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Research Article

EFFECT OF PARTIAL REPLACEMENT OF NATURAL FINE AGGREGATE WITH CRUSHED STONE DUST: A CASE STUDY OF MAKAWANPUR DISTRICT

P. Muktan*, K. P. Parajuli, B. R. Gyawali
Master of Science in Construction Management
Lumbini Engineering Management and Science College (Pokhara University) Rupandehi, Nepal
*Corresponding mail: pt9825216900@gmail.com

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Abstract:

Stone dust is a waste material produced in stone crusher industry. Stone dust produced from the crushed stone industry is quite numerous. Nowadays in Makawanpur district of Nepal, the availability of high-quality natural fine aggregate has become increasingly limited and expensive due to factors such as restricted river access, illegal dredging, and the rapid surge in construction activities. This situation necessitates the exploration of alternative materials for construction purposes. Crushed stone dust emerges as a compelling substitute, offering an effective solution to partially replace natural fine aggregate in construction applications. To achieve this objective, a meticulous experimental program was designed, involving the creation of cube-shaped specimens. The findings of the study reveal that stone dust can indeed serve as a viable replacement for natural fine aggregate with crushed stone dust, as evidenced by compressive strength measurements. This emphasizes the feasibility and effectiveness of integrating stone dust as a strategic alternative to natural sand in construction endeavors. This study aims to find out the maximum percentage of stone dust to substitute sand in a concrete mix to obtain the maximum strength and good workability. The cement used throughout this work was Ordinary Portland Cement (OPC) of 43 grade. The natural sand was taken from Rapti river and Manahari river, while the crushed stone dust and coarse aggregate were taken from same source from different crusher of Makawanpur district. The percentages of crushed stone dust replacing natural fine aggregate were varied from 20, 40, 60 and 80% to find out the maximum percentage of crushed stone dust to replace natural fine aggregate from river to produce the maximum compressive strength of concrete. The results of this research showed that the maximum percentage of crushed stone dust, which could replace natural fine aggregate in concrete mixture was 40% with the higher compressive strength than that of concrete with natural sand only. In addition, decreasing the slump value when natural fine aggregate replaced by 20%, 40%, 60% and 80% slightly

Keywords: Concrete, natural fine aggregate, coarse aggregate, crushed stone dust, Makawanpur, compressive strength.

INTRODUCTION

1.1 Background

The construction industry is known for its inherent vagueness and complexity, making it a consistently challenging and high-risk sector. Numerous developing nations encounter diverse obstacles during the process of infrastructure development. Over time, a range of construction materials has been employed to achieve successful project outcomes. Concrete stands out as a particularly prevalent substance in the construction industry. Throughout history, ancient structures utilized various binding materials such as surkhi and timber dust in combination with clay[1-2]. Nowadays, there is a noticeable surge in the utilization of mass-produced items in construction projects. The construction industry is the sector of the economy that encompasses the creation, alteration, and repair of buildings, structures, and other physical infrastructure. It involves the planning, design, financing, and execution of various projects. Cement, sand, aggregate and water are the basic composition of concrete. Concrete can be prepared by hand mixing and machine mixing[3,4]. Huge quantity of concrete is consumed during construction work. Utilization of the waste materials and by-products are one of the challenging task for anyone so many expertise are discussed for the preserving the natural resources and for making environmental friendly. Nepal, being a developing country, encounters a multitude of problems such as environmental concerns, hazardous risks, and government policies when it comes to procuring natural fine aggregate sand. While river sand has traditionally served as the primary source of fine aggregates, its scarcity has been steadily increasing. As a result, crushed aggregates have become the preferred alternative in concrete production. The utilization of crushed stone dust, which is abundantly available as waste from crushers, poses a significant environmental risk in terms of disposal. By partially or fully substituting natural sand with crushed stone dust in concrete, not only can the project costs be reduced, but also the disposal of this waste product can be addressed. The nominal size of the crushed coarse aggregate of size less than 20mm was used. In Nepal few research have been carried out to check the quality of samples taken from different River’s crusher[5-7]. The objective of this study was to finding the effect of compressive strength of concrete cubes made from different River crusher and suggested to use crushed aggregates for construction from the Rivers, where aggregates exists. This study investigated the feasibility of utilizing waste crushed stone dust in concrete effectively. The case study involved the utilization of crushed coarse aggregate and crushed stone dust obtained from various crushers located in different regions of Makawanpur district, including the Mahabharat range, inner terrain, and Chure range. The findings of this study can contribute to reducing the reliance on natural fine aggregate, thereby lowering the construction project's budget. Engineers and other stakeholders can gain valuable insights into suitable crushed aggregates and alternative options for sand in concrete production[8,9]. Concrete holds a significant position as a fundamental construction material on a global scale. Its widespread usage in the construction industry is immense.

1.2 Objectives

The main objectives of this study is to investigate the effect of partial replacement of natural fine aggregate with crushed stone dust of origin same as coarse aggregate on the compressive strength, workability and density of concrete. Major scope of this research is in construction industry. This research is mainly focused on identify the optimum percentage of crushed stone dust that can be used as a partial replacement for natural fine aggregate in concrete. This research helps to identify any potential limitations or drawbacks of using crushed stone dust as a partial replacement for natural fine aggregate in concrete. This research also contributes to the body of knowledge on the use of alternative materials in concrete production, and to inform future research and development in this area.

