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USE OF DEMOLISHED CONSTRUCTION AGGREGATES FOR CONSTRUCTION OF BASE COURSE FOR ROAD CONSTRUCTION

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ABSTRACT:

The managing and use of demolished aggregate in new construction had led the environment friendly that led the use of waste to utilize it in different fields including construction fields. The main aim is to do the construction which has the advantage of avoiding waste which are in large quantities at landfills and also to avoid the borrow construction material which are not available easily in some areas. The construction and demolished waste has very good impact on the construction works. The aim of the research is to find the technical viability of waste aggregate for Base course layers. For this purpose various tests are formed to check the result of using CDW (Construction and demolished aggregate) in construction of pavement composed of asphalt mix, concrete and ceramic waste aggregate. This was done by analyzing the recycled aggregate on actual road section. It was found that result of using a CDW in making base course for road surfacing was satisfactory.

INTRODUCTION:

In the recent years, considerable work has been made to implement the guidelines and regulation to use the waste materials for different purpose for its proper use of disposal. The main objective is to encourage the reuse of waste in construction sector.

In many countries recycling techniques have been made since 1970.For example the reuse of concrete and building masonry for the preparation of base course for road in Netherland. Molenaar and van Nierkerk (2002) studied the unbound base course materials made from recycled concrete and masonry by measuring parameters such as Composition and gradation etc. Their study determined that the degree of compaction is the most important factor affecting to the mechanical characteristics of unbound base courses made of recycled materials. Nataatmadja and Tan (2001) studied the capacity of

the resilient response of a sub base made from four types of recycled aggregate with a view to verifying whether its strength was comparable to that of a sub base made of natural aggregate. Significant research initiatives are currently under way to determine how technical characteristics, such as moisture content, the California bearing Ratio (CBR), and degree of compaction, are affected when recycled construction and demolition waste (CDW) aggregate is included in pavement layers.

Park (2003) studied the physical properties and compaction of two types of recycled aggregate obtained from the housing development and from concrete pavement rehabilitation developments. He found that the optimal moisture content increased when the absorption of water by the aggregate increased. Taha et al. (2004) conducted various laboratory tests on demolished concrete and concluded that the results obtained indicated that such material can be used for road base courses and sub bases. Chong presents an industry framework for the continuous development of CDW reuse and recycling. This paper underlines that current incentives provided for the additional work that contractors must perform when CDW is used are clearly insufficient. Furthermore, designers lack the knowledge of what actually can be recycled in the region. Nor are they truly aware of how to reduce the cost of recycling (Chong 2009).

The aim of research is to find the technical viability of CDW in preparing a base course for road. The CDW include concrete, asphalt mix and ceramic materials.

RESEARCH AIMS AND OBJECTIVE:

The aim of our research study was to verify the technical viability of using construction waste as material for the Base course construction. For this purpose, a field study was carried out, which analyzed the performance of a surface course base of mixed Recycled aggregate composed of concrete, asphalt mix, and ceramic material.

METHODOLOGY:

Our study includes analysing the performance the recycled aggregate for the preparation of base course and to compare it with the one made from natural aggregate. Our research consists of following phases:

1) Characterization of materials used for base course for road construction.

2) Treatment of material used

3) Performing of tests on road section

4) Results

5) Conclusions

1) CHARACTERIZATION OF MATERIALS USED FOR BASE COURSE FOR ROAD CONSTRUCTION:

The first stage was to define a materials and their volume percentage in the mix. Three types of materials are used:

1) Concrete from demolished buildings.

2) Asphalt mix from rehabilitation of road project.

3) Ceramic materials from partition walls of demolished buildings.

The maximum percentage of ceramic and asphalt used are 20 percent and 5 percent respectively and concrete used in the mix is 75 percent.

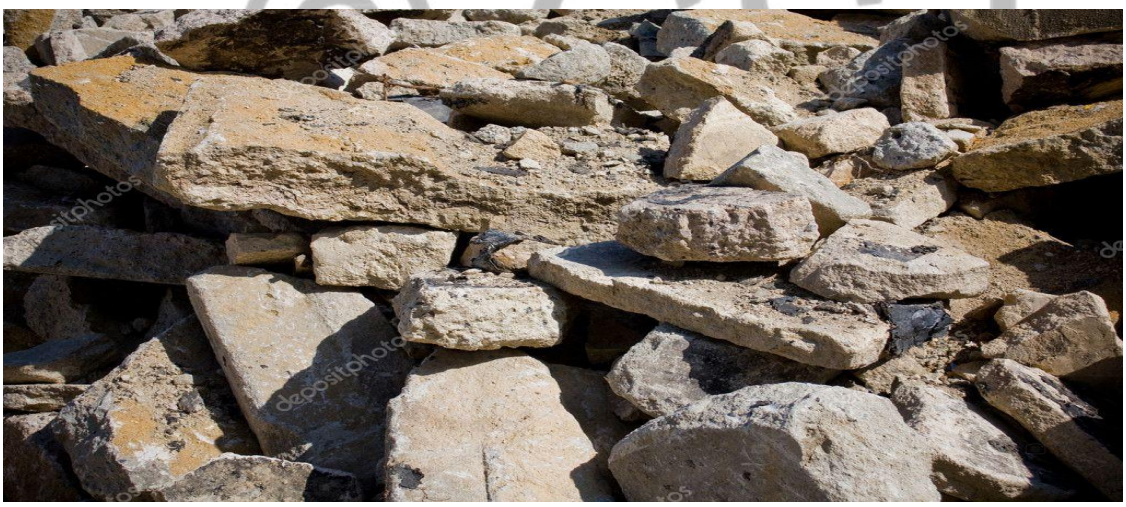

Figure 1 Demolished building Concrete

Figure 2 Recycled Asphalt Mix

Figure 3 Ceramic materials waste

2) TREATMENT OF MATERIAL USED:

