CHAPTER –1

INTRODUCTION

1.1 GENERAL

The construction industry and concrete manufacturers have realised that they will need to use available aggregate rather than search for the perfect aggregate to make an ideal concrete suitable for all purposes. Simultaneously, significant increases in concrete recycling result in hundreds of tonnes of Recycled Concrete Aggregate (RCA) that could be used in the production of concrete for specific purposes. Currently, RCA is mainly being used as a substitute material for natural aggregate in unbound sub-base and base pavement layers in road construction. One of the most significant steps in promoting the use of recycled concrete aggregate in new concrete was, the 1994 publication by the RILEM Technical Committee of 121 titled ‘Specification for Concrete with Recycled Aggregate’ (RILEM, 1994). The specification supplemented numerous research efforts from researchers around the world, especially from the United States, Europe and Japan. The research efforts have been oriented towards two principal aims, firstly at increasing the understanding of basic engineering properties of locally manufactured recycled concrete aggregate and secondly at the utilisation of the aggregate in concrete.

1.2 NEED OF THE PRESENT STUDY

The recycled coarse aggregate concrete (RCAC) is a new concrete which is similar to natural aggregate concrete, but the only difference is that the aggregate used is arrived from the demolished concrete waste. Till today the research of RCAC are mostly carried out in countries like United States, Europe and Japan etc., in India its
research is at very initial stage. Advanced countries are using this RCAC mostly for
the non structural elements because the research is also limited to basic physical and
mechanical properties. However, for greater applications and cater environmental
factors in developing countries like India and developed countries like United States,
Europe and Japan, it is essential to investigate the feasibility of producing different
RCAC structural elements with locally available waste concrete.

1.3 OBJECTIVES OF THE PRESENT WORK

The present investigation aims at conducting a feasibility study of producing
recycled aggregate concrete slab elements. Accordingly, the specific objectives of the
present work are listed below.

➢ To conduct feasibility study of mechanical properties of recycled aggregate
  concrete.

➢ To conduct feasibility study of punching shear properties of recycled
  aggregate concrete slab elements.

➢ To conduct extensive experimentation on recycled aggregate concrete slabs
  with replacement ratio 0, 20, 40, 60, 80 and 100% of NCA with RCA with all
  edges simply supported and fixed edge conditions.

➢ To evaluate the stiffness of recycled aggregate concrete slab elements in shear.

➢ To evaluate the energy absorption of recycled aggregate concrete slab
  elements in shear.

➢ To study the suitability of IS-456, ACI 318, B.S 8110, Euro code 2 (CEB)
  codes and yield line analysis for estimating the punching shear of recycled
  aggregate concrete slab elements.
➢ To develop regression models for predicting punching shear strength of recycled aggregate concrete slab elements.

➢ To conduct feasibility study of flexural behavior of recycled aggregate concrete slab elements.

➢ To conduct extensive experimentation on recycled aggregate concrete slabs with replacement ratio 0, 20, 40, 60, 80 and 100% of NCA with RCA with all edges simply supported and fixed edge conditions in flexure.

➢ To evaluate the energy absorption of recycled aggregate concrete slab elements in flexure.

➢ To conduct yield line analysis for estimating the flexural capacity of recycled aggregate concrete slab elements and compare with experimental results.

➢ To compute bending moment coefficients using yield line analysis for recycled aggregate concrete slab elements for design purpose.

Thus, a detailed experimental programme will be carried out on recycled aggregate concrete slab elements and their behaviour in punching shear and flexure will be studied. The results obtained by testing of recycled aggregate concrete slab elements in punching shear and flexure will be compared with corresponding results of Natural Coarse Aggregate (NCA) slabs to establish the performance of recycled aggregate concrete slab elements. The results will be analysed and useful conclusions will be drawn. The results of the experimentation will be synthesised in to statistical regression models for predicting punching shear of recycled aggregate concrete slab elements with all edges simply supported and fixed conditions. Bending moment coefficients will be developed for the design of Recycled Aggregate Concrete slab elements. It is felt that this will lead to a chain of development in the field for usage of Recycled Coarse Aggregate Concrete (RCAC) and thus leads to greater applications.
of this material in this country. This is the focus of the study presented and also underlines the guiding philosophy of this thesis.

1.4 ORGANISATION OF THE THESIS

The presentation of the investigation carried out to achieve the specific objectives mentioned in the previous section is planned in the following manner:

Chapter 2 deals with the literature review of recycled aggregate, recycled aggregate concrete and slabs.

Chapter 3 presents the details of tests conducted on basic raw materials like cement, fine aggregate, natural coarse aggregate, recycled coarse aggregate and water. And also presents Mix design, dosages of materials, casting and testing of cubes and cylinders for getting the mechanical properties of design concrete and casting of slab specimens. The experiments have been conducted as per the specifications of relevant IS codes.

Chapter 4 deals with the details of experimentation conducted on recycled aggregate concrete slab elements with replacement ratio 0, 20, 40, 60, 80 and 100% of NCA with RCA to evaluate the punching shear strength with all edges simply supported and fixed edge conditions. Based on the failure pattern and the geometry, regression models have been derived for computation of punching shear loads. The experimental results have been compared with the provisions of IS 456, ACI 318, B.S 8110 and Euro code 2 (CEB) codes.

Chapter 5 deals with the details of experimentation conducted on recycled aggregate concrete slab elements with replacement ratio 0, 20, 40, 60, 80 and 100% of NCA with RCA to evaluate the flexural strength with all edges simply supported and fixed edge conditions. Based on the failure pattern and the geometry, the yield line
analysis is performed and bending moment coefficients are derived. The experimental results have been compared with the resulting yield line analysis.

Chapter 6 outlines the overall conclusions and inferences drawn from this investigation along with the suggestions for further investigation.

A comprehensive bibliographical list is provided at the end of the thesis with a view to help present and future investigators working in the related areas.