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PAVE STABILIZATION WITH THE APPLICATION OF ROCKWASTE

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Abstract: - *Filling of stone are being widely used for a variety of applications nowadays, due to their cost effectiveness, durability, flexibility & other advantages. Compared to RCC the pave can achieve around 30% to 40% saving in the construction cost. If the costly stone filing is replaced by a locally available cheap material like rock waste, the cost of construction can be further brought down. In this study filling is replaced with rock waste. Experimental investigation was constructed on model pave constructed in field as well as inside laboratory. The influence of rock waste on the behavior of pave stabilization studied by using different combination of stone of rock waste. The results from the study show that a 30% to 40% combination of rock waste stone filling can be recommended for low height.*

Keywords:- *Pave , rock waste , durability , cheap material , stabilization .*

1. Introduction

Rock waste is a multipurpose material for yard construction . A compacted layer of rock waste is well suited to a yard or passageway surface. It is also a great choice for sub base in laying paving blocks of slabs & jointing natural stone such as slate. As a rock waste surface is extremely compacted & waterproof banking must be taken into consideration during installation. Rock waste is by produced of crushing with a typical grain size of 0-3.4 mm or 0-6.8 mm because rock waste contains very fine mineral it forms a hard, load-bearing surface. Rock waste is more prone than sand to setting & drainage problem when used as a base beneath walkway or patio pavers. A proper base material can be compacted easily, however due to rock waste powdery nature it doesn't compact as well as other materials. When paves are laid a dry grout product can be used to seal the joints. It is offer a mix of sand & cement. The benefit
of using this method is that it doesn't cause staining & is quite easy to complete.

The research work in this field early 1978 the author at the time in soil mechanics at university of lulled with a background in rock mechanics, geology & structural design of industrial plants. Around 1980 the international Stripa project an autonomous OECD activity for developing & testing techniques for isolating highly radioactive waste was stared with Canada, Finland, France, Great Britain, Japan, Sweden & USA as member nations.

2 Methodology

2.1Material selection:-

Rock waste collected from Jaglpur Govindpur Dhanbad Jharkhand crushing plant for testing after stock sampling. Ordinary Portland cement 43 grade & admixture water reducer &super plasticizer obtained from the local dealers were used in the design for concrete manufacture. (Taking sample in dry condition & gray in color, use as thoroughly retained on 150µ IS sieve for entire investigation. Fineness Modulus, Specific Gravity of rock dust was 2.60 & 2.40 respectively. Particle size distribution curve with conforming to the grading zone –II as per IS 383-1970 specification with upper and lower permissible limit (UPL & LPL) as shown in fig 1

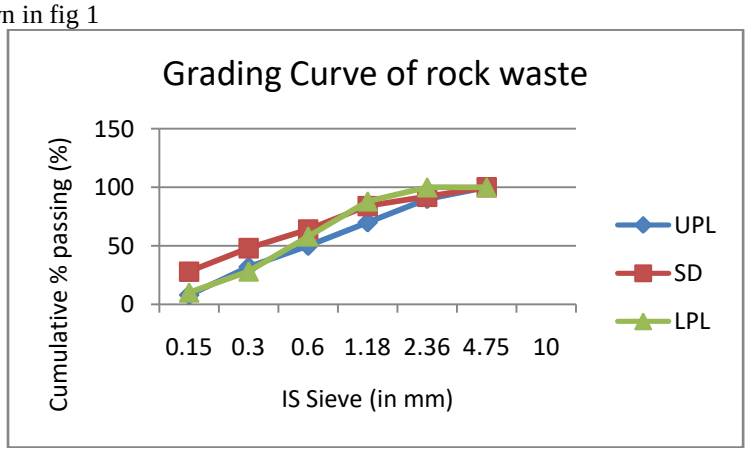


Fig 1 Grading of rock waste

2.2 Index properties of rock waste:-

Index property of rock waste were material as per IS code & are presented in table. The rock waste is classified as rock waste was randomly mixed with sand sample 10%, 20%, 30%, 40% & 50% of the dry weight of sand.

