CHAPTER – 3

SCOPE OF THE PRESENT INVESTIGATION

3.1 SCOPE OF THE WORK

Cement mortar mixing water is generally required to comply with British Standards (BS 3148-1980)[15], ASTM Standards[11] or with the Indian Standards(IS 456-2000)[32]. The standards specified for various aspects of water do not represent the true picture of their impact on strength development of cement mortar. Moreover, the standards specified in IS 456-2000 are stringent in nature with regard to alkalinity. Most ground water that are available in the world and particularly in India possess more alkalinity than that specified by the standard codes. In addition to that, review of literature suggests that very limited work relating to the effect of impurities involving different sulphate chemicals or salts that may exist in water.

The present study is regarding various water quality parameters which influences the parameters like hardening, strength development of cement mortar. The chemical substances like sodium sulphate, magnesium sulphate, calcium sulphate, ammonium and ferrous sulphate are considered with different concentrations in the present investigation on compressive strength and various durability studies.

Cement Mortar is the factor considered which are likely to be influenced by the individual compounds with varying concentrations present in water. These include various chemical substances categorized like Sulphates Na$_2$SO$_4$, MgSO$_4$, FeSO$_4$, CaSO$_4$. The higher limit of concentration of an individual substance was arrived at based on its existence in both surface and ground water. The compressive strength test results are compared with the specimens cast with neural water. The effects of individual chemicals at various concentrations can be studied only when the test samples are compared with the control sample of the deionised water. Comparison becomes difficult, if the control samples are made with local water as the properties varies depending on the place and time. Results are interpreted with the standards specified by IS 456-2000, current knowledge and literature available.

The sulfate chemical substances present in ground water and surface water vary in concentrations in tropical and subtropical water bodies. The various sulfate
chemical substances present in water such as calcium sulphate, magnesium sulphate, sodium sulphate, ammonium sulphate and iron sulphate are generally grouped and classified into (i) individual sulphates (ii) Double sulphates combinations (iii) Triple sulphate combinations (iv) Four sulphate combinations and (v) Five sulphate combinations. These said sulphate chemicals are considered in the present investigation for the assessment of influence on setting times of fly ash blended cements, compressive strength and chloride ion permeability of blended cement mortars.

Setting times of cements, compressive strength and permeability of Fly ash Blended Cement Mortar (FBCM) are the factors considered which are likely to be influenced by the individual compounds with varying concentrations present in water. These include various sulphate chemical substances categorized like

a) Individual Sulphates such as:

i. CaSO$_4$

ii. MgSO$_4$

iii. Na$_2$SO$_4$

iv. (NH$_4$)$_2$SO$_4$

v. FeSO$_4$

b) Double Sulphate combinations:

i. DSC1: (CaSO$_4$+MgSO$_4$)

ii. DSC2: (CaSO$_4$+Na$_2$SO$_4$)

iii. DSC3: (CaSO$_4$+(NH$_4$)$_2$SO$_4$)

iv. DSC4: (CaSO$_4$+FeSO$_4$)

v. DSC5: (MgSO$_4$+Na$_2$SO$_4$)

vi. DSC6: (MgSO$_4$+(NH$_4$)$_2$SO$_4$)

vii. DSC7: (MgSO$_4$+FeSO$_4$)

viii. DSC8: (Na$_2$SO$_4$+(NH$_4$)$_2$SO$_4$)

ix. DSC9: (Na$_2$SO$_4$+FeSO$_4$)

x. DSC10: ((NH$_4$)$_2$SO$_4$+FeSO$_4$)
c) Triple Sulphate combinations:

i. TSC1: (CaSO\textsubscript{4}+MgSO\textsubscript{4}+Na\textsubscript{2}SO\textsubscript{4})

ii. TSC2: (CaSO\textsubscript{4}+MgSO\textsubscript{4}+(NH\textsubscript{4})\textsubscript{2}SO\textsubscript{4})

iii. TSC3: (CaSO\textsubscript{4}+MgSO\textsubscript{4}+FeSO\textsubscript{4})

iv. TSC4: (CaSO\textsubscript{4}+Na\textsubscript{2}SO\textsubscript{4}+(NH\textsubscript{4})\textsubscript{2}SO\textsubscript{4})

