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STUDENT REPORT

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RESEARCH TITLE

TEST PROPERTIES OF CONCRETE MIX PREPARED FROM CONSTRUCTION WASTE

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بسم الله الرحمن الرحيم

﴿يَرْفَعِ اللَّهُ الَّذِينَ آمَنُوا مِنْكُمْ وَالَّذِينَ أُوتُوا الْعِلْمَ دَرَجَاتٍ وَاللَّهُ بِمَا تَعْمَلُونَ خَبِيرٌ﴾ [المجادلة: **11**]

صدق الله العلي العظيم

//الإهداء

إلى صاحب السيرة العطرة ،والفكر المستنير؛

فلقد كان له الفضل الأوّل في بلوغي التعليم العالي

(والدي الحبيب)،أطال الله في عُمره.

إلى من وضعتني على طريق الحياة ، وجعلتني رابط الجأش،

وراعتني حتى صرت كبيرًا

(أمي الغالية)،طيّب الله ثراها.

إلى إخوتي ؛من كان لهم بالغ الأثر في كثير من العقبات والصعاب.

إلى جميع أساتذتي الكرام ؛ ممن لم يتوانوا في مد يد العون لي

أُهدي إليكم بحثي المتواضع هذا...

الشكر والتقدير

الحمد الله سبحانه وتعالى الذي منَّ علينا بنعمة العقل والدين، وهو القائل في محكم التنزيل: "فَٱذْكُرُونِىٓ أَذْكُرْكُمْ وَٱشكر والى وَلَا تَكْفُرُونِ"،[1] وقد قال رسول الله صلى الله عليه وسلم: "مَنْ صَنَعَ إِلَيْكُمْ مَعْرُوفًا فَكَافِئُوهُ، فَإِنْ لَمْ تَجِدُوا مَا تُكَافِئُونَهُ فَادْعُوا لَهُ حَتَّى تَرَوْا أَنَّكُمْ قَدْ كَافَأْتُمُوهُ"،[2] وأيضًا وفاءً وتقديرًا واعترافًا مني بالجميل والفضل الجزيل أتقدم بجزيل الشكر للأساتذة الأفاضل المخلصين الذين لم يبخلوا علينا بأي جهد في مساعدتنا في مجال البحث العلمي وفي دعمنا للوصول إلى نجاحنا، ولهم منّي خالص آيات الشكر وأسمى باقات التقدير على هذه الدراسة، وهم أصحاب الفضل في توجيهي ومساعدتي في تجميع المادة البحثية، فجزأهم الله كل خير عني وعن جميع الطلاب، ولا أنسى أن أتقدم بجزيل الشكر للأستاذة(عبير عبد الجبار)، التي قامت بتوجيهي طوال فترة الدراسة هذه، وأخيرًا أتقدم بجزيل الشكر إلى كل من مدَّ لي يد العون والمساعدة في إعداد هذه الدراسة على أكمل وجه، والحمد لله رب العالمين...

Abstract:-

Concrete considers as the most popular building material because of the many Advantages that it has. This come up with a huge amount of concrete waste. As a way to Produce a concrete which is friend to environment, four percentages 0%, 50%, 75%, 100% .Of coarse recycled aggregate as replacement of natural coarse aggregate in concrete mix Are used in this research. The workability and wet and dry density are presented in this Study. The compressive strength at age of 7, 28, 56 days are estimated, also splitting tensile Strength and modulus of elasticity are founded at 28 day. The study shows that when The Percentage of recycled aggregate exceeds 50% in concrete mix the mechanical properties Reduce. When 100% of recycled aggregate is used the compressive strength, splitting Tensile strength and elastic modulus , so it is Possible to use recycled aggregate concrete in production of non-structural elements.Reusing construction waste in the production of new concrete achieves two goals together, the first is to remove large amounts of The sources of environmental pollution resulting from these wastes, and the second is to provide cheap sources of concrete aggregate. You have included This study is to test the properties of a concrete mix prepared using coarse aggregate from local concrete waste after removing pieces Large gravel, i.e. using the mortar of this waste after crushing, grading and washing. The results showed that this reused aggregate has a lower specific weight and higher absorption compared to the usual aggregate. User in Iraq. The results also showed that the concrete prepared from this aggregate has resistance to compression and absorption Acceptable, as it has good flexural resistance, and low dry density compared to concrete prepared from ordinary local aggregates. This concrete is suitable for use in paving streets, sidewalks, squares, walkways and making concrete building block

