CHAPTER 6

SUMMARY AND CONCLUSIONS

6.1 MAJOR CONCLUSIONS

The first chapter, the introduction, discussed about the importance of the concrete prepared with the replacement of different admixtures. In this chapter, the objective of adding the admixture, types of admixtures etc are discussed. Finally the first chapter, the introduction, is concluded with a detailed objective of the project. The second chapter, review of literature presents an overview on the use and purpose of the admixture in the concrete. It also gives the observations and the importance of various parameters affecting the properties of the concrete like the effects of the concrete subjected to the durability properties such as sulphate attack, chloride attack, corrosion studies etc and mechanical properties such as compressive strength, tensile strength, flexural strength, permeability, etc by the addition of the various admixtures. The second chapter is concluded with the scope of the project, problem definition and proposed methodology of the research work.

In the third chapter, materials used for preparing the concrete samples, mix design, the properties of the various admixtures and the experimental procedure for carrying out various tests on the concrete are described in detail.
In the fourth chapter, the behaviour, results and discussions of using the various admixtures for the preparation of the concrete are studied and presented pertaining to the strength properties of the concrete.

In the fifth chapter, results and discussions about the durability properties of the concrete prepared by replacing the various admixtures for preparing the concrete are discussed in detail.

Finally in the sixth chapter, the conclusion on this experimental research work is given as well as suggestions on future developments are also provided.

Based on various and repeated trials, it was determined that by the replacement of the admixtures in the following proportions of 15.0% fly ash, 10.0% silica fume, 10.0% rice husk ash and 3.0% calcium nitrate with the cement, durability properties and strength properties of the concrete were improved.

It was observed that despite of low water cement ratio for M30 grade of the concrete, a better workability was observed with the replacement of the various admixtures. A required compaction factor was obtained for both the grades of concrete. There is no segregation observed in the concrete prepared by using admixtures. The water absorption was reduced in the concrete specimen prepared with the addition of the admixtures.

The compressive strength of the concrete increased between 1.98% and 7.04% for M25 grade of the concrete and 1.51% and 2.76% for M30 grade of the concrete for various durations of testing due to the replacement with the admixtures. Hence based on the experimental results it was
concluded that there was only a marginal increase in the compressive strength of the M25 and M30 grade of the concrete prepared by replacing 15.0% fly ash, 10.0% silica fume, 10.0% rice husk ash and 3.0% calcium nitrate with the cement.

It was also observed that the tensile strength of the concrete increased approximately between 5.84% and 6.59% by the replacement with the admixtures for M25 grade of the concrete and between 4.14% and 13.05% by the replacement with the admixtures for M30 grade of the concrete. The flexural strength of the concrete was only marginally increased for both the M25 and M30 grade of the concrete prepared by replacing 15.0% fly ash, 10.0% silica fume, 10.0% rice husk ash and 3.0% calcium nitrate with the cement. It was observed that there was no reasonable improvement in the deflection or strength of the concrete beam.

It may be concluded that the permeability was decreased with the replacement of the cement with admixtures. There was a reduction in permeability from 10.5% to 1.92% with respect to age of the concrete for M25 grade of the concrete and 6.25% to 4.04% for M30 grade of the concrete. An inference was also made from the various results of the research work that the lower the air permeability of the concrete indicated a greater resistance to sulphate attack, chloride attack and acid attack.

The loss of weight of the concrete specimen subjected to sulphate attack is reduced up to 0.61% and compressive strength of the concrete increased between 29.31% and 78.48% for M25 grade of the concrete and the loss of weight of the concrete specimen subjected to sulphate attack is reduced up to 0.47% and compressive strength of the concrete increased between 17.39% and 78.81% for M30 grade of the concrete. With the
replacement of 15.0% fly ash, 10.0% silica fume, 10.0% rice husk ash and 3.0% calcium nitrate, the serious ill effects due to sulphate attack on the concrete were drastically decreased. From the results, it can be concluded that by using multi component blended concrete, the sulphate resistance of the concrete had been increased.

The loss of weight of the concrete specimen subjected to chloride attack is reduced up to 0.52% and compressive strength of the concrete increased between 1.98% and 7.04% for M25 grade of the concrete and the loss of weight of the concrete specimen subjected to chloride attack is reduced up to 0.43% and compressive strength of the concrete increased between 2.09% and 3.45% for M30 grade of the concrete. The important factor for the loss of weight of the concrete specimen subjected to chloride attack was because of the porosity and permeability which increased the rate of penetration chloride ions. By the addition of admixtures, the permeability was significantly reduced and hence the effect due to the chloride attack both in terms of loss of weight of the concrete specimen and reduction in compressive strength was also considerably decreased.

The weight loss is reduced up to 0.95% and the compressive strength is increased up to 5.45% due to the replacement of the admixture with the cement for M25 grade of the concrete and the weight loss is reduced up to 0.97% and the compressive strength is increased up to 13.7% due to the replacement of the admixture with the cement for M30 grade of the concrete. It may be concluded that the acid attack was almost neutralized by the addition of the admixtures in the suitable proportions. Hence the structures constructed by using the above said admixtures in suitable proportion can be used for storing liquids which are harmful to concrete, industrial buildings or
plants where the floor or wall may be damaged due to the presence of chemicals or acids, damp conditions etc.

The loss of weight of the reinforcement bar in the concrete prepared by replacing admixtures is reduced up to 4.01% for M25 grade of the concrete and the loss of weight of the reinforcement bar in the concrete prepared by replacing admixtures is reduced up to 3.95% for M30 grade of the concrete. It may be concluded that by the replacement of 15.0% fly ash, 10.0% silica fume, 10.0% rice husk ash and 3.0% calcium nitrate with the cement while preparing the concrete, corrosion of the steel embedded in the concrete was considerably reduced.

By the use pozzolanic admixtures, the major environmental concern raised due to the cement production is reduced considerably. The disposal problem of the by-products such as fly ash, silica fume etc are reduced significantly. The pozzolanic materials improved the interfacial transition zone due to the pozzolanic reaction and the finer the pore size distribution. In general, it may be finally concluded that by the replacement of the admixtures in the following proportions 15.0% fly ash, 10.0% silica fume, 10.0% rice husk ash and 3.0% calcium nitrate with the binding material cement, the pore structure, strength properties and durability properties of the concrete were significantly improved.

6.2 SCOPE FOR FURTHER RESEARCH

1. This type of multi component blended concrete can be tried in some adverse conditions and structures exposed to severe conditions.
2. Further by adding five admixtures while preparing the concrete, the properties may be studied.

3. The studies may be prolonged for 5 years or 10 years and the properties of the concrete may be observed and studied for longer duration.

4. The slabs may be constructed by adding the admixtures and load versus deflection characteristics may be studied.

The concrete samples can be studied and analyzed after 10 years or 20 years through scanning electron microscopy (SEM analysis) and X-ray diffraction method.