Simulation of the flow of self-compacting concrete in the L-box using smooth particle hydrodynamics (SPH) method

Muna M Al-Rubaye\*, Bhushan L Karihaloo and Sivakumar Kulasegaram

School of Engineering, Cardiff University

[\*AL-RubayeMM@Cardiff.ac.uk](mailto:*AL-RubayeMM@Cardiff.ac.uk)

Self-compacting concrete (SCC) has been widely used in structures around the world because of its ability of flow without external intervention. The ability of passing around and between obstacles and the filling of the formwork are important properties of SCC; they determine how well the SCC mix can flow through confined and limited zones. For this reason, it is essential to devise numerical tools aimed at the simulation of how SCC fills formwork as a homogeneous mass without the segregation of mix components. The present paper reports numerical investigation of the flow of SCC in the L-box using the three-dimensional Lagrangian particle based smooth particle hydrodynamics (SPH) method. This numerical simulation treats an SCC mix as a non-Newtonian incompressible fluid whose rheology is best described by a Bingham-type model, which contains two material properties: the yield stress and the plastic viscosity η.

There are two aims of this modelling simulation; the first is to investigate the effect of the inevitable delay in the lifting of the L-box manually gate on the flow times. The second aim is to reveal the distribution of coarse aggregate particles larger than or equal to 8 mm in the mix and to compare it with the distribution of the aggregate particles of the corresponding sizes in the cut sections of the L-box test specimens after they have been cured. For this purpose, the large coarse aggregate particles in the size ranges (8 ≤ g < 12, 12 ≤ g <16, 16 ≤ g < 20 and g ≥ 20 mm) of the test SCC mixes were colour coded with non-toxic non-water soluble paints so that the outlines of the aggregate particles would be clearly visible in the cut sections of the L-box test specimen and compared with the numerical simulations. The results will be shown during the presentation.

***Keywords:*** *Self-compacting concrete (SCC); Smooth particle hydrodynamics (SPH); yield stress; plastic viscosity (η) and L-box*.