EXPERIMENTAL STUDY ON PERFORMANCE OF MARBLE WASTE AND GLASS FIBRE IN CONCRETE FOR RIGID PAVEMENT

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It is certified that the work contained in this dissertation thesis entitled '**Experimental Study on Performance of Marble Waste and Glass Fibre in Concrete For Rigid Pavement**' submitted **by Mr**.**Makwana Rohit B, 190041010** studying at Civil Engineering Department, Faculty of Engineering & Technology, for the award of M.Tech (Civil-Transportation Engineering) is absolutely based on his own work carried out under my/our supervision and that this work/thesis has not been submitted elsewhere for any degree/diploma.

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Dedication

Every challenging work needs self–efforts as well as guidance of elders specially those whew extra very close to our heart.

My humble effort I dedicated to my sweet and loving family.

Parents

Whose affection, love encourages and prays of day and night makes me able to get such success and honor,

And who light up my world like nobody else.

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Research brings about dramatic changes in the traditional lookout of Science & Technology. It has widened our vision, opened newer avenues and lightened the dark obscure facts of mysterious universe. Behind every successes there are lot many effects, but efforts are fruitful due to hands making the passage smoother. I express my deep sense of gratitude for hands, people extended to me during my work.

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At the occasion of this presentation, I would like to thank from the bottom of my heart to all mighty and **My Parents and Brother** for their endless love, support and encouragement.

Makwana Rohit B

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ABSTRACT:-

Now a day India growing the road capacity. In India most of state connect in their capital city. Government is launch pmgsy to connect the villages. Most of the village is connect the district level. More transportation increase so road pavement strength is more importance. So as transportation engineering pavement is main function. So most of two type of pavement like flexible pavement and rigid pavement. So it can be their compressive strength and flexural strength is consider. As per IRC 44 2017. As per design m40 concrete design considered. To use waste material to made concrete pavement. To use as waste marble waste in concrete. It is partial replacement of coarse aggregate. In partially replacement of coarse aggregate in 10%, 20%, & 30%. And to compare the normal pavement concrete to partially replacement of concrete pavement. And use as admixture 0.5% glass fiber in concrete pavement.

KEYWORDS:-

Cement, Sand, Concrete Pavement aggregate, Fiber, Marble Waste As Coarse Aggregate, Rigid Pavement.

CHAPTER – 1

INTRODUCTION

1.1 GENERAL

Transportation has been one of the essential components of the civil engineering profession since its early days. From time immemorial, the building of roads, bridges, pipelines, tunnels, canals, railroads, ports, and harbors has shaped the profession and defined much of its public image. As cities grew, civil engineers became involved in developing, building, and operating transit facilities, including street railways and elevated and underground systems the role of civil engineers is to providing transportation infrastructure to accommodate a growing population. The transportation by road is the only road which could give maximum service to one all.

Transportation engineering, as practiced by civil engineers, primarily involves planning, design, construction, maintenance, and operation of transportation facilities. The facilities support air, highway, railroad, pipeline, water, and even space transportation. The design aspects of transport Engineering include the sizing of transportation facilities (how many lanes or how much capacity the facility has), determining the materials and thickness used in pavement designing the geometry (vertical and horizontal alignment) of the roadway (or track). Beside these operations planning, logistics, network analysis, financing, and policy analysis are also important to civil engineers, particularly to those working in highway and urban transportation.

Regional and national transportation systems are made up of networks of interconnected facilities and services. As a result, practically all transportation projects must be evaluated in light of their location within a modal or intermodal network, as well as their potential impact on network performance. That is, a transportation project's network context is usually quite significant. As a result, a chapter on national transportation networks is an ideal place to start a volume on transportation engineering. The topic of national transportation networks can be handled from a couple of different angles. Most introductory transportation textbooks take one method, which discusses the physical elements of various forms of transportation and their division into categories. Functional subsystems. A second approach focuses on the availability of national transportation network databases and their use for engineering planning and operations studies. The latter approach is emphasized in this chapter; with the aim of providing the reader with some guidance on obtaining and using such networks. In describing these network databases, however, some high-level descriptions of the physical networks are also provided. The modal networks considered are highway, rail, waterway, and pipeline and their intermodal connections. Airports and airline service networks are deliberately excluded, as air transport is markedly different in character from the surface transportation modes. Likewise, urban highway networks and bus and rail public transportation networks are not covered, since the emphasis is on national and state-level applications. For reasons of space and focus, only transportation networks in the United States are included, although the general concepts presented apply to any national or regional transportation network

The planning aspects of transport engineering relate to urban planning, and involve technical forecasting decisions and political factors. Technical forecasting of passenger travel usually involves an urban transportation planning model, requiring the estimation of trip generation (how many trips for what purpose), trip distribution (destination choice, where is the traveler going), mode choice (what mode is being taken), and route assignment (which streets or routes are being used). More sophisticated forecasting can include other aspects of traveler decisions, including auto ownership, trip chaining (the decision to link individual trips together in a tour) and the choice of residential or business location (known as land use forecasting). Passenger trips are the focus of transport engineering because they often represent the peak of demand on any transportation system. Mobility is a basic human need. From the times immemorial, everyone travels either for food or leisure. A closely associated need is the transport of raw materials to a manufacturing unit or finished goods for consumption. Transportation fulfills these basic needs of humanity. Transportation plays a major role in the development of the human civilization. For instance, one could easily observe the strong correlation between the evolution of human settlement and the proximity of transport facilities. Also, there is a strong correlation between the quality of transport facilities and standard of living, because of which society places a great expectation from transportation facilities. In other words, the solution to transportation problems must be analytically based, economically sound, socially credible, environmentally sensitive, practically acceptable and sustainable. Alternatively, the transportation solution should be safe, rapid, comfortable, convenient, economical, and eco-friendly for both men and material.In the last couple of decade's transportation systems analysis has emerged as a recognized profession. More and more government organizations, universities, researchers, consultants, and private industrial groups around the world are becoming truly multi-modal in their orientation and are opting a systematic approach to transportation problems.

1. TYPES OF PAVEMENTS

A Road pavement is a structure made up of stacking layers of process material over the natural soil base &sub-grade, with the distributing vehicle of loads to the sub grade. Its pavements structures can be able an appropriate riding surface with suitable skid resistance, good light reflecting properties, and low noise pollution. The ultimate goal is to ensure that the transmitted stresses caused by wheel load are decreased to the point where they do not exceed the sub-bearing grade's capability. There are two types of pavements that are commonly used for this purpose: Rigid pavements. This chapter provides an overview of the various pavement kinds, layers, and their applications. Pavements leads to early failure of pavements the riding quality.

Pavement concerned with the structural behavior design by roads, both bitumen concrete, which is referred to as (flexible rigid pavements) respectively. It covers paver material design, layer thickness concluded, and construction and maintenance of cost pro. The design primarily focuses on structural, operative and drainage considerations. Structural design is pavement has normal strength to with the impact loads, design on the riding quality, and the protects the pavement from to water aquifer.

2. FLEXIBLE PAVEMENT

Flexible pavement is defined as a layer of compacted granular material of appropriate quality over the sub grade that is made up of a mixture of asphaltic or bituminous material and aggregates. Flexible pavements include water-bound macadam roads as well as stabilised soil roads with or without asphaltic overlays. The look of the Water bound macadam roads and stabilized soil roads with or without asphaltic toppings are examples of flexible pavements. The design of flexible pavement is based on the principle that for a load of any magnitude, the intensity of a load diminishes as the load is transmitted downwards from the surface by virtue of spreading over an increasingly larger area, by carrying it deep enough into the ground through successive layers of granular material. As a result, there might be grading in the quality of materials used for flexible pavement, with materials with a high degree of strength employed at or near the surface. As a result, the thickness of the sub grade is mostly influenced by the strength of the sub grade.

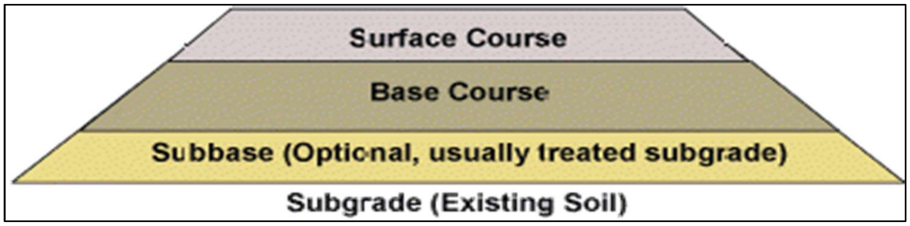


Fig – 1.1 Flexible Pavement

Flexible pavement. Category of semi-rigid pavements. The design of rigid pavement is based on providing a structural cement concrete slab of sufficient strength to resists the loads from traffic. The rigid pavement has rigidity and high modulus of elasticity to distribute the load over a relatively wide area of soil.

1.2.2 RIGID PAVEMENT

Fig- 1.2 Rigid Pavement

Concrete roads as the defined as most of type cement concrete roads of high quality. These roads can be built directly on a well-compacted soil sub grade and may or may not require sub-base or basic courses. Its the flexural strength it to support the strain of material on the driving wheels while also overcoming the deficiencies of the layers beneath it. However, providing sub-base/base course below the cement concrete pavement will improve its performance significantly; therefore, a well-designed and well-constructed cement concrete pavement will be a rigid pavement capable of providing hassle-free and high-quality riding Surface it is a high-volumes and heavy traffic loads for as long as 30 to 50 years. PPC is well understood in its engineering behavior and hence, a concrete pavement can be rationally designed. Pavement Quality Concrete (PQC) is cement concrete made with coarse aggregates according to IRC specifications and placed on a dry concrete base. This construction isspecially used for highway and airport runway pavements as it can withstand heavy loads.

Because it can sustain tremendous by weights, it's ideal for highway and airport runway pavements. It is a ubiquitous that serves as the foundation for contemporary constructions and our countless kilometers of highways. Modern concrete is made up of aggregates linked together with fluid cement. The aggregate was basically bits of rocks and gravel that serve to boot a strengthen the concrete. Aggregates are the most mined materials in the world. Most modern concrete uses Portland cement and water. The Portland cement usually comes from limestone, and is turned into a fine powder that is produced by heating it to high temperatures. It is also know hydraulic cement, which means it by reacting with water. Cement concrete pavements represent the group of rigid pavements. The load carrying capacity is mainly due to rigidity and high modulus of elasticity of the slab.

Marble waste is a rock result from the transformation of a pure limestone. The purity of marble is responsible for its color and appearance if it is white then the limestone is consisting solely of calcite. The result is that the mass of marble waste 20% of total marble quarried as reached as extreme as masses of tons and causes a significant problem to the environment. In India, Which indicates that using marble waste, can indirectly reduce CO_2 emission to the atmosphere. Marble waste wasn't only the suppose material then improves the properties of the concrete so by varying marble dust contents the mechanical and physical characteristics of fresh and hardened concrete can be improved.

A Highway pavement could be multi-layer parts of this road which is subjected to stresses imposed by vehicular loading moment applied, as well as to deterioration this from the effects of weather and the abrasive action of moving load traffic. Layer is the actual travel surface especially made long-lasting and functional to withstand the traffic load travelling upon it. Layer allows friction for the vehicles thus providing comfort to the driver and transfers the traffic load from the upper surface to the natural soil. A satisfactory pavement design is one that can withstand these effects for a required period. A pavement consists of a multi-layer system, which is formed of several layers of compacted unbound aggregates or bound materials.

1.2 MARBLE WASTE

Marble waste was produced from marble waste industries. More production waste, creates environmental content. It has marble waste production has generate a considerable near of marble waste materials. Completely 69-73 % minerals to gets waste in the mining, process and polishing stages when a serious effect on the environment have. Also, it is large quantity of marble is accumulate in the environment due to demolition of old building having marble. It is causes environmental pollution. A per economically viable solution to this problem should include utilization of these waste materials for new products especially in construction applications which in turn minimizes the heavy burden on the nation's landfills, saves natural resources, energy and reduces environmental pollution.