introduction:-

Concrete waste is the rubble resulting from the construction and demolition processes of various facilities, as it results from the restoration of facilities Existing ones, demolishing the old ones, or constructing new ones. These wastes are also produced from factories that produce ready-made concrete pieces, such as: The cache, the block, the sticker and others, as well as the prefabricated building factories, which consist of cutting stones, bricks or concrete Or mortar of different sizes, these wastes are thrown in the waste collection places and accumulate annually in large quantities because they have It has a high durability, so it does not decompose or decompose naturally, and therefore it has become an increasing pollution problem every year all over the world. Sweden, for example, produces one and a half million tons annually of construction waste [1], while in Poland it produces three and a half million tons of waste. Million tons annually and it is on the increase, and that which is reused of it does not exceed 5%, while the rest is thrown into landfills Waste 2. [ ] One of the methods of reusing this waste that is currently used is to use it instead of the usual aggregate, partially or completely, to produce concrete. New by breaking clean blocks that do not contain pieces of wood or reinforcing bars or residues of gypsum products into Sizes similar to those of grains of pebbles, then washed and graded, i.e. separated on sieves into different sizes.A cheap source for concrete aggregates, especially in countries that do not contain gravel or crushed stone suitable for concrete. Naturally. The use of this type of aggregate also reduces the operations of extracting gravel layers or crushing rocks to prepare the aggregate. Natural, as these processes cause damage to large areas of the natural environment in the world. The reused aggregate, which became known as "Aggregate Recycled" resulting from construction and demolition waste, carries Characteristics of the concrete from which it was produced and contains the same compounds, and it may be a mixture of different concretes, and this affects the Characteristics of concrete produced from this aggregate, so it was commonly used in paving roads, pouring sidewalks and squares, or producing Ready-made concrete

pieces used at the edges of roads or for paving walkways, and they are of little use for the production of concrete Construction, as no more than 20% of the total aggregate used in this concrete is used, and it is mixed with ordinary aggregates For the production of this concrete if used 3. [ ] Choosing a well-recycled aggregate source can raise the properties of The resulting concrete In Finland, it was possible to produce concrete from recycled aggregates, which gave a resistance that was two to three times higher than that of Concrete produced from local crushed rock 1.[ ] The recycled aggregate has a lower specific weight, higher absorption and lower workability because it has a rough surface when compared to aggregates. The normal used in Iraq, and thus it needs larger quantities of water to obtain workable concrete It is equal to that produced from ordinary aggregates, and it absorbs water during and after mixing operations, so it is preferable to mix it while it is saturated. With water when producing concreteuncrate is one of the most important building materials because of its positive features, especially as a cheap and local building material Usually the reconstruction of buildings At the end of the last decade of the twentieth century, the movement of demolition and the purpose of fitting new purposes or because of Significantly, the end of the design life of the buildings, which led to them. Accumulation of large quantities of waste that makes up concrete part It became a new challenge and society. For the environment Environmental awareness globally, and the reuse or recycling of construction and demolition waste has become one of the goals that have increased recently Sustainable development that has a significant positive impact on the environmental, economic and social aspects. Recycling has become a policy adopted and insisted by many developed countries Denmark is a pioneer in it, as shown in Figure (0), and this process is usually summarized in the collection and treatment of construction and demolition waste. Using it again, i.e. returning it to its life cycle and making it a usable material for the same or other purposes This method is environmentally beneficial as it reduces the volume of waste generated and thus saves the area of land used as a landfill Waste, and contribute to preserving the original natural resources Several studies have investigated the properties of recycled aggregates (RA, Aggregate Recycled) and the properties of Concrete produced from it (RAC, Concrete Aggregate Recycled), many

researchers have reached Recycled RA differs from that of recycled aggregate to) Muralist et al.

