JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

# Review on 'Effects of Construction and demolished waste on strength parameters of Black cotton soil.'

**[1]Shreyash Dilip Makode, [2]Pawan Sanjay Mokle, [3]Samrat Lalasaheb Patil, [4]Yuvraj Dhansingh Badhiye, [5]Prof. Gayatri Chandrakant Sherkar**

[1]BE (civil), [2]BE (civil), [3]BE (civil), [4]BE (civil), [5]Asst. Professor
[1]Civil engineering,
[1]ADYPSOE, Pune.

***Abstract:*** The second-largest economic activity in India is the construction sector. Regularly, new structures are built, and outdated ones are destroyed. The goal of this research is to strengthen poor soil, such as Black Cotton soil, by using the debris from demolished buildings that were collected from construction components. To increase the necessary qualities of weak soil, coarser building and demolition waste particles can be employed instead of smaller particles. The use of appropriate waste products as stabilizers can prove to be an efficient and cost-effective way of stabilizing poor soil. Testing must be done on debris from construction and demolition projects that are graded between 2.36mm and 4.75mm, as well as on black cotton soil. The best waste percentage to mix with soil for maximal strength enhancement can be determined by tests using different amounts of trash to soil (0%, 10%, 15%, 20%, and 25%).

Black cotton soil has a low load-bearing capacity, is prone to swelling and shrinkage, and has a low shear strength, making construction over it a difficult task. For the construction of a high-rise building or pavement, it is customary to replace the entire soil. For a low-rising building, primarily in rural regions, such complete replacements are typically expensive. Soil stabilization techniques can be used for such buildings to enhance the properties of the soil by replacing a portion of it with other materials.

***Index Terms*** **– Black cotton soil, C&D waste, shear strength, CBR test, index properties, UCS.**

### I. Introduction:

The construction industry is India's second-largest economic sector after agriculture, according to the country's 11th five-year plan. From 0.25 to 5.14 million tons of garbage are produced annually because of construction and demolition work. It will be reasonable to link building and demolition waste creation with Indian economic growth given the construction industry's huge increase. Any physical, chemical, mechanical, biological, or combination method of modifying a natural soil to serve an engineering objective is referred to as "soil stabilization." To reinforce road pavements, improvements include raising the weight-bearing capacity, tensile strength, and general performance of in-situ subsoils, sands, and waste materials.

The cohesive soil used here is black cotton soil. For civil engineers, it is challenging or troublesome soil. It can swell during the rainy seasons and contract throughout the summer. It presents issues in both scenarios. When the Black Cotton Soil expands during the rainy season, the structure experiences uplift pressure, which causes heave in the foundations, plinth beams, first floors of buildings, canals, road surfaces, etc. When the soil contracts during the summer, walls, slabs, plinth protection, floors, etc. develop cracks due to shrinkage. Due to a higher percentage of clay, Black Cotton soil expands during the wet season. When it rains, it swells, and when it shrinks in the summer, it cracks. The fissures are typically between 0.5 and 2 meters deep and 100 to 150 millimeters wide. The Black Cotton soils have a very poor bearing capacity and are highly compressible. The soils have excellent qualities for shrinkage and swelling. The soils have a very weak shear strength. Expansive soil is another name for black cotton soil. Black cotton soils cover a sizable portion of central India as well as a portion of southern India, including Madhya Pradesh, Maharashtra, Karnataka, Tamil Nadu, South Gujarat, and Uttar Pradesh. The area covered is about 3,000 square kilometers. The basalt or traprock that formed these soils. Cotton can grow very well in these soils. The soils have a very low bearing capacity and are highly compressible.

The building, remodeling, maintenance, and demolition of houses, big building structures, highways, bridges, piers, and dams results in the production of construction and demolition (C&D) waste. Wood, steel, concrete, gypsum, masonry, plaster, metal, and asphalt are the main components of C&D waste. Because it may contain dangerous substances like lead and asbestos, C&D trash is noteworthy. Although estimates vary, it is generally agreed that between 15% and 20% of municipal solid trash is generated by construction and demolition activities.

