

Structural Lightweight Concrete

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*Developing Innovative Precast Systems, including
Application of Structural Lightweight Aggregate and
Rapid Hardening PFA concrete, for Economic Production*

Housing Authority Research Fund 2003

Research on Material Properties

- ❖ Study based on Lightweight Expanded Clay Aggregates (LECA)
- ❖ Carried out **60 trials mixes** with combinations of water/cement ratio, cement content and PFA content.

Main testing items included:

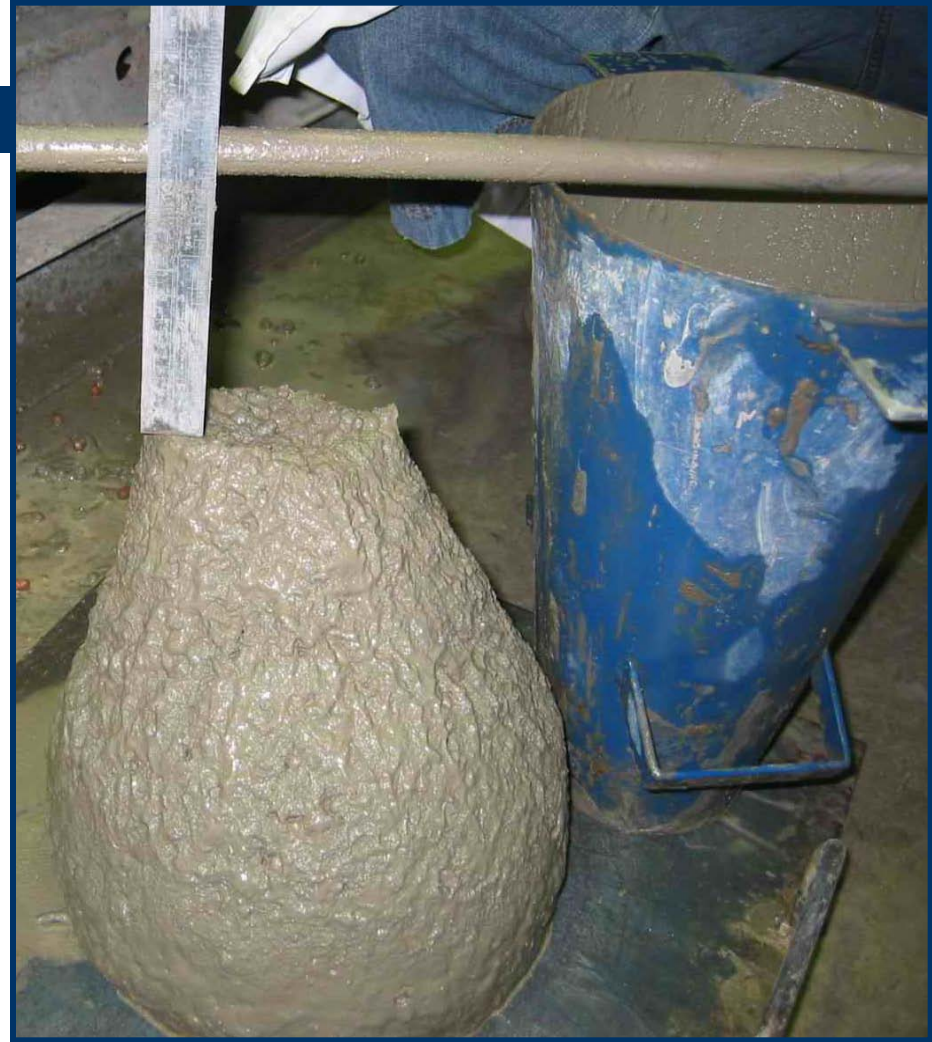
- Workability [slump]
- Density & Compressive Strength
- Static Elastic Modulus
- Shrinkage
- Water Permeability
- Bond Strength



Workability of lightweight concrete mix



Fresh Lightweight Concrete



Research on Material Properties

- **Finalized Grade 30 and Grade 35 concrete mixes according to the strength results.**
- **Conducted prototype design, laboratory testing and full scale trial for design verification and modification.**

Mid-span deflection under serviceability load



LWC Composite slab (6.4m x 4m)





Materials Properties

- Comparable strength
- Shrinkage of the LWAC is about 33% higher than that of NWC.
- Elastic modulus of the LWAC is about 20% lower than that of NWC.
- Bonding strength and water permeability slightly lower but not significant.

Concluded

- Structural lightweight aggregate concrete can be used in precast structures such as staircases, slabs, facades and water tanks

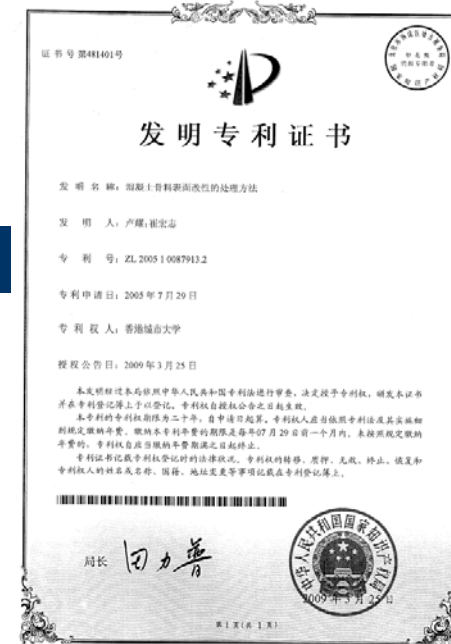
Works Forward

Both lightweight aggregate and recycled aggregate are high absorption aggregates that requires pre-wetting before concrete mixing. Compare with the normal aggregate, 30 minutes water absorption of the recycled aggregate ranged between 7%~15%; while for lightweight aggregate, it can be as high as 8%~20%.