The stone was play role in human attempting since earliest recorded history. Marble waste ranks the large produced natural stone in the world and it accounts for 55% of the world's natural stone production. Around 91.85% of mass of marble waste from Rajasthan state. The marble waste is mining industry has come up in early past. Rajasthan has approx.4000 up marble mines and about 1100 marble labours. The industry involves mines, processing plants and cutters for the production of tiles for walls. The industries produce a lot of marble waste in irregular shape the form of powder/slurry and pieces of irregular size of stones.

Waste and overburden are thrown on forestland, highways, riverbeds, pasture lands, and agricultural fields, causing extensive environmental deterioration. The overburden is not separated from the stones, resulting in the loss of fertile top soil. Quarry operations demonstrate a lack of ability in waste segregation and disposal.


Fig -1.3 Marble Waste

If the waste product of number of industry is RCA as a for the raw material of another industry, it will thereby reduce the. Use of RCA in concrete pavement can be useful for environment related. RCA are the materials for the future. Many countries are giving infrastructural laws relaxation for increasing the use of recycled aggregate. The amount of natural material required is reduced. This eliminates the energy-intensive and environmentally damaging process of mining natural aggregate, while also reducing the amount of land required for resource extraction and the amount by industrial marble waste that must be throw ofNow, waste marble was been found to be more useful and research has been conducted to examine their application.

1.3 GLASS FIBRE

Glass fiber is also famous with name of Glass wool or Fiber Glass. It was invented by Russell Games Slate of Owen- Corning. It is not durable and rigid as carbon fiber but it is economical than carbon fiber. It was primarily invented for thermal insulation but now it is used in different areas. Glass fiber is made when thin strands of silica based glass are extruded from suitable opening.

Fig -1.4 Glass Fiber

Glass fibers added to enhance the flexural strength of concrete. After the addition of fiber, a complex material was formed which showed different properties from on-reinforced concrete. As improving in other mechanical properties. Development of fast rate construction of road and other infrastructures, glass fiber reinforced concrete are being used in practice. Different type of fibers are available in the market such as steel fibers, glass, acrylic, armed, polyester and some natural fibers such as sisal, jute, cellulose etc.

1.3 CHEMICAL PROPERTIES OF CEMENT

Generally three grade of OPC is available i.e. 33, 43 & 53. OPC 53 of grade ultratech Cement is used throughout the project work. It is locally available in Rajkot city of Gujarat.

TABLE :-1.1 CHEMICAL PROPERTIES OF CEMENT	
Lime (CaO)	59 to 67 %
Silica (SiO_2)	12 to 25%
Alumina (Al_2O_3)	4 to 8**%**
Iron oxide (Fe_2O_3)	5 to 6%
Magnesia (MgO)	1 to 4%
Sulphur trioxide (SO_3)	1 to 3%
Soda and/or Potash (Na_2O+K_2O)	5 to 1.3%

1.4 FINE AGGREGATE

Sand used in this study was conforming to grading zone 2of BIS: 383- 1960. The results of spg and water absorption of sand are presented.

1.5 COARSE AGGREGATE

Crushed stone aggregate used this study were used from a nearby. Specific gravity and water absorption of CA are show that. The nominal maximum size of CA used was 6 mm, 10 mm and 19 mm. The chemical compositions of natural aggregate are presented table.

1.6 CHEMICAL COMPOSITIONS MARBLE WASTE AND NORMAL AGGREGATE

Marble waste used on this study was nearby Rajkot area and crushed in to crusher. Specific gravity is obtain and water absorption of marble aggregate are presented. The chemical of marble waste are presented in Table. It is nominal maxi marble aggregate it is use 20 mm. The particle size distribution of marble aggregate and conventional coarse aggregate is given in Table

It could be saw that water absorption of marble aggregate is about 10% and 12% of that of natural conventional CA. The particle size distribution shows that marble aggregate lacks inner fractions as compared to natural aggregate.

TABLE 1.2 CHEMICAL COMPOSITIONS OF MARBLE WASTE AND NATURAL AGGREGATE.		
Component	**Marble waste (%)**	**Natural aggregate (%)**
LOI	45.07	5.08
SiO_2	3.75	53.70
CaO	33.12	4.83
MgO	17.91	2.01
Fe_2O_3	0.13	10.66
Al_2O_3	Traces	Nil
Sulphate content	Nil	Nil

1.7 PROBLEM IDENTIFICATION

Infrastructure development is rapidly expanding, particularly in emerging countries. All of these activities necessitate the extensive use of natural resources such as cement, sand, and aggregate. Natural resource depletion is a major problem for humanity. Industrialization, on the other hand, is expanding in developing countries. In India, stiff pavement is used on both urban and rural roads. In the city, area special purpose so constructed to rigid pavement road it is most use to natural source in pavement so this source is very limited so it is ability is less in future aspects our aim to mining and construction of site marble stone is available is large amount in irregular shape so this use as waste of partially replacement of course aggregate and as admixture of glass fiber. So marble waste stop the landfill and they use it and environment friendly.

1.8 NEEDS FOR STUDY

- To increase strength of rigid pavement using waste as cores aggregate and reduced of natural source.
- Currently road construction infrastructure increase and material requirement is very large amount.
- To reduce overall cost of rigid pavement construction.
- To make environment ecofriendly.

1.9 OBJECTIVEOF THE STUDY

The objective of study is use Marble waste as partially replacement of coarse aggregate (natural) & addition of Glass Fibre as admixture to increase strength in concrete for rigid pavement.

1.10 SCOPE OF THE STUDY

- The current study used an experimental programme to investigate the strength properties of mixtures incorporating marble debris.
- The research could be expanded to look at the qualities of durability.
- It has the use of glass fibre to use as an admixture and raise the strength.
- It has the use of marble waste to use as a coarse aggregate to replace natural source in the rigid pavement.

CHAPTER 2

LITERATURE REVIEW

2.1 RESEARCH STUDIES

The research papers which are studied for this work are following:

1. Impact of marbles waste as coarse aggregate on properties of lean cement concretes.

Sudarshan, D. Kore, A.K. Vyas.

The main study of modify of marble waste as a replacement of conventional natural coarse aggregate in concrete pavement. Experimental investigated were carry out to examine the practically of use of marble waste as a CA in concrete pavement. Conventional natural coarse aggregate was replaced by marble aggregate in different 100% by weight. The concrete were prepared with a constant water–cement ratio 0.60 to 0.61. It has seen that workability of concrete pavement mixes content marble waste as aggregate by 14% to increase 15% more than that of control concrete. The workability of all the concrete mix increases with increased percentage of replacement of natural coarse aggregate by marble waste aggregates. Until 80 percent marble is used as coarse aggregate in concrete, the concrete's compressive strength displays an upward trend. iii. The permeability of the concrete increases as the percentage of natural coarse aggregate replaced by marble aggregate increases, owing to the presence of pores in the concrete. iv. When concrete is exposed to acids, it loses its compressive strength on average.

2. Optimum Replacement of Marble Chips and Marble Dust as Aggregates in M20 Concrete.

Athul Krishna K R.

It is was important that consumption of marble waste and to growing needs for aggregates because of developed country to increase constructed road, to decrease a natural source and save a natural material. a high volume of marble waste production in mass has generated a considerable amount of waste materials; almost60% - 70% of that mineral additives gets marble wasted in the mining, process unit and polishing stages which has a serious effect on the environment, particularly in the production of concrete goods for building. The major purpose of this research is to show that marble wastes may be used as a substitute for natural aggregates in concrete manufacturing. The methodology for the investigation is presented in this publication, as well as the results. The concrete pavement formulations was produced with a constant WC ratio to be 0.45 and to determine the density of concrete the highest compressive strength has been taking by in entire specimen.

3. Effect of fly ash and marble Powder on strength of pavement Quality concrete.

Alok Kumar Shukla, Prof. Sanjay Saraswat, Prof. Pramod Sharma.

Industry sectors that are growing Contamination and permanent environmental harm can arise from improper industrial waste disposal. Managing industrial waste is one way to protect our environment from harmful pollutants. As a result, industries and enterprises should be held responsible for their waste. We must also think about the environment. To address this issue, and for its strength, durability, outstanding performance, and total long-term savings, concrete is used all across the country. Cement was partially substituted by fly ash at two distinct replacement levels (10 percent, 20 percent,). At two different replacement levels, cement was partially replaced with fly ash (10%, 20%), marble powder, and other materials. The test was conducted out after the concrete had set for 28 days. Using M30 and M40 solid grades, cubes and beams were created to assess the compressive and flexural strengths of concrete. To provide appropriate strength, just a little amount of fly ash can be replaced. The lower the strength from 7 days to 28 days marble powder can achieve 80 percent of strength from 7 to 28 days when we talk about pavement quality concrete it depends on the flexural strength because of wheel load on the road and the next thing that The Beam word cast for various different grade of concrete which is M30 and M40 and of concrete Marble powder and fly ash replace with 10% and 20% could achieve the flexural strength in this study marble powder and fly ash could achieve the desired flexural strength in future we can reduce the water-cement ratio is future we can try to achieve the flexural strength. One approach to safeguard our environment from dangerous contaminants is to manage industrial waste. As a result, industries and businesses should be held accountable for the garbage they produce. We must think about our environment and find a solution to this problem. Concrete pavement construction is becoming more popular across the country as a result of its strength, durability, high performance, and overall long-term viability. There is a need to develop better road sections that can withstand heavy loads. This can be achieved using high compressive strength concrete made from OPC cement with fine to coarse aggregate. In the construction, we will use industrial waste to carry out the construction. Fly ash is a by-product of burning coal in a thermal power plant, and marble powder is a by-product of the Marble industry. Fly ash and marble powder are used as additional cementations materials to improve the properties of cement concrete. This study aims to develop paving concrete

10% and 20% of the cement is replaced with fly ash and marble powder, respectively. The study's goal is to evaluate the concrete mix's resistance characteristics to those of concrete pavements. Fly ash is a waste product that results from the combustion of coal in power plants. Cement, sand, fine aggregate, and water make up concrete.as well as coarse aggregate As a result of rising industrial pollution, global warming has been gradually increasing. Smoke and greenhouse gases are released into the atmosphere by industries, contributing to global warming. A particular amount of fly ash and marble powder can be replaced for cement in the manufacturing of eco-friendly concrete, enhancing the strength of pavement concrete.

4. Replacement of Recycled Construction and Demolition Waste Coarse Aggregates in Pavement Quality Concrete.

Puneeth H C, S P Mahendra, Sachin B V, Subbaiah.

A coarse aggregate replacement method in concrete is explored using five alternative replacement ratios: 20%, 40%, 60%, 80%, and 100%. After beneficiation, recovered materials were used to substitute coarse aggregates in concrete grades M30 and M40. The compressive strength of m30 – 40.45n/mm^2 and M40 – 51.33n/mm2 was discovered, whereas the flexural strength of m30 – 11.55n/mm2 and M40 – 51.33n/mm2 was discovered– 51.33 N/mm^2,the flexural strength is found to be for m30 – 11.55n/mm^2&M40 – 15.60n/mm2 . Supplanting material with insignificant changes in mechanical properties. The change in the strength properties were contrasted with conventional mix. From the study, it is found that an effective replacement of 45.75 % and 23.35% of Recycled coarse Aggregate for M30 & M40 grade respectively. The compressive strength is found to be for M30 – 40.45N/mm2 & M40 – 51.33N/mm2, the flexural strength is found to be for M30 – 11.55N/mm2& M40 15.60N/mm2 and the fatigue strength with respect to stress ratio 0.75 for M30 – 6540 no. of cycles & M40 – 10806 no. of cycles. From the compressive strength test results obtained, the mix proportions up to 20% replacement have achieved required target strength for M40 grade and up to 40% for M30 grade of concrete. Using the above data, a statistical analysis was conducted, and the optimum replacement was calculated to be 45.75 percent for M30 and 23.35 percent for M40. All of the mix proportions with replacement have attained the requisite strength as per IRC standards, based on the flexural strength test findings. The fatigue strength testing findings are used to determine all of the mix proportions with response. The number of cycles required according to IRC regulations Based on the data thus far, it is possible to conclude that the beneficiation process improves aggregate quality and concrete strength. A more ecologically friendly building approach will be achieved by using C&D waste aggregates in concrete and silica instead of cement.

5. Comparison of conventional concrete with partial replacement of coarse Aggregate with marble waste in concrete.

K.Raghavi, S.Bhagyalakshmi, M.Vidhya Lakshmi.