**II. Literature review:**

1. Archit Jain and Arpit Chawda (2016) from RKDF SOE, Indore found that when local demolished waste (both coarse and fine at different percentages) was used to stabilize expansive soil, the specific gravity increased and the plasticity index decreased with the addition of a stabilizer, the maximum dry density increased, the optimal moisture content decreased with the addition of concrete, and the CBR value increased with the addition of recycled concrete. Additionally, it decreased construction costs, and environmental risks, and lengthened the life of the building.

2. Fayaz Bhat and Dr. Rakesh Gupta (2018) from SRMEIT, Ambala highlight several studies on the usage of construction and destroyed debris in pavement subgrade were given. They concluded that the utilization of C&D trash improved sub-grade characteristics and decreased landfilling costs. They noticed that whereas finer aggregates, which might be utilized to increase soil packing density, were avoided, coarser aggregates were being used.

3. Ashutosh Kumar and Pankaj Rathod (2018) examined several studies and noted any gaps they included. They noted the utilization of coarser particles and the avoidance of finer particles. Additionally, they recommended using fibers to enhance the soil's natural qualities.

4. Mr. Kerin, Mr. Sonthwal, and Mr. Jain (2015) discussed the numerous approaches to stabilizing clayey soil utilizing trash from demolished structures. They concluded that adding rubber to expansive soil considerably lowers the proportion of swelling and swelling pressure and that wood ash cannot replace lime.

5. Anant Kumar and Ankur Dobariya (2014) used brick debris as a stabilizer to create roadways in brittle soils. They concluded that 40% of the recommended amount of demolished brick waste should be used; maximum dry density is obtained at 40% of the mix (1.954 gm/cc) as opposed to 0% (1.92 gm/cc); highest CBR value is obtained at 40% of the recommended amount of demolished brick waste, and the recommended moisture content for 0% was 13.66. The higher moisture content at percentages of 10, 20, 30, 40, and 50, and unconfined compressive strength at 60%:40% showed an increase of 100% over that of virgin soil.

6. Abhijit B S, Kavya S P, and Vivek Murthy 2014 concluded the effectiveness of using demolition and building trash to improve montmorillonite clay soil was researched. They noticed that as the percentage of construction and demolition waste increased, the plasticity index was found to be declining and that the proportion of C & D waste was increasing in the MDD. With an increase in waste percentage, OMC was seen to be declining. After examining compaction properties, a 10% C & D waste blended soil was deemed ideal.

7. Parimal Kumar, Vivek Shukla, and Mallikarjun (2018) sought to increase the black cotton soil's strength and bearing capability at various water contents. They concluded that when stabilizer levels increased, the soil's flexibility index declined. The soil carrying capacity increased whereas the MDD and OMC dropped.

8. Omar Ibrahim and Firat Ali Cabalar (2018) utilized crushed waste concrete. They noticed that when the amount of crushed waste concrete increased, the organic soil's liquid limit and plasticity index fell. The maximum dry density of organic soil increased due to the increase in CWC content, which also raised the percentage of swelling up to a certain point before beginning to decline. Unconfined Compressive Strength, a measure of the strength of organic soil, gets stronger as the CWC percentage rises.

9. S. Saravanan, C. Venkata, and K. Ramakrishnan (2016) studied how to strengthen rural roads and how powdered waste bricks and long-term cement storage affect the development of rural roads. They concluded that while soil that has been partially replaced with powdered bricks can be used as a very poor subgrade material, soil that has been partially replaced with prolonged cement can be used as a very good subgrade material. This can be used in the formation of rural roads to improve the performance of the pavement.