Table 1 Index properties of rock waste

Property	Value
Natural moisture content %	8.23
Particle size distribution	
sand %	80.6
silt %	19.4
Specific gravity	2.6
Liquid limit %	NP
Plastic limit %	NP
Plasticity index %	NP
OMC %	12.35
MDD (g/cm^3)	1.87
Angle of internal friction (°)	36°
Cohesion (KN/m^2)	0.08
CBR soaked %	12.3
CBR unsoaked	27.28

2.3 Test on rock waste:-

Rock waste is a result of crushers while doing quarrying. Quarring waste was obtain from near by quarries at the home place like Nairo more Govindpur, Dhanbad Jharkhand. The present investigations are aimed at studying the effect of quarrying waste when it is replaced with sand partially in pave. The quarry waste samples collected from Nairo more resion were studied & compared in terms of Geotechnical properties. The physical properties of zone-II following quarry waste used in compressive strength study. The program involes casting & testing cube specimens in each set consisting of 3 cubes.

The variation in standard deviation of strength greater than $5N/mm^2$ is not considered for every set of the whole series. The cube were caste using standard cubes 70mmX70mmX70mm specific gravity of sand & quarry dust of 2.6 &2.7 for zone-II classified type is obtained 43 grade cement is used for the mix. Curing was done by conventional moist curing for the pave compression testing machine of 1000 KN capacity was used to test the cube specimen. The series is as follows.

(a) In the first series 1:3 proportion of mix cement with 20 25 &30 percentage replacement of quarry dust tested for 3 days 7 days 28 days is studied & the result are presented

(b) In the second series 1:4 proportions of mix cement & with 20, 25 &30 percentage replacement of quarry waste tested for 3 days 7 days & 28 days is studied & the results are presented.

(c) In the third series 1:3, 1:4 &1:6 proportion of mixing of cement with 20, 25 &30 percentage replacement of quarry dust by varying the water cement ratio of .45 & .50 are studied & the result are presented.

3. Discussion on Results

(a) The compressive strength result of rock waste pave were obtain in the first series were 1:3 proportion of mix cement with 20, 25 &30 percentage replacement of rock waste tested for 3 days 7 days &28 days is studies of result are presented. The specimen were with conventional material i.e fine aggregate is nature river sand with 1:3 proportion mixing using ordinary Portland cement (OPC) . With the increase the pave the compressive strength increase up to 30% replacement of rock waste as fine aggregate. The partial replacement of rock waste gave a 28 days peak compressive strength at 30% replacement level. Compressive Strength of 1:6 Proportion mix of cement with varying age of concrete by replacement level up to 30%.

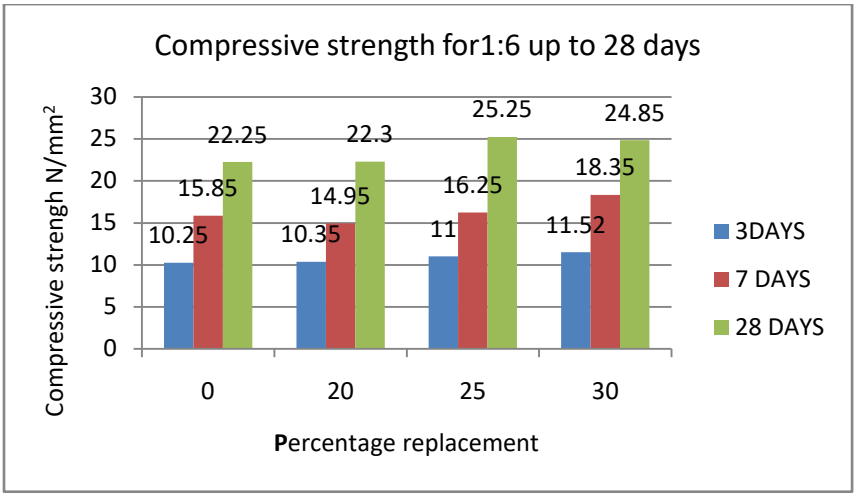


Fig 2 Compressive strength of rock waste

(b) The compressive strength results of rock waste pave were obtained in the second series where 1:4 proportion mixing cement with 20,25,30 percent replacement of rock waste tested for 3 days, 7days & 28days is studied & the result are presented with observation of 20% rock waste (7days) the average with compressive strength is 15.62 N/mm2 where that for natural sand is 14.44N/mm2 for 25% quarry dust, the value increased to 15.98N/mm2 .Finally for 30% rock waste the strength increased to 16.44N/mm2 .Hence rock waste can be effectively used to replace of pave .The slight variation is obtained in compressive strength for 3 days &7 days age in pave strength up to 30% of replacement of rock waste also increased.