It is the material and deposited to open land and environment causing numerous. This trash it. The study was to see if marble waste as CA might be used as a partial replacement or fully replacement of marble waste as CA. The viability of using marble waste as a CA in concrete was finding using experimental methods. Coarse aggregate was used in the past. Marble aggregate has been replacement in various percentages: 40 to 80% are use of their natural CA by weight. A constant value ratio of 0.50 was used to make the concrete compositions. The compressive strength of such cubes is evaluated on the 7day, 14day, and 28 days. All data concrete mixes including marble aggregate show an increased trend in compressive strength until they reach 80 percent replacement level. Natural aggregates can be replaced if necessary. It is the largest producer of natural stone, accounting for half of all output. Rajasthan produced 85% of India's marble waste production. In last year the marble mining business has grown dramatically. Around 4000 marble mines and 1100 marble gang saws are located in Rajasthan (processing plants). Mines, processing factories, and cutters for the production of wall tiles are all part of the industry.

6. Waste Marble Chips As Concrete Aggregate

Jay P Chotaliya, Kuldip B Makwana, Pratik D Tank.

Above study it can be concluded that the waste marble chips can be used in concrete production as a coarse aggregate with fully replacement with natural aggregate. Marble concrete proves more economical at rate of around 7.44% than concrete made with conventional coarse aggregate. It reduces use of natural aggregate which reduces mining to extract natural Aggregate. It is the waste plain concrete marble concrete increase in compressive strength Waste when compared to plain concrete, marble waste concrete an increase in compressive strength is 81.32% split tensile strength of 46.20 %, and flexural strength of 43.42 % at the age of 28 days. As a result of production, marble waste is produced by marble industries. More output equates to more garbage, and more garbage equates to more pollution in the environment. A large volume of marble manufacturing has resulted in a significant number of waste materials; approximate 70-75 % of the minerals additive are squandered throughout the mining, processing, and polishing processes, posing a huge environmental threat. Utilization of these waste resources for the creation of new products, in particular in building applications, is an economically viable solution to this problem that decreases the heavy burden on the nation’s landfilling, saves natural resources, energy, and reduces pollution.

7. Durability Properties of Concrete Produced by Marble Waste as Aggregate or Mineral Additives.

Gulden Cagin, Ulubeylia, Turhan Bilira, Recep Artirb.

It is the use of effect waste of marble as coarse aggregate in durability parameters absorption and shrinkage chlorine penetration. water is absorption capably properties reduced when coarse aggregate marginally when CA are adding of marble waste and use it. Use of granite and other marble waste it is content 20 to 100% marble waste. And conventional or self-compacting concrete.

8. Cost Effective Design of Sustainable Concrete Using Marble Waste as Coarse Aggregate.

Sudarshan d. Kore , a. K. Vyas

Marble waste was used as 75% to 100 % of the coarse aggregate, resulting in a cost-effective concrete product. It is the coarse aggregate reduction of 20% of marble waste the use of marble waste as a coarse aggregate resulted in a 20% & 14% reduction in overall concrete production cost, demonstrating that the use of marble waste as a coarse aggregate improves it is the durability is the taking of concrete.

9. Glass fibre reinforced concrete for rigid pavement

Sanjeev Kumar, Suman, And Pratik Kumar.

This paper presents study of mainly on mechanical properties of M30 grade of concrete considering water cement ratio 0.47.Glass Fibre was added in green concrete by volume of concrete percentages from 0% to 0.4% with increment of 0.1%. Mechanical properties like compressive strength, flexural strength, indirect split tensile strength and modulus of elasticity along with ultrasonic pulse velocity were carried out. Compressive strength is 32% and 13% at 7daysand 28 days respectively flexural and split tensile strength rose by 35% and 32%, respectively. The compressive strength of M30 grade concrete was equal to that of M40 grade concrete. The use of glass fibres reduces the slump. At 7 days and 28 days, the highest increase in compressive strength is 32 percent and 13 percent, respectively. Flexural and split tensile strength both increased by up to 35%. Modulus of elasticity increases significantly and higher value of it indicates the controlling factor of sudden failure. Ultrasonic pulse velocity result represents the quality of concrete. Concrete slab for rigid pavement was designed and found safe and economic thickness.

10. A Review on Effect of Fibre Reinforced Concrete on Rigid Pavement.

Ms.Amreen N. Al ,Mr.Milind. V. Mohod.

The increment in stresses for SFRC lies in the range of 20-41% when compared with those of conventional concrete. Polypropylene fibres reduce the water permeability, plastic, shrinkage and settlement and carbonation depth. Notable increase in compressive strength is reported with addition of polypropylene fibres. Fibre reinforcement (depend of type of fibres) is expected to improve the mechanical performance, deformability, fatigue and cracks under the loading. The percent of fibres is oriented to change the brittle failure, and in this paper, we can analyses the different percentage of fibres and difference effect from steel and polypropylene fibres. The comparison of the results will lead us to propose the type and percentage depend of structural characteristics.

2.2 SUMMARY OF LITERATURE REVIEW

Paper 1 Impact of marble waste as coarse aggregate on properties of lean cement concrete pavement. It is study paper to give many normal CA was replaced by marble waste aggregate in different category percentages 0–100% by weight of CA as marble waste.
Paper 2 Optimum Replacement Of Marble Chips And Marble Dust As Aggregates In M20 Concrete. We have observed that paper to marble dust and marble dust to use in different grade of concrete pavement.
Paper 3 Effect of fly ash and marble Powder on strength of pavement Quality concrete. It is observation to different grade of concrete pavement as per IRC 44 2017 and mix design to be calculation is read.
Paper 4 Replacement of Recycled Construction and Demolition Waste Coarse Aggregates in Pavement Quality Concrete. A coarse aggregate replacement method in concrete is explored using five alternative replacement ratios: 20%, 40%, 60%, 80%, and 100%. After beneficiation, recovered materials were used to substitute coarse aggregates in concrete grades M30 and M40.
Paper 5 Comparison of conventional concrete with partial replacement of coarse Aggregate with

marble waste in concrete. To observed compare by conventional concrete pavement & partial replacement of concrete pavement in different parentage.
Paper 6 Waste Marble Chips As Concrete Aggregate. It is paper observation there is cost is low as compare to normal aggregate and it is economical.
Paper 7 Durability Properties of Concrete Produced by Marble Waste as Aggregate or Mineral Additives. Coarse aggregate 20, 50,100 percent effects of waste marble on several durability parameters.
Paper 8 Cost Effective Design of Sustainable Concrete Using Marble Waste as Coarse Aggregate. Marble waste was used as 75% of the coarse aggregate, and the balance was regular Coarse aggregate. So only 1/4 % natural aggregate use so cost is less compare to conventional concrete pavement
Paper 9 Glass fiber reinforced concrete for rigid pavement To study the addition of glass fiber as admixture to use Rigid pavement
Paper 10 A Review on Effect of Fiber Reinforced Concrete on Rigid Pavement**.** It is observed to effect of fiber of different parentage to add the fiber.

CHAPTER - 3

MATERIAL AND METHODOLOGY

3.1 GENERAL

This chapter deals with the methodology which are used. It is deal with material characteristics and use of marble waste. The different type of properties of marble waste are tested. The tests carried out are briefly explained.

3.2 MATERIAL SELECTION

3.2.1 BASICMATERIALS

In this chapter, the basic properties so different materials, which were used during experimental work, were identified. Some basic tests were performed on this material to check the physical properties sand the chemically properties so silica sand. The fundamental properties of materials used throughout the experimental work are as given below:

- Cement
- Coarse Aggregates (20 mm, 10mm, 6mm.)
- Sand(fine aggregate)
- Glassier

3.2.2 CEMENT (IS: 1489 (PART-1)-1991)

With the previous consent of the Engineer-in-Charge, any of the various types of cement capable of achieving the design strength may be used, provided that they meet the specifications in the appropriate IS codes. Cement should have a minimum compressive strength of 43 MPa after 28 days. OPC (Ordinary Portland cement) 43 Grade & 53 Grade, IS: 269.

a. PPC (Portland Pozzolana Cement)
b. PSC (Portland Slag Cement)
c. Composite Cement

TABLE 3.1 - PHYSICAL PROPERTIES OF CEMENT		
Initial setting time		78 min.
Final setting time		240 min.
Compressive strength	7days	32.3 N/mm2
	14days	40.9 N/mm2
	28days	58N/mm2
Fineness (90umsieve)		1.7 %
Standard consistency		25.85 %

3.2.3 COARSE AGGREGATE (IS 2386 (PART-1), (PART-3), (PART4-)

Aggregates for pavement concrete shall comply as per IS: 383 except for grading and any other specific requirement given in IRC: 15 2017 and IRC 44 2017. CA should consist is clean, hard, dense stronger, dense, non-porous and durable pieces is crushed stone or crushed gravel and shall be vacuum of dissolved stone, soft, flaky, elongated, extremely angular, or splintery fragments The combined flakiness & elongation index should be more than 35 per cent. Aggregate Impact Value more than 30 per cent. Limestone aggregate may be used as per to IS: 383. The maximum size of coarse aggregate not more exceeds 31.5 mm in PQC.

Continuously graded aggregates may be used, depending on the combined grading of the coarse and fine aggregate. No aggregate which has water absorption more than 2 per cent shall be used in concrete mix. Wherever aggregates of 2 % water absorption are not available, higher value of water absorption subjected to the maximum of 3 per cent may be allowed if other engineering properties are satisfied as per IS:383.

3.2.4 SIZE AND GRADING OF COARSE AGGREGATES

Coarse aggregates shall be supplied in the nominal sizes. Table 1 may be used as guidance for procurement.

TABLE 3.2 COARSE AGGREGATES FOR PAVEMENT QUALITY CONCRETE

Sieve Designation (mm)	Percentage Passing for Single-Sized Aggregate of Nominal Size			
	31.5 mm	19 mm	12.5 mm	9.5 mm
37.5	100	-	-	-
31.5	85-100	-	-	-
19	0-20	85-100	-	-
16	-	-	100	-
12.5	-	-	85-100	100
9.5	0-5	0-20	0-45	85-100
4.75	-	0-5	0-10	0-20
2.36	-	-	-	0-5

3.2.5 COARSE AGGREGATE (IS 2386 (PART-1), (PART-3), (PART-4)

In concrete use of cement, water and aggregate. And recourse coarse and fine aggregate smoke around 75% - 80% of the total number of concrete material. The for reties significantly important to determine the various physical properties of the coarse aggregates.

3.2.6 COMBINED GRADATION OF FINE AND COARSE AGGREGATES (IRC 44 2017)

It is the archive combined Gradation of fine and as per IRC 44 2017 it is taking value. To take nominal size of aggregate fine and Coarse aggregate as IRC 44 2017. In suitable proportions for crushing of marble stone sands, the permissible limit on 150-micron IS: Sieve is increased to 20 per cent. The use of crushed stone sand is granted in PQC. However, its percentage of fines passing 75 micron sieve (wet sieving) shall not exceed 12 per cent.

