



iJRASET

International Journal For Research in
Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 7 Issue: X Month of publication: October 2019

DOI: <http://doi.org/10.22214/ijraset.2019.10088>

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Marble Waste Powder - A Promising Material Improving Pavement Soil Subgrade

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Abstract: Foundation is a significant part that drives generally advancement of the Indian economy looking to the populace boomt, ascend in street vehicles, genuine State area and different structures which has brought about the decrease of good quality accessible land. Far reaching soil is a hazardous soil for structural specialists as a result of its low quality and cyclic swell therapist conduct. Plan and development of asphalts on and with sweeping soils is a difficult errand for specialists. Subsequently adjustment of soil ends up essential as it improves soil properties to withstand the heaps from foundation to satisfy the predefined prerequisites. This is a survey paper on soil adjustment concentrating on marble waste powder as an added substance featuring the exhibition of subgrade streets and affordable to the arrangement creators and contractual workers; likewise the issues of quick development of businesses of marble squanders making a major issue to the people encompassing them just as contamination which influence the biological arrangement of the earth can be limited.

Keywords: Marble dust, Expansive soil, stabilization, Engineering properties, Utilization.

I. INTRODUCTION

In civil engineering structures, diverse styles of soils are used; but, a few soil deposits of their herbal shape are suitable for construction purposes, while others are flawed without treatment, inclusive of the difficult soils. These soils want to be excavated after which replaced, or their homes ought to be modified before they can maintain the implemented hundreds with the aid of the top structures. Typical of problematic soils are the expansive soils, which might be regularly determined because of their existence worldwide, besides the arctic regions. The inherent quantity trade characteristics of expansive soils are especially because of their satisfactory-grained clay mineral content material. Due to price implication, geotechnical engineers frequently choose enhancing the houses of quality-grained soils in situ via stabilization in contrast with the soil alternative in exercise. State-of-the-art in exercise of expansive soil stabilization is mentioned with appreciate to the impact of numerous additives and techniques on engineering homes of the stabilized soil. Finally, this paper discusses the stabilization effects of various components to expansive soils, which is probably beneficial in addressing the problems associated with the realistic utility of expansive soil stabilization.

II. CHARACTERIZATION OF EXPANSIVE SOIL CONDUCT

Expansive soils are difficult due to the performances of their clay mineral constituent, which makes them exhibit the cut back-swell characteristics. This form of soil, upon wetting and drying, causes excessive damages to pavement constructed on such soil. Generally pavements on expansive subgrade soils show early distresses causing the premature screw ups of the pavement shape. Expansive soils typically have undesirable engineering houses, including low bearing capacity, coupled with low stability and immoderate swelling. The nature of those soils growing serious problems to the civil engineering structures especially road pavements built on them. The decrease-swell behaviours make expansive soils irrelevant for direct engineering utility of their natural form. In an attempt to lead them to greater possible for production functions, several materials and techniques have been used to stabilize the soil. It may be very luxurious to replace the inferior soil totally soil and for this reason, soil stabilization is the issue to search for in these instances.

Soil Stabilization is the alteration of soils to decorate their bodily homes by using including marble soil, fly ash, upward push husk ash, polymers, brick dust, Wood ash, fibers, including lime, by using exceptional geo materials like geo artificial, geo grid and geo form. With the assist off stabilization, waterproofs the soil, improves soil strength, lessen soil volume trade because of temperature or moisture, improves soil workability, reduces soil in paintings environment, upgrades marginal materials, improves sturdiness, dries wet soils, conserves mixture substances and decreases fee. There by improving the load bearing potential of a sub-grade to help pavements and foundations. Stabilization allows for the established order of design standards in addition to the determination of the right waste additive price to be applied in order to obtain the favoured engineering residences.

III.MARBLE POWDER

India ranks third in phrases of global production of natural stones, and money owed for an eleven% percentage of the worldwide market. Marble, Granite, Limestone, Slate and Sandstone are the chief materials that India exports. And the trend seems set to maintain within the future as properly, making the India marble & stone marketplace one of the brilliant spots in an economy that is already looking to grow as aggressively as is viable. India natural marble production stood at a few INR 2,925 crore in 2016, implying that India marble & stone marketplace may simply provide the impetus to an economy which desires to emulate China's export based totally boom version.

