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Economic and Environmental Impact of Construction and Demolition in Green Buildings: A Case Study of Jordan

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ABSTRACT

This study aims to examine the impact of construction and demolition in green buildings in Jordan. It discusses the benefits that might be achieved as a result of the adoption of the green building in the construction projects, executed by the construction sector. The study highlights the importance of the reduction in waste resulting from the construction works, saving in water, energy and natural resources, as well as, the positive effects on the environment. The study utilizes a descriptive methodology based on survey analytical methods. It explores the several advantages that have been achieved in applying the building method in the construction of the WHO organization's building at the economic and environmental levels. The study recommends taking several steps to activate the proposed incentives to support the adoption of the green building method by Jordanian construction companies, encouraging the engineering offices to consider the green building specifications in the design and the execution of building and the projects, increasing the awareness about the importance of the green building and its positive environmental effects. The study contributes to bridging the gap in the existing literature regarding energy savings and environmental benefits of construction and demolition in green buildings, which lacks applied research in developing countries. The results of this study are not limited to Jordan, but could easily be adopted by other developing countries.

Keywords: Green Building, Construction Works, Energy and Natural Resources, Jordan
JEL Classifications: Q42, Q51, Q56, Q57, O13

1. INTRODUCTION

In recent years, concerns about pollution prevention and preserving the environment have increased over the years because of the health hazards associated with irresponsible actions by the industrialized societies and cities. As a result, wastes from the different sectors including the construction sector became public health concerns. In the construction sector, materials, energy and water are key inputs for the construction projects, while wastes material and solid wastes are outputs. The huge amounts of wastes resulted from the construction activities and very serious negative impacts on the environment became very crucial and important to deal with in many of the developing countries. In many developing countries, construction wastes are illegally doming. This phenomenon has created the need to establish and formulate new approaches to reduce the amounts of wastes through the application of construction waste management practices. This study seeks to achieve the following objectives:

1. Highlighting the save that might be achieved from the adoption of the green building constructions
2. Identifying the extent to which the construction companies and institutions are able to use this strategy with the available technologies, skills, and experiences
3. Determining the positive effects of waste reduction and minimizing environmental pollution.

The building of the WHO in Jordan was the first building in the region to be awarded the leadership in energy and environmental design (LEED) certificate (rate V2.2). As a "green" building, the WHO premises were eligible for this certificate after receiving 42 points it qualified for a gold certificate (USGBC,

Table 1: Descriptive statistics for whole gravels of green building (WHO) construction, 2017 (in m³)

Whole gravels		Fine gravel	Medium gravel	Coarse gravel	Very coarse gravel	Mixed aggregate	Sand	Cobble
Valid		37	43	200	40	3	31	50
Std. Deviation		0	1.1756	0.4479	0	0.5774	1.1216	0
Variance		0	1.382	0.201	0	0.333	1.258	0
Range		0	1	2	0	1	3	0
Minimum		12	8	8	12	11	8	12
Maximum		12	12	14	12	12	11	12
Quartiles	25	12	12	12	12	11	11	12
	50	12	12	12	12	11	11	12
	75	12	12	12	12		11	12

All gravels were classified according to American Association of State Highway and Transportation Officials

Table 2: Fine, medium, coarse, and very coarse gravel (m³) during the construction of WHO in 2017

Soft gravel		Freq.	%	Valid %	Cumulative %
Valid - 12		37	8.9	100	100
Missing System		380	91.1		
Total		417	100		
Medium Gravel		**Freq.**	**%**	**Valid %**	**Cumulative %**
Valid	8	4	1	9.3	9.3
	12	39	9.4	90.7	100
	Total	43	10.3	100	
Missing system		374	89.7		
Total		417	100		
Coarse gravel		**Freq.**	**%**	**Valid %**	**Cumulative %**
Valid	8	2	0.5	1	1
	12	196	47	98	99
	14	2	0.5	1	100
	Total	200	48	100	
Missing system		217	52		
Total		417	100		
Very coarse gravel		**Freq.**	**%**	**Valid %**	**Cumulative %**
Valid - 12		40	9.6	100	100
Missing system		377	90.4		
Total		417	100		

Table 3: Mixed aggregate, sand, and cobble (m³) during the construction of WHO, 2017