The first step in the treatment process was to wash the materials used by manually and mechanically to remove the impurities such as paper, glass, wood etc. After that it was grinded to make it to the size of aggregate used in preparation of base layer. After grinding the electromagnet was used to remove the metals from the materials. After that the materials are ready for constructing of base layer. The materials used in this are 50 mm down size are used. The gradation curve of the material shall be smooth and within the envelope limits for Grading A or B given below as specified by NHA Pakistan.

Grading Requirements for Aggregate base Material		
Sieve Designation	Percent passing	
Inch	A	B
2	100	100
1	70-95	75-95
3/8	30-65	40-75
#4	25-55	30-60
#10	15-40	20-50
#40	8-20	12-25
#200	2-8	5-10

3) PERFORMING OF TESTS ON ROAD SECTION:

The road section selected was village road near district Mansehra of length 200 meter.one sections is prepared with natural aggregate and other one with CDW composed of demolished concrete, ceramic material and recycled asphalt mix aggregate. The section made with natural aggregate is prepared to compare it with that made of CDW materials. The ADT (Average Daily Traffic) was in between 100-200 and of medium intensity of traffic. Different tests were conducted including Los Angeles abrasion test, flakiness index, modified proctor test etc. The results of both sections are compared.

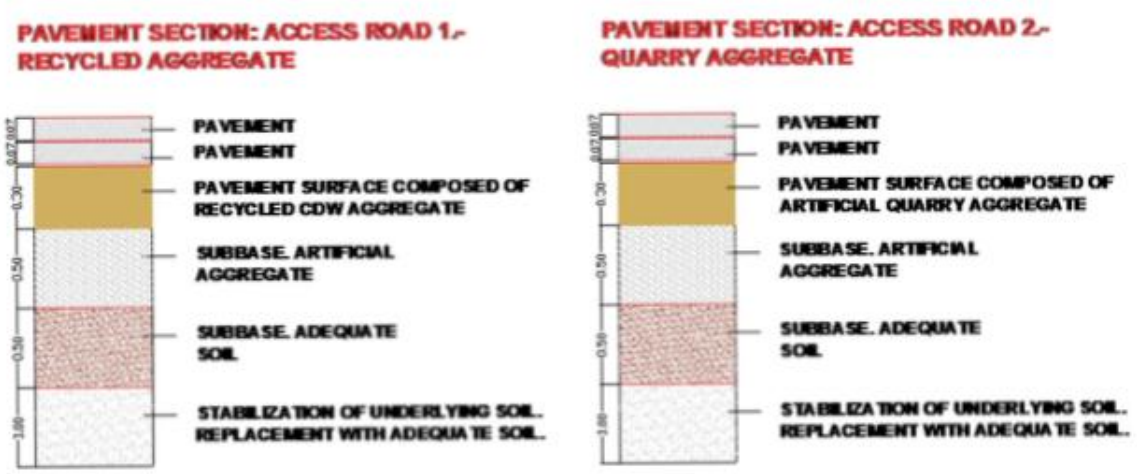

Figure 4 Road sections made of recycled CDW aggregate and pavement made of quarry aggregate

4) RESULTS:

Table 1 Tests on aggregate made from CDW and Quarry aggregate

Origin	Modified Proctor Test	OMC	FLAK INDEX	Fracture Face	Los Angeles Abrasion value
Quarry	2.28	6.4	7	100	27
Recycled	2.07	9.6	11	100	33

Table 2 Moisture and Density results from Quarry Aggregate

Point	1	2	3
Density(g/cm3)	2.25	2.26	2.24
Moisture content (%)	5.3	5.6	5.2
Compaction Achieved(%)	99	100	98

Table 3 Density and Moisture results from CDW aggregate

Point	1	2	3
Density(g/cm3)	2.05	2.0	2.0
Moisture (%)	7.6	11.3	9.8
Compaction (%)	100	100	98

5) CONCLUSIONS:

The compaction of CDW aggregate is much difficult as it required more water as compared to natural aggregate. It requires more water initially also when compaction continues. This result homogenization of water and aggregate mix.

It was observed that load bearing capacity of CDW aggregate is satisfactory which is made of concrete, asphalt mix and ceramic materials as long as it is free from plastic, wood, glass etc, also it needs more water to achieve the desired level of compaction

It is also observed from our tests result and from the literature that density given by CDW aggregate is low as compared to density given by natural aggregate.

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