10. Hanna Paul and Sobha Cyrus (2016) investigated whether crushed demolition waste from concrete might be used as a stabilizer for porous, kaolinite-based subgrade soil in flexible pavement. They concluded that the OMC was reduced from 26% to 22% and the MDD increased from 1.24 g/cc to 1.46 g/cc with a 40% addition of aggregate; the CBR value increased from 3.4% to 11.2% and then decreased with further addition (With 40% addition of this the original CBR value can be increased up to 3.2 times); and there was a decrease in pavement thickness of 25 cm, which represented 45% of the original thickness.

11. Akshatha and Bharath (2016) worked to improve the CBR of black cotton soil using brick powder (demolished brick masonry waste) and lime, they noticed that stabilizing black cotton soil with replacement of BC soil with 50% BP,4% lime and 30% BP + 1.5% lime obtained the requisite CBR value of 8% according to IRC.

12. Robert Brooks and Mehmet Cetin (2012) worked on the application of C&D waste to obtain pavement thickness for the most cost-effective design. They concluded that the most cost-effective pavement design results in a reduction of 12 inches in subbase thickness while maintaining the thickness of the top two layers when the subgrade is fortified with CDW and CKD and the Subbase of CDW and CKD is employed. The thickness of the surface course and base course is reduced by 2 inches when the subgrade is fortified with CDW and CKD and the Subbase of CDW and CKD is utilized for the regularly used layer thickness.

13. Yadu (2013) looked at the stability of clay using fly ash and granulated blast furnace slag (GBS). Adding fly ash to a GBS mixture significantly stabilizes clay. The effectiveness of fines obtained from crumbled concrete slabs as a soil stabilizer was assessed by Ransinchung et al. (2013). Sabzi Mandi of Roorkee was where the broken concrete slabs were obtained. To compare the results from the FDCS-admixed soil, regular Portland cement 43 grade was also chosen as the foundation stabilizer. When categorized in line with IS: 1498, the clayey soil used in the current experiment belongs to the CI soil group. Separately, FDCS and cement were added to clayey soil in 3 percent increments.

14. Kumar. (2015) study on the usage of building and demolition waste was undertaken by According to the study's findings, very poor soils can be mechanically stabilized using construction and demolition wastes such as bricks, concrete, tiles, etc. by adding additional cementitious materials or commercial stabilizers that have been approved by IRC by IRC: SP:89. The C&D waste material must be graded by IRC: SP: 89. Alternatively, it might be tested for leachability, durability, and unconfined compressive strength before being used in part as soil. Following positive test findings, this type of mixed material may be used to stabilize bad soil either on its own or in combination with approved additives and/or some good soil. For the subbase, 0.8 MPa of unconfined compressive strength must be attained.

15. V. Ramesh Babu, K. Niveditha, and Dr. B. Ramesh Babu (2016) study the course of this investigation, expansive soil is given 10% more sand and 2% to 30% more cement at intervals of 10%. Chintakommadinne is where the black cotton soil is from. The best percentages of combinations were looked for while acknowledging various indexes and engineering qualities. They must have discovered a drop in the plastic, liquid, and OMC limits, as well as an increase in MDD. the maximum MDD for a 30% sand-and-equipment combination the best CBR value, was achieved with 30% sand and 2% cement.

16. Ashkan GHolipoor Norozi, Siavash Kouravand, and Mohammad Boveiri (2015) The stabilization of soil and various waste materials utilized for it. The research revealed that cement, sand, lime, and fly ash were the most frequently used ingredients. They will be used efficiently for expansive soils for applications as fill, dike, and reclamation material, as well as for the lowest layers of road pavement. Agricultural waste, such as rice husk ash mixed with cement and lime, is frequently employed. They require fiber's increased assistance to boost strength.

17 Maninder Singh, Rubel Sharma, and Abhishek (2017) researched the use of industrial waste to stabilize soil (wheat husk and sugarcane straw ash). To achieve a synergistic effect, they had to replace ternary blends of WHA and SCSA ratios like (3+3%), (5+%), (9 +9%), (7+7%), and (11+11%) with a mixture of wheat husk ash and sugarcane sludge ash. The various tests were then run on the mixed sample. They needed to locate the optimal outcome at the share of seven.