II. Methodology

In this thesis work, the crushed aggregates were collected from different crushers in Makawanpur district. Cement for concrete production was collected from a nearby supplier. Fine aggregate used for testing was collected from nearby suppliers from Manahari River in Makawanpur district. There were numerous rivers and crushers supplying coarse aggregates in Makawanpur district, but we tested and evaluated samples from the Mahabharat range (Sisneri River, Indraearowar R.M.), Chure range (Sisneri River, Makawanpurgadhi R.M.), and inner terrain range (Rapti river, Hetauda Submetro.). During concrete production, natural fine aggregate was replaced with crushed stone dust sourced from the same origin as the coarse aggregate. The experimental study conducted in Makawanpur district utilized materials obtained from various sources[10-12]. Crushed aggregates were collected from different crushers located in the Mahabharat range, Chure range, and inner terrain range within the district. Fine aggregates were sourced from the Rapti river and Manahari River in Makawanpur. The cement utilized in the study belonged to the Shivam brand of Ordinary Portland Cement (OPC), and its fineness was assessed through a specific test. To determine the particle size distribution of natural fine aggregates and crushed stone dust, sieve analysis was performed in the laboratory[13-17]. The aggregate sizes used in the study were 10-20mm for crushed aggregates. Potable water available on-site was employed for the concrete mixing process. The slump value test was conducted to assess the workability of fresh concrete, while the compressive strength test was carried out on hardened concrete. Concrete cubes were prepared using a ratio of 1:1.5:3 for cement, fine aggregates, and coarse aggregates, respectively. The impact of replacing natural fine aggregates with crushed stone dust at varying proportions (20%, 40%, 60%, and 80%) was investigated, and different properties were examined. A water-to-cement (W/C) ratio of 0.45 was maintained throughout the study. From each crusher, a total of 45 cubes were made in the laboratory. From Sisneri Kogate River, a total of 45 cube specimens were made. Nine cubes were made using cement, natural sand high silica content, and crushed aggregates, and the remaining 36 cubes were made by replacing 20%, 40%, 60%, and 80% of natural sand with crushed stone dust of the same origin as the coarse aggregate. Similarly, cubes were prepared from samples collected from Samari River and Rapti River. High silica content sand was taken from the Manahari River located in Manahari Rural municipality. From each crusher, samples were taken for the compressive strength test at 7 days, 14 days, and 28 days. Crushed coarse aggregates were used in all specimens. Workability test was performed on fresh concrete. Workability test was performed on fresh concrete. Workability test was performed on fresh concrete. After casting the concrete cubes in the lab, the cubes were wrapped with jute sacks and kept in a cool place overnight without any disturbance. In the lab, after 24 hours of casting, the cubes were taken out from the molds and cured under standard conditions for 7, 14, and 28 days. The concrete cubes underwent testing using a specialized test machine to determine their compressive strength, adhering to the specifications outlined in IS 516 (1959) as set by the Bureau of Indian Standards (2004). For each crusher sample, a total of 15 specimens were tested for compressive strength at 7 days, 14 days, and 28 days. The specimens were subjected to compression loads in a hydraulic press with a capacity of 1000 kN, and the crushing strength was recorded. The testing was conducted at the Bhutandevi School’s Civil Engineering Laboratory. It's important to note that the sand samples used for all the tests were sourced from the same location to maintain consistency in the study. Secondary data regarding the study were collected from various sources.

III. RESULTS AND DISCUSSION

3.1. Workability of fresh concrete

The workability of concrete pertains to the smoothness and uniformity of handling freshly mixed concrete or mortar. In straightforward terms, it encompasses the degree to which freshly blended concrete can be effortlessly combined, positioned, compacted, and refined while minimizing any compromise to its uniformity.

As per IS 1199:1959 methods of sampling and analysis of concrete and conforming to IS 7320:1974 concrete slump test apparatus and the procedure for testing, the slump test was conducted. Concrete mix of grade M20 of ratio (1:1.5:3) with keeping constant water-cement ratio of 0.45 is made throughout the experiment of normal concrete mix with replacing 20%, 40%, 60% and 80% of natural fine aggregate by crushed stone dust of origin same as coarse aggregate[18-19]. The slump value and data which are obtained from slump test are recorded and tabulated in Table no 3 and data are also presented in the graph chart and line chart shown in figure 11 and figure 12 respectively. The effect of replacing natural fine aggregate by different percentage of crushed stone dust of origin same as coarse aggregate on workability are observed, evaluated and also compared with the normal concrete. From the test data and result it is evaluated that the workability goes on decreasing as we increased the percentage of replacement of natural fine aggregate by crushed stone dust which is also clearly illustrated in the figure 13 and 14 below.

Concrete workability refers to the seamless and consistent manipulation of freshly mixed concrete or mortar. In essence, it encapsulates the effortless manner in which freshly mixed concrete can be blended, positioned, compacted, and refined, while minimizing the loss of uniformity. A concrete slump test measures the consistency of a concrete batch to see how easily the concrete will flow. The test not only observes consistency between batches, but it also identifies defects in a mix, giving the operator a chance to amend the mix before it is poured on site. As shown in table 3, the slump value of Rapti River crusher sample has better then Samari River crusher sample and Sisneri River crusher sample. Thus, Rapti River crusher sample used in concrete gives higher consistency then Samari River crusher sample and Sisneri River crusher sample but high silica sand can give more consistency.

