

FACTORS AFFECTING INCREASING WASTE IN GAZA STRIP CONSTRUCTION SITES

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Abstract— Waste has been recognized as a major problem in the construction industry. Not only does waste have an impact on the efficiency of the construction industry but also on the overall economy of the country. The main objective of this study is to identify the main waste causes in Gaza Strip construction industry.

The current research primarily employed the method of questionnaire surveys to collect the required data. Following a thorough literature review and structured interviews with professionals who have work experience in the field of construction in Gaza Strip. Comprehensive list of factors were identified and categorized into five groups with total thirty- five factors. Then, eighty- four questionnaires were distributed to contracting companies working in the field of construction projects in Gaza Strip.

This study focused on material waste in construction sites in Gaza strip including building work. A statistical analysis was conducted to calculate mean, standard deviation (SD) and standard error (SE) for each factor. The results were accepted when the value of the standard error is less than 0.2. A comment on the results that have been reached is shown in order to illustrate the extent of the impact of those factors on increasing waste on construction projects in Gaza Strip.

Index Terms— Construction projects, Gaza Strip construction industry, Waste construction, factors.

1. INTRODUCTION

The increasing quantities of waste have created a bad image for the construction industry. In addition, an ineffective planning and control of materials on sites could lead to poor performance and undesirable project outcomes [1]. Nevertheless, the economic impact, contributions to employment and the benefits of investment in construction industry are very enormous.

Construction activity forecasts the general direction of an economy and for this reason the industry is often described as a leading economic sector. According to Horvath (1999), the construction industry is one of the largest and most important industries, being at the same time the main consumer of natural resources and one of the largest polluters.

Construction material contributes significantly to the cost of construction project; therefore, material wastage has adverse impact on construction cost, contractor's profit margin, construction duration and can be a possible source of dispute among parties to a project [2]; Fellows, Langford and Newcombe, 2002) [3].

The cost of material waste generated on building sites represents avoidable cost in construction which can either be eliminated or reduced. Hoe (2005) stated that the extent to which waste can be prevented in the construction industry has been a long-debated issue [4].

Whereas it is impossible to completely eliminate all wastage, the concern should be how practices in the local industry can be managed to minimize waste.

The main objective of this study is to identify the

main waste causes in Gaza Strip construction industry in order to establish an initial framework for future studies to develop methods for prevention and elimination of waste causes inherent in the construction process. The objectives of this research have been achieved through eighty- four questionnaires received from construction firms operating in Gaza Strip. Enshassi (1996) found from a study of 86 housing projects in the Gaza strip that the materials losses resulting from direct and indirect wastes were about 3.6–11%, which was significantly higher than the values that were normally allowed (2–4.5%) [5].

2. METHODOLOGY

A quantitative approach is selected to determine the importance of the factors which affect the causes of materials waste in construction projects in Gaza Strip. In this research, site visits, structured questionnaire, interviews and literature research related to the construction industry used for data gathering. This study has been conducted to show the degree of influence of 35 factors divided into five groups, namely, On Site practice group, Materials handling group, materials/ transportation group, site management group, site supervisor group. These factors have been selected by a careful review of literature and previous researches in the field of waste in construction. The population of this study includes contracting companies of first, second and third category that have a valid

registration by Palestinian Contractors Union (PCU) in Gaza Strip. The target population was distributed between three levels of contracting companies: the first class has 34 companies; the second class has 21 companies; the third class has 29 companies. A statistical analysis was conducted to calculate mean, standard deviation (SD) and standard error (SE) for each factor.

3. RESULT AND DISCUSSION

3.1 WORK EXPERIENCE OF RESPONDENT

Figure 1 shows that 94% of contracting companies are involved mainly in construction building works, while 6% of them are involved secondarily in building works. This gives a high confidence in the quality of answers, because the study involved building construction projects.

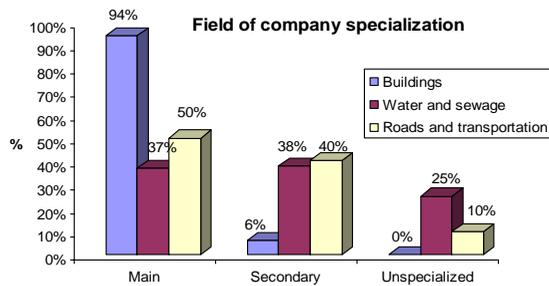


Fig. 1: Field of company specialization

3.2. FACTORS OF CAUSING MATERIAL WASTE

In this part, the respondents were asked to identify the main causes of material waste.

