Abstract

Masonry structures constitute a significant portion of building stock worldwide. Seismic performance of unreinforced masonry has been far from satisfactory. Masonry is purported to be a major source of hazard during earthquakes by reconnaissance surveys conducted aftermath of an earthquake. Reasons for the poor performance of masonry structures are more than one namely lack of deformational capacity, poor tensile strength & lack of earthquake resistance features coupled with poor quality control and large variation in strength of materials employed. Fibre Reinforced Plastic (FRP) composites have emerged as an efficient strengthening technique for reinforced concrete structures over the past two decades. Present thesis is focused towards analysing the behaviour of Fibre Reinforced Plastic (FRP) strengthened masonry under axial compression and in - plane shear loading. Determination of in - plane shear resistance of large masonry panels requires tremendous effort in terms of cost, labour and time. Masonry assemblages like prisms and triplets that represent the state of stress present in masonry walls and masonry in - fills when under the action of in - plane shear forces present an alternative option for research and analysis purposes. Hence, present research is focused towards analysing the performance of FRP strengthened masonry assemblages and unreinforced masonry assemblages.

Chapter 1 *provides a brief review on the behaviour of masonry shear walls and masonry in - fills under the action of in - plane shear forces in addition to the performance of masonry structures during past earthquakes. Review of available literature on FRP confinement of masonry prisms with bed joints inclined from* 0^0 *to* 90^0 *to the loading axis under axial compression, analytical models available for FRP confined concrete, shear strength of masonry triplets attached with FRP is presented.*

Chapter 2 *primarily focuses on determining the various properties of the materials involved in this research investigation. Test procedure and results of the tests conducted to determine the mechanical and related properties of the materials involved are presented. Elastic properties and stress - strain response of burnt clay brick, mortar and FRP laminates are presented.*

Studies conducted on behaviour of GFRP confined masonry prisms under monotonic axial compression are included in ***Chapter 3****. The study comprised of testing masonry prisms, both unconfined and FRP confined masonry prisms under axial compression. Stretcher bond and English bond prisms, with bed joints normal and parallel to loading axis are included in this study. Two grades of GFRP, 360 g/m^2 and 600 g/m^2 are employed to confine masonry prisms. The experimental program involved masonry prism types that accounted for variations in masonry bonding pattern, bed joint inclination to the loading axis and grade of GFRP. Review of the available analytical models predicting compressive strength of FRP confined masonry prism is presented. Available models for FRP confinement of masonry are re-calibrated using the present experimental data generating new coefficients for the already existing model to develop new expression for predicting the compressive strength of FRP confined prisms. In addition to the prism types mentioned earlier, behaviour of unconfined and GFRP confined stretcher bond prisms with bed joints inclined at 30^0, 45^0 & 60^0 to the loading axis are further investigated.*

Chapter 4 *primarily deals with the shear strength and deformational capacity of masonry triplets that represent joint shear failure in masonry. An experimental program involving masonry triplets attached with different types of FRP (GFRP and CFRP), grade of FRP, percentage area covered by FRP and reinforcement pattern is executed. This exercise determined the influence of these parameters over the enhancement achieved in terms of shear strength and ultimate displacement. Results of tests conducted on stretcher bond prisms presented in* ***chapter 3*** *and results of tests on shear triplets presented in this chapter are combined to study the interaction between shear and normal stresses acting along the masonry bed joint at different angles of inclination.*

The thesis culminated with ***chapter 5*** *as concluding remarks highlighting the salient*

information pertaining to the behaviour of FRP strengthened masonry under axial compression and in - plane shear loading obtained as an outcome of the research conducted as a part of this thesis.