TABLE- 3.3 GRADATION CHART												
IS SIEVE	INDIVDUAL GRADATION				COMBINED GRADATION				COMBINED	IDEAL	LOWER	UPPER
	20 mm	10 mm	6 mm	Sand	21.0	30.0	11.0	38.0	100.0	95.0	90	100
19	100	100	100	100	21.0	30.0	11.0	38.0	75.53	63.0	48	78
9.5	5.85	84.35	100	100	1.23	25.31	11.00	38.00	46.16	44.0	30	58
4.75	0	3.6	64.35	100	0.00	1.08	7.08	38.00	18.29	21.5	8	35
600	0	0.415	0.53	47.6	0.00	0.12	0.06	18.11	0.86	6.0	0	12
150	0	0.365	0.51	1.83	0.00	0.11	0.06	0.70	0.43	2.5	0	5
75	0	0.28	0.36	0.81	0.00	0.08	0.04	0.31	100.0	95.0	90	100

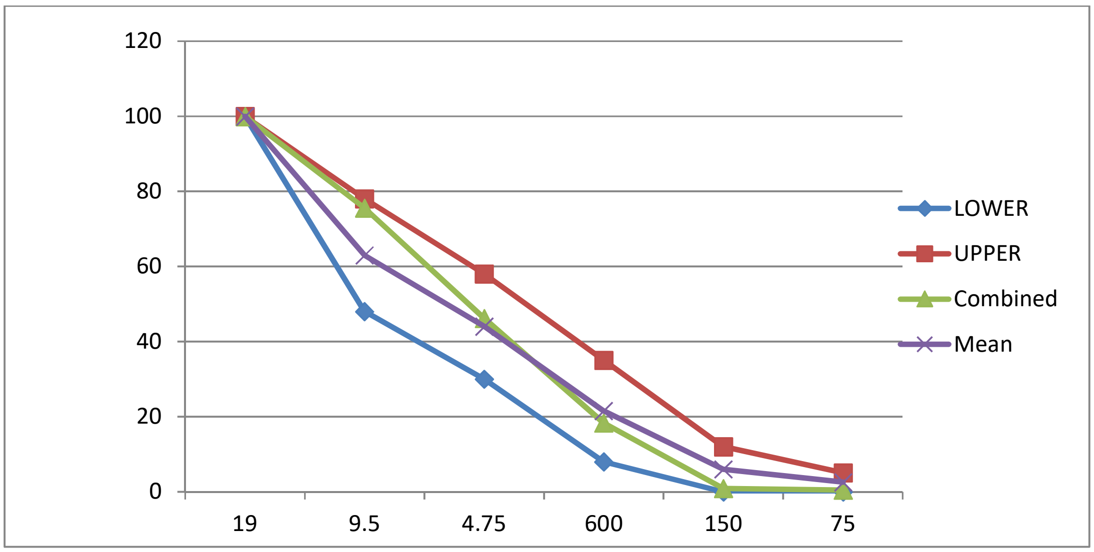


FIG – 3.1 GRADATION CHART

TABLE 3.4 - PHYSICAL PROPERTIES OF COARSE AGGREGATE	
Aggregate Impact value	12.4
Aggregate Abrasion Value	16.3
Specific Gravity	2.85
Water Absorption	0.94
Combined Flakiness Index, Elongation Index	19.36

3.2.7 FINE AGGREGATE

Fine aggregates is free from soft and hard particles, andclay, shale, loam, cemented particles, mica and organic and other foreign matter. Fine aggregates which have water absorption more than 3 per cent shall not be used. The fine aggregate shall not contain material passing IS sieve 75 micron (wet sieving) more than the following:

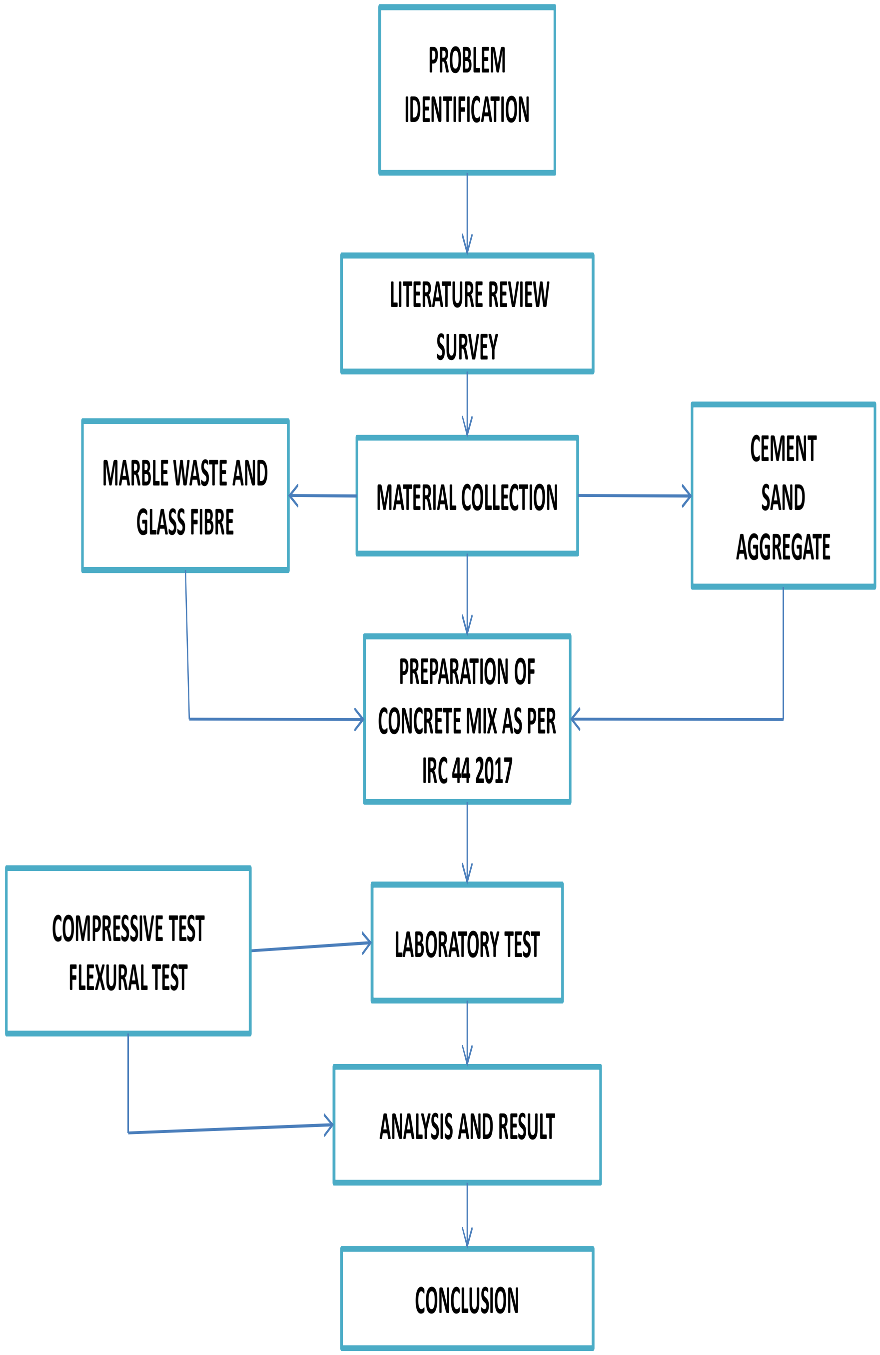
i) Natural sand : 3 %- 4% by weight of natural sand

ii) Crushed Stone sand: 12 %- 14% by weight of crushed stone as marble waste.

iii) Blend of natural sand and crushed stone sand shall not exceed 8 % by total weight of fine aggregates (IS:383)

TABLE 3.5 - PHYSICAL PROPERTIES OF FINE AGGREGATES	
Gradation	Falling Zone II
Moisture content	1.4%
Fine modulus	2.56

3.3 METHODOLOGY CHART.



➢ METHODOLOGY OF PROJECT

1. Material collect like cement, sand, marble waste, coarse aggregate and fibre should be taken.
2. It is the preparation of concrete mix as per IRC 44 2017 and M40 grade of concrete pavement.
3. Conduct various test of physical properties of aggregate, cement and sand.
4. It is the partial replacement of marble waste as coarse aggregate like 10%, 20% and 30% by natural coarse aggregate.
5. Casting cubes and beam after one day remove the mould and curing 7 days, 14 days and 28 days.
6. Than After the compressive test and flexural test collect data and analysis of the result.
7. It has to made conclusion to achieve desirable strength.

3.4 MIX DESIGN

a) Grade of concrete pavement	M 40
b) Cement	OPC 53 grade as per IS296
c) Maximum nominal aggregate	19 mm
d) Minimum cement content (as per IRC: 15 2017)	360 kg/m^3
e) Maximum WC ratio (as per IRC: 44 2017)	0.42
f) Workability	25 ± 10 mm (slump)
g) Degree of supervision	Good
h) Aggregate type	Crushed angular aggregates
i) Cement content (Maximum)	450 kg/m^3
j) Type of Admixture	Glass Fibre

A. DESIGN COMPRESSIVE STRENGTH FOR MIX PROPORTIONING

$F'_{ck}= F_{ck}+1.65\ S_c$

or

$F'_{ck} = F_{ck} + X$

Whichever is higher is taking and calculated

Where

F'_{ck} = Compressive Strengthtarget averageat 28 Days,

F'_{ck} = Characteristic Compressive Strength at 28 Days,

S_c= Compressive Strength. (Standard Deviation)

It Is Table 6, Standard Deviation, S_c= 5.0 N/mm^2.

TABLE- 3.6 ASSUMED STANDARD DEVIATION VALUES FOR MIX DESIGNS BASED ON COMPRESSIVE STRENGTH		
Sr no	**Grade of concrete**	**Assumed Standard Deviation N/mm^2**
1	M30	5.0
2	M35	
3	M40	
4	M45	
5	M50	
6	M55	
7	M60	
8	M65	6.0
9	M70	
10	M75	
11	M80	

Therefore, target strength using both equations i.e.

i) $F'_{ck} = F_{ck}+1.65\ S_C$

$= 40+1.65x5.0 = 48.25$ N/mm^2

ii) $F'_{ck}= F_{ck}+ 6.5$ (The value of * for M40 grade as per Table 4 is 6.5 N/mm^2)

$= 40+6.5 = 46.5$ N/mm^2

The higher value is to be taken.so target strength will be

48.25 N/mm^2 as 48.25 N/mm^2 grater46.5 N/mm^2

TABLE- 3.7 AS IRC 44 2017		
Sr no	**Grade of concrete**	**Value of X N/mm^2**
1	M30	5.0
2	M35	
3	M40	6.5
4	M45	
5	M50	
6	M55	
7	M60	
8	M65 & above	8.0

B. APPROXIMATE AIR CONTENT

Table 7, amount of airentrapped to be expected in normal (non-air entrained) concrete is 1.0 per cent for 19 mm nominal maximum size of aggregate. As per table IRC 44 2017.

TABLE- 3.8 APPROXIMATE AIR CONTENT	
Nominal Maximum Size of Aggregate, mm	**Entrapped Air, as Percentage of Volume of Concrete**
9.5	1.5
19	1.0
26.5	0.9
31.5	0.8

C. SELECTION OF WATER-CEMENT RATIO

It is Table 9, the necessary w/c ratio for goal strength of 48.25 N/mm^2 is 0.42.

TABLE- 3.9 PRELIMINARY SELECTION OF WATER – CEMENT/CEMENTITIOUS MATERIALS RATIO FOR THE GIVEN GRADE FOR MIX DESIGNS BASED ON COMPRESSIVE STRENGTH			
SR NO.	**Compressive Strength at 28-Day N/mm^2**	**Approximate Water- Cement/ Cementitious Materials Ratio**	
		OPC-43 Grade	**OPC-53 Grade**
1	32	0.47	0.50
2	37	0.43	0.48
3	42	0.39	0.45
4	48	0.36	0.42
5	53	0.33	0.38
6	58	0.30	0.35
7	65	0.27	0.32
8	68	0.24	0.29

D. SELECTION OF WATER CONTENT

From Table 10, water content for 19 mm aggregate = 186 kg/m^3

TABLE- 3.10 APPROXIMATE WATER CONTENT PER CUBIC METRE OF CONCRETE FOR NOMINAL MAXIMUM SIZE OF AGGREGATE (WITHOUT PLASTICISER/SUPERPLASTICISER)	
Nominal Maximum Size of Aggregate mm	**Suggestive Water Content kg/m^3**
9.5	208
19	186
31.5	165

E. CALCULATION OF CEMENT CONTENT

Water–cement ratio = 0.42

Water content = 186 kg/m^3

Cement content = 186 / 0.42 = 442 kg/m^3

Check for minimum and cement content (maximum) as per IRC: 15

Cement content (Minimum) as per IRC: 15, 360 kg/m3 < 400 kg/m^3 Hence, O.K

Cement content (Maximum) as per IRC: 15, 450 kg/m3 > 400 kg/m^3 Hence, O.K

F. PROPORTION OF VOLUME OF COARSE AGGREGATE AND FINE AGGREGATE CONTENT

From Table 11 Volume of coarse aggregate corresponding to 19 mm size aggregate and Fine aggregate grading Zone II = 0.62. This is valid for water-cement ratio of 0.50.

