

# An Experimental Investigation Of Partial Replacement Of Aggregate By Various Percentage Of Recycled Aggregate & Marble Sludge Powder-A Review

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## ABSTRACT

The use of recycled aggregate in concrete has great potential to positively affect the properties of concrete in a wide spectrum. Leaving the waste materials to the environment directly can cause environmental problem. Thus use of waste material has been emphasized. New products can be produced by using recycled aggregate & marble sludge powder so that natural resources are used more efficiently and the environment is protected from waste deposits.

The main goal of this study is to check the properties of concrete when the recycled aggregate & marble sludge powder is used as a partial replacement of aggregate. It ultimately helps to evaluate recovery and reuse of by-products coming from destroyed buildings & marble processing industries. So that it helps to conserve the use of natural aggregate and it preserves the use of landfill for materials which cannot be recycled.

**KEYWORDS:** -Compressive strength of concrete, marble sludge powder, recycled aggregate concrete.

## 1. INTRODUCTION

Recycling of concrete helps to protect natural resources and eliminates the need for disposal by using the readily available concrete as an aggregate source for new concrete or other applications. According to a 2004 FHWA (Federal Highway Administration) study, 38 states recycle concrete as an aggregate base; 11 recycle it into new Portland cement concrete. The states that do use recycled concrete aggregate (RCA) in new concrete report that concrete with RCA performs equal to concrete with natural aggregates. Most agencies specify using the material directly in the project that is being reconstructed.

Advance concrete technology can reduce the consumption of natural resources and energy sources thereby lessen the burden of pollutants on environment. We describe the feasibility of using the marble sludge dust in concrete production as partial replacement of fine aggregate.

Presently large amounts of marble dust are generated in natural stone processing plants with an

important impact on environment and humans. This project describes the feasibility of using the marble sludge dust in concrete production as partial replacement of fine aggregate. In INDIA, the marble and granite stone processing is one of the most thriving industry the effects of varying marble dust contents on the physical and mechanical properties of fresh and hardened concrete have been investigated.

## 2. Aim of this study:

This study aims to reduce the environmental problems which are generated from dumping the construction and demolition wastes. This can be achieved by recycling the construction and demolition wastes to produce concrete mixes for structural elements with high performance as natural aggregate.

## 3. Objectives of this study:

3.1 To Study the physical and mechanical performance of recycled aggregate used in concrete.

3.2 To check the possibility of using recycled aggregate in concrete mixes.

3.3 The bonding strength can be investigated between reinforcement bars and concrete from recycled aggregate.

3.4 To optimize the ratio of recycled aggregate to natural aggregate which produce better result of concrete mix.

#### 4. Recycled Aggregates

Concrete recycling is a relatively simple process. It involves breaking, removing, and crushing existing concrete into a material with a specified size and quality. See ACI 555 (2001) for more information on processing old concrete into recycled concrete aggregates. The quality of concrete with RCA is very dependent on the quality of the recycled material used. Reinforcing steel and other embedded items, if any, must be removed, and care must be taken to prevent contamination by other materials that can be troublesome, such as asphalt, soil and clay balls, chlorides, glass, gypsum board, sealants, paper, plaster, wood, and roofing materials.

#### 5. Marble sludge powder

In natural stone processing plants large amounts of marble dust are generated with an important impact on environment and humans. This project describes the feasibility of using the marble sludge dust in concrete production as partial replacement of fine aggregate. In INDIA, the marble and granite stone processing is one of the most thriving industry the effects if varying marble dust contents on the physical and mechanical properties of fresh and hardened concrete have been investigated. Slump and air content of fresh concrete and absorption and compressive strength of hardened concrete were also investigated. Test results show that this industrial by product is capable of improving hardened concrete performance up to 10%, Enhancing fresh concrete behavior and can be used in architectural concrete mixtures containing white cement. The compressive strength of concrete was measured for 7 and 28 days. In order to evaluate the effects of marble dust on mechanical behavior, many different mortar mixes were tested.

### 6. LITERATURE REVIEW:

There are various literature reviews are available some of them are given below.

#### 6.1 Ayed Ahmad Zuhud, (2008)<sup>ibid</sup>

- Due to light weight of recycled aggregate and bad compaction because of the nature of recycled aggregate and its texture, the density of recycled aggregate concrete is lower than that of natural aggregate by 5.5%.
- The absorption capacity of recycled aggregate is more than two times of natural aggregates; due to this the workability of recycled concrete is reduced.
- Using the same quantity of cement, the recycled aggregate concrete can provide strength almost equivalent to a corresponding concrete with natural aggregates. If we replace 60 % of recycled coarse aggregate in concrete mixes it is found that the compressive strength decrease by 24.6.0%.

#### 6.2 G.Murali(2012)

- According to G.Murali, By replacing 10 % natural aggregate by recycled aggregate without chemical admixtures, the tensile strength has been gradually increased as 5.88% & with chemical admixtures, the tensile strength was noted as 8.82%.
- If they replace 20 % natural aggregate by recycled aggregate without chemical admixtures, the tensile strength has been gradually increased as 11.40% & with chemical admixtures, the tensile strength was noted as 16.91%.
- If they replace 30 % natural aggregate by recycled aggregate without chemical admixtures, the tensile strength has been gradually increased as 21.70% & with chemical admixtures, the tensile strength was noted as 28.3%.
- If they replace 40 % natural aggregate by recycled aggregate without chemical admixtures, the tensile strength has been gradually increased as 15.7% & with chemical admixtures, the tensile strength was noted as 19.85%.

