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Use Of Recycled Materials In Road Construction

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Abstract
With the evolution of the road industry and growing traffic on roads, construction materials have also been evolved and more unconventional ingredients have been incorporated. The rationales was the scarcity of conventional natural materials and the jeopardized environment which have underpinned the tendency towards evaluation other materials resources to be incorporated in the road industry. The inclusion of such materials entails several secondary and tertiary materials. Several waste by-products and materials have been investigated, assessed, evaluated for utilizations and practiced in the field. Depending on the attributes of the characteristics of the recycled material, the inclusion varies. Some recycled material have been proven to possess preferable properties over the other and have performed satisfactorily in the field. However, there are numerous concerns regarding such incorporation based on both laboratory experimental, and field observations which have turned out to be of the essence for further in depth studies.
In the present study experimental investigation of sub grade soil determined soil characteristics by using recycled materials like fly ash and plastic waste. The percentage of fly ash and plastic waste used is 0%FA+0%PW, 5%FA+1%PW, 10%FA+2%PW, 15%FA+3%PW and 20%FA+4%PW. The comparison of soil characteristics like liquid limit, plastic limit, standard compaction, un confined compressive strength and CBR test vales are determined for various percentages of recycled materials.
Key words: recycled material, sub grade soil, fly ash, plastic waste.

1. Introduction
The pivotal thrust of utilizing waste materials into road construction field is diminishing the detrimental repercussions of processing natural materials on the environment, to alleviate the burden on authorities in both developing and developed countries in providing landfills and setting provisions for such wastes, and to reaffirm the commitment of the industry towards better road services and riding quality. Besides, the scarcity of the natural resources is also an intuitive rationale that underpins utilizations. Several experimental and research studies have been dedicated to investigating potential incorporating of waste materials in road construction field. Many pieces of research have proven a success in reusing and recycling of some compositions of these waste materials in pavement structures and others are still undergoing comprehensive research studies to further shed the light on what can be gained from their recycling into pavement constructions. Due to some stringent knowledge and shortage of funding for in-depth analysis of utilizing the some waste materials in the utmost beneficial way, the waste material is a core problematic issue to governmental institutions and transportation legislation authorities in several parts of the world. International cooperation is a key factor in protecting the environment through diminishing the greenhouse gasses emission and preserving natural resource via exploiting viable recycled materials into the construction field and giving focus on assessing approaches in employing such materials .
The Non-conventional material is defined as the material that does not possess the required properties as per the traditional specifications. With the unending demand for aggregates material in road construction, the scarcity of accepted quality material as well as the urge in preserving natural resources, there has become urgent necessity for inclusion secondary material and waste by-products in road construction field. Several waste recyclable materials

have been incorporated in various projects all over the globe and displayed the opportunity in not only budgetary saving but also in protecting the environment. Road responses and long-term performance rely exhaustively on serious of attributes of the incorporated material in the compositions of the structure, it is an overarching issue to thoroughly comprehend the behaviour and pattern of these materials and their transmutation effects when used on its own or assorted with other materials and used in road pavement structure. It is believed that the responses to the increasingly huge demand on providing substitutions for natural materials in road construction has been efficiently responsive and reflected mounds of researches have been dedicated to executing feasibility studies on using these surrogate material with the consideration of sustainability perspective for both the environment and the economic.

Materials and methodology

Expansive soil

As a piece of this examination, the sweeping dark cotton soil was obtained from the site. The dark cotton soil subsequently got was conveyed to the research center in sacks. A limited quantity of soil was taken, sieved through 4.75 mm strainer, gauged, and air-dried before gauging again to decide the common dampness substance of the equivalent.

Fly ash

A waste material extricated from the gases exuding from coal terminated heaters, by and large of a warm power plant, is called fly fiery debris. The mineral buildup that is abandoned after the consuming of coal is the fly cinder. The Electro Static Precipitator (ESP) of the power plants gather these fly cinders. Basically comprising of alumina, silica and iron, fly fiery remains are small scale measured particles. Fly powder particles are commonly circular in size, and this property makes it simple for them to mix and stream, to make an appropriate mixture.

