Flowable slurry or controlled low strength material (CLSM) is gaining popularity in the new millennium due to versatility in the construction field. Flowable slurry is a self compacting cementitious material with specified compressive strength of 8.3 MPa or less at the age of 28 days. Flowable slurry is generally being used in the areas of backfilling, structural filling, mining and underground construction, erosion control and pavement bases.

An attempt has been made in the present study to evaluate the properties of high volume fly ash gypsum slurry with quarry waste and its suitability in pavement base/sub-base course. The characteristics of ingredients such as fly ash, gypsum, quarry waste, river sand, coarse aggregate, gravel and water used in flowable slurry, granular sub-base, water bound macadam and slurry bound macadam were evaluated to assess their suitability. Subsequently, experiments were carried out to arrive at optimum proportion of various ingredients for Fly ash-Gypsum slurry (F-G) and Fly ash-Gypsum-Quarry Waste Slurry (FGQWS) mixtures, having 150 mm, 300 mm, 375 mm, 425 mm and 500 mm flows (according to ACI Committee 229R, 2005). The designed mixtures have been tested for density, compressive strength and plastic properties. Also, an attempt has been made to compare the performance of FGQWS with FGRSS (Fly ash-Gypsum-River Sand Slurry).
Further, the durability studies were carried out on FGQWS with 10% filler having 425 mm flowability to assess resistance to weathering, sulphate and chloride environments. Also, scanning electron microscope (SEM) and energy dispersive analysis through X-ray (EDAX) were carried out to find out the mineralogical and morphological characteristics to identify the cementitious compounds formed during hydration process to substantiate the strength and durability properties.

Finally, the characteristics of F-G slurry bound macadam (FGSBM) such as penetrability of FGQWS, compressive strength and modulus of elasticity were evaluated. Also, semi field investigations were carried out on FGSBM to evaluate its performance as sub-base/base pavement material.

The results show that even a small variation in water content drastically affected the flowability of both F-G slurry and FGQWS. The addition of quarry waste has increased both wet and dry density of FGQWS due to higher specific gravity of quarry waste. Also, it is found that almost all FGQWS mixtures containing 10% of filler material have shown higher compressive strength than F-G slurry mixtures. Further, it is noticed that the rate of strength development varies from 58% to 96% at the age of 7 days depending on the flowability of mixture (assuming that the strength at 56 days is 100%). In addition, an attempt has been made to compare the characteristics of FGQWS and FGRSS. It is evident that the water requirement for FGQWS mixtures is significantly less than FGRSS mixtures irrespective of filler content with same flowability. It is due to the higher volume of solids present in FGQWS mixtures and also higher specific gravity of fly ash – gypsum and quarry waste blend.
The durability studies indicate that the FGQWS exhibit reasonably good resistance against weathering and also resistant to sulphate and chloride attack. It is observed from scanning electron microscope analysis that needle shaped ettringite and mono-sulphate are absent in the slurry due to leaching of gypsum during in the initial 30 minutes period. Absence of ettringite and tobermorite resulted in poor strength of slurry. In addition, the pH of the system was reduced to less than 12. Hence, the initially formed hydrates of alumina and silicate in the system could not proceed further formation of secondary compounds like calcium silicate hydrate The energy dispersive analysis through X-ray reveals that the sulphate environment has activated iron and magnesium to enter into hydrated matrix and retarded the strength. However, it can be stated that the durability of F-G slurry is not significantly affected by sulphate and chloride environment.

The compressive strength of Slurry bound macadam is found to increase with decrease in the density of pre-packed aggregates. The higher quantity of slurry produces more amounts of cementitious compounds and thereby strengthens the interface between binder and aggregate. Also, the plate load test results shows that the load carrying capacity of FGSBM having 200 mm thickness is about 56.2% higher than water bound macadam (WBM) having same thickness at 1.25 mm settlement. The FGSBM can be used in pavement as base/sub base course in the place of WBM to utilize the industrial waste material in large scale, reduce the cost and also improve the performance of pavement.