Table 3: Slump value of different location sample

Slump test data of M20 1:1.5:3 (Normal condition)	
	Slump value in mm
Rapti river crusher sample	105
Samari river crusher sample	100
Sisneri river crusher sample	95
Manahari river (High silica sand)	100

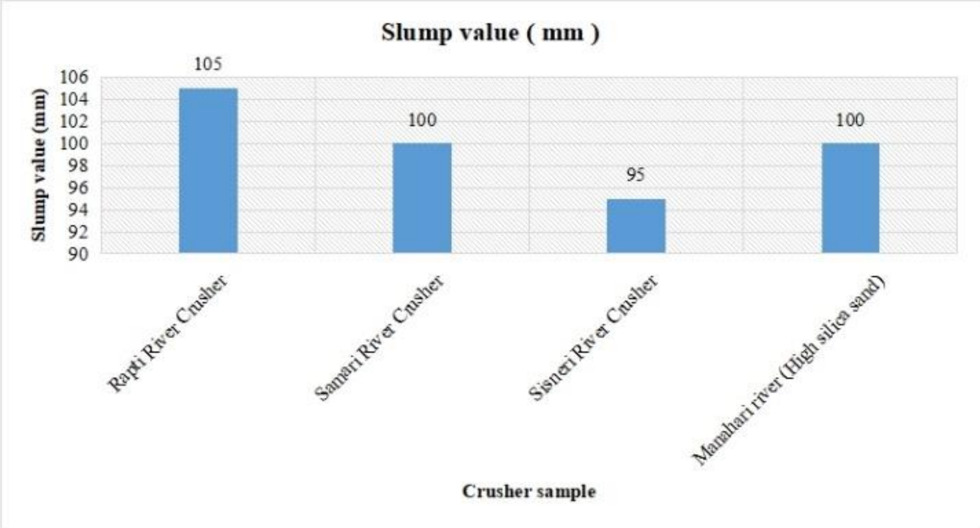

Figure 11: Slump value of three crusher sample and one high silica content sand sample

(Source: Lab Test, 2023)

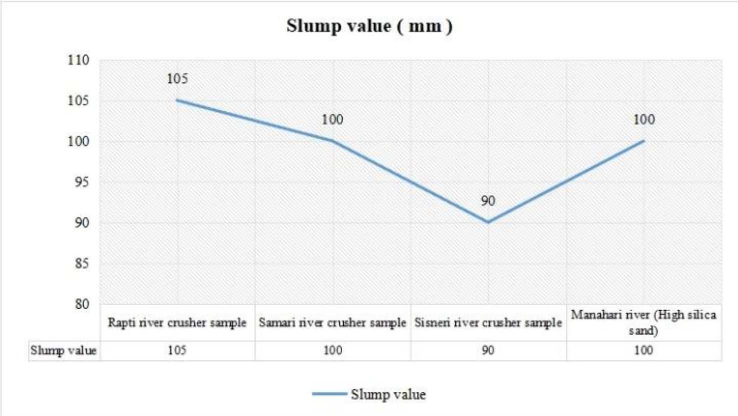

Figure 12: Slump value in line graph analysis

(Source: Lab Test, 2023)

Figure 13: Slump value after replacement of natural fine aggregate by crushed stone dust (Rapti river crusher sample, Samari River crusher sample and Sisneri River crusher sample)

(Source: Lab Test, 2023)

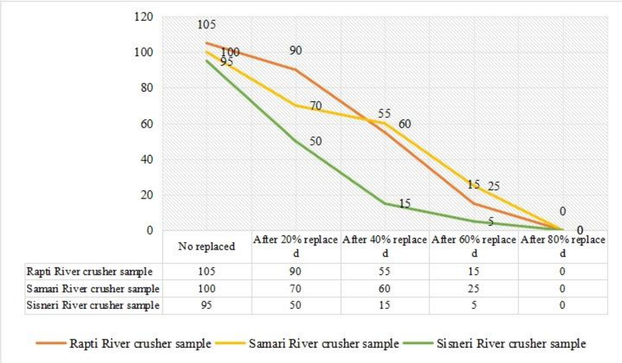

Figure 14: Slump value after replacement of natural fine aggregate by crushed stone dust (Rapti river crusher sample, Samari River crusher sample and Ssneri River crusher sample)

(Source: Lab Test, 2023)

Figure 13 and 14 effectively conveys valuable information about the slump values after replacing natural fine aggregate by crushed stone dust of origin same as coarse aggregate in different crusher sample, facilitating a comprehensive analysis of their workability and consistency. Figure clearly shows that slump value is decreasing with increase in percentage of crushed stone dust in concrete.

3.2. Density of concrete

As commonly understood, the density of concrete refers to the mass of concrete per cubic meter, calculated by dividing the weight of thoroughly compacted concrete by the volume of the container it occupies[20-21], i.e.

Density of concrete (kg/m^3) = Weight of concrete cube (kg)/ volume of cube (m^3)

To perform the density test, a concrete mixture with a ratio of 1:1.5:3 (designated as M20) was employed. This mixture was prepared with varying degrees of partial replacement of natural fine aggregate, namely 20%, 40%, 60%, and 80%. For each replacement level, nine concrete cubes, each measuring 15cm x 15cm x 15cm, were cast using cube molds. After a 24-hour period, the molds were removed, and the cubes were submerged in water for curing.