TABLE- 3.11 VOLUME OF COARSE AGGREGATE PER UNIT VOLUME OF TOTAL AGGREGATE FOR DIFFERENT ZONES OF FINE AGGREGATE AS PER IS:383			
Nominal Maximum Size of Aggregate mm	**Volume of Coarse Aggregate Per Unit Volume of Total Aggregate for Different Zones of Fine Aggregate.**		
	ZONE III	**ZONE II**	**ZONE I**
9	0.48	0.46	0.44
9.5	0.64	0.62	0.60
26.5	0.69	0.68	0.65
31.5	0.68	0.65	0.63

As water cement ratio is actually 0.42, the ratio is taken as 0.648 to reduce sand content. (Asprepares 4.4.5 and Table 11)Volume of fine aggregate content = 1 – 0.0.636 = 0.364 per unit volume of total aggregate.

G. CHECK FOR COMBINED GRADING OF FINE & COARSE AGGREGATE

It is the achieve It is suggested to achievethe combined grading of fine and coarse aggregates as per Table 3 as per IRC 44 2017. is Graded of coarse aggregate to single-sized coarse aggregates of nominal size of shall be mixed in suitable proportion with fine aggregatesand the volumes of coarse and fine aggregates shall be adjusted suitably to achieve the combined grading requirement of IRC 44 2017.

TABLE- 3.12 COMBINED AGGREGATE GRADATION FOR PQC

Sieve Designation	Percentage by weight Passing		
	31.5 mm Nominal Size	26.5 mm Nominal Size	19 mm Nominal Size
37 mm	100	100	100
31.5 mm	90-100	100	100
26..5 mm	85-95	90-100	100
19 mm	68-88	75-95	90-100
9.5 mm	45-65	50-70	48-78
4.75 mm	30-55	30-55	30-58
600 micron	8-30	8-30	8-35
150 micron	0-10	0-10	0-12
75 micron (Wet Sieving)	0-5* 0-2**	0-5* 0-2**	0-5* 0-2**
*Crushed Sand, **Natural sand			

H. MIX DESIGN CALCULATIONS

a) Absolute Volume of concrete = 1- volume of air = 1-0.01 = 0.99 m^3

b) Volume of cement (Mass of cement/Specific gravity of cement) * (1/1000)

= (442/3.15) *(1/1000)

= 0.140 m^3

c) Volume of water (Mass of water/Specific gravity of water) * (1/1000)

= (186/1) * (1/1000)

= 0.186 m^3

d) Volume of all in aggregate = {a - (b+c)}

= 0.99-(0.140+0.186)

= 0.664 m^3

e) Mass of coarse aggregate = (e) x 0.636*Specific gravity of coarse aggregate *1000

= 0.664 x 0.636*2.74 * 1000

= 1157 kg/m^3

f) Mass of fine aggregate = (e) * 0.364* Specific gravity of fine aggregate * 1000

= 0.0.664* 0.364* 2.62 * 1000= 633 kg/m^3

g) Mass of marble waste (10%) = 1157*10/100=115 kg/m^3

(20%) = 1157*20/100=231kg/m^3

(30%) = 1157*30/100=347kg/m^3

I. MIX PROPORTIONS OF TRIAL NUMBER 1 BASED ON AGGREGATE IN SSD CONDITION

- Cement = 442 kg/m^3
- Water = 186 kg/m^3
- Fine Aggregate = 633 kg/m^3
- Coarse Aggregate =1157 kg/m^3
- Water-cement ratio = 0.42
- Marble waste = 115 kg
- glass fibre (0.5 %) = 2.2 kg/m^3

CHAPTER - 4

EXPERIMENT WORK

4.1 GENERAL

Casting of concrete process has been explained curing and storage of concrete specimens is also explained in short. Different type of test have been performed fresh as well durability and hardness concrete during this experiment work The perfumed test are in details with the observations made experimental working this chapter.

4.2 BASIC TEST ON AGGREGATE:

1. Shape test (IS:2386-Part1)

   Flakiness Index

   Elongation Index
2. Specific gravity test
3. Impact value test
4. Crushing value test
5. Abrasion value test

1. SHAPETEST(IS:2386-Part1)

INTRODUCTION:

Cause inherent weakness in which possibility of Breaking down during compaction as the under in heavy loading traffic Load rounded aggregate and irregular shape are taking in cement concrete road work as the workable the concrete improve and sustainable and particle are divided for granular base due to increase stability derived from the Better the interlocking.

A. FLAKINESSINDEX:

The flakiness index is aggregates is the percentage by weight of particles which least dimension (thickness) is less than 3/5 (0.6) of their mean dimension. The test is not applicable to size smallerthan6.3mm.

APPARATUS

The apparatus consists of a standard thickness gauge sizes 63 to 6.3 mmanda balanceto number of weigh the samples.

PROCEDURE

It is the value taking to that FI. It has to sample taken and put the aggregate that is first to make weight of each aggregate passing and retained on the specified set of required. On the sample example it is weight of 200 pieces to taken 1 kg of aggregate to passing 50 mm sieves and an retained 40 mm sieve size of particle is this fractions to that aggregate is tried to be passed through the specified thickness for specimen this is 27-28 mm thickness slot once again taken 2 pieces or 1 kg aggregate retained like W, W2, W3 etc. weight is W1+W2+W3 to be determine.

B. ELONGATION INDEX:

The elongation index an aggregate is the percentage by weight of particles whose greatest dimension (length) is higher than one and fifth (1/5) times (1.8 times) their mean dimension. The elongation test is not applicable to sizes smallerthan6.3mm. And use it.

APPARATUS:

The apparatuses consists of the length gauges IS sieves of sizes 50 to6.3mmandabalance.

PROCEDURE:

Taking of 200 pieces of each fraction is taking weight. As a 200 piece aggregate 50mm sieve and determine of 40 mm sieve. For each particle taking of aggregate passing 50 mm sieve an deterred on passed through the number of slot of the specified length in this example the 81 mm to 85 mm length slot similar hit of 200 pieces are taking of coarse aggregates retained on sieves be W, W2, W3 etc. elongation index has the total weight of the aggregate material retain on the various length and thickness gauges.

2. SPECIFIC GRAVITY TEST (IS: 2386 - PART 3)

OBJECTIVE:

To finding the specificgravityofaggregates and water absorptionbyperforated basket.

INTRODUCTION:

The spg aggregate to find measure of strength of durability or quality of the material. To find specific gravity test to determine the identification of stone. Water is the absorption seen an of strength and durability of aggregate. Porous martial immature and have generally considered unsuitable unless they are found to be acceptable based on strength.

APPARATUS:

A. It is the basket wire is the not more than less than 6.3 mm mesh or perforated is the containers of convenient size with hangers wire for from the balance weights.

B. It is maintain temperature of 100°to110°c.

C. To Container of filling water and suspending the basket wire and it length.

D. Basket wire and it length.

E. Basket an airtight container capacity similar of that basket.

F. Capacity 5 kg and curates 0.5 g such any type.

PROCEDURE:

Sample is taken 2 kg and it is use it thoroughly and sand, drained and throw in sample of bucket wire to water use of distiller immersed temperature between 22- 32. And that cover of at least 5 cm of water above the top of basket.

Immersion is complete air has to remove from the lifting by the basket containing it 25 mm under the base of the tank and allowing drop at the rate about 10 per second.

Sample is taken as per the weighed while suspended in water at a temperature of 22 to 32 C. suspended water weight =W1g.

Basket and coarse aggregate to remove from water and to drain for a few minutes then after aggregates are transferred to the dry absorbent clothes. The empty of basket is then returned the water tank jolted 25 T and weighed in water= W2 g.

The aggregate was placing in a shallow tray and kept in an oven maintained at a temperature of 110° C for 24 hrs. It is then removed by the oven, cooled in an air tight container and weighted=W4 g.

1. Specific gravity of water - W2 – W1(W2 – W1) W2
2. Water absorption -
3. Dry weight of aggregate - W1
4. Weight aggregate immersed in water = W2 =
5. Water absorption = $W2 - W1$ / W1 * W2

3. IMPACT VALUE TEST (IS : 2386 – PART 4)

OBJECTIVE:

To finding the impact value of give sample using aggregate ITM.

APPARATUS:

The apparatus consist to a cylindrical measure, tamping gross sieves, balance and oven.

PROCEDURE:

To take a sample to passing 12.5 mm sieve and retained of 10 mm IS sieve and dried in an oven from the four hours tem to 110 to 110 C it is cooled. It is the impact machine were place with their bottom plate to on the floor it's that the hammer guided column are vertical The cup is fixed firmly is taken to the base of the machine and the whole sample taken the measurement of cylindrical to the cup and compacted by tamping rod with 25 strokes. It is the hammers to raised lower face the is 37 cm to above the upper surface of the aggregate in the cup the allowing to fall freely on the aggregate the test sample was subjected it is a total of 15 to 25 each blows. It has part of particle has to round and angular it has to more useful than other to taking a sample to that conveyance. It is the particles of the passing of retained on the sieve size is and added it has not be less weight of the specimen taken by more than one gram.

4. CRUSHING VALUE TEST (IS : 2386 – PART 4)

OBJECTIVE:

To finding the crushing value of the given sample of aggregate 20 mm with the help of compress on test in machine and other equipment.

APPARATUS:

Steel Cylinder with open ends, and internal diameter 15.2 cm, circular base plate, plunger having a piston of diameter 15 cm with a hole provided across the stem of the

Cylindrical measure eternal diameterof11.5 to 12 mm command height18 to 20 cm Steel tamping rod with on round end blow use it, having a diameter of 1.6 cm and length 45 to 60 cm Balance of capacity 3 kg with a accuracy level up to1g.

PROCEDURE:

It is aggregate passing 12.5 mmand 10 mm IS sieve and retained on 10 mm IS sieve is selected for standard test. The aggregate should be in surface dry condition testing. Aggregate may be dried by it is heating at a temperature 100 C and110 C for use of oven drying. It is cylindrical moulds filling by the test sample of aggregate in three layers of each surfaces equal depth, each layer has being tamped 25 to 26 times by it has to rounded end of the tempers rod. Then after the third layer is temper the aggregates at the top of the cylindrical measure are levelled off by using the tamping rod as a straight edge. It is cylinder of the equipment is place in held theirposition on the base, 1/3 of the test sample are taking in this cylinder and tamper 25 T by the tamping rod similarly to parts of the test specimen is taking, each layer being subjected to 25 rode blows. The total depth of the material in the cylinder after tamping shall however be 10 cm to 12 cm. it is the aggregates is levelling and the plunger inserted so that it rests on this surface in level position. It is cylinder mould with the test sample and plunger in position is placed on compression machine. Rate of 4 tons per minute until the total load is 40 tons. Aggregates including the crushed portion are removed from the cylinder and sieved on a 2.36 mm IS sieve. The material which passes through the sieve is collected.

5. ABRASION VALUE TEST (IS : 2386 – PART 4)

OBJECTIVE:

To study the hardness of the sample rebate by testing for abrasion value by using Los Angles Testing Machine.

APPARATUS:

a) Los Angeles Machine Of Tasting Aggregate
b) hollow steel -cylinder 700 mm in die 500 mm in side length projecting radials
c) steel self-88 x 25 x 500 mm
d) On inside of the cover plate.

PROCEDURE:

oven at 105° C to 110 °C to constant weight and it is Clean aggregate dried any one of the grading A, to G, as per Table and construction Aggregates weighing 5 kgnearest to the grading to be used in construction. 5 kg weight is of aggregate is taken and grading in different type of like A, B, C or D to E and 10 kg to 15 kg for grading zone E, F to G may be taken as test specimen and placed in the cylinder mould. The abrasive charge it is also chosen in accordance with help of that machine depending on the zone grading of the coarse aggregate and is placed m the cylinder machine. The machine is rotation is for 500 rpm for grading A, B, C and D. For grading E, F and G, it shall be rotation for 1000 rpm the machine should be balanced and driven in such a way as to maintain uniform peripheral speed. After the taking number of rpm are counted, the machinewas stopping and the material is discharge from the machine taking care to take out entire stone dust. The portion of material coarser than 1.70 mm size is washed and dry and dried in an oven at 105 C and110 C g.

