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A Comparative Study of River Borne Coarse Aggregates Of The Rivers - Pagladiya, Kopili And Kulsi (Assam) In Their Natural Form For Their Utility As A Road Construction Material

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Abstract: **Aggregates play an important role in civil engineering construction. They are used to build and maintain urban,suburban, and rural infrastructures including commercial and residential buildings; highways,bridges, sidewalks, and parking lots; factories and power generation facilities; water storage, filtration, and delivery systems; and wastewater collection and treatment systems. In the past, the river borne aggregates and aggregates collected from quarry were both used in construction purposes depending upon their availability. Collection of aggregates by blasting can create huge amount of pollution and excessive destruction of hilly structures and forest materials. Thus, it has become necessary to locate the alternative sources of locally available natural aggregates.The Northeastern part of India is a hub to several rivers and their tributaries, which carry considerable amount of coarse aggregates. The engineering properties of such river borne aggregates need to be studied in details for better evaluation of their utility as road construction material. The present study involves a detailed analysis of river borne coarse aggregates in their natural state collected from three rivers, viz. Pagladiya, Kopili and Kulsi. The aggregates have been collected from the banks of these rivers flowing through various places of Assam. Also, a comparative study has been made between the engineering properties of the aggregates collected from the three rivers showing the nature of variation in these properties and thus, inferring that the aggregates collected from which river is more suitable for road construction purpose.**

Keywords – River borne aggregates, road construction, engineering properties

1. INTRODUCTION

Aggregates are essential constituents of concrete. They are crystalline or granular rocks that are extracted for use in the various construction works. With the increasing demand of construction, use of aggregates has become equally necessary. Aggregates can be collected from the river sites or by blasting of rocks in the quarries for their use in construction purposes, depending upon their availability. But due to quarrying by blasting various harmful and noxious gases are released into the environment which eventually pollutes the environment [2]. Thus it has become necessary to locate the alternative sources of locally available natural, river borne aggregates.

The present study involves a detailed analysis of river borne aggregates in their natural state. The aggregates have been collected from the banks of the river Pagladiya, river Kopili and river Kulsi, which flow through the various places of Assam and a comparative study has been made between the engineering properties of the aggregates collected from the three rivers. From this study, we can interpret the suitability of the river borne aggregates as construction material.

The main purposes of the study are as follows:

1. To carry out the geotechnical tests on natural form of river borne aggregates.
2. To see the property variation, if any, of the aggregates collected from river Pagladiya, river Kopili and river Kulsi.
3. Finally, interpretation of results to find their suitability as road construction material.

2. STUDY AREA

The Pagladiyariver originates from southern slopes of Bhutan hills latitude of 26°59’ north and longitude of 91°27’ east. It is outfalls of Brahmaputra near Laopara. The river flows for a length of 19 K.M. in the hilly track of Bhutan and rest 177.80 K.M. flows through the Nalbari and Baksa districts of Assam. The aggregates were collected from the banks of the river Pagladiya in a place

called Subankhata, situated in the Baksa district of Assam.

The Kopiliriver originates in the Meghalaya plateau and flows through southern part of Assam before its confluence with the Brahmaputra. In Assam, it flows through the districts of KarbiAnglong, Kamrup and Nagaon. The river flows for a total length of 290 km and has a catchment area of 16,420 sq. km. The aggregates were collected from the banks of the river Kopili in a place called Rani, situated in the Kamrup district of Assam.

The Kulsiriver originates in Meghalaya and after flowing through the East-Khasi districts of Meghalaya, completely enters into the Kamrup district of Assam. The entire Kulsiriver covers an area of about 3770 sq.km. before merging into the Brahmaputra. The aggregates were collected from the banks of the river Kulsi in a place called Boko, situated in the Kamrup district of Assam.

3. METHODOLOGY

The following methodology has been adopted during the study.

1. Field work
2. Laboratory work

In the field work, river borne aggregates has been collected from the river sites using hand tools such as shovels and chisels.