Upon reaching 7 days, 14 days and 28 days of curing, the density test was conducted by weighing each individual concrete cube and subsequently dividing the weight by the cube's volume. The resulting data from these laboratory experiments were meticulously recorded and calculations were performed to determine the density of each concrete cube. These acquired data points were compiled and graphically depicted in Figure 19 to figure 26. The findings drawn from the laboratory analyses indicate a discernible trend: the density of the concrete exhibited a progressive increase up to the point of 40% replacement of natural fine aggregate with crushed stone dust that shares the same origin as the coarse aggregate. Beyond this point, at the 60% and 80% replacement levels, there was a slight decline in density. The following bar graph and line graph helps to understood about density variation clearly.

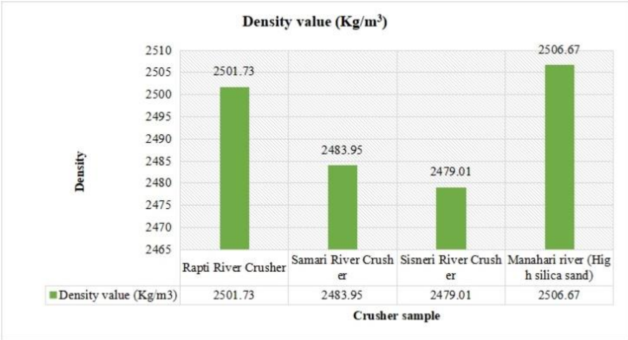

Figure 15: Density values of three different crusher sample and one high silica content sand

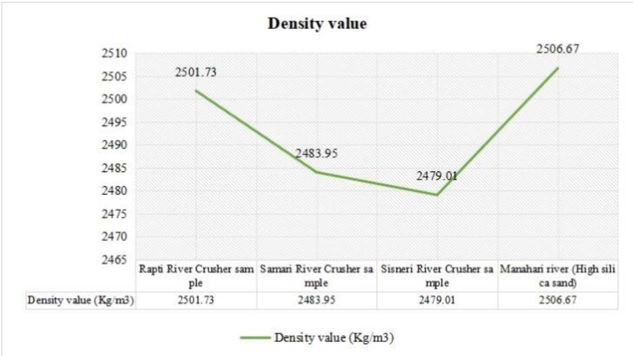

Figure 16: Density values of three different crusher sample and one high silica content sand

(Source: Lab Test, 2023)

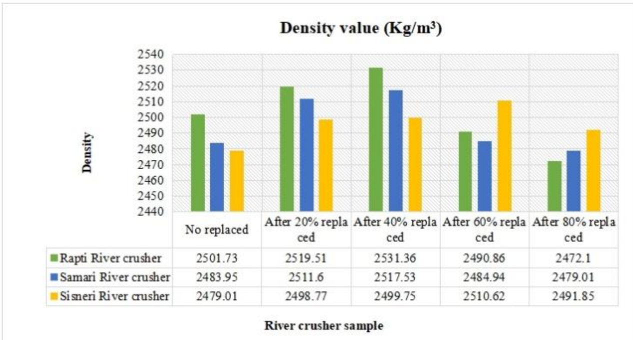

Figure 17: Change in density with respect to replaced percent of natural fine aggregate by crushed stone dust (Rapti River, Samari River and Sisneri River crusher sample)

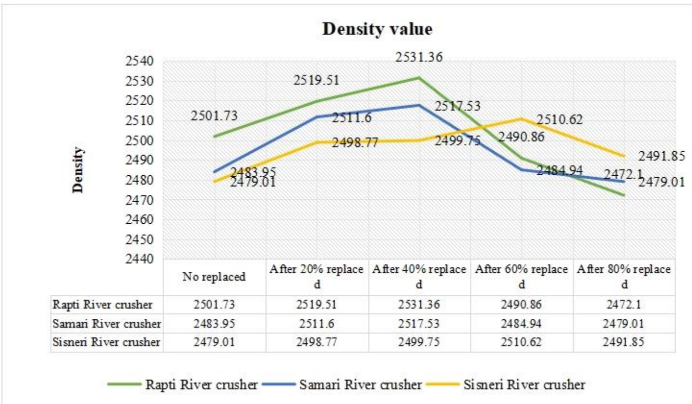

Figure 18: Change in density with respect to replaced percent of natural fine aggregate by crushed stone dust (Rapti River, Samari River and Sisneri River crusher sample)

(Source: Lab Test, 2023)

3.3. Compressive strength of concrete

The cubes of concrete were casted in laboratory where aggregates and stone dust of same origin of coarse aggregates are used from different crushers of Makawanpur district. The cubes were cured and tested in lab at an interval of 7, 14 and 28 days. Test was done in lab of Bhutandevi technical school, with compressive strength test machine of 1000 KN capacity. The result of mean compressive strength of concrete cubes which are made in normal mix and by replacing natural fine aggregates with crushed stone dust obtained from 3 different crushers were presented in following figures.