Research and its objectives:-

The aim of this research is to check the possibility of utilizing waste concrete as aReplacement for natural coarse aggregate in conventional concrete. Concrete is one of the most widely used building materials, and therefore the demolition of existing buildings under the circumstances The current situation has resulted in a huge amount of concrete waste that must be utilized in order to achieve the environmental benefit Both economic and social. This is done through conducting scientific research showing the extent to which these wastes can be used. Thus, data and data are available that may help the government in the future to provide the necessary facilities and equipment for the use of the rubble. Shove Recycled and use of concrete waste in a useful and correct manner. This research aims to study the efficiency of concrete produced from recycled coarse aggregate when used as an alternative Partial or totality of natural coarse aggregate, by evaluating some of its physical and mechanical properties such as pressure, tensile strength Slit and modulus of elasticity Concrete is a good material to construct with, but the world faces a main problem in how to Control concrete waste because of its hardness, weight and big quantities. In Iraq, the Construction waste is thrown on the side of roads and neglected yards because there is no Regulated method for its disposal. Qasim [4] estimates that the construction wastproduced By the Iraqi cities is (1111788 tons/year). The increasing quantities of construction waste in Iraq are from wars and conflicts (whole cities are demolished), old buildings that have Reached their life limit, and the lack of suitable landfills for construction waste disposal. In Addition, the rapid increase in population in which the country is pushed towards constructing New building complexes using extra amounts of concrete. Furthermore, the increase in Concrete manufacturing is in direct relation to the increase in exploiting the natural resources Of aggregate. Therefore, the utilization of concrete waste is a must as a means of recycling. This research will endeavor on using waste concrete as coarse aggregate at different Replacement levels to check for the feasibility of using Iraqi waste concrete in manufacturing Green concrete.

The theoretical part

1- The materials used:-

First: the basic materials, which are: cement, aggregate, and water.

Second: Special additives, to modify one or more properties of concrete.

The first axis: the basic materials, which are as follows:

1-1Cement :-

It is a material that has cohesive and adhesive properties. With the presence of water, which makes it able to Connecting the concrete components to each other and cohesion with the reinforcing steel and turning it into a complete interconnected unit. Cement has the property of freezing (setting) and hardening (due to chemical reactions and in the presence of water, so it is known Cement hydraulic.)

Portland cement was discovered by English builder Joseph Aspiden in 1824 by burning

A mixture of clay and hard limestone, which is finely crushed in the kiln and called cement.

Portland is relative to the island of Portland in England, which contains building stones that have the same color and quality as Portland cement.

Cement Industry:-

Cement is made by mixing limestone materials such as CaCO3 (CaCO3) or chalky limestone.

Chalk (with clay materials such as shale or clay.)

The main components involved in the manufacture of Portland cement:-

1- Calcium oxide (CaO) and this is found in limestone ($CaCO_3$) and chalky limestone.

$CaCO_3$ in the oven heating $CaO + CO$

2- Silicon dioxide or silica (SiO_2) and this is found in clay.

3- Alumina and iron and these are found in clay.

4- Magnesia and alkali (Alkalis, sodium, calcium, potassium) and phosphates, and these are present in the clay.

The raw materials are ground and mixed well and in specific proportions, and then burned in a large rotary kiln (diameter). About (5 m) and (150 m) in length with a temperature ranging from C (1500-1300) where the material melts and agglomerates in the form of Small balls known as clinker, and then the clinker is cooled and ground into a fine powder after adding sulfate. Hydrated calcium ($2H_2O.CaSO_4$) (known as gypsum) and the gray color of Portland cement produced about the presence of iron.