The collected samples were brought to the laboratory and various engineering tests were performed on the coarse aggregates to find out their engineering properties. The grading of aggregates was performed by the IS Sieves as per requirements for the various tests. Laboratory tests were carried out to find the various properties like Specific Gravity, Water Absorption, Aggregate Impact Value, Los Angeles-Abrasion Value, Aggregate Crushing Value,Slake Durability Indexetc.

4. RESULTS AND DISCUSSIONS

The results are categorized from engineering point of view.

Table 1: *Engineering Test Results*

Name of tests	Results for different rivers		
	Pagladiya	Kopili	Kulsi
Fineness Modulus	4.88	4.1	4.37
Impact Test	18.10 %	23 %	18.87 %
Abrasion Test(for Grade G)	24.5 %	28.8 %	28.3 %
Crushing Test	25.26 %	29.34 %	27.15 %
Specific Gravity	2.74	2.62	2.64
Slake Durability Test	99.30 %	99.8 %	99.6 %

The experimental observations are compared to the different Indian Standard and Indian Road Congress codes for evaluation of their suitability as road construction material.Starting with the fineness modulus, for coarse aggregates, its range lies between 3 to 7[3]. Thus, the coarse aggregates are within suitable limit of fineness modulus. For dense bituminous macadam, the maximum impact value, as per IS 2386(Part IV)-1963, is 35%.The experimental aggregate impact values lie within the limit of 35%.Hence, from the point of view of impact value, the coarse aggregates are suitable for road construction. The experimental aggregate abrasion values lie within the limit of 30% for concrete road construction, as per IS 2386(Part IV-1963), and hence, the aggregates are suitable for road construction. The crushing value of aggregates is restricted to 30% for concrete used for roads and pavements as per IS: 2386(Part- IV) 1963. Laboratory experiments show that it is within the permissible limit and hence can be used for road construction work. The allowable limits of specific gravity of aggregates are not specified. However coarse aggregates with specific gravity greater than 2.6 are preferred for road construction purpose. Slake durability values of coarse aggregates determine the durability of an aggregate. According to Gamble's Slake Durability Classification (Goodman, 1980), the coarse aggregates are highly durable and therefore, suitable for road construction.

5. COMPARISON OF THE ENGINEERING PROPERTIES

The engineering properties of the coarse aggregates collected from the three rivers, viz., Pagladiya, Kopili and Kulsi, can be compared by graphical representations.

