I. INTRODUCTION

Sustainable construction rather than a fancy idea now is a necessity. Concrete industry which uses 12.6 billion tons of raw materials each year is the largest user of natural resources in the world. As the demand for this natural resource is surpassing the availability has resulted in fast depletion of natural resources. One of the major challenges of our present society is the protection of environment. Some of the important elements in this respect are the
reduction of the consumption of energy and natural raw materials and consumption of waste materials. These topics are getting considerable attention under sustainable development nowadays. The use of recycled aggregates from construction and demolition wastes is showing prospective application in construction as alternative to primary (natural) aggregates. It conserves natural resources and reduces the space required for the landfill disposal a possible solution to overcome these problems is by using demolished aggregates and robo sand as an alternative.

- Recycled coarse aggregate (RCA) is produced by stage crushing of demolished concrete and robo sand is produced by crushing of stones.
- As per reports, robo sand is widely used all around the world because of its consistent gradation and zero impurity.
- RCA reduces the impact on landfills and can provide cost savings.
- In our project, workability of fresh concrete and strength parameters of hardened concrete such as compressive strength were studied.
- The presiding properties were studied for three different periods of curing 3, 7 and 28 days.

II. OBJECTIVE

Objectives have been listed as shown below to achieve the aims of this study

1. To determine the suitability of demolished coarse aggregate and robo sand in concrete production.
2. To investigate the strength parameters of concrete with RCA and Robo sand and to compare the performance between conventional concrete and concrete with partial replacement of RCA and robo sand as coarse aggregates and fine aggregates.

III. EXPERIMENTAL WORK

2.1 Materials used:
The materials used for the work are Cement, River Sand, Natural Coarse Aggregates, Recycled Coarse Aggregates (RCA), Robo Sand. The Recycled Coarse Aggregates are obtained from a renovating building near NAD Junction Vizag (AP) and Robo sand is collected from Robo Sand manufacturing plant near Gajuwaka, Vizag (AP).

2.2 Proportioning of materials:
In this stage we will partially replace coarse aggregates and fine aggregates with Recycled Coarse Aggregates and Robo Sand respectively. Five cases are formed with different proportions of materials. Cubes are casted for determining the compressive strength for 3, 7 and 21 days.

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Number of cases</th>
<th>Cement %</th>
<th>Fine aggregate %</th>
<th>Robo sand %</th>
<th>Coarse aggregate %</th>
<th>Recycled coarse aggregate %</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Case – 1</td>
<td>100</td>
<td>100</td>
<td>0</td>
<td>100</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>Case – 2</td>
<td>100</td>
<td>50</td>
<td>50</td>
<td>100</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>Case – 3</td>
<td>100</td>
<td>50</td>
<td>50</td>
<td>90</td>
<td>10</td>
</tr>
<tr>
<td>4</td>
<td>Case – 4</td>
<td>100</td>
<td>50</td>
<td>50</td>
<td>80</td>
<td>20</td>
</tr>
<tr>
<td>5</td>
<td>Case – 5</td>
<td>100</td>
<td>50</td>
<td>50</td>
<td>70</td>
<td>30</td>
</tr>
</tbody>
</table>

IV. TEST RESULTS
Nine cubes are casted in each case for determination of compressive strength. Tests are conducted at the age of 3 days, 7 days and 21 days of the specimens. Specimens are placed in the compression testing machine as per IS: 516-1959. Calculations are made by dividing the maximum applied load to the cross sectional area of the cube specimen.

Table – 2 Compressive strength in N/mm²

<table>
<thead>
<tr>
<th>Number of cases</th>
<th>Replacement % of Fine and Coarse aggregates</th>
<th>3days</th>
<th>7days</th>
<th>28days</th>
</tr>
</thead>
<tbody>
<tr>
<td>Case – 1</td>
<td>0% CA and 0% FA</td>
<td>15.11</td>
<td>20.14</td>
<td>30.58</td>
</tr>
<tr>
<td>Case – 2</td>
<td>0% CA and 50% FA</td>
<td>21.99</td>
<td>35.40</td>
<td>46.07</td>
</tr>
<tr>
<td>Case – 3</td>
<td>10% CA and 50% FA</td>
<td>19.55</td>
<td>22.66</td>
<td>33.18</td>
</tr>
<tr>
<td>Case – 4</td>
<td>20% CA and 50% FA</td>
<td>20.73</td>
<td>31.10</td>
<td>36.44</td>
</tr>
<tr>
<td>Case – 5</td>
<td>30% CA and 50% FA</td>
<td>17.47</td>
<td>22.36</td>
<td>29.07</td>
</tr>
</tbody>
</table>

V. DISCUSSIONS

The following graph shows the compressive strength of different cases for 3 days, 7 days and 28 days curing period of the specimens. The case 2 (50% replacement of fine aggregate with Robo sand and 0% replacement of Coarse aggregate) gives more strength than the conventional concrete. For Case 3 (50% replacement of fine aggregate with Robo sand and 10% replacement of Coarse aggregate with RCA) and Case 4 (50% replacement of fine aggregate with Robo sand and 20% replacement of Coarse aggregate with RCA) gives lesser strength than case 2 but however it attains the target strength. The case 4 (50% replacement of fine aggregate with Robo sand and 30% replacement of Coarse aggregate with RCA) give lesser strength than the target strength.
VI. CONCLUSIONS

Based on the experimental work the following conclusions were given-

a) Compressive strengths for CASE – 2 (50% replacement of robo sand and 0% recycled coarse aggregates) and CASE – 3 (50% robo sand and 10% replacement of recycled coarse aggregates) was increased by 15.49% and 2.6% respectively when compared with 0% replacement (control specimen). Hence 50% replacement of robo sand and 0% recycled coarse aggregates is effective percentage of replacement in M25 grade concrete.

b) Compressive strength for CASE – 4 (50% replacement of robo sand and 20% recycled coarse aggregate) was increased by 5.86% when compared with 0% replacement (control specimen)

c) Compressive strength for CASE – 5 (50% replacement of robo sand and 30% recycled coarse aggregate) was decreased by 1.5% when compared with 0% replacement (control specimen)

We can conclude that Robo sand can be used as an alternative material to the natural river sand partially up to 50% and can be introduced as a functional construction material. The strength of the concrete is increasing due to better particle packing. However Recycled coarse aggregates can also be used up to 20% replacement. Care should be taken while using Recycled Coarse aggregates, the Recycled Coarse Aggregates should be cleaned well before using it.

REFERENCES


Shetty, M. S., “Concrete technology, 2019” Chand S. and Co.Ltd, India