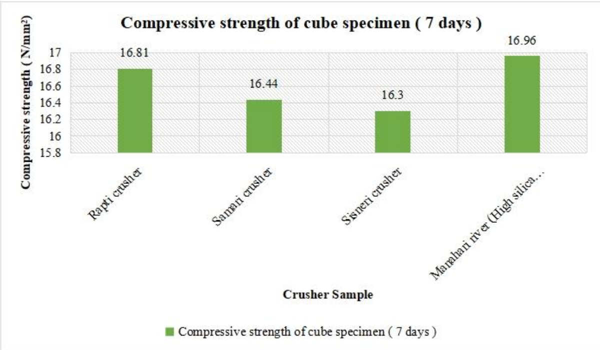

Figure 19: Compressive strength of concrete cube after 7 days of three different crusher sample and one high silica sand sample

(Source: Lab Test, 2023)

Figure 20: Compressive strength of concrete cube after 7 days of three different crusher sample and one high silica sand sample

(Source: Lab Test, 2023)

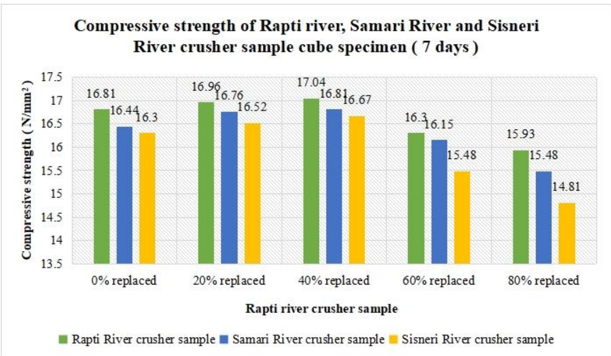

Figure 21: Compressive strength of concrete cube specimen after replacing natural fine aggregate with crushed stone dust (7 days)

(Source: Lab Test, 2023)

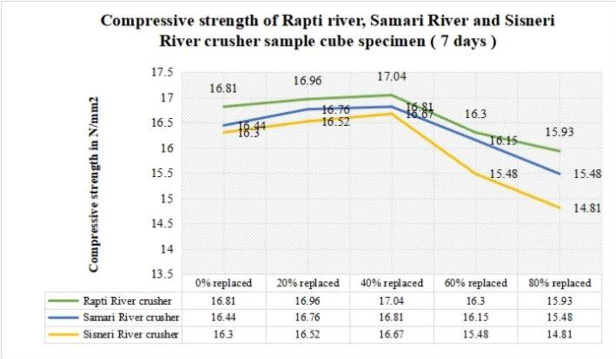

Figure 22: Compressive strength of concrete cube specimen after replacing natural fine aggregate with crushed stone dust (7 days)

(Source: Lab Test, 2023)

In Figures 19 to 20, the 7-day mean compressive strength of M20 concrete ranged from 16.32 N/mm^2 to 16.81 N/mm^2, with the highest strength achieved using the Rapti river crusher sample and high silica content sand from Manahari River. Figures 21 and 22 displayed the compressive strength values of the Rapti, Samari, and Sisneri river crusher samples after replacing natural fine aggregate with crushed stone dust. Specifically, the Rapti river crusher sample maintained a range of 16.81 N/mm^2 to 15.93 N/mm^2, the Samari river crusher sample ranged from 16.44 N/mm^2 to 15.48 N/mm^2, and the Sisneri river crusher sample varied from 16.32 N/mm^2 to 14.81 N/mm^2. Notably, all three locations showed that the optimal strength was achieved at a 40% replacement of natural fine aggregate with crushed stone dust, while all data remained within permissible values as per IS 456:2000.

According to Karanjit (2019), the 7 days mean compressive strength value of different rivers which is Panauti, Melamchi, Chaukidada, Khopasi, KaalDhunga of Kathmandu valley varies from 12 to 18, where Melamchi have lower value than other Rivers and Chaukidada have higher value than other Rivers. In our test results compressive strength of concrete varies from 14.87 $N/mm^2$to 16.72 N/mm^2which is in the range of Kathmandu valley aggregates. Thus, the resulted values of 7 days mean compressive strength of our test is in the range of Nepalese River.

Following the analysis of compressive strength values in comparison with Karanjit's research data[12, 21], it was observed that after 7 days, the compressive strength of the Makawanpur district river sample surpassed that of the river sample from Kathmandu Valley. Additionally, the compressive strength values of the Rapti river crusher sample and the Manahari River high silica sand sample were found to be higher than those of the other two river crusher samples. Notably, in the case of Manahari River high silica sand, crushed aggregate from the Rapti River crusher was employed in the production process. This information sheds light on the past assessment of compressive strength values, highlighting variations in strength among different river samples and the utilization of materials from various sources in the construction process.