Mixed aggregate		Freq.	%	Valid %	Cumulative %
Valid	11	1	0.2	33.3	33.3
	12	2	0.5	66.7	100
	Total	3	0.7	100	
Missing system		414	99.3		
Total		417	100		
Sand		**Freq.**	**%**	**Valid %**	**Cumulative %**
Valid	8	5	1.2	16.1	16.1
	11	26	6.2	83.9	100
	Total	31	7.4	100	
Missing system		386	92.6		
Total		417	100		
Cobble		**Freq.**	**%**	**Valid %**	**Cumulative %**
Valid - 12		50	12	100	100
Missing system		367	88		
Total		417	100		

2012). The building was designed, constructed and supervised by Jordanian and national firms. The building was designed by Amman-based firm engineering construction, which was responsible for the architectural, interior design, structural and electromechanical designs, preparation of tender documents, as well, services supervision. During the construction, the LEED engineer assessed when to periodically replace the gravel at the site as the gravel became less useful. Stockpiles were not accumulated during the initial excavation phase as the restrictions on site (due to space limitations) forced the removal of any stockpiles. The soil which we unearthed is unsuitable soil for backfilling purposes and its disposal was anyways necessary. The soil which we unearthed was also re-used by the Jordanian armed forces.

The WHO used a pipe of diameter 6 inches that periodically tested. During rainfall, the line was checked to ensure that it was indeed diverting water from the adjacent paved parking lot and that there were no leaks. There were stand-by pumps to ensure that continuous pumping of rainwater was diverted to the water tanks. The mechanical engineer was responsible for ensuring that the sump pit and the lines worked. Stored water was re-used for construction purposes. The structure consists of four floors. It was designed, built and occupied through the use of environmentally-friendly features, which is aimed to improve the efficiency of energy and water (22.5% and 60% respectively). This cause a reduction in the emissions of CO_2 and other Greenhouse gases (GHG), and refining the quality of indoor environments, resource conservation, as well, impact mitigation.

In response to the need to rationalize water consumption, particularly in Jordan the building was designed and constructed as a model for water use efficiency and conservation. It reduces water consumption rate by more than 60%, since it collects rainwater (300.250 m^3/yr), and water resulting from the intensification of air conditioners (200.150 m^3/yr) collected and stored in a separate water tank, to be used in toilets, bathrooms and watering garden plants with little water consumption of and general cleaning purposes. Sanitary waters include the building hydrants are powered by infrared sensors, and machine guns (showers) light flow, toilets and a double system of water flow. The building was designed and constructed design so the energy consumption is 22.5% less than standard buildings. Carbon dioxide CO_2 emissions from the building will be reduced by 75 tons per year. The total cost to create this green building is increased by only 4 % in order to enter the specifications companion healthy and environmentally friendly, which is expected to completely recover through energy savings alone in a period not exceeding 5 to 6 years.

Table 4: Descriptive statistics for whole gravels (in m³) of green building (WHO) construction, 2018

Whole gravels		Fine gravel	Medium gravel	Coarse gravel	Very coarse gravel	Mixed aggregate	Sand	Cobble	Powder
Valid		16	28	16	19	2	19	1	0
Std. Deviation		0	2.2678	3	0	0	0		
Variance		0	5.143	9	0	0	0		
Range		0	12	12	0	0	0	0	
Minimum		12	12	12	12	12	11	12	
Maximum		12	24	24	12	12	11	12	
Quartiles	25	12	12	12	12	11	12		
	50	12	12	12	12	11	12		
	75	12	12	12	12	11	12		

Table 5: Rubble (in m³) during the construction of WHO, 2018

Rubble	Freq.	%	Valid %	Cumulative %
Valid - 0.0123	0.012	0	100	100
Missing system	0	0		
Total	0.12	100		

2. REVIEW OF LITERATURE

Many studies addressed the issue of construction waste showed several negative effects on the environment, on the society and economy (Wang et al., 2008). For many developing countries it is time to create and adopt sustainable construction waste management to prevent and avert the dangerous negative effects (Nagapan et al., 2012). In the construction sector, waste can be formed in many ways including material, time and cost losses. Material waste is a physical construction waste that is generated from construction activities in the form of material waste like steel scrap, concrete leftover, debris and other scraps, (Poon et al., 2004). The traditional concepts about construction management of turning inputs to outputs had created the tremendous blame to this sector as the main contributor and root causes of many environmental problems and pollution (Nam and Tatum, 1988). One of the major elements of pollution is the increase of wastes in the through the contractions activities that leave behind them millions of tons of derbies worldwide either through dumping them in the rivers or seas or in nearby locations, that create the negative impact on the environment. It is a fact that the humans make what it takes to achieve their needs at fewer costs, for this reason, they manipulate the natural environment through building the infrastructure that suits this business or activities, adding to this the increased consumption of water and energy (DEFRA, 2011). This waste contributes to huge amounts of pollution and the emission of harmful gases like CO_2 and methane from the degradation of the wastes. One of the most dangerous effects of negative acts and trends that is observable these days that many natural areas are affected and severely damaged by construction activities. The result is destroying the ecological integrity because constructions require space and destroy natural resources while at the same generate wastes (EPHC, 1998).