Marble dust is received as a waste product from marble industry. It is produced at some point of slicing and grinding of marble. The waste is generated from the industries within the form of both strong and slurry. The strong waste is produced on the mine sites or at the processing gadgets and slurry is within the semi- liquid shape generates at some stage in sawing and sprucing operations. The era of waste marble soil is about 30-forty% of the full marble treated per 12 months. It makes relevance due to the fact each yr about sixty eight million ton of marble is synthetic all over the global. The essential states of India at which the marble is observed are Rajasthan, Haryana, Gujarat, Jammu & Kashmir, Madhya Pradesh, Uttar Pradesh, Maharashtra, Andhra Pradesh, Sikkim and West Bengal.

In 2016, Rajasthan accounted for more than 80% production of marble in India. The capability for marble slab manufacturing in Rajasthan is round 1,000 million sq. Ft. in line with annum. Gujarat that is at 2nd area is not even near, with only approximately 10% share inside the general India engineered marble manufacturing.

India engineered marble production share, by state, by volume, 2016



Need Of The Use Of Marble Dust

Huge quantity of marble waste is being generated from marble slicing plant life and mineral industries. As those wastes have damaging impact on our environment, it is very important to find the secure disposal method for this kind of waste or to discover a right answer for the utilization of this waste.

The studies provide an eco-friendly answer for the usage of marble waste and facilitates in retaining our eco device. Waste marble powder consists in weight of CaO 30-68.8%, MgO 20-22.13%, SiO₂ 3-6%, Al₂O₃ 2.75-4.8%, Fe₂O₃ 0.5-0.8%, Cr₂O₃ 0.2-0.4%, ZnO 0.2-0.5% and TiO 0.54-0.6%.

When unsafe waste is dumped on the land, it reduces porosity, water absorption and water percolation leading to poor land first-rate. In monsoon, the stone slurry is carried away to rivers, roads, drains and waters our bodies which have an effect on the quality of water. So, it ultimately damage aquatic lifestyles, and decrease garage capacities. When the stone slurry will become dry, the exceptional debris is fast dispersed and it ends in air pollutants.

The web sites which can be used as dumping ground are constrained and supply repulsive soil appearance. As the dumping layer of stone waste will increase, finer debris block the flow regime of aquifers, hence it directly influences on the sub floor resources of water. Due to opencast nature of the mining, de flora of the area is approaching. Also dried slurry deposited over plants and plants hampers their growth.

Running mines, abandoned mines, dumping websites, slurry waste web sites, deposition of dried slurry over almost every structure in surrounding regions are a completely awful sight. Hills having been excavated and dumps over them are very unaesthetic. Already grown bushes and bushes have died out and new ones do not grow. Animals have also been disadvantaged of their meals and safe haven. There are some of accidents due to unscientific dumping of mine waste on street and quarry sites.

IV. LITERATURE REVIEW

Over the years, various outcomes have been carried out inside the vicinity of expansive soil stabilization, in all likelihood because of deeper insight and information of expansive soil conduct. Pavement engineers have already made huge attempt toward expertise the behaviour of expansive soils underneath loading situation using medical standards, and numerous laboratory experiments had been consequently designed.

K. Manohar (2019) states that usage of marble powder can lessen the environmental pollution. The Maximum dry density received at 15% marble powder i.e., 1.72 gm/cc. The most CBR cost also obtained at 15% of marble powder as 8.474%. E. The maximum unconfined compression energy of the soil was acquired at 15% as 777.11KN/m². Better outcomes can be obtained using marble powder at 15% dosage.

Rishi bhalavada (2019) done the effect of marble soil zero% to 40% of marble soil by means of weight of dry soil on report residences of dark cotton soil in laboratory concluded that the soaked CBR cost increasing from 1.71% to 4.18% of the expansive soil accelerated up to 30% addition of Marble dust. Further addition of Marble soil reduced the soaked CBR of the expansive soil. The effects are very favourable for design of pavement in expansive soil. □ The Maximum UCS price improved from 1.76kg/cm² to two.3kg/cm² at 30% of marble powder. The UCS fee for soil with 30% additive is 31.37% extra compared to black cotton soil.

Magdi Zumrawi (2018) made an attempt to evaluate using Marble Waste Powder (MWP) to stabilize expansive clay. Soil samples were combined with various proportions of MWP (0%, 10%, 15 % and 20% by means of dry weight). Laboratory experiments encompass sieve evaluation, Atterberg's limits; Standard Proctor, Unconfined Compression Strength (UCS) and Free Swell were performed on treated and untreated soils. The consequences found out that addition of 20% MWP to the soil drastically reduced the soil plasticity and unfastened swell index via nearly 12%, while the United States significantly increased through nearly 3.5 times of the initial cost. It's concluded that using MWP will enhance the expansive soil homes and its miles beneficial for good value and environmental concerns.