3.2.1 Main group

The questionnaire of this study considered 35 factors which cause material waste in construction, and those factors were distributed into five groups, namely, on site practice; materials handling; material transportation; site management; and Site supervision. Figure 2 gives the result of a collected data, namely, causes of materials waste and illustrates the mean and ranking of each group. The survey revealed that the site supervisor group is the major causes of materials waste with mean 4.59 and highest ranking, while the lowest mean 3.16 is for onsite practice group.

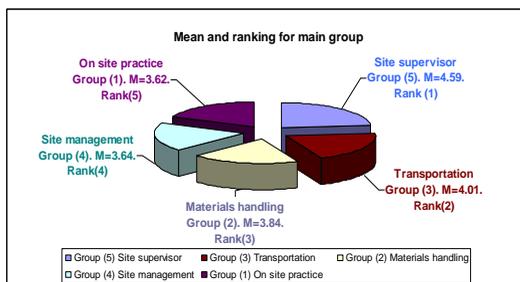


Fig. 2: Mean and ranking for main group

3.2.3 Mean and ranking of On Site practice group (G1)

The mean of each of the sub-factors of the On Site practice group which causes materials waste are presented in Table (1) in a descending order. Rank of each factor is also listed. "Materials damage on site; improper cutting of materials; manufacturing defects" had the highest means 4.26, 3.915, and 3.790 respectively. While "lack of materials (due to closure); burglary, theft and vandalism; over sizing structural elements during execution" had the lowest rank with means 2.74, 3.42 and 3.50 respectively.

Table 1
Mean and ranking of On Site practice (G1)

Factor	Mean	Rank
Materials damage on site.	4.263	1
Improper cutting of materials.	3.915	2
Manufacturing defects.	3.79	3
Poor quality of materials.	3.765	4
Existence of unnecessary materials on site.	3.69	5
Overproduction/Production of a quantity greater than required or earlier than necessary.	3.638	6
Lack of onsite materials control.	3.615	7
Poor storage of materials.	3.541	8
Using excessive quantities of materials.	3.514	9
Over sizing structural elements during execution.	3.501	10
Burglary, theft and vandalism.	3.417	11
Lack of materials (due to closure).	2.742	12

The result in Table (1) shows that "materials damage on site" factor was ranked in the first position with mean value 4.263. It was ranked in the fourth position among the ten factors that caused material waste at materials/on site factors group done by Al-Moghany study [2]. It was also ranked in the first position among the thirty five factors that caused material waste, see Table 6. And, the results showed that "lack of materials due to closure" was ranked as the lowest factor which increasing waste with mean value 2.742, but this factor was ranked in the ninth position with mean value 3.33 by Al-Moghany study [2].

3.2.4 Mean and ranking of Materials handling group (G2)

Table 2 shows the mean of each of the sub-factors of the materials/ handling group which causes material waste in a descending order. Rank of each factor is also listed. Improper handling of materials on site with mean 3.975 had the highest ranking. And insufficient instructions about handling mate-

rials on site with mean 3.701 had the lowest rank.

The results in Table 2 showed that “Improper handling of materials on site” factor was ranked in the first position with mean value 3.975. It was also ranked in the third position among the thirty five factors that caused material waste (Table 6). This problem is due to lack of training, lack of manuals for dealing with materials at the construction sites, and insufficient instructions about handling materials on site.

Table 2

Mean and ranking of Materials handling group (G2)

Factor	Mean	Rank
Improper handling of materials on site.	3.975	1
Duplication of transporting material on site.	3.854	2
Insufficient instructions about handling materials on site.	3.701	3

3.2.5 Mean and ranking of materials/ transportation group (G3)

Table 3 shows the mean of each of the sub-factors of the materials/ transportation group which cause materials waste in a descending order. Rank of each factor is also listed. The results in Table 3 showed that “Improper materials” factor was ranked in the first position with mean value 4.156. It was also ranked in the second position among the thirty five factors that caused material waste as shown in (Table 6).

