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TIP NO. 11

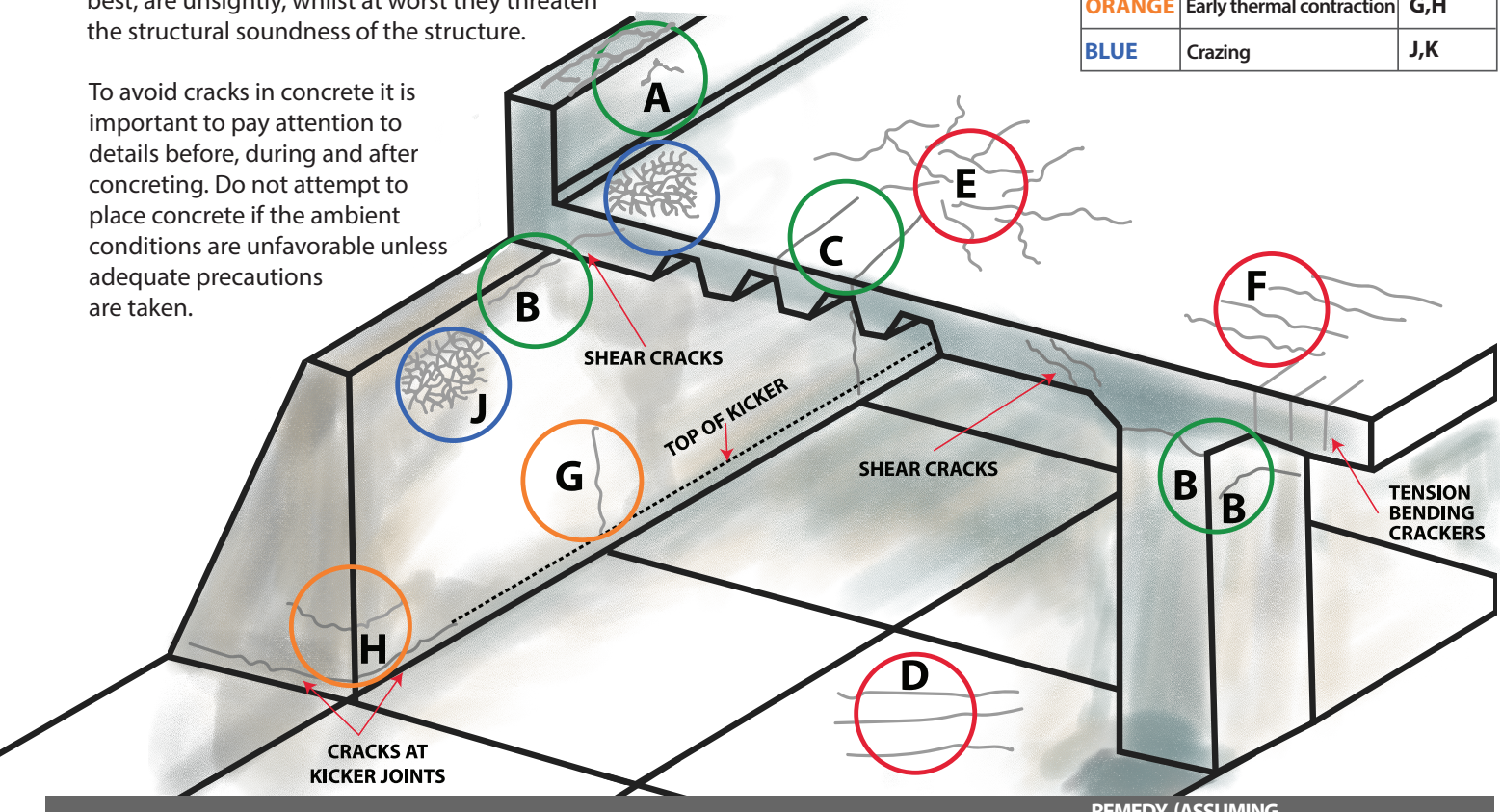
Quantum Readymix Concrete

TYPES OF CRACKS IN CONCRETE

Cracks reveal themselves in many forms and at best, are unsightly, whilst at worst they threaten the structural soundness of the structure.

