International Journal of Environmental Sciences
ISSN: 2229-7359
Vol. 11 No. 5, 2025
https://theaspd.com/index.php

Limitation The Maximum Utilization Rate Of Recycling Construction Waste In Iraq For A New Concrete Production

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Abstract:
The review was to decide the most extreme and trial of affecting reusing Construction squander like (bits of dirt blocks, tiles, glass and a portion of the old concrete because of the destruction of working) as a material replaces absolute weight of total (coarse and fine) underway of new concrete and study there impact on properties of concrete like compressive strength, retention, usefulness, w/c proportion by utilizing an alternate level of development squander (25, 50,75,100) % supplanting from the total complete weight, were utilized to make blends
Results demonstrated that:
1-Compressive strength of another substantial expanding by decreasing the rate proportion of supplanting development squander subsequent to smashing and wetting.
2-A high ingestion rate, as the higher the level of reused materials, the high measure of water needed for blending.
3-Low functionality of another substantial
4- A limit the greatest use pace of reusing development squander was 25% of total weight (fine + coarse), the compressive strength was 19 Mpa, droop = 3 cm, which is feasible to make new cement utilized in better places:
- Blinding cement
- Sidewalks and walkways
- Concrete square industry
- An establishment for light establishments, for example, traffic signals and publicizing and lighting posts
- Other applications.
Keywords: *extreme of affecting, supplanting, construction squander, new concrete, properties of concrete.*

аннотацию :
обзор должен был решить наиболее экстремальные и пробные последствия повторного использования строительных отходов, таких как (кусочки глиняных блоков, плитки, стекла и часть старого бетона из-за разрушения рабочих) в качестве материала, заменяющего абсолютный вес общего (крупнозернистый и мелкозернистый) новый бетон в стадии разработки и изучается влияние на свойства бетона, такие как прочность на сжатие, удержание, полезность, соотношение в/ц за

счет использования альтернативного уровня разбавления (25, 50, 75, 100) % вытеснения от общего полного веса , использовались для приготовления смесей
Результаты показали, что:
1- Прочность на сжатие другого значительно увеличивается за счет уменьшения доли вытесняющих отходов развития после разрушения и смачивания.
2-Высокая скорость поглощения, так как чем выше уровень повторно используемых материалов, тем больше воды требуется для смешивания.
3-Низкая функциональность другого существенного
4- А предел наибольшей нормы использования повторного использования разрыхлителя составил 25% от общей массы (мелкий+крупный), прочность на сжатие 19 МПа, провисание = 3 см, что позволяет сделать новый цемент лучше утилизируемым:
- Ослепляющий цемент
- Тротуары и пешеходные дорожки
- Бетонная квадратная промышленность
- Установка для световых сооружений, например, светофоров и рекламно-осветительных постов
- Другие приложения.

Ключевые слова: крайняя степень воздействия, вытесняющий, строительные отходы, новый бетон, свойства бетона.

I. INTRODUCTION:

In light of the frightening depletion of natural resources on the planet, the need arose for many techniques through which the use of these resources is either reduced, reused, or recycled into other usable materials, whether in the same field from which they were taken or in another field. The products of building demolition are considered as a type of waste, and there are no global statistics on the amount of waste in the world and may contain waste resulting from building demolition, but it usually ranges from 20%-80% of the total amount of waste. The amount of waste generated from facilities and building demolition is estimated at 900 million tons annually in the United States of America, Europe, and Japan only, as shown in Table (1) [1]. This means directing attention to finding a way or ways to reduce the depletion of raw materials for the concrete industry, which will be in one of three ways: reducing the use of concrete; reusing the same concrete; and finally, concrete recycling

Table (1) Amount of waste per year in three main regions

Waste	Europe	United State	Japan
Construction and demolition waste	510	317	77
general waste	241	228	53

The issue takes on exceptional importance for countries that suffer from wars and crises that produce tons of construction and demolition waste as a result of bombing with various weapons, especially in Iraq and after 2003, The amount of rubble resulting from the demolition of old buildings and the increase in the construction area in various parts of the country under the absence of supervision and law, in the city of Mosul only, and after the end of the terrorist ISIS war in 2014, the amount of construction waste is estimated at (7-8) million tons, according to United Nations statistics [2].
We needed to think of sound solutions to such problems, it was found through studies that 80-90% of demolition waste, including concrete waste, can be recycled. As the concrete recycling process provides the following:

-Reducing the use of natural resources
-Reducing the cost of producing and transporting these raw materials
-Reducing materials that are transferred to landfills

II. PREVIOUS STUDIES:

- Regional studies indicate that Gulf countries collectively produce more than 120 million tons of waste annually, 5.18% of which is solid construction waste. For example, according to recent statistics conducted by Dubai Municipality, the percentage of construction and demolition waste constitutes 75% of the total 10,000 tons of public waste that the city produces daily, and demolition debris constitutes about 70% of this amount.
- The Kuwait's government has become aware of the problems caused by the remnants of the demolition of facilities. To reduce the area of land needed to put these wastes, the Government of Kuwait approved the Environmental Protection Industrial Company (EPIC). Start by constructing a construction waste recycling plant with a daily capacity of approximately 7-20 thousand tons of construction waste
- For the Kingdom of Saudi Arabia, a recycling plant was established in Jeddah, which has a sorting capacity of 1,200 tons per day, but this plant does not recycle any construction material. Support for the limited implementation of concrete recycling operations in the Kingdom has been called for by events such as the Chairman of the Founding Group of the Council Building Green Saudi, inviting municipalities in Jeddah and other cities to launch recycling plants.
- The United Arab Emirates is one of the most active countries in the Arabian Gulf region when we talk about concrete recycling applications. Dubai Central Laboratory has signed an agreement with the Emirates Recycling Authority and Dubai Municipality to study and evaluate construction demolition waste. Since these wastes are often neglected by contractors, the project aims to find useful applications for the use of construction debris. In Abu Dhabi, many Projects are related to green building and environmentally friendly building materials. As for the Emirate of Sharjah, it has had a share of these activities in the field of sustainable facilities. A new recycling plant was recently opened in the industrial area of Sharjah. Where this station receives concrete and other construction waste from various regions in the Emirates and treats them to be used again for construction purposes [3].
- In Japan, the land is used very effectively, and to avoid obtaining areas of land that contain waste, the Japanese have worked to recycle demolition waste. In 1981 a proposal for standards for the use of recycled aggregates from concrete was written by the contractors Building Society of Japan. Japan continued to invest extensively in recycling research.
(Ikeda and Fuji) (1988), Yamato, found that the bearing capacity of fully recycled aggregate concrete under compaction was about 7%-20% lower than that of conventional aggregate concrete [4].
- In 2004 Germany produced about 201 million tons of construction and demolition waste and about 89% of it was recycled. Table (2) shows the recycling rates in Germany [5].

Table (2) Percentages of construction and demolition waste recycling in Germany

Type of construction and demolition waste	reused or recycled %	Quantity Produced (2004)
Soil drilling	88%	128
Construction waste	91%	51
road works	99%	20
Other	-25%	2

Table (3), also shows the available information about the quantities of concrete that were recycled according to a report Construction Industry Monitoring (2007) In many countries of the world[6].

Table (3) Quantities of recycled concrete in various countries around the world. (2007)

Country	Total	Rotated	Rotated%
Australia	14	8	57
Belgium	14	12	86
Canada	N/A	8 (recycled concrete)	N/A
England	90	46	50-90
France	309	195	63
Germany	201	179	89
Ireland	17	13	80
Japan	77	62	80
Holland	26	25	95
Norway	N/A	N/A	50-70
Portugal	4	Minimal	Minimal
Spain	39	4	10
Switzerland	7 (incl.of concrete)	2	Near 100
Taiwan	63	58	91
Thailand	10	N/A	N/A
United State	317 (incl.155 of concrete)	127 (recycled concrete)	82

III. OBJECTIVES OF THE STUDY:

The study aims to reach clear results on the effect of concrete properties represented in its resistance to compression and properties that are related to its durabilities such as porosity and absorption rate when using different ratios as an alternative to the weight of aggregates (coarse and fine) which used in the concrete mixture and determination the maximum percentage ultimate's well as to promote and spread the reuse of concrete in Iraq and encourage research And development in this field, as advanced reuse systems for concrete and building demolition waste in countries around the world have proven the possibility of reaching highly effective products that help reduce costs and the impact on the environment.

IV. PRACTICAL PROGRAM:

Used materials:

a) cement:

Portland cement was used and it conforms to Iraqi specifications No. (5) for the year 1984, and it was stored well to preserve it from the influence of moisture.

