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# Feasibility of Recycled Aggregates and Steel Fibre in Concrete

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**ABSTRACT**: This report presents a study of mechanical properties of concrete made by using the demolished concrete as coarse aggregate in addition to steel fibres. In the concrete mixes the ratios of concrete aggregate range from 0% to 100% with the increment of 25% the ratio of steel fibre was 6% of whole mix volume. Three concrete mixes have been prepared with proportion of 1:2:4, the water cement ratio was 0.5. The essential mix was control mix without steel fibre for comparison, the other mixes with or without steel fibres with different proportion of recycle concrete aggregate. The mixes were casted in standard specimens, cylinders and cubes and tested under static loading The specimens were tested for compression strength and splitting tensile strength,This research shows that increasing recycle concrete aggregate will decrease the compressive strength and splitting tensile strength but adding steel fibre will increase these strengths. The recycled concrete aggregate with steel fibre are found to make a good quality concrete therefore recycle concrete aggregate can be used successfully for structural concrete instead of natural aggregate..

## I. INTRODUCTION

The amount of concrete debris collected from demolished structures is huge. Without proper treatment it can cause secondary pollution. The application of building rubble collected from damaged and demolished structures become an important issue in every country. After crushing and screening, these materials could serve as recycled aggregate in concrete. Thus, recycling aggregate and reusing this concrete debris can not only reduce the waste but also transform them into aggregate resources. Many significant researchers have been carried out to prove that recycled concrete aggregate could be a reliable alternative as aggregate in production of concrete. A widely reported recycled aggregate are suitable for non-structural concrete application. Recycled aggregate also can be applied in producing normal structural concrete with addition of fly ash and condensed silica fume etc. [1] Strength concrete is affected by using the type of coarse aggregate used. It is necessary to know the characteristics of RCA and the effects of using RCA in concrete. Recycled aggregate normally has higher water absorption and lower specific gravity. Density of recycled aggregate used is lower than the density of normal aggregate. Porosity of recycled aggregate is also much higher than those of natural aggregate. Recycled aggregate concrete RCA is concrete made from recycled aggregate. It was found that the workability of fresh RCA decreases with an increase in recycled aggregate due to water absorption of mortar adhered to recycled aggregate. The strength of RCA is reported to be less by about 10% compared to normal concrete.[3] Concrete with RCA can be transported, placed and compacted in the same manner as conventional concrete. Special care necessary when using fine RCA. Recycling concrete provides sustainability several different ways. The simple act of recycling the concrete reduces the amount of material that must be land filled. The concrete itself becomes aggregate and any embedded metals can be removed and recycled as well. Asspace for landfills becomes premium, this not only helps reduce the need for landfills, but also reduces the economic impact of the project. Moreover, using recycled concrete aggregates reduces the need for aggregates. [4] This in turn reduces the environmental impact of the aggregate extraction process. By removing both the waste disposal and new material production needs, transportation requirements for the project is significantly reduced. There are a variety of benefits in recycling concrete aggregate Keeping concrete debris out of landfills saves landfill space. • Using recycled material as gravel reduces the need for gravel mining. • Using recycled concrete as the base material for roadways reduces the pollution involved in trucking material. • Protect natural recourses. • Elimination the need for disposal by using readily available concretes • Cost Efficiencies

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• Greatly reduces fuel costs • Cuts costs by using a recycled material to replace natural aggregate • Reduces dumping fees at landfills • Environmental Advantages • Keeps our landfills clear of recyclable product • Greatly reduces the need to use natural aggregate • Recycles man-made product • Reduces the need for gravel mining • Helps in the fight to keep our environment clean • Portable Concrete Recycling/On-site Crushing The aim of this research project is to utilize recycled concrete as coarse aggregate with addition of steel fiber for production of concrete. It is essential to know whether the replacement of RCA in concrete is acceptable or not.[7]Reducing the use of natural resources and replacing it with waste material to avoid problematic landfills has been the principal focus of an emerging and important recycling market in most developed countries. Crushed concrete and masonry waste can be suitable for replacing coarse aggregate in concrete. When crushed masonry is used, compressive strength is lower and the material's high porosity affects durability and shrinkage. With crushed concrete aggregate the compressive strength and durability depend on the quantity of attached mortar, which is responsible for higher porosity, weak zones in the aggregate, and is also related to the new concrete durability. Smart crushers liberate more adhered mortar and could provide a good solution. [9] Methods to guarantee the quality of production are applied, but in homogeneity of the concrete waste of different origins continues to inspire distrust in many consumers, who continue to prefer the use of sub base material in roads. Irregularity of the distribution of chlorides or other contaminants makes the quality control a complicated process, but combined analysis of durability and sustainability as well as the use of indicators and models can be a solution. In situ recycling with only one origin of concrete can assure homogeneity. Many research papers imply the need of using more cement to compensate for the differences in properties compared to concrete with primary aggregates