S.Shraavan Kumar (2018) conveys that the marble soil in experimental application is acquired from slicing of marble. The environmental degradation due to marble mining is way but the environmental degradation because of the waste from marble technique flowers. The practical exams reveals that the there is an improvement of all of the residences of marble soil powder and coconut shell powder handled black cotton soil. From the outcomes of unconfined compression check it is determined that the most unconfined compression power is acquired via addition of 15% MP + 15% CSP to the Black cotton soil. From the monetary evaluation it is discovered that, a good sized save in value of production is feasible.

Riddhi Choksi, C. B. Mishra, Nandan Patel (2018) conveyed the key findings feature that mutually the grow of waste marble powder, maximum dry density is going on growing whilst best moisture is going on lowering which is a worthwhile signal of soil as greater dense and tough. The top-quality moisture content material of 12.97% is reached at forty five% of waste marble powder. The initial growth within the CBR is expected because of the sluggish formation of cementations compounds and this rise in trend is stated as much as forty five% addition of waste marble powder after which lower is of note that is subject to collapse moisture living the lifestyles of riley and collapses MDD. The boom in CBR for 45% additive is 2.76 times that of normal soil. The UCS vale for soil with 45% additive is 1.5 instances extra compared to ordinary.

V.Keshavan et al (2017) says that the clay soil has a poverty assisting ability and large change in album on variations of moisture content. Such expansive soils manage need to be converted to collect them sufficient for production sports. To penetrate the effect of marble dust and granite dust contradictory tests had been conducted on soil jointly varying percent of marble powder with 0%, 25%, 50%, and seventy five% of marble dust by using weight of limited soil. The liquid restriction would lower from 38.6% to 17.33%. The plasticity index reduced from thirteen.6% to three.13%. Shrinkage limit increased from 4.366% to 40.88%.

Dhruv Saxena (2017) mentions the studies; paper describing the impact of marble dust powder and first-class sand on homes of Expansive soil. The clay soil is mixed with marble soil and sand from 30% to 50% and 20% to 40% respectively at a c programming language of 10%. From the evaluation of check results it become observed that , liquid restrict plasticity index, most advantageous moisture content, permeability and brotherly love decreased and plastic restriction, shrinkage restrict, most dry density, California bearing ratio and angle of internal friction multiplied with an increase of marble powder content material. From the monetary analysis, it was determined that marble soil up to twenty% is ultimate for sand blended with clayey soil.

Sreekumar. V. Babu (2017) shows in his observe that marble dust addition showed stepped forward performance in problematic soils with the help of action trade response. The presences of excess Ca²⁺ ions are responsible for the progressed performance. Also the power characteristics UCC and CBR are increasing up to nine% addition of marble dust after which decreases with further addition. Hence nine% marble dust addition can be appeared as the optimal percent for stabilizing the soil sample.

Hitesh Bansal and Gurtej Singh Sidhu (2016) upload the waste marble dust in the soil via percent weight in aesthetic precept of 10% to 30% at the same time an interruption of 10%. He manages that with boom in percentage of waste marble dust from 0% to 30%, the liquid limit fee decreases forever from 31.70% to 25%, plastic charge from 17.69% to 19.26% and it become located that most desirable moisture content material (OMC) Of clay reduced from 18% to fourteen.10% and maximum dry density extended from 1.738gm/cc to 1.884gm/cc, CBR Value increases from 2.46% to six.07%.

Adarsh Minhas (2016) had studied about stabilization of alluvial soil the use of marble soil and found that the addition of marble powder within the soil sample the OMC improved. This shows some variant in OMC due to the addition of marble powder. All in 3 cases (five, 10, and 15%) of marble soil to the alluvial soil indicates equal variant in OMC and outstanding improvement seen in CBR values whilst herbal soil is replaced via the addition of marble soil.

