Engineering Assessment of Coarse Aggregate Used in Srinagar

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***Abstract* - This paper presents the qualification of coarse aggregates obtained from various existing quarries in and around Srinagar city for their use in structure concrete. Out of the ten(10) four(4) quarries were experimentally investigated. The site were selected on the basis of being easily accessible and productive. Various tests including bulk density ,soundness of aggregates los Angeles Abrasion Alkali-silica Reactivity(ASR), Alkali-carbonate Rock Reaction(ACR)and petro graphic Examination of aggregates were carried out according to ASTM standards .The results of this study show that the aggregates investigated have no unstable form of silica and Reactive carbonates. The Alkali-silica and Alkali carbonate Reactions have shown no expansion, therefore, the representative samples are considered harmless to be used in concrete. Based on the experimental study of this research, coarse aggregates from the mentioned sources (River sind Nilagrad River, Lidder River and Beas River) can be safely used in structure concrete works. Out of four sources River sind is found to be best source of coarse aggregates.**

Key words: Regulatory Body, Private coaching Industry, Indian Education systems

I. INTRODUCTION

Concrete is a multiphase material consisting of coarse aggregates, mortar matrix and interfacial zone. Coarse aggregate is the strongest phase in and responsible for the strength of concrete. The presence of aggregate greatly increases the robustness of concrete and serve as reinforcement to add strength to the overall composite material. Concrete is used more than any other man-made material in the world as of 2006 survey conducted by united state geographic services (USGS); about 7.5 cubic kilometres concrete are made each year, more than one (1) cubic meter for every person on the earth. The aggregate occupies at least three quarters of the volume of concrete and provides volumetric stability and reduces cost. Its quality is of considerable importance. The aggregates with undesirable properties cannot produce strong and durable concrete. Rather it greatly affects the durability and structural performance of concrete. The examples of undesirable chemical properties (alkali-silica reaction), are seen in hydroelectric dam building a 10km long tunnel after 10 years of construction. This phenomenon of Alkali-silica reaction attracted to investigate the engineering properties of the aggregates used in Srinagar. Coarse and fine aggregates of Jutana formation and sakeasar limestone were suitable for road construction. The coarse and fine friction of Sind river, and Lidder river qualify in strength, durability and recommended for use in construction work. The aggregates of neelum river contain mylonites, slates, phyllites, micro-crystalline quartz and highly strained quartz. These potentially reactive rocks can initiate alkali aggregates reaction that will damage the infrastructure if prevented measures are not considered. The major role in d deposition of quaternary sediments in Srinagar is played by the river sind and river bees. They are the main sources of crush aggregates.

(a)

(b)

Figure 1: Sources of aggregates

This assessment will provide a summary of specific existing sites that have potential to provide quality aggregates for the region. The importance of using the right type and quality of aggregates cannot be ignored. It is

recognised fact that aggregates are both strategic and vital resource for the construction industry in Srinagar. The fine and coarse aggregates generally occupy 60% to 75% of concrete volume (70% to 85% by mass) according to ACI education boliton E1-07 and strongly influence the concretes freshly mixture and hardened properties, mixture proportions and economy.

A detailed survey was carried out to identify the quarries responsible for the production of aggregates in Srinagar city. The following four sources, being major and accessible were selected.

1. River sind
2. River lidder
3. River nilagard
4. River bees

II. METHODOLOGY

Project was divided into two parts. Sampling of the aggregates and then testing them in laboratories.

Experimental work was performed on the concrete aggregates (coarse) in soil mechanical laboratory in national institute of technology Srinagar (NIT), Kashmir council of science and industrial research laboratories (KCSIR) Srinagar and material testing laboratory department of geology, islamic university Kashmir.

Sampling of aggregates from quarries

Sampling is equally as important as the testing, and the sampler must use precautions to obtain samples that are true representative and will show true nature and condition of materials. The sampling of coarse aggregates from the above sited quarries was done according to ASTM D-75-03 standards. According to the standard, a sample of coarse aggregates is obtained by combining the portions taken from the conveyer belt, storage bin, truck, railcar, or stock pile. In this research, three samples were collected from stockpile and one from conveyer belt.

Figure 2: Samples Collection

Testing

The samples collected from queries were transported to laboratories for assessment of their following properties.

1. Bulk density (ASTM C-29/C-29M) [4]
2. Soundness of aggregates
3. (ASTM C-88) [5]
4. Los Angeles Abrasion
5. (ASTM C-131) [6]
6. Alkali-silica reactivity
7. (ASTM C-289& C-1260) [7]
8. Petrographic examination of aggregates (ASTM C-295)[9]

All the above mentioned tests were performed in the laboratories of civil engineering department NIT Srinagar. Figure 3 shows the soundness test performed on the aggregates sample.