**Steel fibre**

## II. EXPERIMENTATION

1. The mould for the slump testis a frustum of a cone, 300 mm (12 in) of height. The base is 200 mm (8in) in diameter and it has a smaller opening at the top of 100 mm (4 in). 2. The base is placed on a smooth surface and the container is filled with concrete in three layers, whose workability is to be tested . 3. Each layer is temped 25 times with a standard 16 mm (5/8 in) diameter steel rod, rounded at the end. 4. When the mould is completely filled with concrete, the top surface is struck off (levelled with mould top opening) by means of screening and rolling motion of the temping rod. 5. The mould must be firmly held against its base during the entire operation so that it could not move due to the pouring of concrete and this can be done by means of handles or foot - rests brazed to the mould. 6. Immediately after filling is completed and the concrete is levelled, the cone is slowly and carefully lifted vertically, an unsupported concrete will now slump. 7. The decrease in the height of the centre of the slumped concrete is called slump. 8. The slump is measured by placing the cone just besides the slump concrete and the temping rod is placed over the cone so that it should also come over the area of slumped concrete. 9. The decrease in height of concrete to that of mould is noted with scale. (usually measured to the nearest 5 mm (1/4 in).portion shall be rotated gently by hand so that uniform seating may be obtained.

M30 Grade of Concrete Mix Design Procedure with OPC 53 Cement For Concrete mix design, we use, IS 456 and IS 10262 Required Data for M30 Grade of Concrete Mix Design Characteristic Compressive Strength: 30 Mpa Maximum size of aggregates – 20 mm Work-ability, slump – 125-150 mm Degree of Quality Control – Good Required Test Data for Materials for M30 Grade of Concrete Mix Design Specific Gravity details: Type of Cement: OPC 53 Grade

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| **Property** | **Mortar** | **10 mm Maximum aggregate size** | **20 mm Maximum aggregate size** |
|---|---|---|---|
| Cement (kg/m)$^3$ | 415-710 | 355-590 | 300-535 |
| W/c ratio | 0.3-0.45 | 0.35-0.45 | 0.4-0.5 |
| Fine/coarse | 100 | 45-60 | 45-55 |
| Aggregate (%) | 7-10 | 4-7 | 4-6 |
| Entrained air (%) | 1-2 | 0.9-1.8 | 0.8-1.6 |
| Fibre content (%) by volume smooth steel deformed steel | 0.5-1.0 | 0.4-0.9 | 0.3-0.8 |

Table 1 **Range Of Proportion for Normal Weight Fibre Reinforce Concrete**

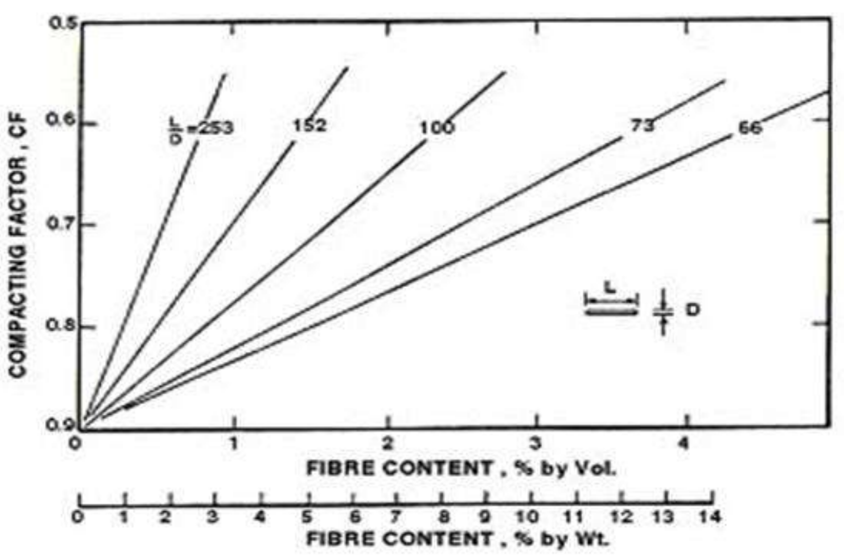


Fig Graph referred from IS Code 456:2000

| Name | Grade of concrete | Recycled coarse aggregate | Steel fiber addition | Compressive strength at 7 days | Compressive strength at 28 days |
|---|---|---|---|---|---|
| CCB | M30 | 0% | 0% | 20.66 | 29.52 |
| RCS5-0 | M30 | 0% | 5% | 18.39 | 37.54 |
| RCS5-10 | M30 | 10% | 5% | 18.08 | 37.41 |
| RCS5-20 | M30 | 20% | 5% | 17.76 | 36.22 |

| | | | | | |
|---|---|---|---|---|---|
| RCS5-30 | M30 | 30% | 5% | 16.81 | 34.47 |

## III. CONCLUSION

Based on the limited study carried out on the strength behavior of SFRC the following conclusions are drawn.

- By adding the steel with recycled concrete fibres in concrete there is gradual increase in compressive strength from 7 to 28 days.
- It is observed that compressive strength increases from 5 to 10% addition of steel fibers along with RCA.
- The total energy absorbed in fiber as measured by the area under the load-deflection curve is at least 10 to 40 times higher for fiber-reinforced recycled concrete than that of plain concrete.
- Addition of fiber to conventionally reinforced beams increased the fatigue life and decreased the crack width under fatigue loading.

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