Cement industry methods:-

A-Wet Process

The grinding and mixing of raw materials is completed in the presence of water, and this method is used when the moisture content in the raw materials is High.

B-Dry Process

The grinding and mixing of raw materials is completed in their dry state, and this method is used:

*** When the raw materials are solid, they do not disintegrate with water.**

*** In cold countries to prevent water from freezing in the mixture.**

*** In the case of scarcity of water needed for the mixing process.**

Types of Portland cement

The properties of cement during hydration vary according to:

1) Chemical composition 2) Degree of fineness

It is possible to manufacture different types of cement by changing the percentages of their raw materials. Limestone are made by mixing calcined materials such as CaCO3 (CaCO3) Stone Lime or limestone. Chalk with clay materials such as shale or clay after grinding and The grinding and mixing process is carried out by the dry or wet method. The raw materials are analyzed, then ground and mixed in the calculated proportions any type of cement.

The materials are burned using a large kiln rotary kiln with a cylindrical hook made of iron and lined From the inside with anti-melting material (fire bricks). The diameter of the furnace reaches 8 meters and its length is 230 meters in the wet method, and in the dry method, its diameter reaches 6 meters. And its length to 105 meters. It rotates slowly about its longitudinal axis, which is slightly inclined from the horizon. Oil or natural gas is pumped from Gradually move the lower end of the furnace, while the materials are fed from the upper end and during their movement towards the bottom the temperature rises The materials suffer a series of chemical reactions:

1- Up to 100°C the raw materials lose free water.

2-Between 150-500°C the chemically combined water is lost

3 - At a temperature of 600 ° C, the decomposition of the magnesium carbonate in the limestone begins.

4 - At a temperature of 900 ° C, the decomposition of calcium carbonate begins.

5- The stage of melting the main materials such as calcium, aluminum and iron oxides at a temperature of 1250

-1350°C, which is when melting begins.

6 - In the areas of the Al-Sinfli oven, where high temperatures 1300-1500 degrees Celsius, it turns from 20-30

% of the dry matter is reduced to silica (melting), and lime (lime), silica and alumina are recombined and new compounds are formed

Which:

1-Tri-calcium silicate S C3

2-Dicalcium Silicate S C2

3- Tri-calcium aluminates A C3

4- Calcium Ferric Aluminate AF C4

In the end, the material is agglomerated into small balls with a diameter of 3-25 mm.

1-1-1Ordinary Portland cement:-

This type of cement use in constructions when there is no exposure to sulfates in the soil or Groundwater .All types of cement used in concrete are ground to a high degree of fineness .

But it varies according to the type of cement produced, and it has the property of reacting with water (hydration), which

It produces - over time - a material that is hard and strong, increasing its strength and resistance

Table(1) of properties of used cement

Feature	The Result	Specification limits
Standard ductility (%)	29.5	_____
Initial hold time (minutes)	80	not less than 45
Final hold time (minutes)	170	no more than 600
softness	260	not less than 230
compressive strength 7days old(Mpa) 28 days old(Mpa)	 17.4 26.9	 not less than 15 not less than 23

Figure (1) shows the rotary kiln in the cement industry.

1-2-Water: Use normal water in concrete work.

1-3-Concrete:-

Figure (2) shows recycled concrete.

is everywhere around us, in homes, schools, hospitals, bridges, roads, markets, offices, factories, and all the components of modern life. It is an excellent material for construction, as it is characterized by its durability, durability, efficiency and economy. It also withstands and protects against weather factors. Small concrete blocks are used as gravel in modern construction projects. A base layer of gravel is laid as the bottom layer of the roadway, and a layer of concrete or pure asphalt is poured over it. The United States Federal Highway Administration may use such means to construct new highways from old highway materials. Recycled crushed concrete can also be used as dry aggregate for new concrete if it is free of contaminants. Concrete pavements can also be broken in place and used as a base layer for asphalt pavement by tamping process.