Figure 3: Breakage of aggregate samples after soundness test

Figure 4 shows the chemical method for alkali silica reaction test of aggregates.

Figure 4: Chemical method for alkali silica reaction

III. TEST RESULTS AND DISCUSSIONS

According to the different tests performed on concrete aggregates (Bulk density, soundness of aggregates, Los Angeles abrasion, alkali silica reactivity, alkali carbonate rock reaction and petrographic examination of aggregate) the following physical and chemical properties of coarse aggregates were determined;

Bulk Density

According to the test results of coarse aggregates, the bulk densities (unit weight) of collected samples are within the range of ASTM standards, which is 2.30 to 3.10. These values revealed that the quarries under investigation show good result with respect to bulk density, bulk SSD specific gravity and apartment specific gravity. The absorption of these samples within acceptable range.

Soundness of Aggregates

The tests were performed according ASTM standard in KCSIR laboratory. A typical value of material loss depends upon the type of soundness test used. The value for sodium sulphate solution is ranging from 0 to 15 percent, while for magnesium sulphate solution it ranges from 0 to 30 percent. The soundness test on the samples obtained from the selected quarries was performed in the solution of sodium sulphate. The soundness values of the samples collected from river sind, river lidder, and neelam river are 13.05, 6.61, and 8.94 percent. Thus the aggregates from these three quarries show better resistance to freeze and thaw actions. However, the soundness value of sample collected from nilagrad river is 17.69 percent, which is slightly higher than the upper limit range (0 to 15). These aggregates will perform well when used in low freeze and thaw areas.

Los Angeles Abrasion test

According to standards the percentage abrasion loss of an aggregate should be in the range of 10 to 45. The aggregates having value near to 10 are considered to be hard rock and the value near to 45 is considered as a soft rock. The abrasion values of the samples collected from river sind, river lider, river nilagard, and river bees are 21.20, 18.50, 24.00 and 20.00 respectively. The abrasive values of the representative samples are toward the lower range of abrasion adapted by standards. These aggregates show better resistance to abrasion and are considered as hard rocks. Therefore they are recommended for use in structural concrete due to their better resistance to abrasion.

Potential Alkali Reactivity of cement aggregate combination (Mortar Bar Method)

All the representative samples of district Srinagar results are considered to be innocuous.

Table 1**:** Potential Alkali-silica reactivity test of aggregate samples

Sample ID	Description of test	Result
Sample 1 River lider	Potential ASR of aggregates	Aggregate samples considered innocuous
Sample 2 River sindh	Potential ASR of aggregates	Aggregate samples considered innocuous
Sample 3 River nilagard	Potential ASR of aggregates	Aggregate samples considered innocuous
Sample 4 River bees	Potential ASR of aggregates	Aggregate samples considered innocuous

Alkali-Carbonate Rock Reaction

According to the results obtained from testing of collected from the investigated quarries it was found that no expansion in the four representative specimen was observed after 28 days.

Petrographic Examination of Aggregates

Petrographic examination of coarse aggregates collected from four representative quarries of district srinagar was performed in geology laboratory, university of Kashmir. Petrographic examination identifies potentially alkali silica reactive and alkali carbonate reactive constituents. Thirteen (13) thin sections were prepared from rocks sample of four quarries with the help of diamond blade rock-cutting saw and examined under petrographic microscope. The following precautions were made:

1. Excessive heating was avoided during preparation of thin sections. (Temperature< 45c)
2. Exposure to air was minimized to avoid carbonation
3. Exposure to water was minimised to avoid hydration

The result of petroghraphic examination of four different samples demonstrated that adverse properties such as presence of unstable form of silica and reactive carbonates were not detected.

IV. CONCLUSION

Based on the experimental investigations conducted on coarse aggregates from the quarries located in district Srinagar, the following conclusions are made:

1. The physical properties such as specific gravity and bulk density etc. Were up to standard.
2. Soundness of thee aggregates was found to be resistant to changes in physical conditions except for river neelam which is slightly higher than the upper limits.
3. Alkali silica reactivity test revealed that all the aggregate samples are innocuous.
4. According to los-Angeles abrasion test, the percentage abrasion loss of all aggregate samples were within the range of 10 to 45.

5. According to alkali-carbonate rock reaction no expansion was found in representative specimens after 28 days.
6. Petrographic analysis demonstrated that adverse properties such as presence of unstable form of silica and reactive carbonates were not detected.

REFERENCES

[1] ASTM C-29/C- Standard test method for bulk density and voids of aggregate.
[2] ASTM D-75-03, Standard sample for sampling of aggregates
[3] C.T By Gambir
[4] ASTM C-586 ASTM standard regarding the Alkali Carbonate Reaction of aggregate
[5] ASTM C-88, Standard test method for soundness and aggregate by use of sodium sulphates or magnesium sulphate.