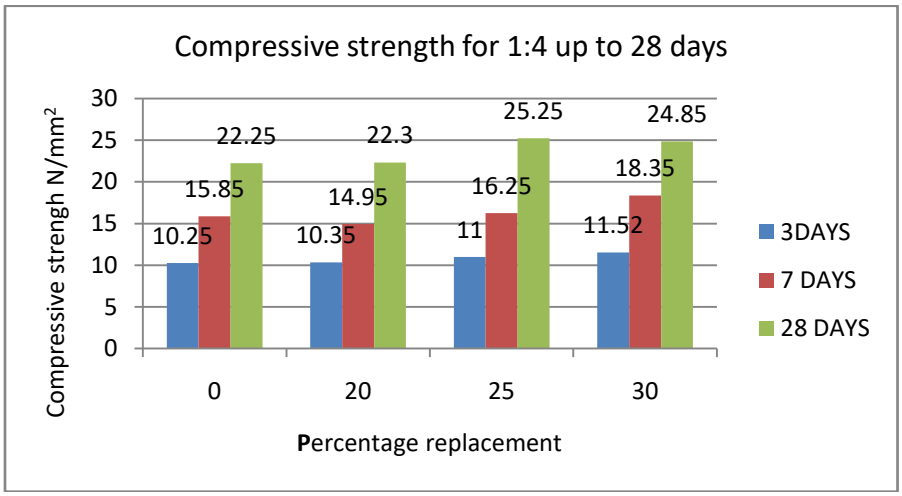


Fig 3 Compressive strength of rock

(c) The compressive strength result of rock waste pave were obtained the third series where 1:3,1:4 & 1:6 proportion of mix cement with 20,25,&30% replacement of rock waste tested for 3 days ,7 days ,28days is studied & the result are presented .The specimens were casted with conventional materials that is natural river sand with 1:6 proportion mixing using ordinary Portland cement (OPC) with the increased in age of pave the compressive strength increased up to 25% replacement of rock waste as fine aggregate .

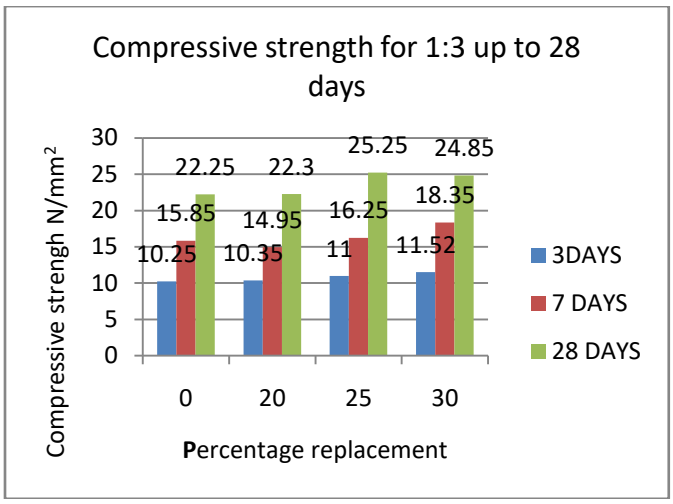


Fig 4 Compressive strength of rock waste

5 Used of rock waste in pave stabilization

Quarry waste of rock can be utilized in pave stabilization as good substitute for natural river sand giving higher strength at 40% replacement while using rock waste as fine aggregate in pave it is found that there is increased in compressive ,flexural & tensile strength of pave. It has been observed that 30% replacement of fine aggregate with rock waste is adoptable. It was observed that the replacement of natural sand by waste of rock increased the compressive strength of pave between 10-20% & it was also found that amongst all the mixes the highest compressive strength was obtained for 30% replacement of sand by rock waste. The required slump could not be achieved by natural sand with given parameter of mix design was achieved. The compressive strength of pave rock should 7.16 higher value than that of the pave made of natural sand. it is found that the compressive & flexural strength of pave made of quarry rock dust are near by 10% more than the general work.

