❖ R&D and Consultancy Services

三和私人有限公司 Samwoh Corporation Pte Ltd

Headquarters : 25E Sungei Kadut Street 1 Singapore 729333
Tel : 65-6269 7288 Fax : 65-6368 2886
Email : info@samwoh.com.sg Web : www.samwoh.com

