Attitudes and Perceptions of Construction Workforce on Construction Waste in Sri Lanka

Introduction and Background to the Study

The amount of construction output is increasing rapidly in most of the countries resulting in a corresponding increase in the utilization of natural resources. Holm (1998) argues that approximately 40% of the produced materials are utilized in buildings and construction work. Further, the construction industry consumes 25% of virgin wood, and 40% of the raw stone, gravel, and sand used globally in each year. Ganesan (2000) states that materials account for the largest input into construction activities, in the range of 50% - 60% of the total cost. In addition, a wide variety of materials are used in the construction industry. Unfortunately, this large portion of materials is not efficiently utilized by the industry. Evidence shows that, approximately 40% of waste generated globally originates from construction and demolition of buildings (Holm, 1998) and this has taken a major portion of the solid waste discarded in landfills around the world. For instance, in the USA it is approximately 29% (Bossink and Brouwers, 1996) and in Australia 44% of landfills by mass (McDonald, 1996).

Further, research indicates that 9% of the totally purchased material end up as waste (by weight) and every single material from 1% to 10% contributes to the solid waste stream of the site (Bossink and Brouwers, 1996). Many researchers have shown that there is a positive correlation between the waste prevention and the environmental sustainability (Federle, 1993; Lingard et al, 2001).

Construction & demolition waste have become a burden to clients, as they have to bear the costs of waste eventually (Skoyles and Skoyles, 1987). Cost on waste blunts the competitive edge of contractors, making their survival more difficult in the competitive environment (Macozoma, 2002). CIRIA (1995, cited in Teo and Loosmore, 2001) estimate that companies

that produce a higher level of wastage are at a 10% disadvantage in tendering. Thus, Alwis et al (2003) argues that construction waste can significantly affect the performance and productivity of the organisation. Moreover, generation of waste is a loss of profits for the contractors due to extra overhead cost, delays and extra work on cleaning, lower productivity etc. (Skoyles and Skoyles, 1987).

Construction waste is also a cost to the environment that threatens its resilience. The unavailability of dumping sites to accommodate the higher volumes of debris from construction sites is becoming a serious problem (Chan and Fong, 2002) and there may be a day that restrictions are imposed on construction waste disposal.

The above context illustrates the problems associated with construction waste. Improving the quality and efficiency of the construction industry is highlighted by Egan (1998) where, one way of achieving this target is stated as reduction of waste at all stages of the construction process. Further, the report "Better Public Buildings" (DCMS, 2002) identifies measuring efficiency and waste as one of the priority areas for the industry to improve its performance. Thus, it can be seen that, construction waste management has become an important area to improve the performance of the industry in terms of economic, quality, sustainability aspects. Accordingly, this paper reports the findings of a survey carried out in Sri Lanka to evaluate the attitudes and perceptions of construction workforce towards waste management practices. The next section describes construction waste with particular reference to the Sri Lankan context and with a literature review on the origins of construction waste and attitudes of construction workforce. This is followed by the research methodology. The paper concludes with the findings of the survey and a discussion based on that.

Construction Waste

Even though across the world, there is widespread recognition of the importance of moving towards sustainability, the construction industry is "notorious for producing huge amounts of construction and demolition waste" (Kwan et al, 2003). The Building Research Establishment (1982, cited in Skoyles and Skoyles, 1987) defines construction waste as the difference between the purchased materials and the used in a project. According to Hong Kong Polytechnic (1993) construction waste is the "by-product generated and removed from construction, renovation and demolition work places or sites of building and civil engineering structures". Further, construction waste has been defined as "building and site improvement materials and other solid waste resulting from construction, re-modeling, renovation, or repair operations" (Harvard Green Campus Initiative, 2004).

Although, resource optimization is one of the main objectives of any organization, less attention is paid on construction waste minimisation even though it has a great contribution to the aforesaid objective. This is due to the perception regarding waste which "has no value and which the junkman can take away" (Leenders et al., 1990). However, it can be argued that construction waste does not fall under this definition, as it is has a residual value and is avoidable.

Construction waste in the context of Sri Lankan construction industry

Cost of waste has a significant impact to the Sri Lankan construction industry. Thus, a number of studies have been carried out in this context. According to Jayawardane (1994), concrete and mortar showed 21% and 25% of wastage respectively due to the excess use of materials in rectification of inaccuracies. Even though it has been identified that minimisation of waste to a certain extent is unavoidable (Skoyles and Skoyles, 1987), Jayawardane (1994) states that the wastage of materials in most of the construction sites in Sri Lanka is beyond the acceptable limits. This fact has been further proven by the study carried out by

Rameezdeen and Kulatunga (2004) which is shown in Figure 1. The Box plot indicates the spread of wastages of materials and their mean values as Sand (25%), Lime (20%), Cement (14%), Bricks (14%), Ceramic Tiles (10%), Timber (10%), Rubble (7%), Steel (7%), Cement Blocks (6%), Paint (5%) and Asbestos Sheets (3%).

