Ans → The strength development of concrete depends on both time and temperature. It can be said that strength if the function of summation of product of time and temperature of concrete. This summation is called Maturity of Concrete. Given as

$$M = \Sigma (T - T_0) \times \text{times } (t)$$

Here, M is the Maturity measure in °C hr or °C days.

T_0 is the datum temperature. It has been exp found that hydration of concrete continously takes place up to -11°C. Therefore, $T_0 = -11°C$.

If we know the strength of concrete when it is fully mature, then strength of concrete at any other known maturity can be calculated using the Plowman equation as given $S = A + B \log \frac{M}{1000}$

where, A and B are constant.

S is the percentage of Strength of concrete of full maturity.

PTO

Calculation:

$A = 32$, $B = 54$ (Given)

It is assumed that day time has 12 hrs & night time also 12 hrs

Maturity of Concrete at 7 days, $M = 7 \times 12 (20 - (-11)) + 7 \times 12 (10 - (-11))$

$M = 4368^{\circ}Ch$

percentage of strength of fully matured concrete achieved by concrete at age of 7 days,

$S = 32 + 54 \times \log (4368/1000)$

$S = 66.56\%$.

∴ Strength of concrete at 7 Days is 66.56% of the strength corresponding to fully matured concrete i.e. Strength $= 0.6656 \times 40 = 26.62$ MPa