Tarkeshwar Pramanik, S. Kishor Kumar and J.P. Singh (2016) had studied about the conduct of Soil for Sub Grade by way of using Marble Dust and Ground Granulated Blast Furnace Slag and observed that the characteristics of soils range appreciably with Marble soil-GGBS content. The Optimum Moisture Content (OMC) increases and Maximum Dry Density (MDD) decreases with boom in percent of Marble soil-GGBS and with will increase 20%-20% of Marble dust and GGBS percentage compressive energy of soil increases. CBR fee for soaked and unsoaked condition will increase with will increase in percentage of Marble soil and GGBS.

Serife Oncu (2016) presents the initial findings of a research which aims to make use of a waste product for recycling cause, in addition to mitigating the expansive soils which reason structural distresses in a semi-arid climate, specifically to mild structures. The experimental findings proven that swell and shrinkage properties stepped forward by means of at the least 10% MP usage and that the effect of curing has been rather massive. However, regarding the flexural power houses, it was located that the MP addition multiplied the brittleness of the soil combinations, for this reason could be encouraged for soils to endure light masses. The predictive determinations of maximum swell and shrinkage values were additionally examined and proved to be very effective. Furthermore, a correlation might be formed between volumetric shrinkage and flexural energy parameters which honestly desire similarly paintings to check its applicability to special soils.

Er. Muthukumar and Er.Tamilarasan V S (2015) add the marble soil in the soil by using percent saddle in aesthetic precept of 5% to 25% with a language of five%. He concluded that jointly growth in percent of marble powder will increase, the Liquid limit price decreases continuously by means of all of five to 25% share of marble powder from 70% to fifty five%, plastic restrict price turned into elevated with the aid of 25% approx., it became observed that the Optimum moisture Content (OMC) of clay accelerated from 18% to 24% and most dry density (MDD) will increase desirable 10% and then starts off evolved reducing with the addition of Marble powder.

Ravi Shankar Mishra and Brajesh Mishra (2015) performed a soil stabilization the use of quarry soil as replacement mutually soil in percent of 20, 30 and forty and follow it with soil stabilize by means of the adhesive and lime. He located that OMC will increase from 23% to twenty-five.1% with boom in the proportion of quarry dust and MDD decreases from 1.83gm/cc to one.71gm/cc. UCS will increase desirable 30% with surest outlay of 19.60kg/m² and then decreases for forty% substitute. Plastic and liquid limits also are increased mutually increase in the share substitute anyways in actually small variety. Free swell index appreciably decreases from eighty five% to forty five%.

Ayhan Gurbuz (2015) in his observe made a pioneer attempt to examine the effectiveness of the usage of marble powder within the stabilization of clayey soil in a road creation underneath freeze–thaw results. Analysis indicated that as the marble powder content on this have a look at reaches 10% inside the clayey soil, the unconfined compressive strength of specimens rises to a top point; meanwhile, plasticity of mixtures decreases.

Mass loss as standards for durability behaviour within the marble powder-stabilized soils at the stop of freeze–thaw cycles is sort of 5%. Test consequences suggest that marble powder can be used as a stabilization material for clayey-type soils in sub-bases in toll road construction underneath freeze–thaw impact.

Patel,B.B., Thakar H.B., Varia H.R., Mishra C.B (2017) in their research paper suggests the impact of waste marble powder on characteristics of black cotton soil.

The percentage of marble powder used was 20% to 60%. The check consequences confirmed a good sized alternate in consistency limits of sample containing marble dust. The liquid restriction would lower from 31.3% to 23.5%. The plasticity index reduced from 11.57% to 4.35%. The CBR take a look at price increased from 10.36 to 27.19. From this laboratory investigation it become concluded that the waste material like marble powder generated from stone industries has a ability to alter the traits of expansive clay soil.

V. CONCLUSION

The present paper surveys the present condition of the field of marble waste powder application for upgrading the designing properties of soil. As an end, it has been seen that the effect of marble waste powder on black cotton soil is certain. By supplanting soil its dry load by marble powder it gives most extreme improvement in the expanding and straight shrinkage properties of black cotton soil. Advantages of the adjustment procedure can incorporate decrease in plasticity, lower permeability, decrease of asphalt thickness, disposal of unearthing material pulling or dealing with improves soil functionality, lessens dust in workplace, overhauls minor materials, improve the durability and performances of pavement subgrade properties. The survey shows that the interaction conduct of marble waste powder with soils can prompt practical answer for enormous scale usage and transfer of it. The audit gives the scientists, approach creators, asphalt originators and thruway temporary workers a sign on the utilization of marble waste powder and the utmost for its use in adjustment of soil.

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