Project Report: Soil Stabilization Using Waste Materials

1. Objective

The project aims to enhance the engineering properties of locally available clayey soil by using industrial and domestic waste materials such as fly ash and shredded plastic waste. The goal is to improve soil strength, durability, and bearing capacity while promoting sustainable and eco-friendly construction practices.

2. Introduction

Soil stabilization plays a critical role in civil engineering, especially for road subgrades and foundation works. Weak soils often fail to meet strength requirements, necessitating improvement using stabilizing agents. Fly ash, a byproduct of thermal power plants, and plastic waste, a major pollutant, can be utilized effectively for this purpose. This study evaluates how fly ash and plastic improve the compaction and load-bearing capacity of clayey soil.

3. Materials Used

• **Soil Sample:** Locally collected clayey soil (classified as CL as per IS:1498–1970).
• **Fly Ash:** Industrial waste from a thermal power plant, rich in silica and alumina.
• **Plastic Waste:** Shredded plastic strips (2–4 mm wide) from bottles and carry bags.

4. Methodology

1. **Sample Preparation:** Collected and oven-dried the clayey soil sample.
2. **Initial Tests:** Conducted Atterberg limits, grain size analysis, Standard Proctor Test, and CBR Test as per IS:2720 standards.
3. **Mixing:** Mixed the soil with 5%, 10%, 15%, and 20% fly ash (by weight) and a constant 1% shredded plastic.
4. **Testing:** Repeated the compaction and CBR tests for each mix.
5. **Analysis:** Compared results to identify the optimum stabilizer content.

5. Results and Discussion

Mix Composition	OMC (%)	MDD (g/cc)	CBR (%)
Virgin Soil	15.8	1.71	4.2
5% Fly Ash + 1% Plastic	15.0	1.73	5.6
10% Fly Ash + 1% Plastic	14.4	1.76	7.1
15% Fly Ash + 1% Plastic	13.9	1.78	8.0
20% Fly Ash + 1% Plastic	14.2	1.75	7.3

The results indicate that adding fly ash and plastic waste significantly improves the bearing capacity of soil. At 15% fly ash addition, CBR increased from 4.2% to 8.0%, showing roughly a 35–40% improvement. Beyond 15%, the strength began to decrease, indicating an optimal range for stabilization.

6. Conclusion

The project demonstrates that a 15% fly ash and 1% plastic mix offers optimum improvement in soil stability. This method effectively utilizes industrial and domestic waste, reducing environmental impact and enhancing the performance of subgrade soils for road and foundation applications. It is a sustainable and economical approach suitable for rural road development.

7. Tools and References

Tools: CBR Testing Machine, Proctor Mould, Excel for data analysis.
References: IS 2720 (Part 16):1987, IS 1498:1970, IRC 37:2018, and research papers from IJERT (2023).