Fly ash

Plastic waste

The plastic waste were produced mainly from waste PET bottles. The plastic bottles were crushed and cut into small pieces using a crushing machine. The plastic aggregates were washed properly to make them clean and to ensure that no other dust particles were present there. Polyethylene terephthalate (PET) is thermoplastic polyester with tensile and flexural modulus of elasticity of about 2.9 and 2.4GPa, respectively, tensile strength up to 60 MPa and excellent chemical resistance. It is a semi-crystalline polymer, with a melting point of about 260°C and a glass transition temperature ranging from 70 to 80°C, in relation to the amount of crystalline region enclosed in the amorphous phase.

Plastic waste

Methodology adopted

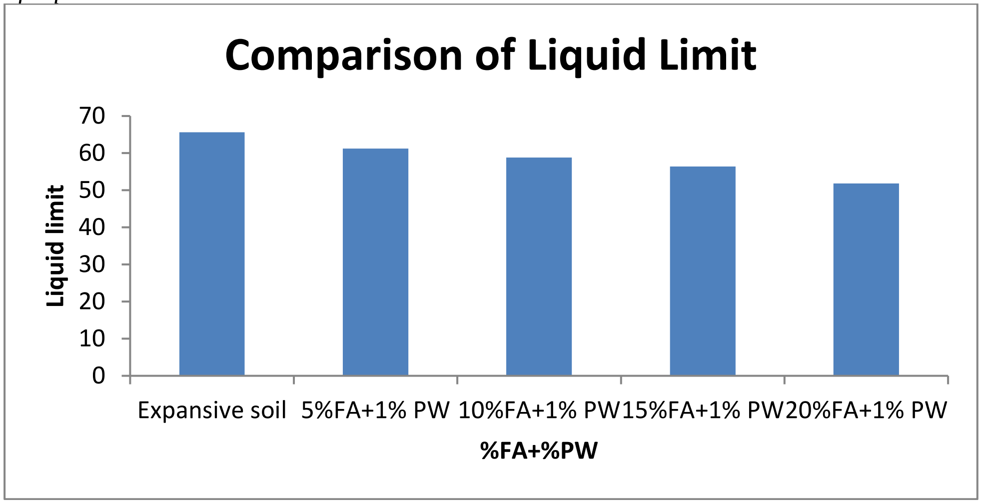
To assess the impact of fly ash and plastic fiber as a balancing out added substance in far reaching soils, arrangement of tests, where the substance of fly powder in the sweeping soil was differed in estimations of 5% to

200% (products of 5) and 1% to 4% plastic fiber by weight of the all out amount taken. The Indian Standard codes were pursued during the conduction of the accompanying analyses:

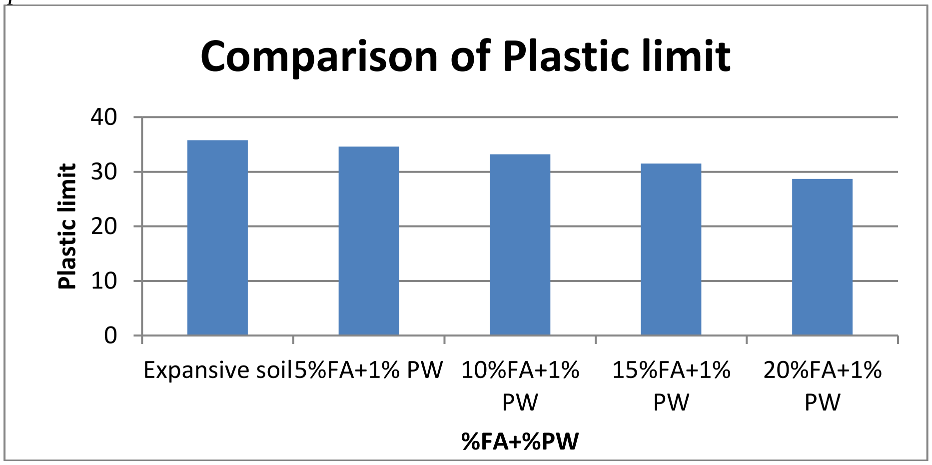
1. Standard proctor test – IS : 2720 (Part 7) - 1980
2. Unconfined compressive strength (UCS) test – IS : 2720 (Part 10) - 1991
3. California bearing ratio (CBR) test – IS : 2720 (Part 16) - 1987
4. Liquid & Plastic limit test – IS 2720 (Part 5) - 1985

