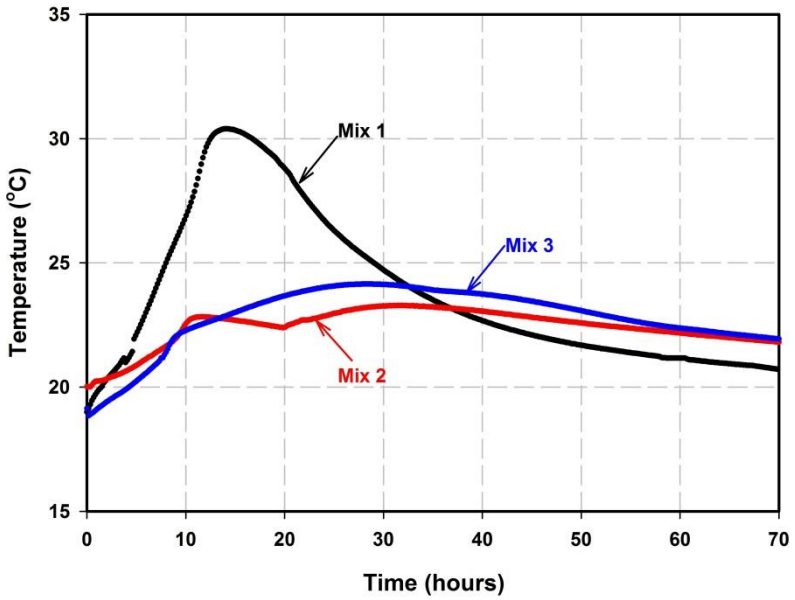
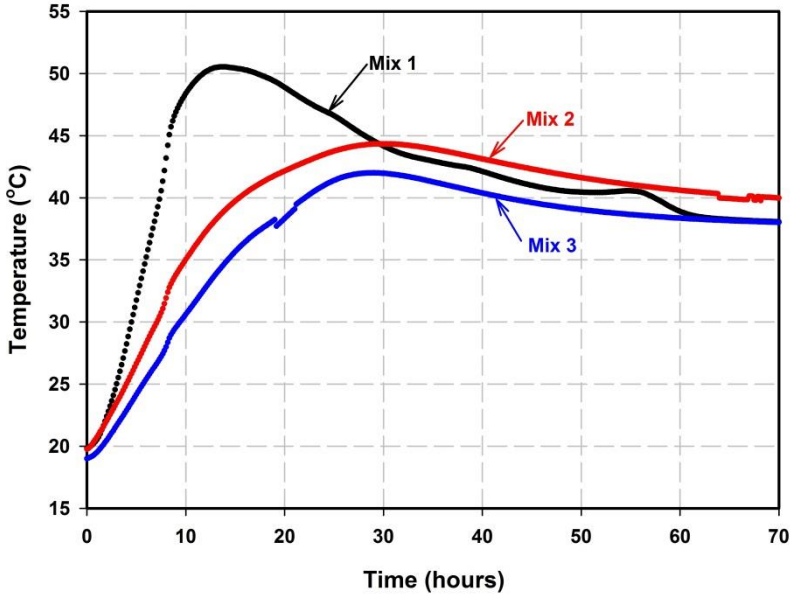


(a) 20°C curing temperature



(b) 38°C curing temperature

Figure 3: Temperature in the centre of slab specimens

Table 5: T1 values in the core of 300mm slab specimens

	T1 (°C)	
	20°C curing temperature	38°C curing temperature
Mix 1: 100% CEM I	10.4	12.5
Mix 2: 50% GGBS	3.3	6.3
Mix 3: 70% GGBS	4.1	4.0

Partial replacement of CEM I with GGBS has a detrimental effect on the early-age strength of concrete under a standard curing temperature of 20°C. The 3-day compressive strengths of GGBS concrete mixes, i.e. Mix 2 and 3, were lower than that of Concrete Mix 1, **Figure 4**. This detrimental effect was found to be less significant at a higher curing temperature. The average 3-day compressive strength of Mix 2 was 24.0N/mm^2 which was very similar to that of Mix 1, 24.9N/mm^2, at 38°C curing temperature.

A high curing temperature however has a detrimental effect on the 28-day strength of concrete. The average 28-day compressive strengths of Mix 1 reduced from 46.4N/mm^2 to 42.2N/mm^2 when the curing temperature was increased from 20°C to 38°C, **Figure 4**. This detrimental effect however became less significant when 50% CEM I was replaced with GGBS. This indicates the strength of GGBS concrete was less adversely affected by the high temperature curing compared to CEM I mixes and this finding agrees with Barnett (Barnett et al., 2006) and Wang (Wang et al., 2012).

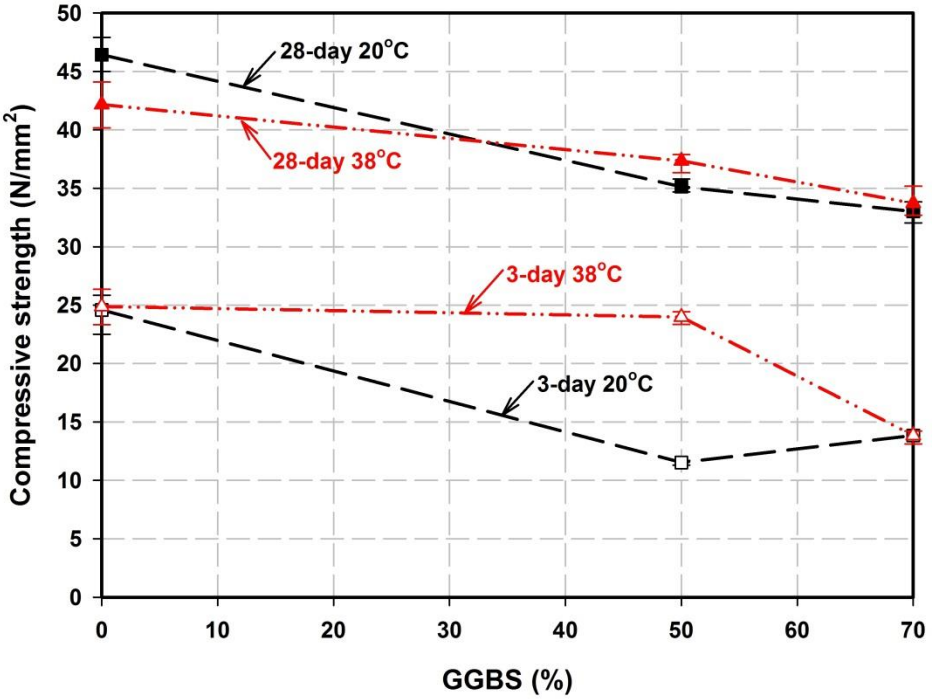


Figure 4: Compressive strengths at 3 and 28 days

4. CONCLUSIONS

Partial replacement of CEM I with GGBS contributes to a reduction in the peak hydration temperature. This has a beneficial effect on hot weather concreting. GGBS concrete has a lower early-age strength compared to CEM I concrete and this may cause a premature tension failure in long-span concrete structures. On the other hand,

early-age strength of GGBS concrete is improved by high curing temperatures. More GGBS concrete mixes will be conducted to identify an 'optimum' replacement level which will balance these factors. A case study investigation will also be conducted to investigate the potential economic benefit through using GGBS in high value markets such as the replacement of cement in long-span concrete structures to reduce the requirement for thermal crack control reinforcement.

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