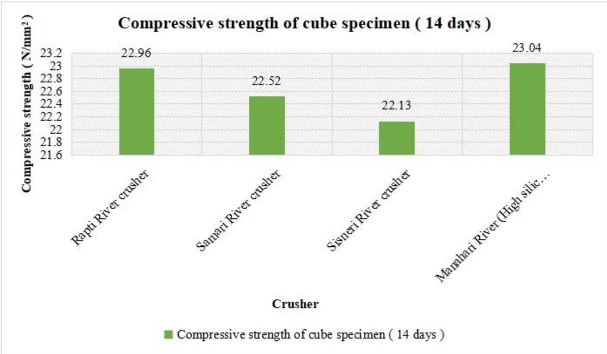

Figure 23: Compressive strength of concrete cube specimen after 14 days of three different crusher sample and one high silica content sand (14 days)

(Source: Lab Test, 2023)

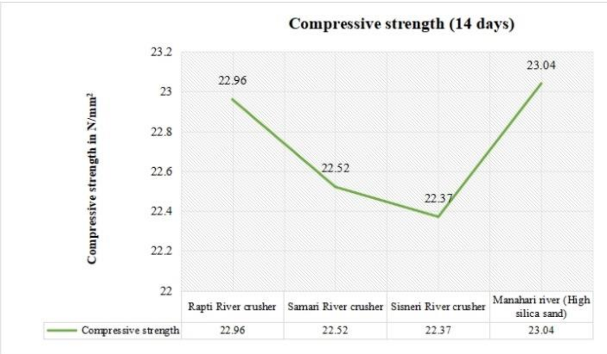

Figure 24: Compressive strength of concrete cube specimen after 14 days of three different crusher sample and one high silica content sand (14 days)

(Source: Lab Test, 2023)

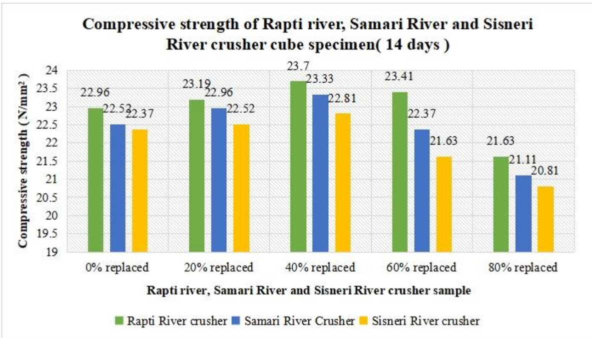

Figure 25: Compressive strength of concrete cube specimen after replacing natural fine aggregate with crushed stone dust (14 days)

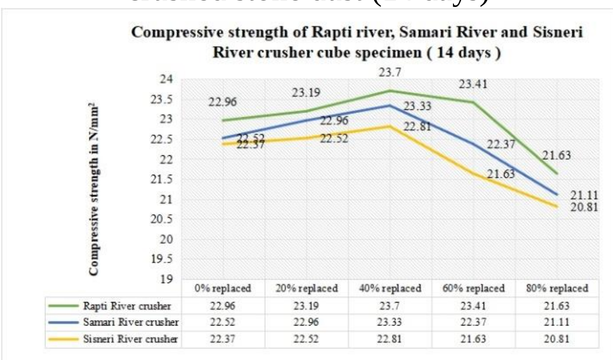

Figure 26: Compressive strength of concrete cube specimen after replacing natural fine aggregate with crushed stone dust (14 days)

(Source: Lab Test, 2023)

In Figures 23 and 24, the 14-day mean compressive strength of M20 concrete ranged from 22.37 N/mm^2 to 23.07 N/mm^2, with the highest strength observed in the Rapti river crusher sample using high silica content sand from Manahari river. Figures 25 and 26 demonstrated that the Rapti river crusher sample achieved the highest compressive strength values up to 23.70 N/mm^2 when 40% of natural fine aggregate was replaced with crushed stone dust, a trend also seen in the Samari and Sisneri river crusher samples. In summary, all three locations showed that the optimal strength was attained at a 40% replacement of natural fine aggregate with crushed stone dust, meeting permissible values outlined in IS 456:2000.

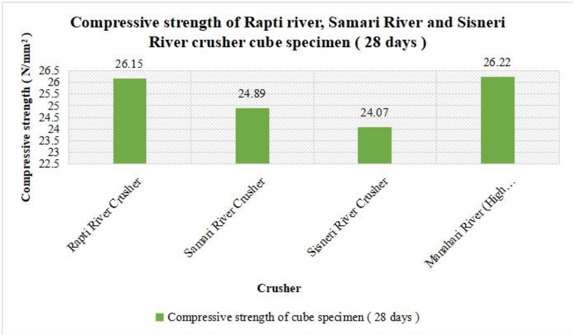

Figure 27: Compressive strength of concrete cube specimen after 28 days of three different crusher sample and one high silica content sand (28 days)

(Source: Lab Test, 2023)

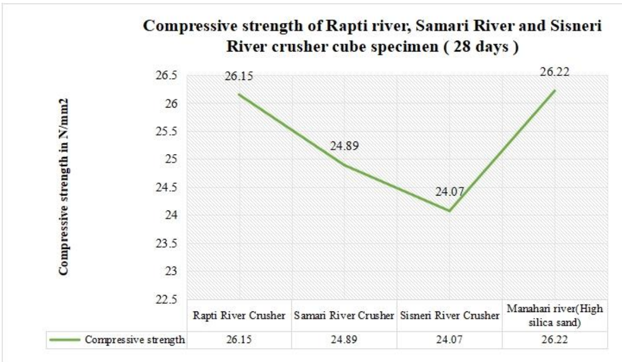

Figure 28: Compressive strength of concrete cube specimen after 28 days of three different crusher sample and one high silica content sand (28 days)

(Source: Lab Test, 2023)