To avoid cracks in concrete it is important to pay attention to details before, during and after concreting. Do not attempt to place concrete if the ambient conditions are unfavorable unless adequate precautions are taken.

COLOUR CODING	TYPE	LETTER
GREEN	Plastic settlement cracks	A,B,C
RED	Plastic shrinkage cracks	D,E,F
ORANGE	Early thermal contraction	G,H
BLUE	Crazing	J,K



TYPE OF CRACKING	LETTER (SEE FIGURE 2)	SUBDIVISION	MOST COMMON LOCATION	PRIMARY CAUSE (EXCLUDING RESTRAINT)	SECONDARY CAUSES/ FACTORS	REMEDY (ASSUMING BASIC REDESIGN IS IMPOSSIBLE) IN ALL CASES REDUCE RESTRAINT	TIME OF APPEARANCE
PLASTIC SETTLEMENT	A	OVER REINFORCEMENT	DEEP SECTION	EXCESS BLEEDING	RAPID EARLY DRYING CONDITIONS	REDUCE BLEEDING (AIR ENTRAINMENT OR RE-VIBRATE)	TEN MINUTES TO THREE HOURS
	B	ARCHING	TOP OF COLUMNS				
	C	CHANGE OF DEPTH	TROUGH AND WAFFLE SLABS				
PLASTIC SHRINKAGE	D	DIAGONAL	RCADS AND SLABS	RAPID EARLY DYING	LOW RATE OF BLEEDING	IMPROVE EARLY CURING	THIRTY MINUTES TO SIX HOURS
	E	RANDOM	REINFORCED CONCRETE SLABS				
	F	OVER REINFORCEMENT	REINFORCED CONCRETE SLABS	DITTO PLUS STEEL NEAR SURFACE			
EARLY THERMAL CONTRACT-ION	G	EXTERNAL RESTRAINT	THICK WALLS	EXCESS HEAT GENERATION	RAPID COOLING	REDUCE HEAT AND/ OR INSULATE	ONE DAY TO TWO OR THREE WEEKS
	H	INTERNAL RESTRAINT	THICK SLABS	EXCESS TEMPERATURE GRADIENTS			
CRAZING	J	AGAINST FORMWORK	FAIR FACED CONCRETE	IMPERMEABLE FORMWORK	RICH MIXES POOR CURING	IMPROVE CURING AND FINISHING	ONE TO SEVEN DAYS. SOMETIMES MUCH LATER
	K	FLOATED CONCRETE	SLABS	OVER TROWELLING			

AIR TEMPERATURE

Air has low heat capacity and, if still, conducts heat poorly. Nevertheless, its ability to take up water vapour increases with its temperature.

A high air temperature can thus increase the rate at which water evaporates from concrete, whether during mixing, transporting, placing or hardening. For example, if air and concrete are at 20°C, the rate of water loss from the concrete by evaporation is twice that which would result if both were at 10°C.