1. Fineness Modulus :

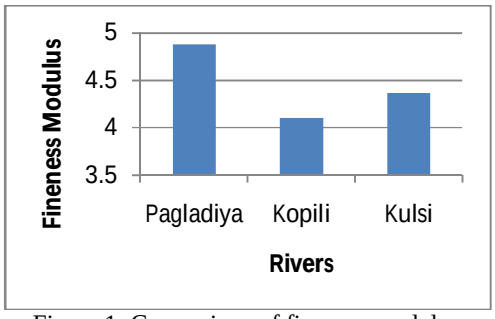

Figure 1: Comparison of fineness modulus

2. Aggregate Impact Value :

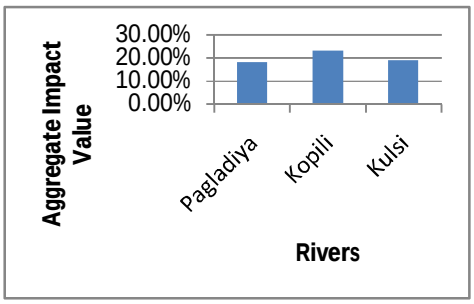

Figure 2: Comparison of aggregate impact value

3. Aggregate Abrasion Value :

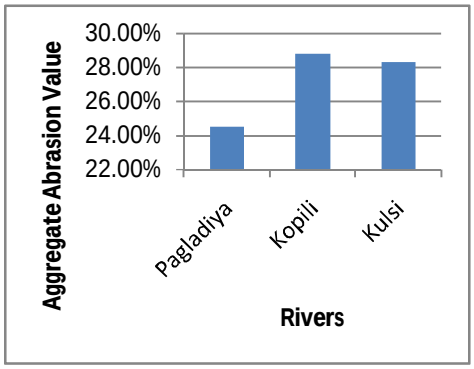

Figure 3: Comparison of aggregate abrasion value

4. Aggregate Crushing Value :

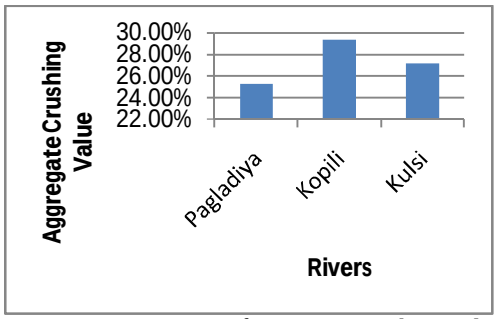

Figure 4: Comparison of aggregate crushing value

5. Specific Gravity :

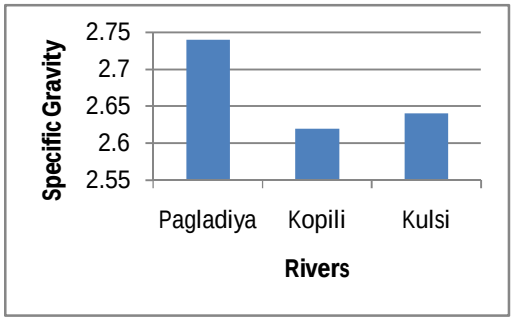

Figure 5: Comparison of specific gravity

6. Slake durability index :

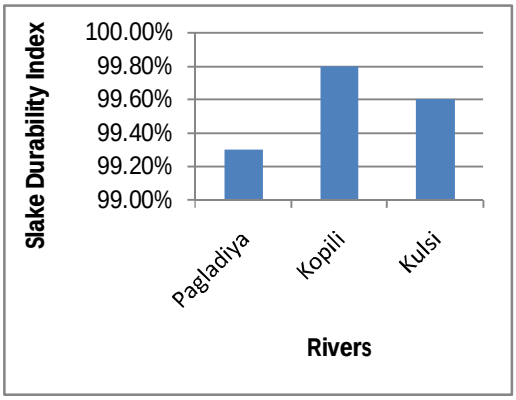

Figure 6: Comparison of slake durability index

6. CONCLUSION

From the comparison of the engineering properties of the coarse aggregates collected from the rivers Pagladiya, Kopili and Kulsi, it is observed that there is some variation in the engineering properties, especially the properties showing strength of the aggregates, viz., Aggregate Impact value, Aggregate Abrasion value, Aggregate crushing value and Slake durability index. These properties of aggregates are highest in case of Kopiliriver, and lowest in case of Pagladiyariver. Thus, coarse aggregates collected from Kopiliriver are most suitable for construction works, among the mentioned three rivers. From the economical aspect, the use of river borne aggregates is more economical considering the cost of production and transportation to work site. Since lesser the anti-ecological operation to prepare the required size of aggregate from river origin and no pollution and risk for accident during blasting operation, the river borne aggregate is more eco-friendly[1]. Again collection of the river-borne aggregates in large scale from river bed of the Pagladiya River, Kopiliriver and Kulsiriver will help in controlling the flood havoc of the basin.

7. ACKNOWLEDGEMENT

The data on the engineering properties of aggregates collected from rivers Kulsi and Kopili, were collected from the 7th semester project reportssubmitted to the Gauhati University by BarshaNath, BhargabanandaDass, Prabal Das and SandeepBhuyan in 2013, and byPoragJyotiPathak, Randhir Kr. Rai, NitulKalita, Ronald Rajbongshi and Sayanika Bora in 2014, respectively.

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