The test results indicated that the replacement of coarse aggregate by 30% had attained a good strength.

### 6.3 BaharDemirel,(2010)ibid

- The compressive strength of concrete has increased with increasing percentages of marble dust additions at all curing ages.
- The concrete series that employed waste marble dust as the substitute for the very fine aggregate passing through 0.25 mm sieve performed better than the series without any addition of marble dust in terms of compressive strength.
- The porosity of the concrete decreased and Ultrasonic pulse velocity increased with addition of percentage of marble dust increases.

### 6.4 M. ShahulHameed,(2009)ibid

- The replacement of fine aggregate with 50% marble sludge powder and 50% Green concrete gives an excellent result in strength aspect and quality aspect.
- The result of his study shown that, the M4 mixes induced higher compressive strength, higher splitting tensile strength.
- If they increase the marble sludge powder content by more than 50%, it improves the workability but affects the compressive and split tensile strength of concrete.
- Green concrete induced higher workability and it satisfy the self compacting concrete performance having the slump flow is 657mm without affecting the strength of concrete.

### 6.5 Nelson, Shing Chai NGO(2004)

- When the percentage of recycled aggregate increases, the slump test indicates a decreasing trend of workability.
- The compaction factor test indicated that, the compaction factor ratio is decreases as the percentage of recycled aggregate increases.
- The compression test indicated that, the concrete specimen with more replacement of recycled aggregate will get the lowest

strength when compared to the concrete specimens with less recycled aggregate.

- The tensile test concluded that, the tensile strength is gradually decreases if more percentage replacement of recycled aggregate used in the concrete specimen.

### 6.6 BabooRai,et.al.,(2011)

- The partial replacement of cement and usual fine aggregates by varying percentage of marble powder and marble granules reveals that increased waste marble powder (WMP) or waste marble granule (WMG) ratio result in increased workability and compressive strengths of the mortar and concrete.

### 6.7 Haliza Bite Mohd Jeffery Ong, (2010)

- The control mixture showed better results compared with the mixture of using recycled aggregate. Research shows that more recycled aggregate is used, the compressive strength of concrete decreases. However, recycled aggregate can be used for structures that do not require a high specification.

### 6.8 Suraya Hani Adnan,et.al.,(2010)

- The compressive strength of concrete containing recycled aggregate & Micronised Biomass Silica (MBS) have more compressive strength than concrete containing only MBS.
- MBS acts as a micro-filler in the concrete due to this MBS be able to lower the water permeability of normal and recycled aggregate concrete.

### 6.9 V.R Ramkumar, et.al., (2012)

- The result shows that, the flexural strength of concrete with natural aggregate is more than the concrete containing recycled aggregate.
- However by providing water & acid treatment the strength of recycled aggregate concrete can be improved.

material design based on the value of relative quality method.

#### 6.10 P.A. Shirule, et.al.,

- If they add 10% of waste marble powder by weight of cement the Compressive strength of Cubes are increased and further any addition of waste marble powder the compressive strength of cubes are decreases.
- If they add 10% of waste marble powder by weight of cement the Split Tensile strength of Cylinders is increased and further any addition of waste marble powder the Split Tensile strength of Cylinders decreases.
- Hence it can be concluded that the optimum percentage for replacement of marble powder with cement and it is almost 10% cement for both cubes and cylinders.

#### 6.11 Yongjae Kim, et.al., (2012)

- As the recycled aggregate replacement ratio increased the recycled aggregate concrete showed an increased workability. This may be due to the increased amount of fine particles from the recycling process.
- Air content slightly reduced upto 30% replacement of the recycled fines with 100% recycled coarse aggregate. With a greater amount of the recycled fines, the air content tended to increase. However the air content did not vary significantly and seemed to be controlled with the addition of air entraining admixture.
- When the coarse aggregate was replaced with the recycled aggregate, compressive strength decreased. As the recycled fines amount increased the additional replacement of the fine aggregate reduced the strength.
- When we replace the fine aggregate more than 60%, the strength reduction became more significantly.

#### 6.12 Yasuhiro Dosho, (2007)<sup>ibid</sup>

- Recycled aggregate concrete using the aggregate replacement method can acquire sufficient quality as structural concrete and/or precast concrete products through

#### 6.13 Khan Naushad H, (2011)

- On increasing marble waste fine aggregate ratio i.e. when marble waste / granules are partially replaced in fine aggregate by weight then there is increase in compressive strength values of marble waste mortar at each curing age.

#### 6.14 Yong P.C., et.al., (2009)

- The slump of recycled concrete made with 100% recycled concrete aggregate is 0 mm therefore the workability of fresh concrete is not satisfied.
- As compare to control concrete recycled aggregate concrete has higher 28 days compressive strength & higher 28 days split tensile strength.

#### 6.15 Gupta Arundeb, et.al., (2011)

- Recycled aggregate concrete gives higher compressive strength with 10% fly ash is used.
- The split tensile and flexural strength are lower in recycled aggregate concrete but it can be improved to an extent by adding 10% by replacement of cement by fly ash.

## 7 Conclusion

According to above literature review it was concluded that if we replace 30% aggregate by recycled aggregate, then we get maximum compressive strength of concrete. In Future we will be experimenting on replacing coarse aggregate & fine aggregate by recycled aggregate & marble sludge powder by 10%, 20%, 30%, 40% & we will be finding out the conclusion.

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