6. Cost Benefit Analysis

The district administration has fixed a price of rupees 3000 for a truck load of ordinary sand & Rs.3500 for fine sand wind 10 km from the loading point. the rate is applicable to two units or 200 cubic ft. of sand. The increased by Rs.500 for every five additional kilo meter. The price of rock waste Rs.1000 for a truck load of ordinary point. The rate is also applicacable to two units or 200 ft. of rock waste the increased to400 for every five additional kilometers.

7. Operation: - Operation of these waste rock dump , generally done by mixing employees involves these activities .

- Ore transport from the mine & or mill to the dump.
- Maintenance, upgrade & expansion of surface water management facilities.
- Dump performance monitoring at dump including seepage water, surface water, ground water quantities& qualities stability, erosion, consolidation & creep.

8. Recommendation:

The user needs to consider high strength pave in the current market as it will greatly improve the pave strengths. There is enough justification for its use in high loaded pave especially in readily congested areas of the cities where land has reduced. Use of high strength pave will also help at petrol pump, airport, railway yard & heavy loaded vehicle. Uses of rock waste will also reduced river sand used which has in the recent presented seriously environmental impact in the rivers where they are minded.

9. Special feature of waste rock:-

The predominant rock type at the Dhanbad area is andesitic & it varies from employetely weather material through to fresh rock. Ignimbrite is also present & its composition also varies from completely weathered to fresh. There are smaller quantities of alluvicem & asters(sand, silt& clay) that mantle the pit area.

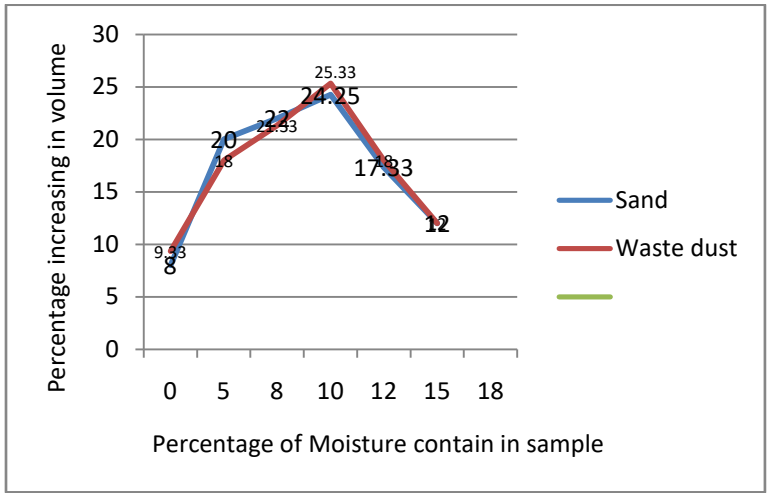
Special feature of the waste rock is that some of it contains sulphide & is capable of producing acid drainage when exposed to origen & water. This rock is referred to as potentially acid forming rock. Waste rock without the potential to form acid drainage is referred to as non acid forming waste rock. Special design & proportional procedures are used to control acid drainage generation. As a contingency provision is made to collect & treat any fluid that is generated.

10. Guidelines for waste rock fill placement and compaction:-

Thickness:-Maximum thickness is governed by maximum waste rock size & type of compaction equipments. Optimum waste rock fill thickness is generally 200 mm to 300 mm with maximum waste rock size. Compaction limit of conventional 5 to 10 tone vibratory steel drum rollers commonly used on modern day waste rock fill. Bulk density & gradation test of settlement versus roller pass curve are recommended in test fills for large waste rocks fill dam or other critical waste rock structures to determine the maximum thickness acceptable for the compaction roller used on site.
Roller Passes:-Optimum roller passes are determined from surveyed settlement versus roller pass curves developed in large scale test fills. The general limit is between 4 to 6 passes. More than 6 passes tends to crush & pulverized the waste rock fill surface without adding significant compaction to the lower part of the lift. Each roller pass should overlap the edge of proceeding passes for 100 percent roller pass coverage on the surface .As a general rule of the thumb the acceptable number of roller passes should be set at 80% of the total surveyed settlement in eight passes on the test section, according to corp of Engineers test. The average settlement of at least 5 surveyed control points is recommended for each 2 passes of the roller compacter to determine the acceptable number of passes.