Despite the positive contribution of the construction sector, the traditional methods of construction produce the negative and dangerous impact on the environment and the people's health from the wastes generates because of various construction activities and the excessive consumption of the natural resources (Shen et al., 2005). All of the shorts coming from the traditional construction methods are characterized by great amounts of natural resources depletion and large amounts of wastes, for these negative impacts, this sector considers the largest polluter of the environment, since there are many types of materials needed to be available to this industry. These materials range from sand, soil, aggregates, water, manufactured goods like cement, bricks, steel, iron, temper and other materials), the result of the increasing use of such materials generates wastes of different kinds and in large quantities that produce the negative effect on the environment (Firmawan et al., 2012).

Green buildings mean the structures that are energy and resource-efficient, environmentally friendly, comfortable and productive places to live and work in, (Yudilson, 2007). Due to the growing awareness of the public about the importance of the environmental issue, the green building has achieved more and more acceptances and became one of the most important strategies for achieving the sustainable expansion and growth. The green building pattern aims to achieve natural existing correspondence between the human and the environment through different many life cycle stages of the building because green building function extends beyond the construction sector to bring the effect and the influence to other sectors including market demands and buyer's requirements for good performing buildings, (Shi et al., 2014). Reducing the construction waste will minimize the greenhouse gas emissions as well as conserving the natural resources which regard as one of the main concerns in environmental that can be lightened by implementing green building solutions. This is in addition to a financial aspect to going green, as the decrease of using energy and water lead to lower utility bills. The benefit of green buildings from minimizing the annual operating costs and command higher rent and building is of more importance than non-green buildings, (Jones, 2018). Another recent study, for 8 BRI countries, revealed the main mechanisms of green energy projects that have an influence on the economy. The study demonstrated the method of green energy projects efficiency estimation. It concluded that China is the main driver for green energy proliferation in Asia, receiving economic benefits through its policy. The main findings are that the BRI green energy dissemination is just the first step to building a tightly interconnected Asian energy infrastructure and that the BRI least developed countries have less positive long-run effects from

Table 6: Descriptive statistics for whole gravels (measured in m^3) of WHO construction, 2017 and 2018

Whole gravels	Fine gravel	Medium gravel	Coarse gravel	Very coarse gravel	Mixed aggregate	Sand	Cobble	Rubble
Valid	53	71	216	59	5	50	51	0
missing	1231	1213	1068	1225	1279	1234	1233	0.0755
Std. Deviation	0	1.7228	0.9244	0	0.4472	0.9091	0	0
Variance	0	2.968	0.854	0	0.2	0.827	0	0
Range	0	4	4	0	1	3	0	0
Minimum	12	8	8	12	11	8	12	0.0253
Maximum	12	12	12	12	12	11	12	0.0253

Table 7: Rubble (m^3) during the construction of WHO, 2017 and 201

Rubble	Freq.	%	Valid %	Cumulative %
Valid - 0.0253	529	41.2	100	100
Missing system	755	58.8		
Total	1284	100		

green energy investment, while in short-term they get a boost for their economies, (Chernysheva et al., 2019).

Green building pattern requires additional costs. so, there will need to raise the consumer's awareness about the advantageous of the green building to be more willing to pay the costs related to the improvement of the buildings, and performance, (Zhang et al., 2012). The main objective of such studies is to develop the appropriate methods that might be able to assess such environmental negative impacts and how to deal with those effectively to achieve the desired goals such as air, water and notes pollution, within the project life cycle, (Masudi et al., 2011). Efforts were made in the last 20 years and devoted to achieving the needed improvements in the performance of the construction sector by focusing on the projects nature and understanding this nature, (Gonzalez et al., 2008). With the advancement in technologies that have the potential to produce green buildings, the construction companies will do better if they focus on the project management on the process and the practice in order to achieve the demands and the requirements to be tabled as green, (Wu and Low, 2010; Sedlacek and Maier, 2012).