WINDSPEED

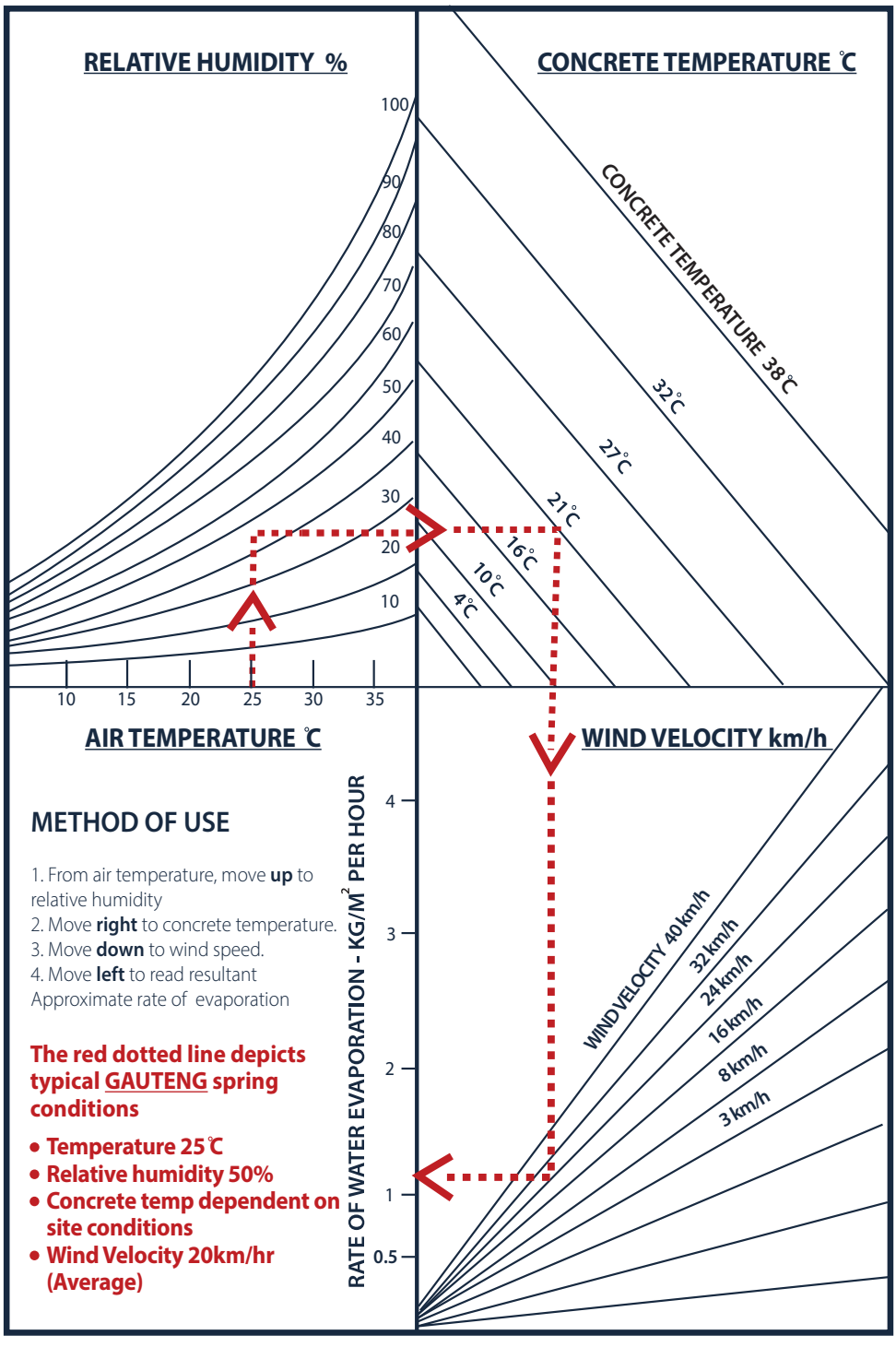
The rate of air movement is probably the factor which does most to create the difficulties associated with concreting in drying weather. Although still air is readily saturated with water vapour, the lightest of breezes provides a constantly renewed supply of air into which water can evaporate from unprotected concrete. Thus, in a breeze of 15km/h, water evaporates at about four times the rate in still air. In a wind of 40km/h, the rate is increased to nine times that in still air.

HUMIDITY

Whilst low humidity may help to prolong the life of cement in store, it has no beneficial effect upon any other aspect of concreting. A decrease in relative humidity from 90% to 50% without change in any other weather condition, will increase five fold the rate of evaporation of water from unprotected concrete - whether this be in the mixer, in transit or in place.

NANOGRAM TO DETERMINE THE EVAPORATION RATE OF CONCRETE SURFACE WATER

Combined influences of air and concrete temperatures, relative humidity and wind speed upon evaporation of water from free concrete surface. (Adapted from ACI Manual of concrete practice.)



Evaporation rates greater than 0.5km/hr are likely to necessitate precautions against premature drying.