Table (4) chemical analysis the ratios of the components of used cement and limits of the Iraqi Standart Specification No.5 of 1987 [7]

Compound Composition	Abbreviation	Percentage By Weight	Limits of Iraqi Specification No.5 / 1984
Silica (%)	SiO_2	22.04	–
Lime (%)	CaO	61.67	–
Alumina (%)	Al_2O_3	4.10	–
Iron Oxide (%)	Fe_2O_3	5.08	–

Sulfate	SO3	1.77	≤ 2.8%
Magnesia (%)	Mg	2.14	≤ 5%
Loss On Ignition (%)	L.O.I	1.99	≤ 4%
Lime Saturation Factor	L.S.F	0.86	0.66-1.02
Insoluble Residue (%)	I.R	0.60	≤ 1.5

b) fine aggregate:
Al-Ukhaidir sand, which conforms to the Iraqi specifications No. (45) for the year 1984[8]., was used, with a specific weight, salt content, and absorption equal to (2.64, 0.08, 0.17) respectively.

Table No.(5) Sieve analysis of fine aggregate

Sieve number (mm)	Passing %	Iraqi specifications No. (45) for the year 1984
4.75	99	90-100
2.23	87	75-100
1.18	76	55-90
0.6	47	35-59
0.3	18	8-30
0.15	6.4	1-10
0.075	1.2	0-3
fineness modulus 2.32		

c) coarse aggregate:
River gravel were used from Al-Nabai area, with a larger size, no more than (10) mm, and conforming to the Iraqi specification No.(45) for the year 1984 [8].

Table No.(6) Sieve analysis of coarse aggregate

Sieve number (mm)	Passing %	Iraqi specifications No. (45) for the year 1984
12.5	100	100
9.5	99	85-100
4.75	16	0-25
2.23	1.8	0-5
fineness modulus 2.48		

d) construction waste:
Construction waste resulting from the demolition of old buildings (pieces of clay bricks, tiles, glass and some of old concrete) as a materials replaces total weight of aggregate (coarse and fine) after crashing and wetting (Construction waste saturated with water for 24 hours and then surface dried with a thermal oven (surface saturated materials dry).
e) water:
Pure water is utilized in the curing and mixing of concrete.
f) concrete mixing:
The following table shows the main components of the reference mixtures used in the research and when replacing construction waste in different proportions (25, 50, 75, 100) % and as a substitute for part of the aggregate (coarse + fine).

Table No.(7) concrete mix details

mixing design	construction waste %	cement Kg/m³	Sand Kg/m³	Gravel Kg/m³	construction waste kg/m³		w/c Ratio	mixing ratios	Compressive strenght N/² mm		
					c.w/ sand	c.w/gravel			7	14	28
C0*	0%	3	6	12	-	-	42%	1:2:4	14	22	24
C25**	25%	3	4.5	9	1.5	3	42%	1:2:4	11	17	19
C50***	50%	3	3	6	3	6	70%	1:2:4	9	12	14
C75****	75%	3	1,5	3	4,5	9	80%	1:2:4	7	10	12
C100*****	100%	3	-	-	6	12	80%	1:2:4	5	7	8

C0*: standard mix
C25**: mixing with 25% construction waste
C50***: mixing with 50% construction waste
C75****: mixing with 75% construction waste
C100*****: mixing with 100% construction waste

V. PRACTICAL TESTS:

a) Concrete mix steps:

The following materials (cement, sand, gravel, construction waste) were mixed, then water was added to the mixer after that and the mixing continued for about 5 minutes until the concrete became homogeneous, then the molds were compacted after the metal molds were lubricated with oil. (15-30) seconds to get rid of air bubbles, then the surface was modified to concrete, and the models were left in the laboratory for about (24) hours, after which they were weighed and immersed in water until the age of the test. The models were tested according to ages, (7, 14, 28) days.

b) Compressive Strength:

Iron molds were used with dimensions (100 * 100 * 100) mm and according to the specification BS 1881 Part 116 – 83[8], The molds were painted for each group of models before the casting process, for an average of three cubes for each model in ages (7, 14, 28) days.

