Experimental Insight on Flow Induced Particle Migration During Concrete Pumping

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The pumpability of concrete is dominated by the formed lubrication layer during pumping, but the independent influences of shear induced particle migration as well as the wall effects on the lubrication layer are far from well-understood. The X-ray CT techniques is applied to estimate particle migration during pumping. The distribution of coarse aggregates in pipeline is reconstructed with high accuracy. And the randomly packing model of these aggregates is simulated by a voxel-based method. By comparing the particle distribution of aggregates before and after pumping, the extent of shear and wall effect induced particle migration is determined independently for the first time. The physical lubrication layer is also identified from the CT slices. The wall effect is found to plays a major role on the formation of lubrication layer. While the shear induced particle migration depends on the rheology of concrete, which is not significant in concrete with low flowability. Despite the lack of shear induced bulk particle migration, the lubrication layer can also form under wall effect.