The study of partial replacement of fine aggregate by using quarry dust in concrete to overcome the shortage of river sand due to environmental impact and economic reasons is the main focus of this research. The objective is to study the workability and strength of concrete using quarry dust as a replacement for river sand. The study involves the preparation of four mixes with different percentages of quarry dust (0%, 10%, 20%, and 30%). The compressive strength and split tensile strength of the concrete were tested to evaluate the performance of the mixes. The results indicate that the strength of the concrete decreases with an increase in the percentage of quarry dust replacement. However, the workability of the concrete increases proportionally with the replacement of quarry dust. The study concludes that quarry dust can be used as a partial replacement of river sand in concrete with appropriate adjustments to the mix proportions to maintain the required strength and workability.
To study the compressive strength and tensile strength of concrete with various percentage replacement of quarry dust

3. Materials

3.1 Cement
Cement acts as a binding agent for materials. Cement is the most expensive materials in concrete and it is available in different forms. Depending upon the chemical compositions, setting and pozzolana cement and Ordinary Portland cement. In this report Ordinary Portland cement (OPC) conforming to IS12269-2013 is used for casting cubes and cylinder. The properties of cement that were studied are normal consistency, fineness of cement and specific gravity and the test was done as per IS 4301-988 (part5). The Reports are in table 1.

**Table 1. Physical Property Of Cement**

<table>
<thead>
<tr>
<th>SL.NO</th>
<th>PROPERTY</th>
<th>RESULT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>FINENESS OF CEMENT</td>
<td>8.4%</td>
</tr>
<tr>
<td>2</td>
<td>SPECIFIC GRAVITY OF CEMENT</td>
<td>3.0</td>
</tr>
<tr>
<td>3</td>
<td>NORMAL CONSISTENCY</td>
<td>33%</td>
</tr>
</tbody>
</table>

3.2 Fine Aggregate:
Fine aggregate used in this study is locally available and confirmed to grading zone III as per IS 383-1970. The aggregates whose size is less than 4.75mm. Sand is generally considered to have a lower size limit of about 0.07mm. The specific gravity of fine aggregate was found out using pycnometer and sieve analysis[15-17].

**Table 2. Physical Property Of Fine Aggregate**

<table>
<thead>
<tr>
<th>SL.NO</th>
<th>PROPERTY</th>
<th>RESULT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>SPECIFIC GRAVITY OF FINE AGGREGATE</td>
<td>2.65</td>
</tr>
<tr>
<td>2</td>
<td>FINENESS MODULUS</td>
<td>2.8</td>
</tr>
</tbody>
</table>

3.3 Coarse Aggregate:
The material whose particles are of size as retained on 4.75mm is sieve is termed as coarse aggregate. Coarse aggregate shall consist of crushed or broken stones and be hard, strong, dense, durable, clean or proper gradation. Locally available coarse aggregate with maximum size of 20 mm and minimum size of 12.5mm were used in this project report conforming to IS 383-1970. The properties of coarse aggregates studied were impact value, los angel's abrasion test, devals abrasion test and specific gravity of coarse aggregate[18].

3.4 Water:
Water to be used in the concrete work should have following properties: It should be free from adverse amount of soils, acids, alkalis or other organic or inorganic impurities. It should be free from iron, vegetable matter or...
any other type of substances, which are likely to have adverse effect on concrete or reinforcement. It should be fit for drinking purposes potable water available in the premises was used for mixing and curing of concrete[19].

3.5 Quarry Dust:
Quarry Dust can be defined as residue, tailing or other non-voluble waste material after the extraction and processing of rocks to form fine particles less than 4.75 mm. This product can be used for asphalt, substitute for sand, and filling around pipes. Quarry dust can be an economic alternative to the river sand. It is a waste obtained during quarrying process. It has very recently gained good attention to be used as an effective filler material instead of fine aggregate. In the present study, the hardened and durable properties of concrete using quarry dust were investigated.