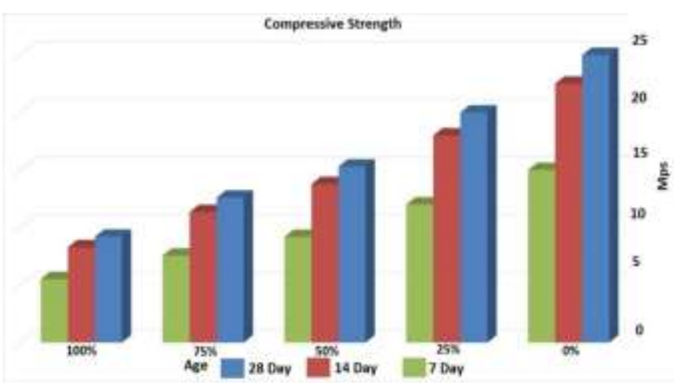

Figure (1): Compressive Strength Diagram

c) Total Absorption Test:

By using cubes (100 * 100 * 100) mm and according to the specification BS 1881 Part 122 – 1989 [9]., the total absorption was checked for all ages of concrete models (7, 14, 28) days.
As an average of three readings for each model, the total absorption is obtained from the following equation:

Total Absorption % = $\frac{W1-W2}{w1}$ *100%

Where,
W_1: Model wet weight rate, gr.
W_2 ; Model dry weight rate, gr.

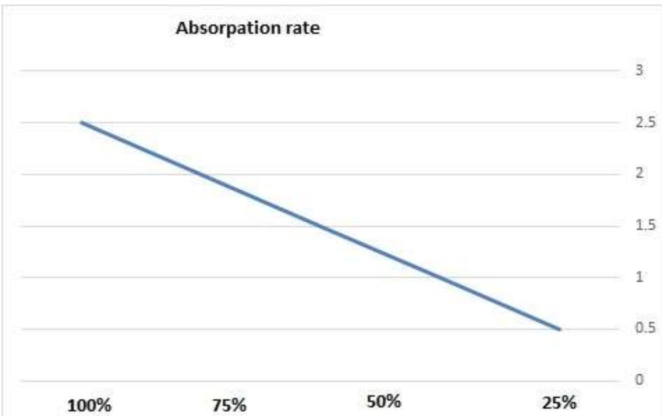

Figure (2): Diagram of the relationship between the percentage of aggregate and absorption

VI. DISCUSS THE RESULTS:

1- Effect of construction waste on concrete's compressive strength:
the effect of the different percentages of construction waste on the compressive strength of concrete at the age of (7, 14, 28) days, as shown in table (7) and figure (1) that by Increasing the construction waste, and this is due to the fact that the particles of the materials are weak and compressed, and that the compressive strength of concrete It will decrease because it affects the strength of other components of concrete. The voids are also increased by mixtures that contain construction waste, and this affects the compressive strength of concrete negatively.
2- Effect of construction waste on the absorption rate of concrete:
The increase in the total absorption ratio relative to the reference concrete, the new concrete (with 25, 50, 75, 100 %) of the construction waste, This percentage increases with an increase in the percentage of construction waste, this is due to the fact that the workability of new concrete is few.
Figure (2) shows the effect of the different percentages of construction waste on the absorption rate of concrete.

VII. CONCLUSION:

1- Recycling of construction waste negatively affects the compressive strength, reflects the decline in compressive strength relative to the reference concrete at the age of (28 days) was 20, 41, 50, 66% for the concrete recycling with (25, 50, 75, 100%) of the construction waste as a weight percentage of coarse aggregate (gravel), respectively.
2- An increase in the percentage of total absorption relative to the age of (28 days) is (0.5, 1.25, 2, 2.5 %) for the new concrete (25, 50, 75, 100 %) of the construction waste used, respectively.
4- Environmental benefits:
- Increasing environmental quality

- Reducing the exhaustion of main resources and raw materials by the utilization of building waste
- Minimize transportation volume by conducting on-site recycling.
- Creating high-value outputs for construction waste.

Recommendations:

Through the results of the research and access to studies and research related to the topic, we recommend the following:

1- A limitation the maximum utilization rate of recycling construction waste, the study showed that 25% of construction waste rate replacing aggregate weight (fine + coarse), the compressive strength was 19 Mpa, slump = 3 cm, which is possible to make fresh concrete used in different places:

- Blinding concrete
- Sidewalks and walkways
- Concrete block industry
- A foundation for light installations such as traffic lights and advertising and lighting poles

If want to enchance the compressive strength of concrete, then should think about chemical admixtures.

2- It is preferable to moisten construction waste (saturated dry surface) before using it in concrete mixtures.

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