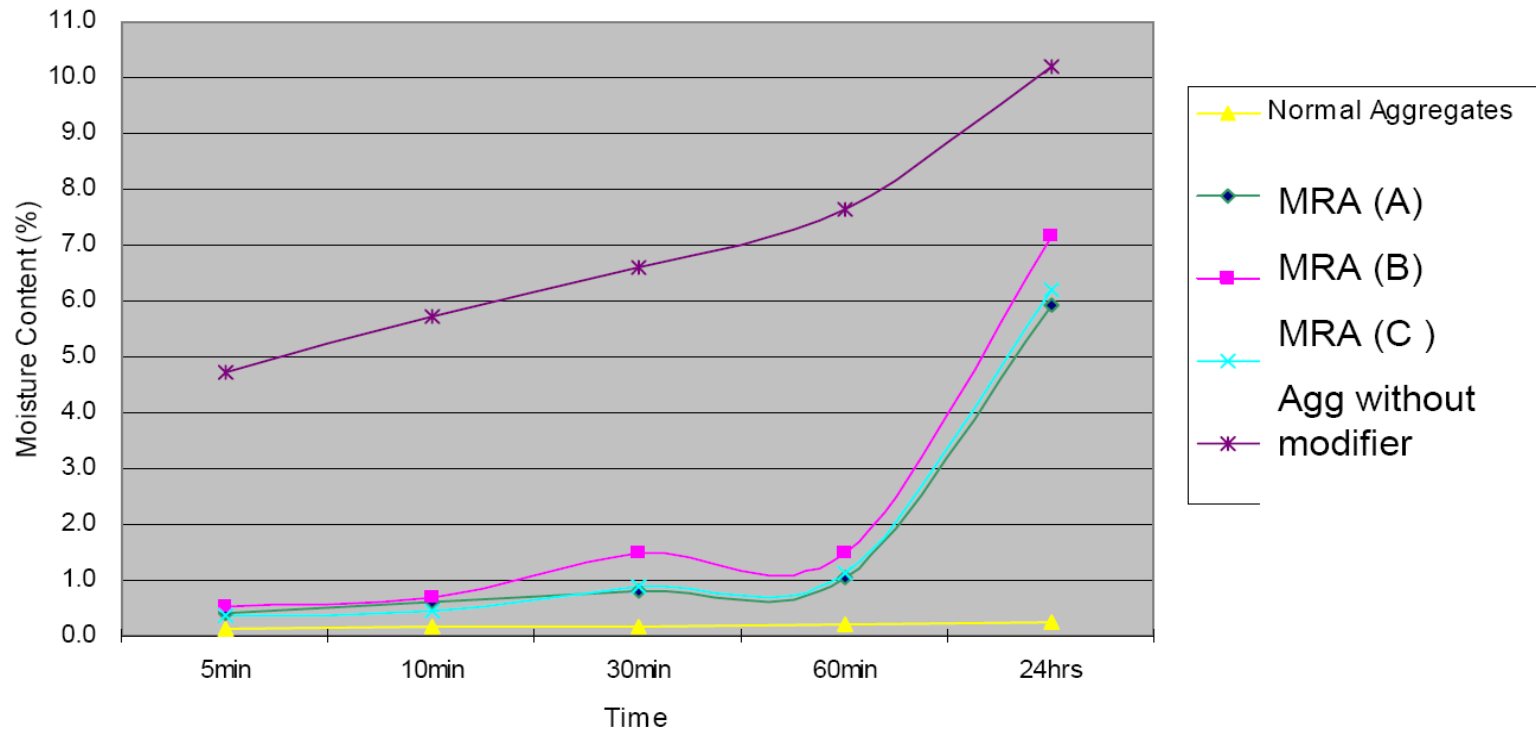
2 Patents in 2009 [Dr Tommy Lo/Dr Cui H Z]

Surface Absorption Modifier for High Water Absorption Aggregates

Application Process of Surface Absorption Modifier for Aggregates with High Water Absorption



Water Absorption of three kinds of lightweight aggregates



The surface absorption modifier when applied to the aggregate will form a protective coating on surface of the aggregates which will prevent the water from being absorbed into the aggregate but maintaining a reasonable bonding.

The modifier is particular useful to control the water absorption of lightweight aggregate with a porous surface and for the recycled aggregate with cement paste content, to a level suitable for concrete production similar to the normal aggregate.

Look Forwards

- Composite slab construction to reduce weight
- Concrete repair of old buildings
- Green buildings and resident comfort [noise and temperature]

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