Experimental Results

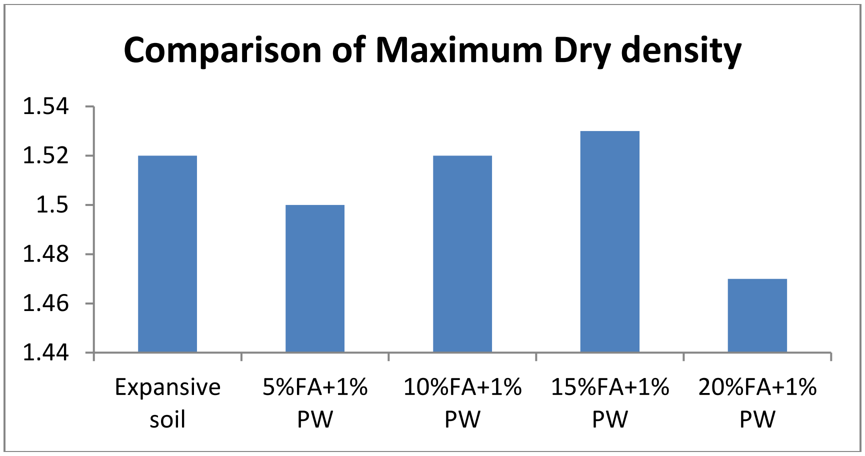
Comparison of liquid limit



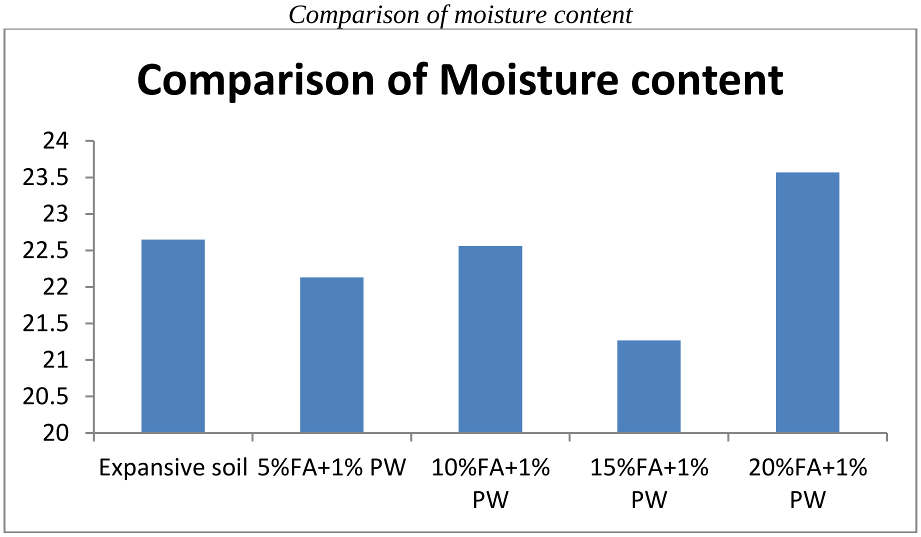
Comparison of plastic limit



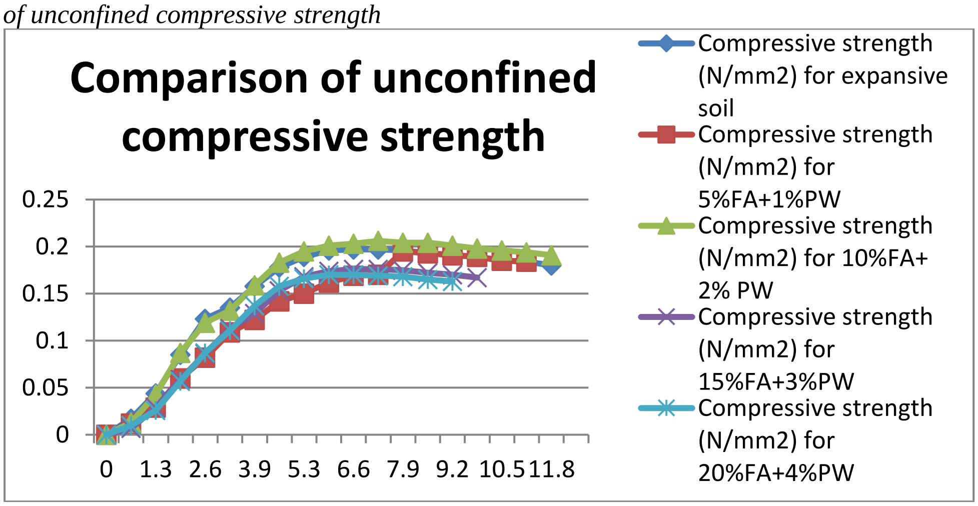
Comparison of maximum dry density



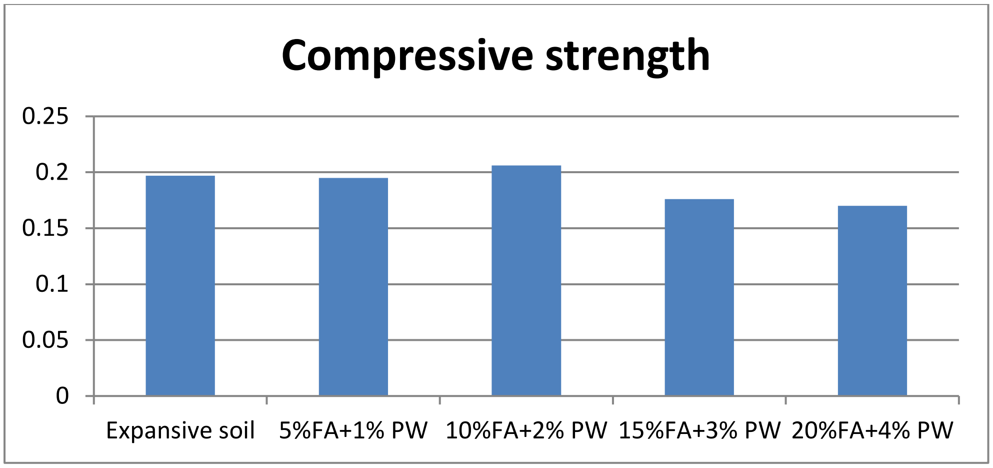
Comparison of moisture content



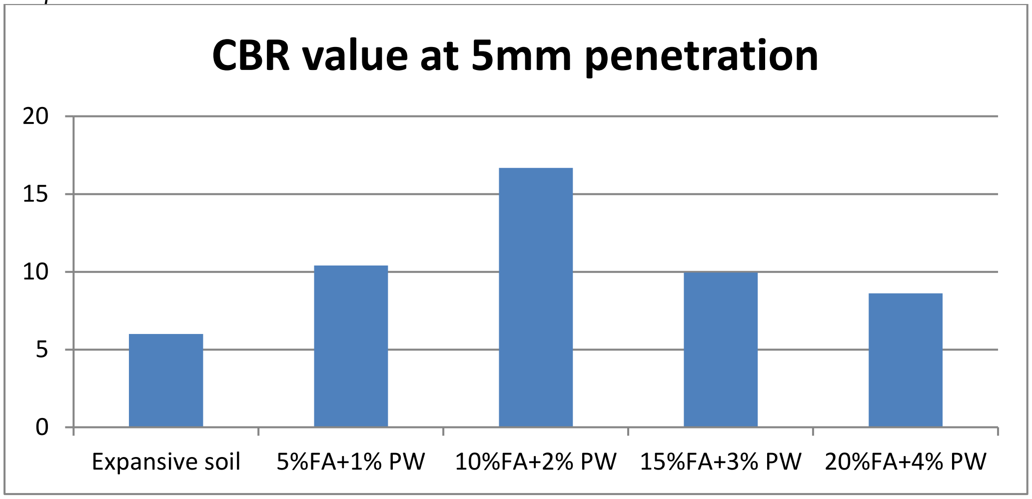
Comparison of unconfined compressive strength



Compressive strength



Comparison of CBR Values



Conclusions

This project is focused on the review of performance of fly ash and plastic waste as a recycle material in road material. The study suggests that if fly ash and plastic waste if properly mixed and applied, can be used as a great soil stabilization technique .On the basis of this project the following results were obtained.

1. Fly ash is used as an excellent soil materials for highly active soils which undergo through frequent expansion and shrinkage.
2. The Fly ash as an additive decreases the swelling, and increases the strength of the expansive soils.
3. The higher value of maximum dry density was observed at 15% fly ash and 1% plastic fiber and the maximum value of Optimum moisture content was observed at 20% fly ash and 1% plastic fiber.
4. The optimal value of unconfined compressive strength was observed at 10 % fly ash and 1%plastic fiber.
5. The optimal value of CBR value was observed at 10 % fly ash and 1%plastic fiber.
6. The values of liquid limit and plastic limits decreases with increasing the percentages of fly ash from 0% to 20% with 1% plastic fiber.

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