The results in Table 3 showed that “storing materials in faraway stores” factor was ranked in the second position with mean value 3.863. It was also ranked in the sixth position among the thirty five factors that caused material waste as shown in (Table 6).

Table 3

Mean and ranking of materials/ transportation group (G3)

Factor	Mean	Rank
Improper materials.	4.156	1
storing materials in faraway stores	3.863	2

3.2.6 Mean and ranking of site management group (G4)

The mean of each of the sub-factors of site management group which causes materials waste are presented in Table 4 in a descending order. Rank of each factor is also listed. “Poor qualification of the contractor’s technical staff assigned to the project; shortage of technical professionals in the contractor’s organization; lack of material and time waste management plan” had the highest means 3.878, 3.782 and 3.775 respectively. While “Lack of a quality management system aimed at waste minimization; providing project team with insufficient information; contractors’ slowness in taking decisions” had the lowest rank with means 3.415, 3.516 and

3.564 respectively.

The results in Table 4 showed that “poor qualification of the contractor’s technical staff assigned to the project.” Factor was ranked in the first position with mean value 3.878. It was also ranked in the fifth position among the thirty five factors that caused material waste (Table 6).

Lack of supervision and poor qualification of the contractor’s technical staff was identified as variables that had detrimental effect when they occurred [6].

Alwi et al. (2002) considered the lack of supervision as a major factor causing waste in construction projects, and was ranked in sixth position in group (1), human resource category [6].

Table 4

Mean and ranking of site management group (G4)

Factor	Mean	Rank
Poor qualification of the contractor’s technical staff assigned to the project.	3.878	1
Shortage of technical professionals in the contractor’s organization.	3.782	2
Lack of material and time waste management plan.	3.775	3
Ineffective control of the project progress by the contractor.	3.692	4
Poor site layout.	3.626	5
Delay in project commencement.	3.578	6
Contractors’ slowness in taking decisions.	3.564	7
Providing project team with insufficient information.	3.516	8
Lack of a quality management system aimed at waste minimization.	3.415	9

3.2.7 Mean and ranking of site supervisor group (G5)

The mean of each of the sub-factors of site management group which causes materials waste are presented in Table 5 in a descending order. Rank of each factor is also listed. “Suspension of work by the owner; poor control of supervision and delay in giving instructions; change orders” had the highest means 3.741, 3.707 and 3.627 respectively. While “Owner’s delay in handing over the site to the contractor; poor coordination and communication among the consultant, the owner and the contractor; slow response from the consultant team to contractor inquiries” had the lowest rank with means 3.441, 3.45 and 3.463 respectively. The results in Table 5 showed that “Suspension of work by the owner” factor was ranked in the first position with mean value 3.741. It was also ranked in the twelfth position among the thirty five factors that caused material waste (Table 6). Al Mogany (2006) mentioned that suspension of work by the owner was ranked in fifth position among ninety-two factors that caused material waste [2].

The results showed that “Owner's delay in handing over the site to the contractor ” was ranked as the lowest factor which increasing waste with mean value 3.441, but this factor was ranked in the seventh position with mean value 3.03 at [2]. Al-Khalil ,etal (1999) mentioned that delay to deliver the site to the contractor by the owner was ranked in twenty-sixth position among sixty factors which cause waste and project delay [1] .

Table 5
Mean and ranking of site supervisor group (G5)

Factor	Mean	Rank
Suspension of work by the owner.	3.741	1
Poor control of supervision and delay in giving instructions.	3.707	2
Change orders.	3.627	3
Poor cooperation of the owner towards settling contractors payments and claims	3.641	4
Delay in performing inspection and testing by the consultant team.	3.565	5
Poor qualification of consultant engineer's staff assigned to the project.	3.517	6
Slow response from the consultant team to contractor inquiries.	3.463	7
Poor coordination and communication among the consultant, the owner and the contractor.	3.45	8
Owner's delay in handing over the site to the contractor.	3.441	9

3.3 OVER-ALL RANKS OF ALL FACTORS CAUSING MATERIAL WASTE

Table 6 outlines the factors causing material waste in descending manner. It indicate that the highest five factors are “Materials damage on site; Improper materials; Improper handling of materials on site; Improper cutting of materials; Poor qualification of the contractor’s technical staff assigned to the project ” with mean ranks 4.263, 4.156, 3.975, 3.915, and 3.878 respectively.

