STABILIZATION OF SUB-GRADE SOIL USING MARBLE DUST – A REVIEW

[1]Ajay kumar, [2]Navdeep Mor
[1]ME student, NITTTR Chandigarh,
[2]Assistant Professor, Civil Engineering Department, Guru Jambheshwar University of Science and Technology, Hisar.

Abstract: Pertaining to the environmental degradation and policies the utilization of industrial by products and wastes in road pavement is important and increasing to ensure proper productive use of waste material. Contribution of government policies and public awareness also helps in enhancement of both this demand and utilization. All over India there are approximately around 4000 marble mines and 1100 marble processing units are established. Near about 5-6 million tones/year of marble dust is generated and is disposed of on road sides causing environmental degradation, drainage problem and damaging agricultural land. To research the utilization of waste marble powder as a stabilizer to fortify the powerless regular sandy soil. The gradation curve of the sieve analysis shows that the soil is sandy associated with silt of low compressibility (SM- Silty Sand). The CBR (California Bearing Ratio) value and UCS (Unconfined Compressive Strength) of soil gives the clear idea about the quality of sub-grade material to that of required as per IRC (Indian Road Congress) Code. The CBR was carried out in soaked and un-soaked condition.

***IndexTerms* – Sub - Grade Soil, Marble Dust, SM, CBR, UCS, IRC.**

1. INTRODUCTION

The economic growth of any country depends on the infrastructural development, optimum use of resources and facilities. In every 5 year plan, the lion share of investment gets allotted for the infrastructure specifically highways and expressways. The eleventh 5 year plan also invested more than 3.5 lakh cores in the road sector. The demand for utilization of Industrial by products and wastes in road pavement is increasing and becoming more important. Hence engineers are taking strenuous effort to design the quality road pavements which ultimately depends on the strength of the sub-grade both in flexible or rigid pavements. Government policies and public awareness is also contributing to the enhancement of both this demand and utilization.

1.1Normally there are two types of pavement:

1.1.1 Rigid Pavement

With reference to figure 1, rigid pavement is made up of cement concrete or reinforced concrete sections. Whereas grouted concrete streets falls under the classification of semi-unbending pavements. The design and plan of rigid pavement depends on giving a basic cement concrete piece of adequate solidarity to oppose the heaps from traffic. The unbending asphalt has inflexibility and high modulus of versatility to convey the heap over a generally wide territory of soil.

1.1.2 Flexible pavement

A flexible pavement as per Figure. 2, i.e. adaptable asphalt can be characterized as the one comprising of a blend of asphaltic or bituminous material and totals put on a bed of compacted granular material of fitting quality in layers over the sub-grade. Water bound macadam streets and settled soil streets with or without asphaltic garnishes are instances of adaptable pavements.