For Jordan, there are few and different parties that are involved in green building. The Jordan Green Building Rating Council play a significant role, along with the other stakeholders for public and private sectors, in providing a clear roadmap of how Jordan will structure its own rating system. Greater Amman Municipality is the main second department involved in green building. It plays a major role in encouraging green buildings it proposed a system of incentives for green building projects of the Jordanian green building standards guide, (Tewfik and Ali, 2014). A more recent study that addressed Jordan's case, provided efficient means of enforcing green building in Jordan. It proposed an assessment tool of Energy Star Rating (ESR) scheme to explain its role for achieving sustainable development during buildings lifecycle and hence reducing energy and water usage. This scheme is based on integrating several factors including renewable energy technologies, water recourses, waste recycling and its management throughout the buildings' life cycle including its design, installation and operation, (Yakhlef et al., 2019).

3. METHODOLOGY

This study utilizes a descriptive methodology based on survey analytical methods. It includes journals, articles, reports, and studies conducted in different countries that have addressed the topic of green buildings, and benefit from the lessons and experiences learned from the adoption and accomplishment of green projects in different countries. The study also finds out how the green building philosophy is gaining a continuous acceptance and appreciation from different sectors, as well citizens, because of the valuable advantages that have been achieved from adopting and implementing this philosophy. Some of the advantages are the better waste management, reduction in the pollution which resulted in improving the health conditions, and the reduction in water and electricity consumption.

4. CLASSIFICATION OF THE GREEN BUILDINGS

The green buildings in the work guide were divided into four basic categories, which are Levels A, B, C, and D. Where level (A) has been classified as more green, and level (D) has been classified as less green. The objective of the Erosion and Sedimentation Control (ESC) plan in this work is to lower the pollution from construction activities in the WHO project site by the following procedures:

1. Prevent the soil loss during construction by a stormwater runoff on wind erosion
2. Prevent the sedimentation of downstream watercourses
3. Prevent the air and dust pollution and particular matter.

5. RESULTS AND DISCUSSION

5.1. Green and Non-green Buildings

The sample supplier was provided with different types of gravel for WHO. The study contains two parts: one for real and accurate values taken from Jordanian supplier of gravel, and it represents the best quantity amounts for each gravel type to standardize fully green building project. The other part contains real values for different gravel types form the same company but for non-green building similar in size to the case study of WHO. The building is for commercial offices and its located in Al Rabia district in Amman. Statistically, there are two experiments (green and non-green building), both contain data values. These values were analyzed for frequency output to see the best practice for green and non-green building gravel product standard amount.

Table 8: Descriptive statistics for whole gravels (measured in m³) of non-green building construction, 2017

Whole gravels		Fine gravel	Medium gravel	Coarse gravel	Very coarse gravel	Mixed aggregate	Sand	Cobble
Valid		417	417	417	417	417	417	50
Std. Deviation		0	0	0	0	0	0	0
Variance		0	0	0	0	0	0	0
Range		0	0	0	0	0	0	0
Minimum		10	11	9	8	4	6	12
Maximum		10	11	9	8	4	12	12
Quartiles	25	10	11	9	8	12	12	12
	50	10	11	9	8	12	12	12
	75	10	11	9	8	12	12	12

Table 9: Valid values for all types of gravels of non-green building construction, 2017

Gravel type	Valid value
Fine gravel	10
Medium gravel	11
Coarse gravel	9
Very coarse gravel	8
Mixed aggregate	4
Sand	6
Rubble	7

5.2. WHO Green Buildings Analysis

Table 1 provides descriptive statistics regarding the data during the construction of WHO in 2017. The results in the above table shows the followings:

1. The values related to the gravels above for deviation and variances have a maximum value of 2 and a minimum value of 0, these values represent the standard for green building gravels quantity
2. The data in the above table was collected directly from the contractor and from accurate invoices for gravel. It represents the range value for gravel above mean, and the lower range values mean we bought the exact quantity we need
3. Minimum and maximum values are connected with valid frequency, which found of value 12 in green building standard studies. Minimum and maximum range value in green building is between 12 and 14.