Larger blocks of crushed concrete can be used in bedrock, which is "a very effective and popular method for controlling watercourse erosion".

With good quality control in fracture facilities, well-graded and aesthetically pleasing materials can be provided as an alternative to stone or landscape bedding. Stone bags (cages) can be filled with crushed concrete and stacked together to provide economical retaining walls. Stacked stone bags are also used to build filter walls (instead of fencing).The concrete industry consumes a large amount of natural raw materials and energy used in heating, crushing, mixing and transportation and produces large amounts of heat emissions, pollution and waste. Concrete is a mixture of a paste that acts as an adhesive for a group of components that can be called aggregate. The paste, consisting of cement and water, encapsulates and surrounds fine ingredients such as sand, and coarse ingredients such as gravel and crushed stone. Through a chemical reaction, the paste hardens and sticks the other ingredients together, and the mixture becomes a solid, rock-like substance called concrete.

Cement is a powdered chemical compound made of calcium, silicon, aluminum, iron and other components. It is obtained by mixing and heating natural raw materials to very high temperatures and then crushing them to form a soft substance that reacts with water to form a concrete paste. The properties of concrete vary according to the quality of the components and the proportions of mixing between them. This leads to a difference in its mechanical and physical properties and is used as needed. As a result of the different components and their proportions in the mixture, many types of concrete arise, including light, heavy, ready-made, polymeric concrete and others, each with properties suitable for different purposes and locations. These mixtures are subjected to experiments and tests to determine their suitability and achieve the required specifications, and there must be laboratories in work sites and concrete manufacturing plants for this and for the development of other types as well.Necessity of concrete recycling:

Millions of tons of waste concrete are produced annually around the world for the following reasons:

-Demolition of the old structure.

-Destruction of buildings and structures during earthquakes and wars.

-Removal of useless concrete from structures, buildings, sidewalks, etc.

-Concrete waste from concrete cube and cylinder testing, destructive methods of testing existing structures etc.

1-3-1-Advantages of concrete recycling:

Demolished concrete is usually shipped to landfills for disposal, but due to increased environmental awareness, concrete is recycled for reuse in concrete works. There are many benefits to recycling concrete instead of burying it in a landfill. Keeping concrete debris away from landfills saves space there

1-3-2-*Quality of recycled aggregate and concrete:*

The strength of recycled concrete is about 10 to 15 percent lower than that of concrete with fresh aggregate. However, suitable mix designs can be made and reliable results can be obtained. The mixture requires a slightly higher amount of cement or the use of additives to reduce the need for water. Recycled concrete can be safely used as regular concrete. With appropriate corrections in the design of the mixture, it can also be used for reinforced concrete.

1-3-3-*Equipment used for concrete recycling*:

The most practical solution for concrete recycling can be a portable crusher that can be moved to different sites or projects. Often times, it is best to install a portable crusher in a central location.

Benefits of Recycling Concrete:

Recycling concrete helps reduce construction waste and extend the life of landfills as well as save you on disposal fees or tips. It also reduces transportation costs because concrete can often be recycled in areas close to a demolition or construction site. If builders are pursuing LEED Green Building certification, they can earn points for using recycled concrete. In some cases, new business opportunities emerge in the recycling business that would not otherwise exist.

4-river sand:-

Figure (3) shows river sand used in the production of concrete.

Given the availability of river sand extracted from rivers and in large quantities when dredging and cleaning these rivers, and the costs

These sands are cheap in Iraq, especially in the cities located on the banks of the Tigris and Euphrates rivers and their affiliated streams.

It is most of the Iraqi cities. The benefit from these sands is confined in most cases to agricultural work.

The content of sulfates (SO3) in most of the Iraqi sands is in a high percentage that exceeds the percentages allowed in the specifications.

