Strength Properties of Eco-mortar Made with Oyster Shell Aggregate and Ground Granulated Blast Furnace Slag and Application to Pavement Material

In recent years steel industry by-products and waste shell management become real challenge due to their large amount, expensive management system and adverse effects on environment. On the other hand the demands of the construction materials are increasing day by day. Eco-mortar (made with recycled aggregate and eco-binder) which has positive relation with reduction of environmental hazards can play a vital role to save the environment and to continue the present construction activities.

The present study was an attempt to elucidate the effects of ground granulated blast furnace slag (GGBFS) as partial replacement of ordinary Portland cement (OPC) and oyster shell (OS) aggregate blended mortar on the strength properties in different conditions and the effective use as pavement material. To know the effective usability of the study materials, brightness, light irradiation, spectrometric analysis and skid resistance test performed. Cylindrical samples (φ 5 cm x 10 cm) were used for the compressive strength test at 3, 7, 28 and 91 days. Blended mortar was top filled on open graded asphalt concrete (30 cm x 30 cm x 5 cm) with about 1 cm thickness by the help of vibrator. Total six types of mortar filled pavement were used for brightness, light irradiation and skid resistance test to compare with asphalt concrete pavement.

Slag could be used up to 85% in partial replacement of cement and 75% slag content will give the highest strength for OS mortar. The compressive strength of river sand (RS)-slag mortar could be lowered at initial stage but finally will increase about 17% than that of no slag mortar. At 28 days age, 30°C water curing samples showed the highest strength for river sand mortar samples, and 20°C water curing showed the highest compressive strength for OS mortar samples.
In brightness, light irradiation test and spectrometric analysis showed that ordinary Portland cement (OPC)-Slag-OS sample is the brightest and highest solar reflector as well as it showed lowest surface temperature within the study pavements. In terms of skid resistance property in wet condition, OS mortar filled pavement could be used in walkways, parking area and other suitable sites.

From the present study, it can be concluded that:

Considering the strength properties, slag can be used in OS and RS mortar at the rate of 75% and 50% respectively in replacement of OPC. Comparatively higher temperature is preferable for the high early strength of GGBFS blended mortar. OPC-Slag-OS blended mortar inserted pavement was the brightest and reduced highest surface temperature (16°C) in compare with asphalt pavement. Slag blended Eco-mortar can be successful used in pavement construction.