Take in Figure 1

Origins of Construction Waste

Construction waste stems from construction, refurbishment, and repairing work and can emerge at any stage of a project from inception to completion. Generation of the stream of waste is influenced by various factors. Gavilan and Bernold (1994) classify the causes of waste into six categories as design, procurement, handling of materials, operation, residual related, and other. As waste barricades the efficiency, effectiveness, value, and profitability of the construction activities, there is a need to identify the causes of waste generation and to control it within reasonable limits. Ekanayake and Ofori (2000) have classified the causes of waste under four major categories as shown in Table I.

Take in Table I

The construction industry is labour intensive; thus, activities initiating from the inception to completion of a project are backed up by the human component. It can be argued that, a majority of the aforementioned causes of waste have been directly or indirectly affected by the attitudes and perceptions of the personnel involved in the construction industry. Accordingly, the human factor involved during the pre contract stage has a significant influence towards the prevention of waste. Ekanayake and Ofori (2000) identify the “design change” during the construction project as the most significant cause for the generation of site waste. Awareness about the waste generation factors and the attitudes of designers can help to minimise the generation of waste that originates from “design” cause. For instance, proper

identification of client's requirements, proper detailing of the documents etc. can avoid most of the changes during the design stage thus avoiding the rework which generates waste.

Furthermore, the human factor involved during the post contract stage can influence the minimisation of waste in ways of ordering materials according to the appropriate quantity and quality, use of proper storage facilities, proper handling of material etc. Formoso et al. (1999) argue that the lack of attention of site management towards determining the waste as a major barrier for the minimisation of waste. Loosemore and Teo (2003) highlight the inadequate contribution of site managers towards development and implementation of waste management plans. Further, research has shown that the construction labourers' attitude is negative towards waste minimisation activities (Formoso et al, 1999; Alwi et al, 2002).

In the Sri Lankan context, it has been identified that "cutting and management" waste as the most significant causes (Rameezdeen and Kulatunga, 2004). Therefore it is argued that in any waste prevention programme, cutting and management waste should be given priority over other causes by means of design interventions (such as dimensional coordination) and by providing adequate supervision and proper organization of site activities to avoid design and management waste respectively.

The above discussion highlights the relationship between the attitudes and perceptions of construction workforce, and the generation of waste. Skoyeles and Skoyles (1987) suggest that "waste occurs on site for a number of reasons, most of which can be prevented, particularly by changing attitudes". Accordingly, this study is focused on identifying the attitudes and perceptions of the construction workforce during the pre and post contract stages. The following section discusses the attitudes and perceptions of construction workforce.

Attitudes of the Construction Workforce

Attitudes

Attitudes are an important concept that helps people to understand their social world. They help us to define how we perceive and think about others, as well as how we behave towards them (Wayne state university, 2004).

Judd et al (1991) define attitudes as "evaluation of various objects that are stored in memory". In a simpler manner, attitudes can be defined as a "psychological tendency to evaluate a particular object or situation in a favourable or unfavourable way, which causes someone to behave in a certain way towards it" (Ajzen 1993, cited Loosemore and Teo, 2003). This was further supported by Teo and Loosemore (2003), who emphasise the importance of attitudes to those who hold them, as it helps people to categorise, structure and prioritise the world around them. Thus, attitudes are important to managers as they determine people's behaviour and provide insight into their motivating values and beliefs. According to the tri- component model (Table II), an attitude includes affect (feeling), cognition (a thought), and behaviour (Spooncer, 1992).

Take in Table II

There are basically two schools of thoughts regarding the development of attitudes (Wayne state university, 2004)

(a) By changing the environment: - Some people say that if you so arrange the matters that people have to behave in a certain manner, eventually their attitudes will change in line with that way. For example, re-use of materials can be made a rule on site.

(b) By changing the attitudes: - In the second school of thought, it is said that if you could change people's attitude, their behaviour would change accordingly. For example, the importance of waste management practices can be conveyed to the employees.

In practice, considering both points of view is significant i.e. reuse of materials should make a rule as well as a better knowledge should be given to the employees regarding the importance waste management practices.

In terms of the formation of attitudes, five steps could be listed out as part of the process (Spooncer, 1992):

(a) knowledge of the correct procedure and ability to carry them out

(b) knowledge of the reasons behind the correct procedure and practices

(c) examples set by managers; sometimes called as the 'culture' of the organisation or 'the way we do things here'

(d) the reinforcement of important messages

(e) support of these attitudes through procedures and reward systems of the organisation

This highlights the importance of attitudes in the social environment and the influence that attitudes can make towards human behaviour. Further, it identifies the possible ways and means of developing and changing human attitudes by applying certain approaches. Accordingly, the following section discusses the attitudes and perceptions of the construction workforce.