It has been noticed that the “Poor coordination and communication among the consultant; the owner and the contractor; Owner's delay in handing over the site to the contractor; Burglary, theft and vandalism; Lack of a quality management system aimed at waste minimization; and lack of materials (due to closure) are the lowest five factors that causing materials waste with mean ranks 3.45, 3.441, 3.417, 3.415 and 2.742.

Table 6
Mean and rank of over-all factors causing material waste

Factor	Group No.	Mean	Rank
Materials damage on site.	G1	4.263	1
Improper materials.	G3	4.156	2
Improper handling of materials on site.	G2	3.975	3
Improper cutting of materials.	G1	3.915	4
Poor qualification of the contractor's technical staff assigned to the project.	G4	3.878	5
storing materials in faraway stores	G3	3.863	6
Duplication of transporting material on site.	G2	3.854	7
Manufacturing defects.	G1	3.79	8
Shortage of technical professionals in the contractor's organization.	G4	3.782	9
Lack of material and time waste management plan.	G4	3.775	10
Poor quality of materials.	G1	3.765	11
Suspension of work by the owner.	G5	3.741	12
Poor control of supervision and delay in giving instructions.	G5	3.707	13
Insufficient instructions about handling materials on site.	G2	3.701	14
Ineffective control of the project progress by the contractor.	G4	3.692	15
Existence of unnecessary materials on site.	G1	3.69	16
Poor cooperation of the owner towards settling contractors payments and claims	G5	3.641	17
Overproduction/Production of a quantity greater than required or earlier than necessary.	G1	3.638	18
Change orders.	G5	3.627	19
Poor site layout.	G4	3.626	20

Factor	Group No.	Mean	Rank
Lack of on site materials control.	G1	3.615	21
Delay in project commencement.	G4	3.578	22
Delay in performing inspection and testing by the consultant team.	G5	3.565	23
Contractors' slowness in taking decisions.	G4	3.564	24
Poor storage of materials.	G1	3.541	25
Poor qualification of consultant engineer's staff assigned to the project.	G5	3.517	26
Providing project team with insufficient information.	G4	3.516	27
Using excessive quantities of materials.	G1	3.514	28
Over sizing structural elements during execution.	G1	3.501	29
Slow response from the consultant team to contractor inquiries.	G5	3.463	30
Poor coordination and communication among the consultant, the owner and the contractor.	G5	3.45	31
Owner's delay in handing over the site to the contractor.	G5	3.441	32
Burglary, theft and vandalism.	G1	3.417	33
Lack of a quality management system aimed at waste minimization.	G4	3.415	34
Lack of materials (due to closure).	G1	2.742	35

4. CONCLUSIONS

The construction industry has been found to be a major generation of waste. This study focused on material waste in construction sites in Gaza strip including building work, it also identified the major causes of waste in construction sites and resented a comprehensive analysis of these causes.

A questionnaire-based survey was used to elicit the attitude of contracting companies towards major factors which causes waste in Gaza Strip construction sites and resented a comprehensive analysis of these causes. 84 questionnaires were distributed between three levels of contracting companies: the first class has 34 companies; the second class has 21 companies; the third class has 29 companies.

The respondents were asked to indicate the degree of

influence of 35 factors which increasing waste divided into five groups, namely, On Site practice group, Materials handling group, materials/ transportation group, site management group, site supervisor group.

The results indicated that materials damage on site, improper materials, improper handling of materials on site, improper cutting of materials and poor qualification of the contractor's technical staff assigned to the project are the highest factors which cases increasing waste in construction sites in Gaza Strip.

Also, the results indicated that lack of materials (due to closure), lack of a quality management system aimed at waste minimization, burglary, theft and vandalism, owner's delay in handing over the site to the contractor and poor coordination and communication among the consultant, the owner and the contractor are the least factors affecting increasing waste on Gaza Strip construction sites.

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