The frequency for each gravel types (fine gravel, medium gravel, coarse gravel, very coarse gravel, etc.) measured in cubic meters during the build of WHO in 2017 are shown, in Table 2:

Table 3 shows that the valid frequency for soft, medium and very coarse gravel (m³) is 12 (mean maximum quantity). It shows that the maximum quantity of soft (m³) is 12. It matches the maximum frequency, which means that this is the accurate quantity needed from a soft, medium and very coarse gravel (m³) in green building. Table 3 also shows that the valid frequency of coarse gravel (m³) is 14. It shows that the maximum quantity of coarse gravel (m³) is 12. It matches the maximum frequency, which means that this is the accurate quantity needed from coarse gravel (m³) in green building. Table 3 shows that the valid frequency for mixed aggregate and cobble (m³) is 12. It shows that the maximum quantity of mixed aggregate (m³) is 12. It matches the maximum frequency which means that this is the accurate quantity needed from mixed aggregate and cobble (m³) in green building.

Table 4 shows that the valid frequency for sand (m³) is 11 while the maximum quantity of sand (m³) is 11. It matches the maximum frequency which means that this is the accurate quantity needed from sand (m³) in green building. The frequency tables for each gravel types (fine, medium, coarse, very coarse, mixed aggregate, sand, cobble, and rubble) measured in (m3) during the construction of WHO in 2018 are found same as those for Tables 2 and 3. It showed that the maximum quantity of fine gravel, medium gravel, coarse gravel, mixed aggregate, sand, cobble (m³) is 12. It matches the maximum frequency which means that this is the accurate quantity needed from cobble (m³) in green building.

Table 5 shows that the valid frequency for rubble is 0.0123 which means very low per cent; this is a valid quantity for green building.

The same analysis is used for the years 2017 and 2018. It shows that the maximum quantity of fine gravel, medium gravel, coarse gravel, very coarse gravel, mixed aggregate, and, cobble (m³) is 12, while it was 11 m³ for sand. It matches the maximum frequency which means that this is the accurate quantity needed in (m³) in green building, as shown in Table 6.

Table 7 shows that the total rubble for the whole construction period (2017 and 2018) is very low at 0.0253. The very little value of rubble means that this is the best value of rubble in terms of the green value.

5.3. Non-green Building Analysis

Table 8 provides descriptive statistics for the major indicators for whole gravels of non-green building construction, during the construction of the non-green building in 2017. The major findings can be summarized as follows:

- Green building 2017 and 2018 valid frequency values for most gravel is 12, which means that this is the standard value for green building-related for gravel study
- Green building 2017 and 2018 valid frequency value for rubble is 0.0253, which means a very low quantity in rubble gravel; this is a high-level standard of clean green building close to free rubble
- Green building standard showed a decrease in the cost, budget, time, and efficiency taken in the construction of this kind of building
- Green building standard will raise the upcountry standard, modelling of building style, size
- Green building helps the country to have its own standard and model to be exported to other countries models and experiences.

Table 10: Full statistics table for whole gravels (measured in m^3) of non-green building construction in 2018

Whole gravels		Fine gravel	Medium gravel	Coarse gravel	Very coarse gravel	Mixed aggregate	Sand	Cobble	Powder
Valid		111	111	111	111	111	111	111	111
Std. Deviation		0	0	0	0	0	0	0	0
Variance		0	0	0	0	0	0	0	0
Range		0	0	0	0	0	0	0	0
Minimum		10	11	9	7	6	4	12	9
Maximum		10	11	9	7	6	4	12	9
Quartiles	25	10	11	9	7	6	4	12	9
	50	10	11	9	7	6	4	12	9
	75	10	11	9	7	6	4	12	9

Table 11: Valid values for all types of gravels of non-green building construction in 2018

Gravel type	Valid value	Gravel type	Valid value
Fine gravel	10	Sand	4
Medium gravel	11	Cobble	11
Coarse gravel	9	Powder	9
Very coarse gravel	7	Rubble	9
Mixed aggregate	6		

Table 8 also shows that the values related to the gravels above for deviation and variances have a maximum value of 0 and a minimum value of 0, these values represent the standard for non-green building gravels quantity. It also shows that range value for gravel above the mean related to real and accurate invoices. Rubble values quantity has a very high mean in this building which is out of green building standard.

The frequency tables for each gravels type (fine, medium, coarse, very coarse), mixed aggregate, sand, and cobble measured in cubic meters for a non-green building as a sample building similar to the WHO in 2017. The frequency for all types of gravels of non-green building construction in 2017 is of value 417, while it is 100% for per cent, valid per cent, and cumulative per cent. The difference was in the Valid Value which is shown in Table 9 for non-green building construction in 2017. Table 9 shows that the valid value for rubble (m^3) is 7. It means a high quantity of rubble for gravel and leads to the conclusion that this is not a green building.