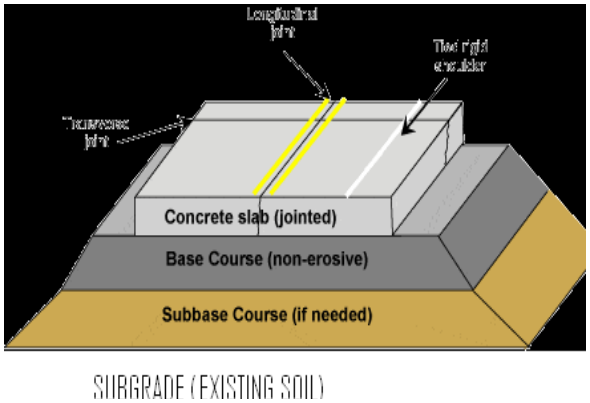

Fig. 1 Typical layers of Rigid Pavement

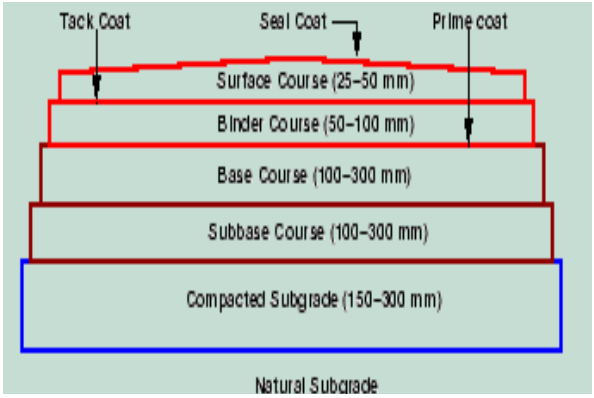

Fig. 2 Typical layers of Flexible pavement

2. PURPOSE

As per according to Unified Classification System the dust example comprises of Sandy Clayey with low plasticity and the properties will be resolved after the test examination of the dust example. After that the replacement of some percentage of clayey sand with the waste marble residue will be proposed. Anyway some replacement of the sandy clayey soil would be possible with the waste marble dust once the effect of dust on sub grade soil is known. This procedure may improve the conduct of the sub level which will be valuable in planning the adaptable streets.

3. MARBLE WASTE

Marble is a transformative shake which is made through changeability of limestone under outrageous warm and weight vitality. It is particularly well known everywhere in the world for its uniform and smooth surface, moderate hardness, and its capacity to be quarried into huge squares, gleaming and smooth cleaned surface which gives a luxurious vibe. Marble industry creates a lot of waste which poses risk to nature. This wasteage is around 40% of the all carried out marble dealt per annum. It makes significance on the grounds that yearly around 68 million of marble is made throughout the world. The waste is created from the stone industry as both powder and slurry. Waste marble powder (WMP) is the result of the marble business which is produced during cutting and granulating of marble. Waste Marble powder influences the earth and causes numerous wellbeing dangers[5]. To research the utilization of waste marble powder as a stabilizer to fortify the powerless regular sandy soil. In the previous couple of years, marble is considered as a standout amongst the most fundamental embellishing building material.

4. LITERATURE REVIEW

C. Gupta and R. K. Sharma (2014) finds that the marble was most favour stone of India and accessible for the most part in Rajasthan and Madhya Pradesh. The creators explored the quick development of businesses of marble produces perilous waste materials which poses a major issue to the people encompassing them just as goes about as a toxin so influence the natural arrangement of the earth. Various studies demonstrate that there was critical required for investigating the option of proper utilization and transfer of these materials.

J.Jayapal1 *et al.* **(2014)** concluded that the local Clayey soil in Chennai can be improved by quarry dust, fly ash and lime and can be used as effective stabilizing agents in stabilizing clayey soil for its usage as a foundation material.

P. S. Singh and R.K. Yadav (2014) investigated mechanical wastes like marble residue could change the building conduct of dark cotton soil and to make it reasonable in numerous geotechnical applications. Different tests were carried on dark cotton soil blended with marble dust in various percentages according to pertinent IS Code of training. This study considered the expansion of marble dust into the dark cotton soil changed the Procter compaction parameters and OMC of the soil sample has diminished and the maximum dry density (MDD) expanded with the expansion of marble dust. They also contemplated the splashed CBR esteems have likewise expanded essentially with the expansion of marble residue content. This study further examined the expansion of 40% marble dust into the dark cotton soil, increment the CBR esteems from 1.81% to 4.17%.

M. Singh and A. Mittal (2016) found that the waste level can be effectively utilised for enhancing the bearing limit of soil upto ideal elastic substance and level waste can adequately be used as soil reinforcement underneath balance, dike and holding divider. This study finished up the lead to by and large sparing in soil material expenses and reusing of level waste and RHA squander.

T. Pramanik *et al.* **(2016)** concluded that the Marble residue and GGBS is conceivably helpful in balancing out of soil. The researchers concentrated on the settling impact which was an essential element of the compound structure, fineness, and expansion dimension of the Marble residue and GGBS just as the sort of parent soil. Marble residue and GGBS was successful soil adjustment specialist, in light of the outcomes watched and portrayed in this postulation. They researched the utilization in the adjustment of soil for sub-grade up degree, which able to diminish thickness of sub-grade.

E. Ravi *et al.* **(2016)** investigated the practicality of using the mechanical side-effect copper slag as a stabilizer in the expansion soil where swelling and shrinkage qualities are higher and makes serious harm to structure and street asphalt. The creators contemplated the satisfactory level of copper slag added substance in the quality enhancement of earth soil. Three unique portions were tested in the present procedure of adjustment viz. 10%, 20% and 30% of copper slag and as needs be the aftereffects of Maximum Dry Density (MDD), Optimum Moisture Content (OMC) and California Bearing Ratio (CBR) were contrasted and the ASTM (American Society for Testing and Materials) and Indian benchmarks for the plan necessities of sub-level for the adaptable asphalt. This study finished up the blend of 70% mud soil and 30% copper slag was the perfect adjustment proportion which expanded all the alluring qualities of sub-grade prerequisites.