(5%) Iraqi Standard No. (45) for the year 1984 (as this sand cannot be used according to

This is confirmed by Kadhimi - Al (1983) due to the great impact and damage caused by those

Salts on Concrete (Neville, 2005) The high sulfur salts also negatively affect the cement paste.

Hardening due to the formation of additional amounts of ittrengeite, where a large volume increase occurs in the dough.

Hardened cement leads to internal stresses that cause cracks in the concrete block, and this in turn affects

On the resistance of concrete (1986, Soroka) and because of this problem, one of the researchers suggested (Salihi-AI, 1994)

The use of river sand as a fine aggregate, because the percentage of sulfate (SO3) in it is not more than (1.0) and it gives

Similar compressive strength to the compressive strength of concrete containing natural sand. This is what has been studied in this research, from

During the use of river sand in concrete as a substitute for natural sand (quarry sand)

Sand is an irreplaceable type of building material, without which no construction site can do anything.

For those in a hurry. we say

River sand is more suitable for construction, especially the foundation, than quarry sand (well washed with salt), like any material, sand is of natural origin. River sand is lifted from the river bed using special equipment, which subsequently affects its cost.

River sand is divided into several types depending on the composition of the grain size:

1. Small (1.5-2.0 mm)

2. Medium (from 2.0-2.5 mm)

3. Large (from 2.5 mm and above)

River sand prices according to the size of the river sand properties

High degree of purification, up to 0.5% of clay impurities and bottom silt;

size unit from 1.5 to 2.5 mm;

grains of sand are uniform and round, as a result, river sand has a high degree of flow ability;

It has a high filtration rate of 5 to 20 cubic meters per day, depending on the sand volume coefficient (MCR), which makes river sand an ideal drainage material;

It has a maximum specific gravity and is 1.5 tons per 1 m3;

Has a successful degree of radiation safety.

river sand range

For the manufacture: concrete mixture for brickwork, it is better to use a group of medium or small fractions, while the large group is more suitable for foundation works, the construction of monolithic walls, roofs, reinforced concrete products (that is, concrete structures)

Use of river sand:

In the preparation of concrete mixtures.

in masonry mortar.

in the brick industry.

In the production of concrete foundations.

in the mixture of asphalt and asphalt concrete;

for drainage in the base layer;

in floor solution;

In anti-salt sand mixtures.

Where river sand is used in production: in the manufacture of glass, for filtering and purification of water, including drinking water, in the metallurgical industry and many other places, the scope of application is wide.

practical part

Materials and tools used:-

1-Concrete mixer:-

***Figure (4) shows the mixer used for the mixing process.**

2-Sieves according to gradations

Figure (5) shows the sieves used for grading of recycled concrete

3-Sensitive scale:-

Figure (6) shows the sensitive scale for weights.

4- oil

5- vibrating machine

6- cubes molds

5-water measuring cylinder

1-materials used:-

1-1-Cement: Use ordinary Portland cement.

1-2-Water: Use normal liquefied water to make concrete.

1-3-Coarse aggregate: The tested concrete cubes were used after they were crushed and the large pieces of gravel were removed from them. Then it was graded to be in conformity with the British Standard 5 [Bm] Maximum measurement (20 mm), (Table (2) contains the characteristics of This rubble.

Table (2) Characteristics of coarse aggregates

Sieve hole (mm)	Passing percentage (%)	Specification limits
50	100	100
37,5	100	100
20	96	100-90
14	66	80-40
10	48	60-30
5	5	10-0
Total specific weight (saturated dry surface)		2,124
absorption Smoothness factor		%10,8 6,85

1-4-Sand: Use river sand

Table (3) Gradient of river sand used.