![Figure 4. Quarry Dust](image)

### Mix Proportion Per $M^3$ Of Concrete

<table>
<thead>
<tr>
<th>WATER</th>
<th>CEMENT</th>
<th>FINE AGGREGATE</th>
<th>COARSE AGGREGATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>186 litres</td>
<td>372 kg/m³</td>
<td>694.83 kg</td>
<td>1219.23 kg</td>
</tr>
<tr>
<td>0.50</td>
<td>1</td>
<td>1.8</td>
<td>3.2</td>
</tr>
</tbody>
</table>

Therefore mix proportion adopted is $1 : 1.8 : 3.2$

![Figure 5. Concrete Mixing](image)

### Test For Concrete

#### Test done for workability:

**Slump Test:**
The concrete slump test measures the consistency of fresh concrete before it sets. It is performed to check the workability of freshly made concrete, and therefore the ease with which concrete flows. It can also be used as an indicator of an improperly mixed batch. The test is popular due to the simplicity of apparatus used and simple procedure. The slump test is used to ensure uniformity for
different loads of concrete under field conditions. A separate test, known as the flow table, or slump-flow, test, is used for concrete that is too fluid (workable) to be measured using the standard slump test, because the concrete will not retain its shape when the cone is removed.

Table 5. Slump test value

<table>
<thead>
<tr>
<th>Sl.no</th>
<th>Mix ratio</th>
<th>Slump value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0%</td>
<td>41</td>
</tr>
<tr>
<td>2</td>
<td>10%</td>
<td>44</td>
</tr>
<tr>
<td>3</td>
<td>20%</td>
<td>47</td>
</tr>
<tr>
<td>4</td>
<td>30%</td>
<td>49</td>
</tr>
</tbody>
</table>

Figure 8. Slump Test

Compaction Factor Test:

Compacting factor of fresh concrete is done to determine the workability of fresh concrete by compaction factor test. The apparatus used is compaction factor apparatus. Procedure to determine workability of fresh concrete by compaction factor test. The ratio of the weight of partially compacted concrete to the weight of the concrete when fully compacted in the same mould. The compaction factor apparatus is used to determine the compaction factor of concrete with low, medium and high workability.

Figure 9. Compaction Factor

Table 6. Compressive strength of cube

<table>
<thead>
<tr>
<th>SL.NO</th>
<th>MIX RATIO</th>
<th>CUBES COMPRESSIVE STRENGTH (N/MM²)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>7 DAYS</td>
</tr>
<tr>
<td>1</td>
<td>0%</td>
<td>13.26</td>
</tr>
<tr>
<td>2</td>
<td>10%</td>
<td>13.82</td>
</tr>
<tr>
<td>3</td>
<td>20%</td>
<td>12.01</td>
</tr>
<tr>
<td>4</td>
<td>30%</td>
<td>11.26</td>
</tr>
</tbody>
</table>

Figure 10. Compressive Strength Bar Graph
5. Conclusion

Based on the experimental investigation concerning compressive strength and split tensile strength of concrete with quarry dust as a partial replacement of fine aggregate, the following conclusion can be drawn:

1. The compressive strength of concrete is increased by the use of quarry dust up to 10% replacement of sand. From 10% there is decrease in compressive strength.

2. The split tensile strength concrete is increased by the use of quarry dust up to 0% replacement of fine aggregate. From 10% there is a decrease in split tensile strength.

3. The compressive strength increase mainly depends on the percentage of quarry dust because of its high pozzolanic nature.

4. The workability of the concrete increase as the percentage of quarry dust is increased.

5. The optimum percentage of replacement of sand by quarry dust is 10% for M20 grade of concrete.

6. The optimum replacement is not beneficial in case of split tensile strength for replacement of quarry dust.

7. The replacement of fine aggregate with quarry dust is more cost economical.

8. The workability of the concrete increase as the percentage of quarry dust is increased.

Reference