H.Bansal *et al.* **(2016)** studied the most ideal usage of the waste marble powder in soil adjustment by supplanting the dirt with waste marble powder in the extent of 10%, 20% and 30%. They additionally contemplated demonstrates that incorporation of waste marble powder makes it a decent option for the dirt adjustment. The researchers closed the waste improved the record properties just as designing properties of soil.

B. B. Patel *et al.* **(2017)** studied the unconfined compressive strength (UCS) and the California bearing proportion (CBR) of the earth soil of Vijapur street, on the under development from RTO (Regional Transport Office) intersection increments by balancing out the dirt with Marble powder. This study likewise considered the one of admixture out of outstanding admixture like stone residue, fly fiery debris, rice husk, polymers, Portland cement, lime and ionic stabilizers.

Beulah M and Prahallada M.C (2013) investigated the impact of replacement of cement by marble dust on the properties of elite concrete exposed to magnesium sulfate assault and found that expansion of marble dust builds its compressive quality as well as improves its protection from magnesium sulfate assault.

R. Raj (2013) studied the physical and mechanical properties of conventional Portland cement concrete containing up to 14% marble dust as a cement replacement material. Examples with water fastener proportion 0.38, 0.36 and 0.33 were tested at compaction factor and Vee – Bee consistometer tests. The researchers contemplated the expansion of MK brought about decrease in usefulness, increment in compressive quality and a decrease in the sorptivity with reference to the control. In RCPT test, the lower evaluation of concrete had a higher current stream than the higher evaluation concrete at all replacement levels.

Ajay (2013) observed the compressive quality and chloride obstruction of marble residue concrete. The creators contemplated that for various w/c proportions of 0.32, 0.35, 0.4 and 0.5. The MK extent was changed from 0 to 15%. The creators saw that MK concrete indicated more prominent quality for higher water cement proportions (0.4 and 0.5) and its protection from chloride particle infiltration was same or less steady for all w/c proportions.

G.Dhinakaran*et al.* **(2012)** observed that with addition, the compressive quality is improved relying on the replacement dimension of OPC by marble dust. This study considered the marble dust incorporation by and large improves rigidity, flexural quality, and bond quality and modulus of versatility. They further examined that expantion in the individual properties relies on replacement level.

Patil (2012) investigated that the ideal replacement amount of marble dust with fly slag to cement in concrete. In this work different preliminaries having fluctuating level of marble residue and fly fiery remains as replacement for cement in concrete are considered and properties of same are examined.

V. Srivastava (2012) studied that the supplanting 8% by weight of cement with Marble residue and Silica rage. Marble dust expansion demonstrated to be valuable, bringing about concrete with significantly higher qualities and more prominent.

V. Srivastava (2012) concluded that the incomplete substitution of cement with marble dust as far as obstruction of MK mortar to sodium sulfate (Na2SO4) arrangement. Results on quality, porosity, pore size dispersion, and calcium hydroxide substance were likewise revealed. The creators examined the sulfate extension results show that the sulfate opposition was expanded as the replacement dimension of cement with marble residue increments, up to in any event 25% replacement. Additionally, albeit after delayed times of introduction to Na2SO4 arrangement, there was huge quality loss of PC mortars and mortar with low dimensions of MK (5 and 10%), for mortar with elevated amounts of MK (15, 20 and 25%), there were reliable quality increase.

5. CONCLUSION

In this study, a review on Marble Dust Using in Sub-Grade Soil state of the current wherein part of pot openings and settlement is particularly during the blustery season and with the development of traffic. The improvement of sub-grade soil with ideal extent of Marble residue is to be considered. Remembering this target marble residue can be utilized as a replacement material of soil in sub-grade in various extents to accomplish wanted quality and thickness. Qualities of soil in this locale fluctuate essentially and because of the dirt profile the street has settled down with part of potholes. The examination was done at a fix by taking an example of each layer beginning from sub-evaluation to base.

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