Guidelines for Concreting in Hot Weather

BACKGROUND

- Hot weather conditions occur infrequently in Ireland.
- Hot weather conditions are usually caused by a combination of factors (some or all) including high ambient temperature, high solar radiation, low relative humidity and high wind velocity.
- However infrequent, hot weather conditions can impact on concrete, both in the fresh and hardened state.
- Hot weather conditions cause an increase in fresh concrete temperatures, resulting in more rapid hydration leading to lower workability and accelerated hardening.
- Plastic shrinkage cracks and crazing can be caused by rapid evaporation of moisture from exposed surfaces in hot weather leading to an increase in permeability.
- Concrete cured at temperatures significantly exceeding 20°C will develop higher early strengths, compared to standard cured concrete. Later-age strength gain is likely to be reduced compared to that of similar mixes cured at standard temperature.
- Higher temperatures tend to accelerate slump loss and can affect entrained air levels.
- In hot weather fresh concrete can have a shorter working life which causes difficulties in transport, placing and finishing. Concrete placed under high temperatures will set quicker and can, therefore require more rapid finishing.

TEMPERATURE

- Two different temperatures need to be considered when working with concrete in hot weather; i.e. that of the ambient air temperature and the concrete itself.

1. **Air Temperature**
   - Ambient temperatures up to about 20°C should not, on their own, cause significant problems, especially in damp or humid conditions.
   - Ambient temperatures of 20°C and above, allied to low humidity and drying winds, require more efficient curing regimes.
   - Thermal shock may result from rapid drops in the temperature of exposed concrete surfaces e.g. when concrete is placed on a hot day followed by a cool night.

2. **Concrete Temperature**
   - I.S. EN206 requires that the temperature of concrete on delivery shall not be more than 30°C. Concrete temperature at placing is generally considered to be in the order of 5°C above mean ambient temperature (Ref. CIRIA C660).
   - In large elements (or rich mixes), faster hydration of cementitious materials due to high ambient temperatures, can result in higher maximum concrete temperatures, leading to a greater risk of early-age thermal cracking on cooling.

CONCRETE MIX CONSIDERATIONS

- It is possible to slow down the hardening process and strength development of concrete as follows:

(a) Aggregates may be shaded or sprayed to reduce their temperature.
(b) Cooler water may be used in production to keep the temperature of the concrete down. For example, water direct from source may be cooler than water stored in tanks.
(c) The temperature of delivered cement should be kept as low as possible.
(d) Where possible mix concrete early in the morning or late in the evening to avoid maximum daytime temperatures.
(e) The use of a "water reducing and set retarding" admixture could be considered (technical advice should be sought)
(f) Cool truck mixers with water and reduce mixing time to a minimum.
(g) Concrete with a higher slump class may be needed to counteract greater slump loss in hot conditions (technical advice should be sought).
(h) Use additions in the mix by agreement with the specifier.

PLACING AND CURING

- Delays in transport should be minimised.
- Concrete should be placed, compacted and finished as soon as possible.
- Concrete slabs can be shaded from solar gain and drying winds by the use of special mats, curing membranes or sheets.
- The addition of water to the fresh concrete, to retain its workability, is not advised, due to the negative effects on strength and durability .
- Match delivery volumes and rates of delivery to resources for placing and finishing in hot weather.
- Dry and/or hot absorbent surfaces should be moistened sufficiently, before placing concrete in contact with them. Existing concrete surfaces, against which concrete is to be placed, should be clean, free of dust and also moistened sufficiently.
- Concrete made with a high or fine sand content may require additional measures to be taken, as the water demand may be increased.

TESTING

- Cubes should be stored indoors in moist conditions and at temperatures of 20°C±5°C for moulded specimens and thereafter in a curing tank at 20°C±2°C for demoulded specimens as per standard.
- It is advisable to use temperature matched curing / maturity calculations, to accurately determine the development of in-situ strength in critical structural elements (in addition to standard cube testing)

DISCLAIMER

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