Attitudes and perceptions of the construction workforce

Waste has been accepted as an inevitable by-product, with a strong belief that waste reduction activities will not be able to eliminate the generation of waste completely (Teo and Loosmore, 2001). These negative perceptions are the main barriers for effective waste management.

As the construction industry is labour incentive, the attitudes and perceptions of the people influence the growth of it. This fact is unquestionably true for the generation and controlling of waste. The importance of attitudes in waste management was identified by Hussey and Skoyles as early as in 1974, when they assert that "it is a change in this attitude rather than a

change in technique which is likely to have most effect overall". Teo and Loosemore (2001) found that attitudes towards waste reduction have become one of the reasons behind the difficulties for the management of waste in the construction industry. Loosemore et al (2002) and Skoyes et at (1987) highlight the importance of human factor for the minimisation of waste and argue that waste could be prevented by changing the attitudes of the people. However, according to Skoyles and Skoyles (1987, cited in Teo and Loosmore, 2001), the involvement of people is being ignored from the waste management equation.

The structure of the construction industry itself influences the attitudes of the people involved in it. For example, the construction industry rewards fast workers and bonuses are paid for early completion (Teo and Loosmore, 2001). Thus the attitudes of people are formed in such a way as to obtain the rewards even by foregoing the waste management practices. Further, due to the high involvement of sub-contractors in projects for a shorter period, adaptation of procedures cannot be identified. For instance, Jayawardene (1994) found out that the wastage of materials by subcontract labour is higher than that by direct labour.

For the successful implementation of waste management measures on a project, the collective effort and the responsibility from the parties involved in it is important. According to Teo and Loosmore (2001), attitudes regarding waste differ from one organization to another, depending on their culture and waste management policies. In addition, various occupational groups have different attitudes towards the generation and controlling of waste (Teo and Loosmore, 2001).

The above arguments support the view that the waste generated by construction is not something to be ignored and the attitudes of the people involved in the industry play a major role in controlling waste. Graham and Smithers (1996), state that for successful waste management practices, interdisciplinary approaches between all the stakeholders are essential. Therefore, by identifying the attitudes and perceptions of construction workforce,

areas which require special attention can be notified leading to the identification of better waste management practices. In the Sri Lankan context, research is limited in this area; thus, this study is aimed at identifying the attitudes and perceptions of different individuals at pre and post-construction stages in the Sri Lankan construction industry. Accordingly, following section briefly identifies the specific aims and objectives of this study, followed by the research methodology adopted.

Aim and Objectives and Research Methodology

Aims and objectives

The principal aim of the study is to identify the attitudes and influence of the construction workforce during pre and post contract stages towards the waste management practices in the Sri Lankan construction industry. To achieve this aim, following objectives are formulated:

1. to identify the attitudes of contractors during the pre-contract stage (estimators) toward the construction waste management practices on various issues
2. to identify the attitudes of different levels of employees of contractor organisations (site managers, supervisors, skilled and unskilled labourers) regarding issues pertaining to construction waste management practices
3. to compare and contrast the differential attitudes of employees at the pre-construction stage against the employees at the post-construction stage
4. to identify the possible ways of developing waste management practices within the construction industry

Research methodology

A structured questionnaire survey was carried out to understand and evaluate the attitudes and perception of workforce. Sample for the questionnaire survey was selected from the building contractors in the Sri Lankan construction industry. Four types of questionnaires

were prepared for project managers/site managers, supervisors, labourers and estimators. Sample of the questionnaire survey is shown in Table III.

Take in Table III

Results and Discussion

Likert scales are commonly used in attitudinal measurements (Ryerson University, 2005). Since this research is also focused on ascertaining the attitudes of the construction workforce, the questionnaires are prepared based on the Likert scale with a five-point scale ranging from strongly agree, agree, neither agree nor disagree, disagree, strongly disagree. Data is analysed using median and mode of the results where appropriate. Data gathered through the questionnaires leads to the following findings.

Perception of the contractors during the pre-construction stage

In a construction organization, the Estimator plays a major role, as he/she is the key person who is responsible for success in securing contracts. According to the data collected, 55% of estimators presumed that their organisations perform well in the area of waste management while 30% and 15% stated their response as “disagree” and “not sure” respectively. Despite this, 75% estimators believed that cost of waste affects the project cost severely. However, the perception of 95% estimators is such that the material waste is unavoidable. A majority of the estimators state that waste management strategies do not exist in their organisations, as represented in Figure 2.