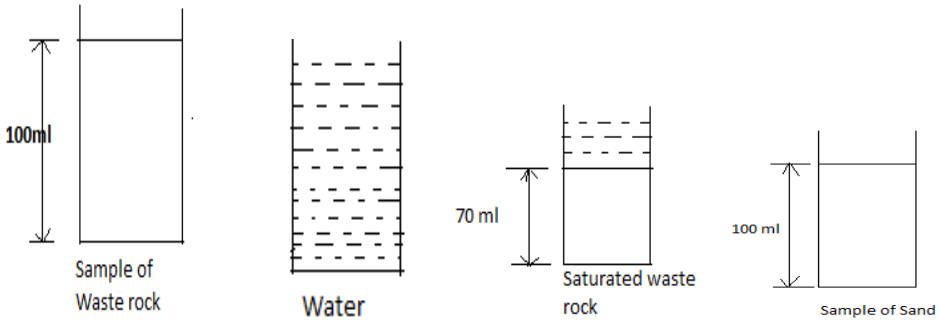
11. Calculation of percentage of Bulking of Waste Rock as compared to sand

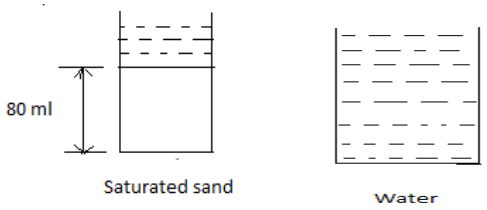
The increase in the moisture of waste rock increases the volume of waste rock. The reason is that moisture causes film of water around the particle which result in the increased of percentage of 8-27% dependending upon waste rock. If the waste rock is more fine there will be more increased in volume .This is known as bulking of waste rock. Graphical representation of bulking of waste rock & sand is shown below.



Test procedure can be used

1. A simple cylinder container is taken & it is filled with 2/3 of waste rock & other cylinder fill of sand of same size to be tested.
2. The height of waste rock sand is measured 100 ml.
3. Now the waste rock & sand is taken out of container care should be taken to see that there is no remains of waste rock & sand should be there in container during this transition.





4. Now the same container is filled with water.
5. Pour the waste rock & sand in container filled with water & stir the waste rock & sand with a rod.
6. Again the height of waste rock is measured say 70ml & sand is 80ml.

Bulking of waste rock is calculate as

$\frac{100-70}{70} \times 100$=42.85%

Bulking of sand is calculate as

$\frac{100-80}{80} \times 100 = 25\%$

12. Conclusion:

On the basis of result obtained during the experiment investigation, following conclusion are drawn:-

- With replacing natural river sand to rock waste (10%-100%) increased compressive strength 10%-20%) can be achieved.
- With replacing natural river sand to rock waste (10%-80%) decreasing bulking of rock waste.
- Rock waste can be used as an opposite substitute for fine aggregate in case of non availability of Natural River sand at reasonable cost.
- Cost of less than sand because the rock waste is availability & required for cleaning the land.

13. References:

1. ASTMDI633-00(2007) standard Test method for compressive strength of molded rock waste cylinder.
2. Miller, G.A.& Zaman, M.(2000) Field & laboratory Evaluation of cement kiln Dust as a soil stabilizer. Transportation Research Record, Transportation Research Board, Washinton, D.C. No.1714, 25-32
3. International journal of geotechnical & environment Volume number 02 ISSN: 0975-4822 July December 2017
4. Http://www.scrip.org/journal/ojce.
5. Kuwai, T (2001) state of the art report on high strength concrete in Japan recent Development & Application.
6.IOSR Journal of Mechanical & Civil Engineering (IOSR-JMCE) e-ISSN 2278-1684 p ISSN 2320-334X,Volume 12,ISSUE IV of I (Jan- Feb 2015)
7. Soosan, T.G; Jose, B.T. & Abrahan, B.M.(2001). Use of crusher dust in embankment & highway construction.Prof. Indian Geotechnical conference, December Indore 274-277.
8.Bshara,A.S. Bind ,Y.K.& Sinha, S.P.K.(2014).effect of stone dust on geotechnical properties of poor soil. Into journal of civil Engineering & Technology (IJCIET) Vol. 5, issue 4,37-47.

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