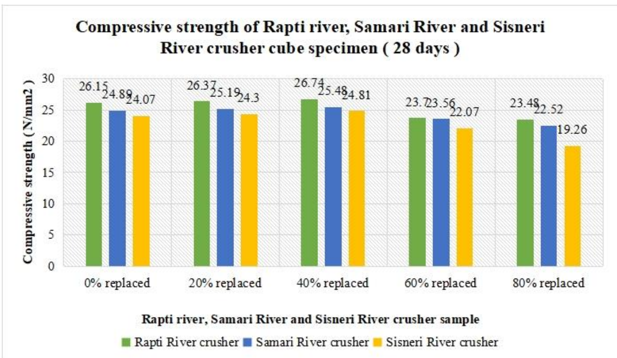

Figure 29: Compressive strength of concrete cube specimen after replacing natural fine aggregate with crushed stone dust (28 days)

(Source: Lab Test, 2023)

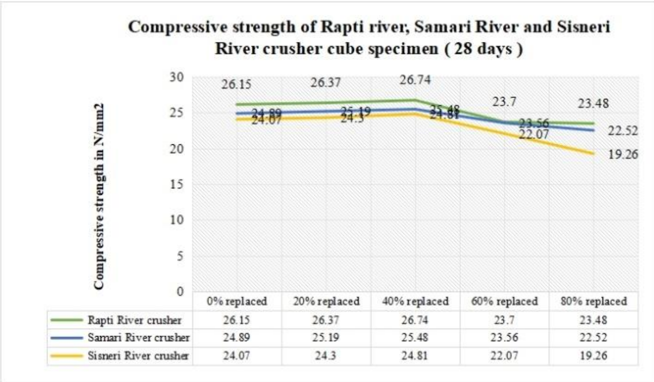

Figure 30: Compressive strength of concrete cube specimen after replacing natural fine aggregate with crushed stone dust (28 days)

(Source: Lab Test, 2023)

In Figures 27 and 28, the 28-day mean compressive strength of M20 concrete ranged from 24.07 N/mm^2 to 26.22 N/mm^2 under normal conditions, with the highest strength achieved using Rapti river crusher sample and high silica content sand from Manahari river. Figures 29 and 30 reveal that the Rapti river crusher sample exhibited the best compressive strength values (26.15 N/mm^2 to 26.74 N/mm^2) when natural fine aggregate was replaced with crushed stone dust, peaking at 40% replacement. Similarly, the Samari river crusher sample reached its optimal compressive strength (25.48 N/mm^2) at 40% replacement, while the Sisneri river crusher sample also peaked at 40% replacement (24.81 N/mm^2). In summary, all three locations showed that 40% replacement of natural fine aggregate with crushed stone dust yielded the best results, meeting the permissible values outlined in IS 456:2000.

As stated by Karanjit (2019), the mean compressive strength values at 28 days for different rivers in the Kathmandu Valley, including Panauti, Melamchi, Chaukidada, Khopasi, and KaalDhunga, range from 17 to 21. Notably, Melamchi exhibits a lower value compared to the other rivers, while Chaukidada showcases a higher value. However, these tested data do not align with the accepted range specified in IS 456:2000.

In our own test results, the compressive strength of concrete ranged from 24.07 N/mm^2 to 26.22 N/mm^2 at normal mix in 1:1.5:3. These values surpass the compressive strength of concrete utilizing aggregates from the Kathmandu Valley. Consequently, the resulting 28-day mean compressive strength values from our tests fall within the acceptable range outlined in IS 456:2000 and are consistent with the range typically observed in Nepalese rivers.

3.4. Cost comparison between optimal percentages crushed stone dust mixed concrete and normal mix concrete

Cost plays a pivotal role in the construction industry, with time and budget serving as critical constraints that significantly impact project planning and completion. Effective cost control stands as a paramount goal in all construction endeavors, aiming to optimize profits within predefined timeframes and budgets. In our study on cost-effectiveness, we meticulously calculate the material expenses per cubic meter of concrete, enabling a detailed comparison of material costs between the optimal 40% crushed stone dust mixed concrete and traditional normal cement concrete[22].

Materials Quantity calculation of m20 grade optimal percentage crushed stone dust mixed concrete (40% replacement)

Weight of cement = (1/5.5)*1.54=0.28m^3/0.0347 =8.0691bag*50=403.455kg

In normal mix, required volume of sand= (1.5/5.5)*1.54=0.42 m^3

Volume of crushed stone dust = 0.42*40%, = 0.17 m^3

Volume of natural sand = 0.42*60%, = 0.25 m^3

Volume of coarse aggregate= (3/5.5)*1.54=0.84 m^3

Table 4: Material cost comparison

Material cost calculation of optimal percentage crushed stone dust mixed concrete of M20 grade				
S.N	**Materials**	**Quantity**	**District rate (Makawanpur)**	**Amount (Rs)**
1	Cement(kg)	403.455 Kg	14	4801.09
2	40% Crushed stone dust (m^3)	0.17 m^3	1050	178.5
3	60% Natural fine aggregate (Sand) (m^3)	0.25 m^3	1720	430
4	Aggregate(m^3)	0.84 m^3	2350	1974
	Total cost of optimal percentage crushed stone dust mixed concrete			RS 7383.5