] gradation	Sieve hole (mm	Model Check Result (Percentage of Transit %)	Specification limits for grading of the percentage passing through %
1	37.50	100	
2	25.00	100	
3	19.00	100	
4	12.50	100	
5	9.50	100	
6	6.30	100	100
7	4.75	100	
8	2.35	100	
9	2.00	100	100-99
	1.18	99	
	0.600	98	
	0.425	25	
	0.075	1	10 or less

Harmful and soft materials	examination	Sulfate test result	Examination limits
Harmful and soft materials	Sulfur salts (%)	0,1	

- **Concrete mixture: A concrete mixture was made with a weight mixing ratio (1:2:4) with a water/cement ratio of 55.0 (and the aggregate was In a saturated state the surface is dry when weighed and mixed with cement and water.**

-Mixing concrete to test the cube either by mixing concrete manually or in a laboratory batch mixer. The hand mixing is as follows:

***1*- Mix cement and river sand on a watertight platform until the mixture mixes well and has a uniform color.**

2- Add the coarse aggregate and mix it with the cement and river sand until the coarse aggregate is uniformly distributed throughout the batch.

3-Add water and mix it until the concrete looks homogeneous and has the desired consistency.

4- Clean the empty cubes by brushing them with oil.

5- Fill the concrete in molds with layers of about 5 cm.

6- Compact each layer with at least 35 strokes per layer using a tamping bar (16 mm diameter steel rod 60 cm long)

7- Level the top surface and smooth it out with a trowel.

8- Cube treatment.

The test samples are stored in moist air for 24 hours and after this period the samples are marked and removed from the molds and kept immersed in clear fresh water until they are taken out before the test The treated water should be tested every 7 days and the water temperature should be at 27 + -2 degrees percentage.

Preparation of casting molds:-

The iron cube mold is painted well before concrete is placed in it, and the laboratory technician, who must be present during the casting to take samples, puts the concrete inside the cube on three layers at a rate of approximately 5 cm for each layer and must compact it at a rate of 35 strokes per layer and must be well compacted so that The course penetrates the layers to improve the cube.

Figure (7) shows the casting molds.

Figure (8) shows the coating of the iron cube mold

The concrete mix was placed inside the molds and compacted at a rate of 35 strokes per layer. The cubes must be exposed to the same conditions as the concrete poured locally. When the curing is stopped with water, the cubes are removed from the water basin.

Figure (9) shows the concretes or samples that were produced.

2- Concrete required tests:-

1- 1-Compressive strength test (150,150,150) mm 6 cubes:

a) 3 test cubes at 7 days old

b) 3 test cubes at 28 days old

2- 2-Testing the water absorption rate of three cubes of 28-day-old cement concrete

2-3-Dry density at 28 days old.

1-1-Compressive Strength test:-

Among the series of physical tests of cement, where the compressive strength test of Portland cement mortar is carried out to get an impression of the cement's bonding ability and the amount of strength development that gives the cohesion properties of the mortar mixture, and the compressive strength of the mortar (cement mixed with sand and gravel) is calculated and not the cement alone.In this test, cement is mixed with sand in a ratio of 1 cement to 2 natural silica sand and gravel 4, and the mixture is mixed with water so that the water/cement ratio is equal to 0.55, and the mixture is used to pour molds with dimensions 150 * 150 * 150 The mortar is kept in the molds for 24 hours for the purpose of its cohesion, after which the cubes are removed from the molds and ripen in water until the time of the examination. When checking, the average force applied to the model is in the range 900 to 1800 N/sec The amount of compressive strength of the obtained cement mortar does not necessarily correlate or reflect the compressive strength of the concrete in which the cement is used, as the compressive strength of concrete is related to various factors, while the compressive strength of cement mortar reflects the property of cement in particular.

***First test (7 days):-**

Three cubes were used (the first contains 100% gravel and is considered standard to compare with cubes of 100% recycled concrete).

Compressive strength:- The load applied to the surface at failure / the surface area of the face exposed to the load .

Table (4) shown test results for the 7-day.