4.3 BASIC TEST ON CEMENT:

1. Soundness Test (IS 4031 - Part 3)
2. Standard Consistency Test (IS 4031 - Part 4)
3. Initial Setting Time & Final Setting Time Test (IS 4031 - Part 5)

1. Soundness Test (IS 4031- Part 3)

APPARATUS:

Le-Chatelaines Apparatus to taking a sample

Le-Chatelaines Apparatus

Venire Calipers to measurement

Water bath Balance to determine volume

PROCEDURE:

oiled mound on a lightly placing of oiled to lightly glass sheet and fill it is the cement paste to taken to its by gauging cement with 0.78 times the water required to give a paste. It is standard consistency another piece of lightly oiled glass sheet, as per the refer IS: 4031 (Part 4)-1988 the palace of the smaller to the weight on this covering glass sheet and submerge the whole assume water at a temperature of 27 ± 2 C and keep there for 24 hours. After 24 hours the distance separating the indicator points to the nearest 0.5 mm. in 25 to 30 minutes, and keep it boiling for three hours. Remove the mound from the water, allow itto cool and measure the distance between the indicator points. 5. The difference between these two measurements indicates the difference between these two measurements indicates the expansion of the cement.

2. STANDARD CONSISTENCY TEST

APPARATUS

- VacateApparatus
- Niddles
- Movable Rod
- Granulated Scale
- Iced Mound

PROCEDURE:

It is the vacateapparatus in a level base it has to vacate apparatus to with help dashpot keep the movable bearing rod to its highest positions to take the and it is the use it. To Work the plunger a number of times. ToAttach has been plunger that taking standard consistency to the movable rod. To taking Work the plunger the number of times and to give that data. Taken 400 gm. of cement in a pan and a weight quantity of water in a beaker. Tokeep the vacatemound on a non porousmaterial plate and fill the cement paste in it.After completely filling the mound, shake it slightly to expel the air. Smooth off the surface of the paste making it level with the top of the molder. The cement paste thus prepared is the test block.Ti can be the Lower is plunger gently use to touches the surface layer of the cement paste and other minerals and quickly release; (when vacate apparatus with dashpot is used, place the mound filled with cement paste and dash pot, bring it in contact with the top cap of the movable bearing rod.

3. INITIAL SETTING TIME & FINAL SETTING TIME TEST:

APPARATUS

- Vacate apparatus
- Balance
- Stopwatch
- Gauging trowel

PROCEDURE:

DETERMINATION OF INITIAL SETTING TIME

Placing the test block confined in the mound to take a resting on the non-porous material of plate, under the rod bearing the needle. Lower the needle gently until it comes in contact with the surface of the test block and quickly release. One more time taking a number of sample this procedure until the needle, when brought in contrast it has test block and to save to as described above, fails to pierce the block beyond 5.0 ± 0.5 mm measuring from the bottom of the sample of mound. The period elapsing between the time when water is added to the cement and the time at which the needle to fails to pierce the test block to a point 5.0 ± 0.5 mm to measuring from the bottom of the mound shall be the IST

DETERMINATION OF FINAL SETTING TIME

To replace the needle to the Vacate apparatus by the needle with an annular attachment. It can be considered finally set when, to finally set when, attachment fails to do so.to cement considered as finally set when, upon apply the needle slowly gently to the surface of the test block, finally set when, while attachment fails to do so.

4.4 COMPRESSIVE STRENGTH TEST

Compressive strength of concrete is the most important characteristic of concrete, which is measured by engineers in designing structures and it area. Compressive strength is the most common test conducted on hardened concrete pavement. Compression test specimens are taken cubesFilled each three equal layers. Compacted foreach layer should 25 times with a 16mm dia. rod. After hardened the specimens are taken out and cured in clean, fresh water. Curing is done until the required days of testing carried out immediately upon the removal of specimen from water curing and after that finding out the compressive strength by compressive testing machine. The mean compressive strength required at a specific age, usually 28 days. To finding of compressive strength using by cube where size of cube specimen is 150 × 150 × 150 mm and this test was performed on a 2000 KN. capacity compression testing machine. The compressive strength of cube specimen is calculated using the following formula: Compressive Strength = P/A N/mm^2

Fig– 4.1 Compressive Strength Test

4.5 FLEXURAL STRENGTH

The normal tensile test stress in concrete pavement, when cracking occurs in a flexure test is known i.e. flexural strength. The standard test specimen is a 150 mm × 150 mm × 700 mm beam of size.

The specimens hold be should be cast and curing day the each manner as for casting of cubesa beam. The specimens of be it waste sated don removal from the water and other material. The strength can be finding out by universal testing machine. The flexural strength can be find out by central loading and three loading point as well as the load is applied through two similar rollers mounted at the third point of the supporting span.

The flexural strength could determine by follows $F_{cr} = (P.L)/bd^2$

P = Fracture load for beam b = Width of the beam

L = Span d = Depth of the beam

Fig – 4.2 Flexural Strength

4.6 CASTING OF CONCRETE

First of falltaking concrete collection of proper material like as cement, fine aggregate, coarse aggregate, water, and also collection of other material require likeadmixtures. The different material was weighed damper the mix design of the concrete. The different material can be weighed by simple weighing machine or electrical weighing gm weighed by electrical sighing machine. The metrical weighing gm. aching use din experimental work had maximum capacity of 50 kg and least measurement of 50 grams. The dry volume of concrete was taking 1.30 times to the wet volume or volume of total number of test specimen cast none mix. For casting, all the mound were cleaned, free from moisture and oiled exactly.

Fig – 4.3 Material Mix Process

Fig – 4.4 Marble Add and Mixing Process

Fig –4.5 Marble Add and Mixing Process

Fig – 4.6 Mould Filling Process

Fig – 4.7 Beam

Fig – 4.8 Curing Process

CHAPTER 5

Result and discussion

5.1 Result

5.1.1 Compressive Strength

- Result of Conventional concrete for Pavement (Without addition of marble waste)

Table5.1ResultsofCompressiveStrength

Mix No.	Marble Waste (%)	7 days (N/mm^2)	14 days (N/mm^2)	28 days (N/mm^2)
1	normal	32.36	38.0	52.32
2	normal	32.48	37.52	51.61
3	normal	32.23	36.28	52.36

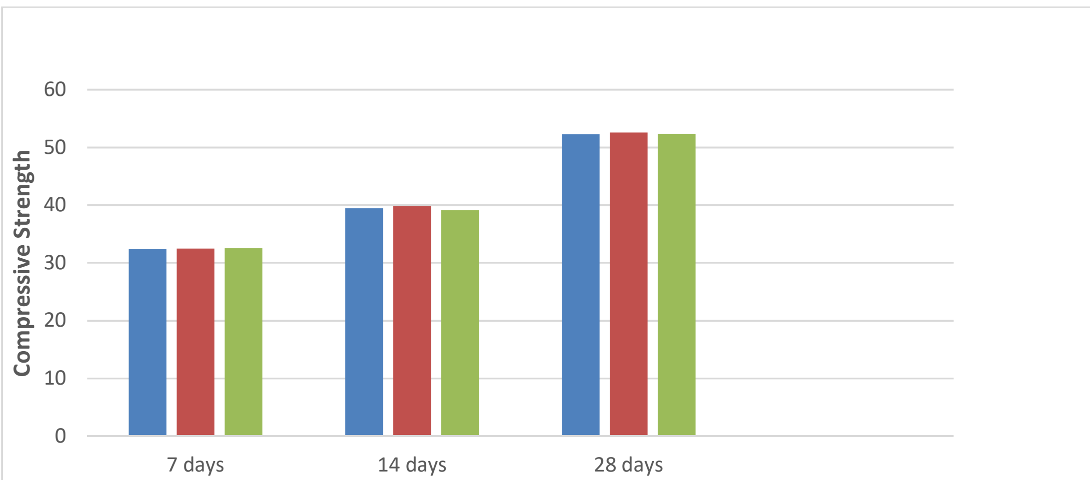


FIG-5.1 COMPRESSIVE STRENGTH

AVG.RESULT:

DAY	RESULTS (N/mm^2)
7	32.35
14	37.26
28	52.09

➢ Result of Conventional concrete for Pavement (With 10% Replacement of marble waste + 0.5% addition of Glass fiber)

Table 5.2 Results of Compressive Strength					
MixNo.	**MarbleWaste (%)**	**Glass Fiber (%)**	**7 days (N/mm^2)**	**14 days (N/mm^2)**	**28 days (N/mm^2)**
1	10	0.5	33.96	41.65	53.10
2	10	0.5	34.32	40.80	53.22
3	10	0.5	34.65	39.25	53.80

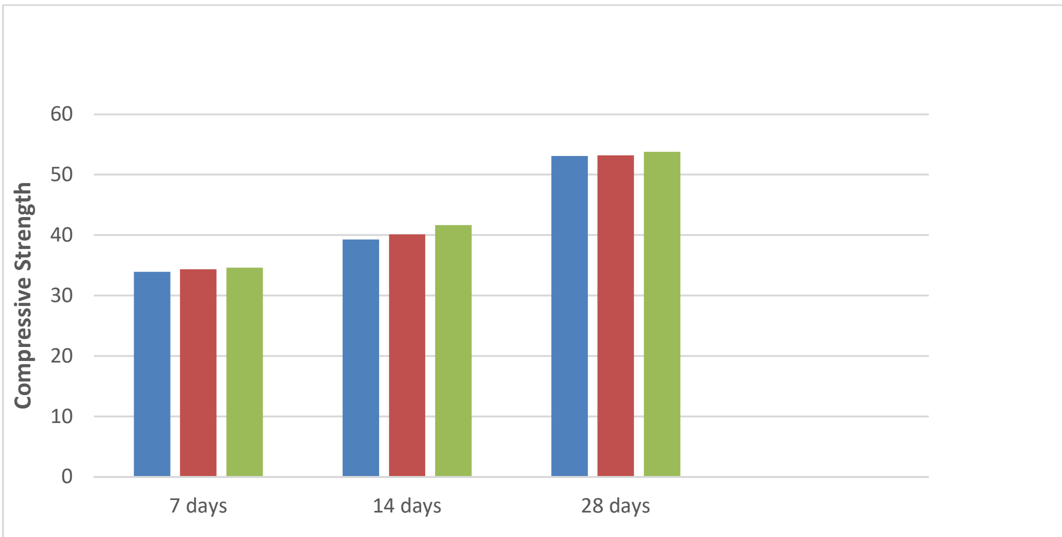


FIG- 5.2 COMPRESSIVE STRENGTH

AVG.RESULT:

DAY	RESULTS (N/mm^2)
7	34.31
14	40.56
28	53.37

➤ Result of Conventional concrete for Pavement (With 20% Replacement of marble waste + 0.5% addition of Glass fiber)

Table 5.3 Results of Compressive Strength

MixNo.	**Marble Waste (%)**	**Glass Fiber (%)**	**7 days (N/mm^2)**	**14 days (N/mm^2)**	**28 days (N/mm^2)**
1	20	0.5	35.02	40.95	55.65
2	20	0.5	35.15	39.65	54.97
3	20	0.5	35.66	40.29	55.98

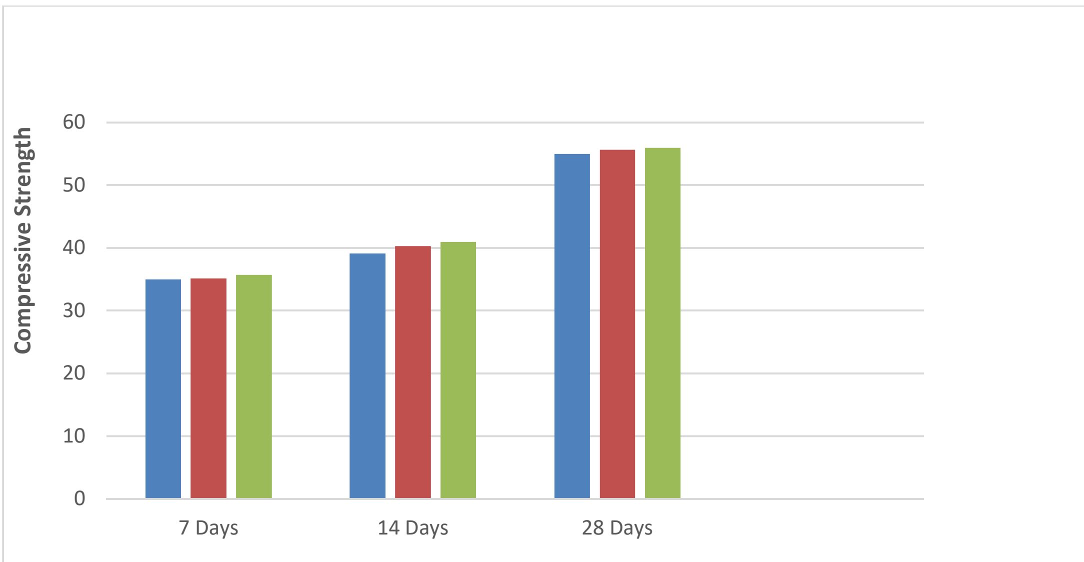


FIG- 5.3 COMPRESSIVE STRENGTH

AVG.RESULT:

DAY	RESULTS (N/mm^2)
7	35.27
14	40.29
28	55.53

- Result of Conventional concrete for Pavement (With 30% Replacement of marble waste + 0.5% addition of Glass fiber)

Table 5.4 Results of Compressive Strength					
Mix No.	**Marble Waste (%)**	**Glass Fiber (%)**	**7 days (N/mm^2)**	**14 days (N/mm^2)**	**28 days (N/mm^2)**
1	30	0.5	36.97	41.35	57.98
2	30	0.5	36.25	41.63	57.32
3	30	0.5	37.38	41.96	57.78

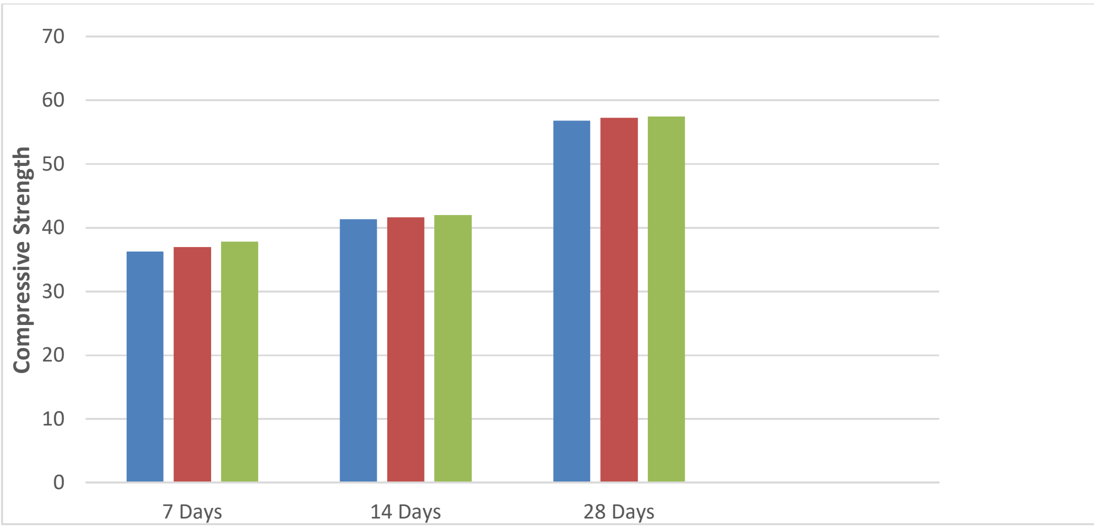


FIG- 5.4 COMPRESSIVE STRENGTH

AVG.RESULT:

DAY	RESULTS (N/mm^2)
7	36.86
14	41.65
28	57.69

5.1.2 Flexural strength

➢ Result of Conventional concrete for Pavement (Without addition of marble waste).

Table 5.5 Results of Flexural strength				
Mix No.	**Marble Waste (%)**	**7 days (N/mm^2)**	**14 days (N/mm^2)**	**28 days (N/mm^2)**
1	Normal	2.59	3.01	4.82
2	Normal	2.76	3.22	4.95
3	Normal	2.79	3.88	4.98

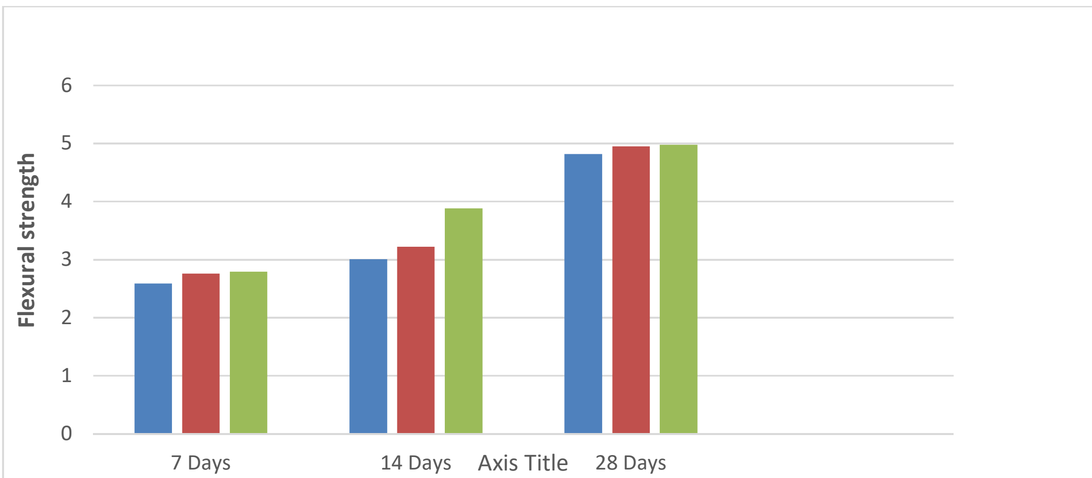


FIG- 5.5FLEXURAL STRENGTH

AVG.RESULT:

DAY	RESULTS (N/mm^2)
7	2.71
14	3.37
28	4.92

- Result of Conventional concrete for Pavement (With 10% Replacement of marble waste + 0.5% addition of Glass fiber)

Table 5.6 Results of Flexural strength					
MixNo.	**MarbleWaste (%)**	**Glass Fiber (%)**	**7 days (N/mm^2)**	**14 days (N/mm^2)**	**28 days (N/mm^2)**
1	10	0.5	2.88	3.05	5.21
2	10	0.5	2.90	3.28	4.81
3	10	0.5	2.96	3.49	5.09

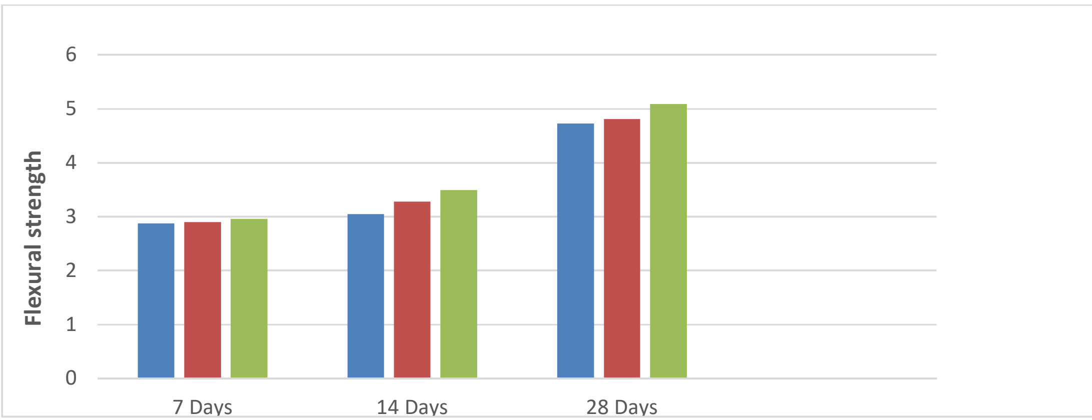


FIG- 5.6FLEXURAL STRENGTH

AVG.RESULT:

DAY	RESULTS (N/mm^2)
7	2.91
14	3.27
28	5.1

➢ Result of Conventional concrete for Pavement (With 20% Replacement of marble waste + 0.5% addition of Glass fiber)

Table 5.7 Results of Flexural strength

MixNo.	**MarbleWaste (%)**	**Glass Fiber (%)**	**7 days (N/mm^2)**	**14 days (N/mm^2)**	28 **days (N/mm^2)**
1	20	0.5	2.93	3.89	4.95
2	20	0.5	2.91	3.98	5.26
3	20	0.5	3.09	4.28	5.33

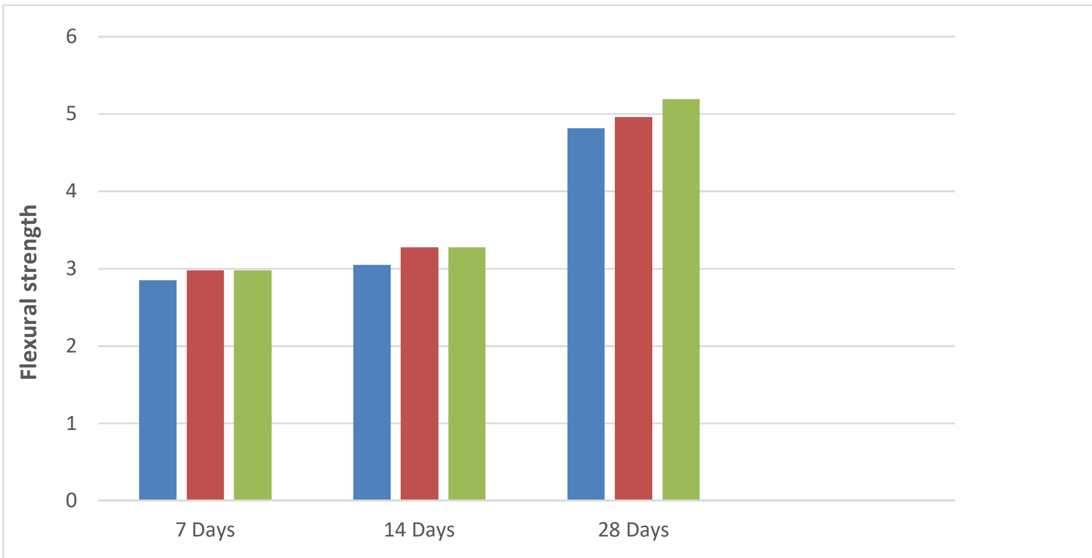


FIG- 5.7FLEXURAL STRENGTH

AVG.RESULT:

DAY	RESULTS (N/mm^2)
7	2.97
14	4.05
28	5.18

- Result of Conventionalconcrete for Pavement (With 30% Replacement of marble waste + 0.5% addition of Glass fiber)

Table 5.8 Results of Flexural strength					
Mix No.	**Marble Waste (%)**	**Glass Fiber (%)**	**7 days (N/mm^2)**	**14 days (N/mm^2)**	**28 days (N/mm^2)**
1	30	0.5	2.94	4.06	5.21
2	30	0.5	2.98	4.11	5.35
3	30	0.5	3.09	4.27	5.42

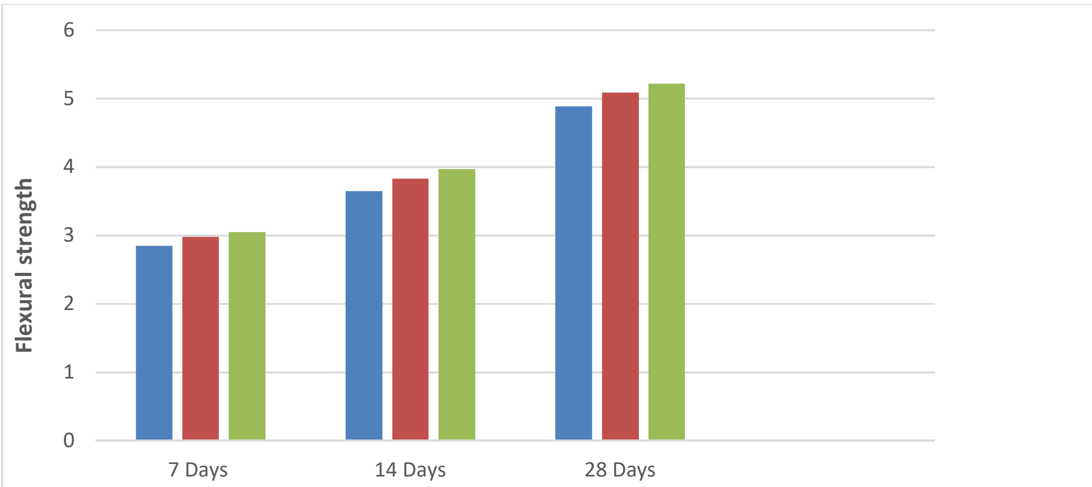


FIG- 5.8FLEXURAL STRENGTH

AVG.RESULT:

DAY	RESULTS (N/mm^2)
7	3.01
14	4.15
28	5.32

5.2 DISCUSSION

This study is an investigate ontheir aim to partial replacement of natural aggregates like coarse aggregate by the waste marble aggregates “The results obtained taking the performance of various concrete pavement mixtures of trial which may help to understand the behaviour of these waste marble aggregates.” Therefore, the orientation of this study purpose has shown that setting certain parameters has identified the best percentage ofpartial replacement for each type of coarse aggregate. Analysis of these results has revealed that the appropriate incorporation of marble waste aggregates can lead to interesting characteristics strength, indeed the use of marble aggregates resulted in a considerable increase in the compressive and tensile strength. The enhancement in resistance is very significant for 10%, 20% and 30% of partial replacement. The concrete workability can be improved by the correct quantity of water and the correct proportioning and grading of the ‘‘waste marble aggregates” and use of as admixture ‘‘Glass fibre” which can provide practical formulations. The marble waste can be used as alternative aggregates for concrete and use ofroad construction pavement.