The full statistics table for whole gravels values of the range, standard deviation, variance, minimum, maximum and quartile for the non-green building in 2018, is shown in Table 10. The table shows that the frequency for each gravels type (fine, medium, coarse, very coarse), mixed aggregate, sand, cobble, and powder. measured in cubic meters for a non-green building as a sample building are similar to the WHO.

The frequency for all types of gravels of non-green building construction in 2018 is of value 111, while it is 100% for per cent, a valid per cent, and cumulative per cent. The difference was in the Valid Value which is shown in Table 11 for non-green building construction in 2018. The valid frequency for rubble (m^3) is 9. This means a high quantity of rubble for gravel, as well as means that this is not the green building.

The frequency table for each gravel type (fine, medium, coarse, very coarse), mixed aggregate, sand, cobble, and rubble measured in cubic meters for a non-green building as a sample building similar to the WHO in 2017 and 2018 are shown in Table 12.

Table 13 shows that the amount of rubble for both 2017 and 2018 is 9.5. This very high value is not normal for green buildings, while it is a normal value in non-green buildings.

6. CONCLUSION

The problem of the study comes from the increasing concerns about the environmental pollution resulted by the constructions and the need for reducing the consumption of the natural resource and the wastes generated from the new trends towards the adoption of the green building strategies. The effect of green buildings in reducing the construction waste, which becomes an important and critical problem in Jordan is discussed. In addition, the study of the influence of the reduced construction waste after 2 years of implementation to the green building of WHO in Jordan, is taken as a case study.

The statistical calculations in this study show that the valid maximum values for most gravel are 12 m^3 for the case of green buildings construction in 2017 and 2018, which is regarded as the standard value for green buildings related to gravel (i.e. correct values for gravels to build a building in green mode). These correct quantities for gravels valid frequencies help us to standardize quantities, the quantity of rubble for whole gravels. It also shows that in the case of green buildings construction, the valid frequency for rubble is 0.253 m^3, which means a very low quantity in rubble gravel; this is regards as a high-level standard of clean green building, which is close to free rubble. The results also showed that the valid maximum values for most gravel are 12 m^3, which regarded as the standard value for green buildings related to gravel (i.e. correct values for gravels to build a building in green mode). These correct quantities for gravels valid frequencies help us to standardize quantities, the quantity of rubble for whole gravels. The results also showed that the green building mode is more efficient in the cost, budget, time, and efficiency taken in the construction of this kind of building.

For the case of non-green buildings construction, the statistical calculations in the study show that valid frequency for rubble (m^3) is 7. This means a high quantity of rubble for gravel and leads to the conclusion that this is a no green building case. The non-green building rubble quantities are found very high in each year; help us to know other gravels increase quantities. It also shows that; the non-green building rubble quantities is very high in each year; which

Table 12: Descriptive statistics for whole gravels (measured in m^3) of non-green building construction in 2017 and 2018

Whole gravels	Fine gravel	Medium gravel	Coarse gravel	Very coarse gravel	Mixed aggregate	Sand	Cobble	Rubble
Valid	417	417	417	417	417	417	50	9.6
Missing							367	11
Std. Deviation	0	0	0	0	0	0	0	11.6405
Variance	0	0	0	0	0	0	0	11.691
Range	0	0	0	0	0	0	0	9.8
Minimum	10	11	9	8	4	6	12	8.7
Maximum	10	11	9	8	4	6	12	9.5

Table 13: Gravel type of rubble (m^3) during the construction of the non-green building in 2017 and 2018

Gravel type of rubble		Freq.	%	Valid %	Cumulative %
Valid	4.7	313	75.1	75.1	75.1
	7	54	12.9	12.9	88
	9.5	50	12	12	100
	Total	417	100	100	

helps us to know other gravels increase quantities. This means that the non-green building rubble results in high cost, and loss of time.

From previous analysis or the whole cases, one can conclude the followings:

- The valid frequency range for gravels in green buildings mode is between 12-14 (minimum and maximum). This means that these values are corrected for gravels to build a building in green mode. These correct quantities for gravels valid frequencies help us to standardize these quantities for whole gravels in each year, specifically those of rubble
- Green building mode is more efficient for time and cost
- Based on gravels increase quantities in non-green building, the rubble quantities is very high in each year
- Non-green building rubble resulted in high cost and loss of time.

Finally, the study shows the needs to promote a green community and awareness, by enforcing building codes. It also shows how the green building helps the country to have its own standard and model to be exported to other countries models and experiences.

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