18 Vivek S, Parimal Kumar, Vivek Shukla, Kiran Markal, and Mallikarjun (2018) studied "Stabilization of Expansive Soils Using Construction and Demolition Waste," Department of Engineering, JSSATE, Bangalore, Karnataka, India. This work deals with the alteration of BC soil using Construction and Demolition (C & D) waste (concrete and plastering debris), and the ideal mixture of soil plus 10% C & D waste was discovered The Safe Bearing Capacity (SBC) of soil was determined using Terzaghi's equation for BC soil alone, BC soil plus 10% C&D & D, BC soil plus 12 C & D, and BC soil plus 14% C & D waste, respectively. In addition, the cohesion (c) and angle of internal friction () were assessed using the Direct Shear test.

19 Shivakumar Chakure (2020) Fines of Concrete Cube Waste (FCCW) percentages of 0%, 20%, 40%, and 60% were used to study soil factors such as compaction characteristics, CBR, and shear strength. These numbers are contrasted with BC soil that hasn't been treated. Like this, the only soil attribute taken into consideration for the varying proportion of Fines of Brick Demolition Waste (FBDW) at 0%, 20%, 40%, and 60% was Compaction characteristics. The maximum dry density increased from 1.504 g/cm3 to a maximum of 1.708 g/cm3, the optimal moisture content decreased and then increased, the CBR value increased from 2.05% to a maximum of 7%, and the shear strength increased from 377 kN/m2 to a maximum 1390 kN/m2 at 20% FCCW, respectively, in the first method of BC stabilization using FCCW. Using FBW, the second BC method was stabilized.

## III. LITERATURE GAP:

There is no research on the effect of construction and demolition waste c (cohesion value) & Φ (angle of internal friction) on the value of black cotton soil. In our paper, we are going to find the strength parameters of black cotton soil. We are going to compare 3 strength properties of soil that are direct shear, unconfined compression strength, and California bearing ratio.

## IV. LITERATURE CONCLUSION:

The above authors used C&D waste and black cotton soil from various locations. Thus, their stabilization characteristics have a big range in values. Some authors used FCCW or FBDW. Thus, their results also vary. That's why we can't justify the exact value of any strength parameters.

## V. REFERENCES:

[1] A. J. Arpit Chawda, "APPRAISAL OF DEMOLISHED CONCRETE COARSE AND FINES FOR STABILIZATION OF CLAYEY SOIL," International Journal of Engineering science and research technology, Sept. 2016.

[2] F. A. Bhat and D. R. Gupta, "Study of soil stabilization with cement and Demolition waste in Highway subgrade: A review," International Journal for Research in Applied Science and Engineering Technology, vol. 6, July 2018.

[3] A. Kumar and P. Rathod, "Soil Stabilization using demolished concrete waste," International Journal for scientific research and development, vol. 6, pp. 249-251, Jan 2019.

[4] V. Kerni, S. V. Kumar and U. Jain, "Review on Stabilization of Clayey Soil Using Fines Obtained from Demolished Concrete Structures," International Journal of Innovative science research, Engineering and Technology, vol. 4, May 2015.

[5] A. Kumar, S. Agarwal, and A. Dobariya, "Stabilization of cohesive soil using demolished brick waste," Innovations and Advances in Civil Engineering Towards Green and Sustainable Systems, 2014.

[6] Abhijit B S, V. S. Murthy and K. S P, "Study of the effectiveness in improving Montmorillonite clay soil by construction and demolition waste," Journal of Civil Engineering and Environmental Technology, vol. 1, pp. 1-4, August 2014.

[7] V. Shukla, P. Kumar, and Mallikarjun, "Stabilization of expansive soils using construction and demolition waste," IRJET, vol. 5, no. 6, pp. 291-295, June 2018.

