Although recycling of waste material has started since the last few decades, recycling as a means of sustainable use of Non-Conventional material did not actually start until fairly recently. Recycling of industrial waste and by-product material which is an environmentally sensitive problem faced by waste manager throughout the world is no exception. Specifically steelmaking operations are concerned by this problem because of the generation of a huge quantity of by-products such as Electric Arc Furnace Slag (EAFS). Basically, there are two reasons to the rationale underlying the usage of slag as a source of aggregate; the need to conserve natural resources and the need to manage waste amicably. However, to make the feasible acceptance of slag as aggregate in concrete, its strength, deformation and durability must also be assured. This research attempts to provide that assurance by conducting a comprehensive investigation on the strength, deformation and durability performance. This study is divided into four main phases: (i) chemical and physical properties of slag and its suitability as aggregate for concrete production (ii) design of mix proportions of SSA using replacement level of 0%, 10%, 50% and 100%. Six (6) series of concrete specimen were cast. The series refer to the difference of w/c ratios between the ranges 0.47 – 0.7. The specimens were tested from 3 days until 365 days (iii) the engineering properties considered include compressive, tensile and flexural strength, modulus of elasticity and drying shrinkage. These properties are important in the performances of the SSA concrete compared to the corresponding NA concrete (iv) in order to access the durability performance of SSA concrete, resistance to carbonation, sulphate attack and gas permeability were conducted. Gradation of the aggregates shows that the slag aggregates is suitable for concrete and complied to existing BS EN 12620:2002. Tests on the aggregate have shown that the resistance to mechanical action such as the impact and crushing value for slag aggregate is lower but higher in specific gravity and water absorption capacity than the natural aggregates. From the strength point of view with various w/c, the slag aggregate concrete compared well with the natural aggregate concrete. The mechanical properties steel slag aggregate concrete increased with the proportion of coarse aggregate. The results indicated that the higher concrete strength was obtained for the mixtures possessed a percentage of 100% SSA as a replacement of the coarse aggregate for all various w/c used. The static modulus of elasticity of the SSA concrete is found to be higher than NA concrete which is the higher the w/c ratio, the lower the static modulus of elasticity. With respect to deformation, SSA concrete produces lower drying shrinkage, at low w/c ratio. The drying shrinkage of the concrete mixtures incorporating with 10 and 100% SSA were approximately 33% and 51% less than of NA concrete respectively. The SSA concrete exhibited good durability performance compared to NA concrete. Using regression analysis, the correlation between the compressive and other mechanical properties and durability performance of control NA and SSA concrete have also been established.

This research investigates the performance of male-female interlocking panel joint connection for precast panel applications. The research involved experimental laboratory work testing of twenty four (24) set of male-female interlocking panel (M-FIP) with and without bar as connector mechanism and used cement grout as wet joint binder. The dimensions size of the panel are 900 mm x 500 mm x 75 mm, was prepared using Grade 30 of concrete strength by used Crushed Concrete waste Aggregate (CCwA) size 10 mm and 20 mm as a major component material in concrete mix production. The concrete mix has been designed with water cement ratio of 0.50 and reinforced with B7 rectangular steel fabric type. Due to use recycled aggregate material in production new concrete mix, the fresh and hardened test was conducted to confirm the properties as satisfy according to the standard. The aspect (H/L) and slenderness ratio (H/t) of the panel are 0.35 and 6.67 respectively. In order to investigate the male and female performance the two pilot tests has been conducted in studied the bonding strength and ductility behavior of this joint connection. A total of twelve (12) set of male and female specimens with size dimension of 75 mm x 500 mm x 200 mm were cast and tested for two types of testing. Eight (8) set were prepared for pullout testing and another four set were prepared for flexural beam testing. Based on the result in bonding strength analysis due to hardened cement grout strength was showed satisfactory bonding between bar connector and cement grout in M-FIP specimens. The bond strength was increased linearly with the age of cement grout strength. For bending test on M-FIP specimen results was indicated that the specimens with bar connector resulted in better performance in term of ductility behavior and pre-cracked controlled compared to specimen without bar connector under bending condition. In all M-Fip samples that have been constructed, it was divided into two experimental setup conditions which are under vertical and horizontal loading respectively. The influence of bar connector and loading distribution types was studied and discussed. The success of this research were provided a new method in jointing system of precast panel due to simple and fast installation process.