Samples	Max Load (KN)	Compressive strength in (KN/mm2)	Compressive strength in (N/mm2)
Samples 1 ((stnd 100% aggrecate))	320.4	0.01424	14.24
Samples 2 (100% recycled concrete)	363.4	0.01615	16.15
Samples 3 (100% recycled concrete)	348.8	0.0155	15.5

-Second test (28 days):-

Three cubes were used (the first contains 100% gravel and is considered standard to compare with cubes of 100% recycled concrete).

Compressive strength:- The load applied to the surface at failure / the surface area of the face exposed to the load .

Table (5) shown test results for the 28-day.

Samples	Max Load (KN)	Compressive strength in (KN/mm2)	Compressive strength in (N/mm2)
Samples 1 ((stnd 100% aggrecate))	473.1	0.0210	21.0
Samples 2 (100% recycled concrete)	493.3	0.0219	21.9
Samples 3 (100%recycled concrete)	482.2	0.0214	21.4

2-2-absorbency test:-

The water absorption test determines the rate of water absorption (absorption) for both exterior and interior concrete surfaces. The test involves measuring the mass increase in concrete samples caused by water absorption as a function of time when only one side of the sample is exposed to water.

Concrete samples are taken from either core drilled or cast into cylinders. Samples must be saturated and weighed prior to testing. Absorption can also be estimated at different distances from the exposed surface. This test was done for samples aged 28 days and immersed in water as shown in the table below:-

The percentage of absorption=(wet weight - dry weight)/ wet weight *100%

Table (6) shows the absorbency calculations for concrete.

Samples	wet weight (kg)	dry weight (kg)	The percentage of absorption
Samples 1 ((stnd 100% aggrecate))	7.6355	7.4745	2.108%
Samples 2 (100% recycled concrete)	7.6930	7.5365	2.076 %
Samples 3 (100%recycled concrete)	7.5005	7.3435	2.137%

2-3-Dry density at 28 days old:-

Three cubes were used (the first contains 100% gravel and is considered standard to compare with cubes of 100% recycled concrete) at 28 days old.

Dry density = dry weight / total mass.

Table (7) shows the dry mass calculations at the age of 28 days for concrete.

Samples	Dry Weight (Kg)	overall Size (m^3)	Dry Density
Samples 1 ((stander 100% aggregate))	7.4745	0.003375	2214.66
Samples 2 (100% recycled concrete)	7.5365	0.003375	2233.03
Samples 3 (100%recycled concrete)	7.3435	0.003375	2223.94

Table (8) Characteristics of concrete containing added recycled concrete waste.

Feature	the value	Specifications
Compressive strength (7) days (Mpa)	15.825 MPa	Not less than 14 (Mpa)
Compressive strength (28) days (Mpa)	21.65 MPa	Not less than 21 (Mpa)
Absorbency % (28) days	2.106%	not more than 10%
Dry density (28) days	2228.485kg/m3	2200-2600

Conclusion:-

From the foregoing, we can conclude the following:

1- The reused aggregate from concrete waste is characterized by a low specific weight and high absorption compared to aggregates.

Local ordinary coarse (gravel).

2-The compressive strength of concrete prepared from reused coarse aggregate is within the limits of the standard specification.

The Iraqi special ratio of mixing, but it is close to its minimum limits.

3-Concrete prepared from reused aggregates has achieved a high flexural strength in relation to the compressive strength which

achieved and compared to that of concrete with ordinary aggregates.

4-Concrete with recycled aggregate also achieved a low dry density compared to the density of concrete with ordinary aggregate.

5-The absorption value of concrete with recycled aggregate was higher than that of ordinary aggregate, but it was acceptable.

For specifications of ready-made concrete pieces such as blocks, side and middle molds for roads.

6-Concrete with aggregate reused from concrete waste is suitable for use in paving roads.

Concrete, parking lots, sidewalks and walkways, and in the work of concrete building blocks and lateral and medial forms

for roads and others.

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