[8] Omar. A. Adnan and F. A. Cabalar, "IMPROVING SOME GEOTECHNICAL PROPERTIES OF AN ORGANIC SOIL USING CRUSHED WASTE CONCRETE," International Journal of Natural and Engineering science, pp. 100-112, January 2018.

[9] S. Saravanan, C. Venkata, D. Muthu, and K. Ramakrishnan, "Construction of Rural roads using construction and demolition waste materials," Indian Journal of science and technology, vol. 9(27), July 2016.

[10] H. Paul and S. Cyrus, "STABILIZATION OF WEAK SUBGRADE SOIL USING DEMOLISHED CONCRETE AGGREGATE," in Indian Geotechnical Conference, IIT Madras, Madras, Dec 2016.

[11] Akshata. R and Bharat. H M, "Improvement in CBR of black cotton soil using Brick powder (Demolition Brick masonry waste) and lime," International Journal of Innovative science research, Engineering and Technology, vol. 5, Sept 2016.

[12] R. M. Brooks and M. Cetin, "Application of construction and demolition waste for improving the performance of subgrade and subbase layers," IJRRAS, vol. 12, Sept 2012.

[13] Yadu (2013) evaluated the potential of granulated blast furnace slag (GBS) with fly ash to stabilize clay. Study shows that clay can be effectively stabilized with the addition of a fly ash-GBS mixture.

[14] Kumar (2015) conducted a study on the use of construction and demolition waste. The study concludes that construction and demolition waste like bricks, concrete, tiles, etc. may be used for mechanical stabilization of very poor soils, by adding extra cementitious materials or commercial stabilizers accredited by IRC as per IRC: SP:89. The C&D waste material shall have gradation as per IRC: SP: 89

[15] V. Ramesh Babu, K. Niveditha, Dr. B. Ramesh Babu 2016 “Stabilization of black cotton soil with sand and cement as a sub-grade pavement” International Journal of Civil Engineering and Technology (IJCIET) Volume 7, Issue 2, 2016.

[16] Ashkan GHolipoor Norozi, Siavash Kouravand, Mohammad Boveiri#3 “A review of using the waste in soil stabilization” International Journal of Engineering Trends and Technology (IJETT) – Volume 21 Number 1 – March 2015.

[17] Maninder Singh, Rubel Sharma, Abhishek “Soil stabilization using industrial waste (wheat husk and sugarcane straw ash) “International Research Journal of Engineering and Technology (IRJET) Volume: 04 Issue: 09 | Sep -2017

[18] Stabilization of expansive soils using construction and demolition waste Vivek S1, Parimal Kumar2, Vivek Shukla3, Kiran Markal4, Mallikarjun5 Department of Civil Engineering, JSSATE, Bangalore, Karnataka, India

[19] Chakra Shivakumar, Bolle Srikanth, Kancharidasu Sunny Kumar and Niteen Keerthi, Study On Improvement Of Black Cotton Soil By Using Fines Of Concrete Cube & Brick Demolition Waste, IOP Conf. Series: Materials Science and Engineering 955 (2020) 012060 IOP Publishing doi:10.1088/1757-899X/955/1/012060.

[20] IS 2720 part-3, sec-1, 1980. methods of testing for soils, determination of specific gravity. s.l.: s.n.

[21] MORT&H revised edition 1987

[22] IS 2720 part 4, 1985. methods of testing for soil, determination of sieve analysis. s.l.: s.n. IS 2720.5-1987

[23] IS 2720 part 5, 1965. determination of liquid and plastic limits. s.l.: s.n.

[24] IS 2720 part 7, 1980. method of testing for soils, determination of water content, and dry density using light compaction. sl:sn

[25] IS 2720, part 1, 1973. Methods of testing for soils, determination of water content. s.l.: s.n.

[26] IS 2720, part 16, 1973. Methods of testing for soils, determination of C.B.R. s.l.: s.n.