v. TSC5: (CaSO\textsubscript{4}+Na\textsubscript{2}SO\textsubscript{4}+FeSO\textsubscript{4})

vi. TSC6: (CaSO\textsubscript{4}+(NH\textsubscript{4})\textsubscript{2}SO\textsubscript{4}+FeSO\textsubscript{4})

vii. TSC7: (MgSO\textsubscript{4}+Na\textsubscript{2}SO\textsubscript{4}+(NH\textsubscript{4})\textsubscript{2}SO\textsubscript{4})

viii. TSC8: (MgSO\textsubscript{4}+Na\textsubscript{2}SO\textsubscript{4}+FeSO\textsubscript{4})

ix. TSC9: (MgSO\textsubscript{4}+(NH\textsubscript{4})\textsubscript{2}SO\textsubscript{4}+FeSO\textsubscript{4})

x. TSC10: (NaSO\textsubscript{4}+(NH\textsubscript{4})\textsubscript{2}SO\textsubscript{4}+FeSO\textsubscript{4})

d) Four Sulphate combination:

i. FSC1: (CaSO\textsubscript{4}+MgSO\textsubscript{4}+Na\textsubscript{2}SO\textsubscript{4}+(NH\textsubscript{4})\textsubscript{2}SO\textsubscript{4})

ii. FSC2: (CaSO\textsubscript{4}+MgSO\textsubscript{4}+Na\textsubscript{2}SO\textsubscript{4}+FeSO\textsubscript{4})

iii. FSC3: (CaSO\textsubscript{4}+Na\textsubscript{2}SO\textsubscript{4}+(NH\textsubscript{4})\textsubscript{2}SO\textsubscript{4}+FeSO\textsubscript{4})

iv. FSC4: (CaSO\textsubscript{4}+MgSO\textsubscript{4}+(NH\textsubscript{4})\textsubscript{2}SO\textsubscript{4}+FeSO\textsubscript{4})

v. FSC5: (MgSO\textsubscript{4}+Na\textsubscript{2}SO\textsubscript{4}+(NH\textsubscript{4})\textsubscript{2}SO\textsubscript{4}+FeSO\textsubscript{4})

e) Five Sulphate combination:

i. FiSC: (CaSO\textsubscript{4}+MgSO\textsubscript{4}+Na\textsubscript{2}SO\textsubscript{4}+(NH\textsubscript{4})\textsubscript{2}SO\textsubscript{4}+FeSO\textsubscript{4})

The higher limit of concentration of an individual substance was arrived at based on its existence in both surface and ground water. The compressive strength test results are compared with the reference specimens cast with neutral water. Tests for the setting times of both initial and final with the same test solutions are also carried out and compared with those of the deionised water. The influence of individual chemicals at different concentrations can be studied only when the test samples are compared with the control sample of the deionised water. Apart from the above, tests for chloride ion permeability of FBCM was also conducted along with XRD analysis.
3.2 SPECIFIC OBJECTIVES

The specific objectives of the present investigation are:

1) Effect of mixing water quality on setting times of both initial and final on Fly ash blended Cement (FBC).

2) Compressive strength development or variations of Fly ash Blended Cement Mortar (FBCM) for short term and long term duration.

3) To conduct chloride ion permeability test to estimate the effect of water quality on permeability of Mortar

4) To formulate possible chemical reactions that take place in hydration of blended cement with chemical substances in deionised water.

5) To evaluate permissible limit of a particular sulphate in mixing water of Fly ash blended cement mortar.

6) To ascertain maximum permissible limit of sulphates or mixed sulphates in a particular combination in mixing water for blended cement mortar.

7) To find out new compounds which may affect setting process and strength development of cement by XRD analysis.

3.3 CLOSURE

The scope of the present investigation is to investigate the effect of five groups of chemical substances viz. (i) Individual Sulphates (ii) Double Sulphate combinations (iii) Triple Sulphate combinations (iv) Four Sulphate combinations and (v) Five Sulphate combination of substances available in water on the strength properties of Fly ash blended Cement Mortar (FBCM)

The specific objectives of the present investigation are also presented in this chapter. In the forthcoming chapter, the materials used for experimental work and their suitability is presented.