Material cost calculation of OPC cement concrete of M20 grade				
S.N	**Materials**	**Quantity**	**District rate**	**Amount(Rs)**
1	Cement(kg)	403.455 kg	14	5648.37
2	Sand (m3)	0.42 m3	1720	722.4
3	Aggregate(m3)	0.84 m3	2350	1974
	Total cost of OPC cement concrete			RS 8344.77

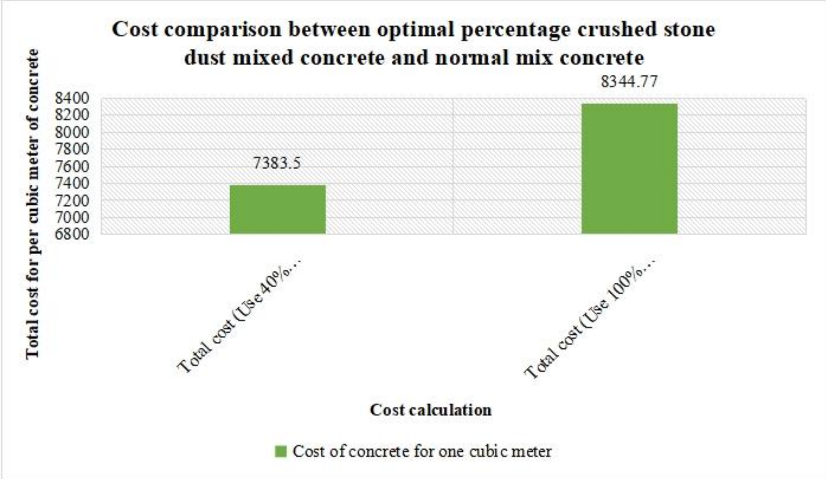

Figure 31: between optimal percentages crushed stone dust mixed concrete and normal mix concrete

Cost reduction = (8344.77-7383.5)/8344.77

=0.1152 =11.52 %

Based on the cost calculations conducted, it is evident that opting for an optimal blend of 40% crushed stone dust in M20 grade concrete, as opposed to the conventional OPC cement concrete of the same grade, yields a noteworthy 11.52% reduction in cost per cubic meter of concrete. This significant cost-saving aspect, as meticulously illustrated in the preceding calculations, underscores the paramount role of budget constraints in construction projects.

Recognizing that budgetary considerations are of utmost importance in any construction endeavor, the adoption of this 40% crushed stone dust mix in concrete not only upholds structural integrity but also aligns seamlessly with a cost-effective approach. This dual benefit, which combines structural efficacy with financial prudence, underscores the practical viability and sustainability of such an approach in the construction landscape.

(Mr. A.C. Dubal et al., 2018) had performed the Utilization of Crushed Stone Dust as a Replacement of Sand in Cement Concrete for M20 grade of concrete. According to his result, if 45 percent sand is replaced by stone dust in concrete it will not only reduce the cost of concrete but at the same time will save large quantity of natural sand and will also reduce the pollution created due to the disposal of this stone dust on valuable fertile land.

IV. CONCLUSIONS AND RECOMMENDATIONS

The present investigations have yielded several significant conclusions regarding the behavior of concrete in different location crusher sample:

1. The compressive strength was found significantly higher in concrete cubes made from Manahari River high silica sand compared to Rapti River crusher sample, Samari River crusher sample and Sisneri River crusher sample.
2. The compressive strength was found higher in concrete cubes made from Rapti River

crusher sample compared to Samari River and Sisneri River crusher sample.

3. The crushed aggregates obtained from all three crushers located in Makawanpur district gave fine results at normal ratio mix 1:1.5:3 and shows that can be used in different purposes of construction industry.
4. The workability of the concrete mixes decreased with an increase in percent of crushed stone dust of origin same as coarse aggregate as partial replacement of natural fine aggregate.
5. It can be concluded that if 40 percent natural fine aggregate is replaced by crushed stone dust in concrete it will not only reduce the cost of concrete but at the same time will save large quantity of natural fine aggregate and will also reduce the pollution created due to the disposal of this crushed stone dust on valuable fertile land.
6. All three sample of Rapti river crusher, Samari river crusher and Sisneri river crusher shows the decrease in workability when natural fine aggregate replace by the same source of crushed stone dust in varying percentage.
7. There can be seen very low slump value after replacing the natural fine aggregate by 60% and 80%. Which shows the less workability and very hard to do work in construction sites. Those concrete can't use in important sections of structures like beam, column, slab etc.
8. This research shows that use of crushed stone dust as fine aggregate in concrete is beneficial in different manners such as environmental aspects, non-availability of good quality of fine aggregate, and strength criteria also.
9. Compressive strength of cubes with stone dust as fine aggregate replacement attains maximum value on 40 percent replacement level of natural fine aggregate with crushed stone dust of origin same as coarse aggregate.
10. This research shows that to get better workability there is need to be add admixture.
11. It can be concluded that if 40 percent natural fine aggregate is replaced by crushed stone dust in concrete it reduced the cost of concrete but at the same time will save large quantity of natural sand and will also reduce the pollution created due to the disposal of this crushed stone dust on valuable fertile land.
12. Similarly taking about cost comparison and sustainable use, it is much economical to use optimal percentage crushed stone dust mixed concrete in comparison to normal concrete. From the calculated data it is found that material cost is reduced by 11.52% per one cubic meter of concrete if we replace 40% cement by crushed stone dust.

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