5.3 CONCLUSION

All the study data shows that the partial of the marble wastes improves the compressive strength and Flexural strength. It is observed their compare conventional concrete pavement to Partial Replacement of Marble waste as Coarse aggregate with use as admixture Glass fibre. Marble waste 10%, 20% and 30% partial replacement of Coarse Aggregate and 0.5% addition of Glass fibre. It is caste a cubes and beam. By curing of different days like 7 days, 14 days and 28 days. I have to follow as per the IRC 44 2017 guideline. It is Concrete pavement grade M40 mix design. It is material physical test to be conduct.

It is observed Compressive strength is conventional concrete pavement is 28 days strength is52.09 N/mm^2. By partial replacement of 10% of marble waste as coarse aggregate and 0.5% addition of Glass fibre their 28 days strength is 53.37 N/mm^2.By partial replacement of 20% of marble waste as coarse aggregate and 0.5% addition of Glass fibre their 28 days strength is 55.23 N/mm^2. By partial replacement of 30% of marble waste as coarse aggregateand 0.5% addition of Glass fibre their 28 days strength is 57.69 N/mm^2.

It is observed Flexural strength is conventional concrete pavement is 28 days strength is 4.92 N/mm^2. By partial replacement of 10% of marble waste as coarse aggregate and 0.5% addition of Glass fibre their 28 days strength is 5.10 N/mm^2.By partial replacement of 20% of marble waste as coarse aggregate and 0.5% addition of Glass fibre their 28 days strength is 5.18 N/mm^2. By partial replacement of 30% of marble waste as coarse aggregate and 0.5% addition of Glass fibre their 28 days strength is 5.32 N/mm^2.

So it is very good achievement of a concrete pavement properties. It observed strength higher 20% and 30%Partial replacement is of marble waste as coarse aggregate. According to India weather condition.

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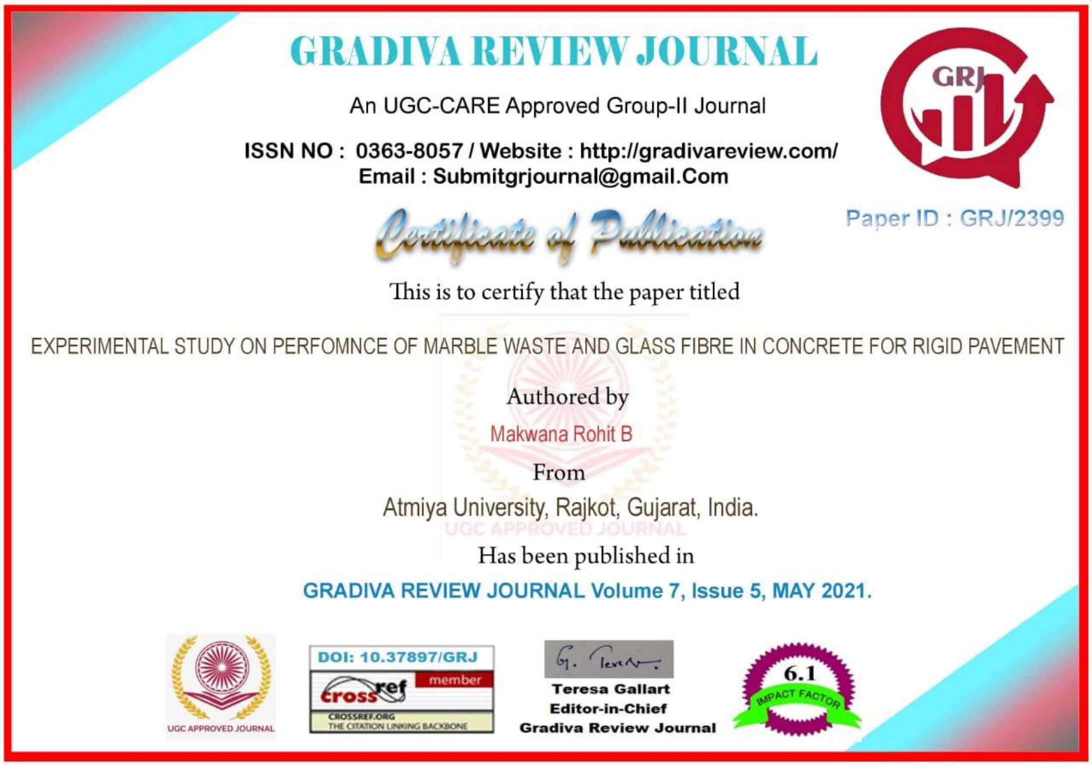
ANNEXURE – A

RESEARCH PAPER CERTIFICATE



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EXPERIMENTAL STUDY ON PERFOMNCE OF MARBLE WASTE AND GLASS FIBRE IN CONCRETE FOR RIGID PAVEMENT

Authored by

Makwana Rohit B

From

Atmiya University, Rajkot, Gujarat, India.

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6.1 IMPACT FACTOR

ANNEXURE – B

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FACULTY OF ENGINEERING & TECHNOLOGY

Master of Technology

(Dissertation Review Card)

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Enrollment No. : 1 9 0 0 4 1 0 1 0

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College Code : 0 5 1

Branch Name : civil (Transportation)

Theme of Title : Rigid Pavement

Title of Thesis : Experimental study on perfomance of Marble waste and GLass fibre in concrete for Rigid Pavement.

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Institute : Atmiya University	Institute :
Institute Code : 051	Institute Code :
Mail Id : hardik.pujara@atmiyauni.ac.in	Mail Id :
Mobile No. : 9924278570	Mobile No. :

~ 1 ~

❖ **Comments For Internal Review (   )** **(Semester 3)**

Exam Date : ___/___/___

Sr. No.	Comments given by Internal review panel (Please write specific comments)	Modification done based on Comments
1.	Need to Improve objective & Relevant literature.	done
2.	Need to Improve Methodology	
3.	Improve presentation skill & depth of knowledge	
		(Guide Sign.)

Particulars	Internal Review Panel	
	Expert 1	**Expert 2**
Name :	Hardik Pujara	Mr. Ashraf Methalia
Institute :	Atmiya University	AU
Institute Code :	—	—
Mobile No. :	99242 78570	9974078377
Sign :		

Particulars	Internal Guide Details	
	Expert 1	**Expert 2**
Name :		
Institute :		
Institute Code :		
Mobile No. :		
Sign :		

~ 2 ~

Enrollment No. of Student : 1 9 0 0 4 1 0 1 8

❖ **Comments of Dissertation Phase-1 (   )** **(Semester 3)**

Exam Date : 09/02/2021

Title : Experimental Study on Performance of Marble waste and Glass fibre in concrete for Rigid Pavement.

1. Appropriateness of title with proposal. (Yes/ No) Yes
2. Whether the selected theme is appropriate according to the title ? (Yes / No) Yes
3. Justify rational of proposed research. (Yes/ No) No
4. Clarity of objectives. (Yes/ No) NO

~ 3 ~

Enrollment No. of Student : 1 9 0 0 4 1 0 1 0

Exam Date : ____/___/_______

Sr. No.	Comments given by External Examiners (DP-I) : (Please write specific comments)	Modification done based on Comments
1.)	Refer IRC guideline for PQC mix design.	done
2.)	Need to change the concept of mix design from general concrete to PQC.	
3.)	Refer the gradation requirement of PQC in IRC:15	
4.)		
		(Internal Guide Sign.)

- *Approved* ☐
- *Approved with suggested recommended changes* ☑
- *Not Approved* ☐

Please tick on any on. If approved/approved with suggession then put marks ≥ 50 %.

➢ ***Details of External Examiners :***

Particulars	*Full Name*	*University / College Name & Code*	*Mobile No.*	*Sign.*
Expert 1				
Expert 2				

~ 4 ~

Enrollment No. of Student : 1 9 0 0 4 1 0 1 0

❖ **Comments of Mid Sem Review (** **)** **(Semester 4)**

Exam Date : 16 / 04 / 2021

Sr. No.	**Comments given by External Examiners :** i) The appropriateness of the major highlights of work done; State here itself if work can be approved with some additional changes. ii) Main reasons for approving the work. iii) Main reasons if work is not approved.	**Modification done based on Comments**
1.	Do proper formatting in Report and Presentation	done
2.	Improve References and their formatting.	done
3.	Complete pending Pending work of experiment	done
4.	Results of mid. work is Good but also need improvement on Replacement study.	
		Internal Guide Sign.

- *Approved* ☐
- *Approved with suggested recommended changes* ☑
- *Not Approved* ☐

Please tick on any on.
If approved/approved with suggession then put marks ≥ 50 %.

➢ ***Details of External Examiners :***

Particulars	*Full Name*	*University / College Name & Code*	*Mobile No.*	*Sign.*
Expert 1	Bindiya Patel			online
Expert 2	Jay Kalariya			

~ 5 ~

Enrollment No. of Student : ☐☐☐☐☐☐☐☐☐

❖ **Comments of DP-II Review (   )   (Semester 4)**

Exam Date : ____/____/________

Sr. No.	**Comments given by External Examiners :** i) Main reasons for approving the work. ii) Main reasons if work is not approved.	**Modification done based on Comments**

- *Approved* ☐
- *Not Approved* ☐

Please tick on any one.

If approved then put marks ≥ 50 %.

➢ ***Details of External Examiners :***

Particulars	*Full Name*	*University / College Name & Code*	*Mobile No.*	*Sign.*
Expert 1				
Expert 2				

ANNEXURE – C

PLAGIRISM REPORT

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Sources included in the report

W	URL: https://www.researchgate.net/publication/352222390_EXPERIMENTAL_STUDY_ON_PERFOMNCE_OF_MARBLE_WASTE_AND_GLASS_FIBRE_IN_CONCRETE_FOR_RIGID_PAVEMENT Fetched: 7/23/2021 7:32:01 AM	30
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W	URL: https://ijartet.com/2227/v4s8mar2017meenakshicivil/conference Fetched: 12/9/2019 7:20:24 AM	4
W	URL: https://repository.ju.edu.et/bitstream/handle/123456789/3850/Mintesnot%20Taderegew%20M.Sc%20Thesis%20final%20pdf%20for%20print%20out.pdf?sequence=1 Fetched: 5/14/2021 9:07:40 AM	3
W	URL: http://www.ir.juit.ac.in:8080/jspui/bitstream/123456789/22577/1/Utilization%20of%20Waste%20Material%20in%20Concrete%20for%20the%20Construction%20of%20Rigid%20Pavement.pdf Fetched: 5/4/2021 11:58:48 AM	1
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