Take in Figure 2

During the estimating process, there is an allowance for waste to compensate the cost of waste during the construction stage. Unfortunately, the results of the survey did not support this argument. It can be clearly seen from Figure 3 that the amounts obtained from the actual waste are greater than the waste allowances at the pre-construction stage. Thus, it can be

argued that most of the contractors are unable to recover the loss arising due to material waste.

Take in Figure 3

Further, the research identified that 75% of estimators agreed that actual wastage is higher than the allowance they consider at the pre-construction stage. The competitive nature in the industry (65%) and unavailability of actual data from the previous projects (75%) have prevented them from using the actual amounts in their tenders.

The less attention for the material waste allowances was further proven by the ranks given by the estimators on their priorities at the pre-construction stage. Table IV clearly shows that profits and overheads of the project have governed the estimator's priories while paying the least attention on construction wastage allowances. Thus, during the pre-construction stage less attention is paid for the construction waste, giving more priorities to other bidding strategies.

Take in Table IV

Estimators apply various mechanisms to build up the 'norm' for material wastage allowances. This research revealed that past experience and norms in the Building Schedule of Rates are used by majority of estimators while about 30% go for work-studies. Even though frequent updating is essential to build up reliable norms, a lack of data flow from construction sites to the estimators was identified, which barricades the knowledge of the estimators regarding the actual material waste.

Perception of the contractors during the post contract stage

It is during the post contract stage that waste controlling tools and management strategies are actually implemented. Thus, the attitudes and perceptions of the personnel involved during the post contract stage are vital for effective waste management.

Almost all the personnel that responded agreed that natural resources should be conserved, stating 100% agreement by both managers and supervisors, and 99% by workers. This indicates that all the respondents have the positive perception regarding the degrading natural resources and the importance of preserving them.

As discussed earlier, for the development of attitudes, environment of the organisation can be arranged in way to direct the behaviours of the people in a certain manner. For example, organisational strategies and company policies can be introduced to influence the workers attitudes towards positive directions. To comply with this, knowledge regarding the existence of a waste management strategy in the organisation was evaluated (Figure 4). Supervisors have the highest positive perception regarding this, followed by the managers. However, the workers knowledge of such strategy is comparatively low and only 10% of them had strongly agreed to this fact. Further, 19% of workers were "not sure" about this. This shows the different awareness of various working groups regarding the *environment* or the *culture* of the organisation. Further, understanding of the organisational strategies has diminished, when the hierarchy of the worker changes from top to bottom. In addition, this gives a better picture about the communication standards within the organisation. Due to a lack of awareness of such strategies, workers do not accept them as explicit activities in the organisations. Thus, it can be suggested that as construction workers are the ultimate handlers of the construction materials, optimum usage of such strategies cannot be gained.

Take in Figure 4

To establish the waste management practices within all the levels of working groups in an organization, proper recognition should be given and it should be incorporated within all other operations in the site (Cole, 2000). The importance given by the different personnel for waste management was assessed as part of this survey. Though the overall attitude about the importance of waste management is highly positive with all the working groups, attention

paid to waste management in the actual practice is not so apparent, as highlighted in Figure 5. This may be due to the lack of time devoted for waste management practices within the real life context. It can also be identified that least attention for waste management practices was given by labourers. The reasons behind the least attention of labourers can be suggested as time constraints of the construction industry and lack of benefits gained by such practices. In the perspective of the labourers, few personal benefits are gained by adopting waste management practices. As construction work is organised in a way to reward the fast workers and in most of the circumstances, the payments are made on piece rate basis, tradesmen are ready to use fresh piece of material rather than spending little more time with cut pieces.

Take in Figure 5

When managers were asked to rank the perceived barriers for the implementation of waste management principles, attitudes of people, difficulty in changing the existing work practices were identified as the main barrier where as 'cost ineffectiveness' was identified as the barrier with the least impact (Table V).

Take in Table V

When implementing a strategy and moving towards a specific target, a better understanding between the parties involved in is important. Negative attitudes and lack of confidence may not yield the maximum benefits. According to the research reported in this paper, a majority of supervisors and workers believe that their management and co-workers have a positive perception regarding the importance of construction waste management. In contrast, management of the organizations do not have a good perception regarding the workers attitudes. Table V further highlights this fact, as a majority of the managers believe the main barrier towards better waste management as the attitudes of workers. This shows the negative attitudes of the managers towards their workers and the positive attitudes of workers towards

their managers. In such a situation, the effectiveness of the managerial functions will not properly come in to practice due to the lack of confidence between parties.

As discussed earlier, five steps are involved in the formation of positive attitudes within an organisation or to make the people behave in a certain direction. Two of them are providing knowledge about correct procedures and reinforcement of important messages. This can be mainly done through the implementation of training programmes. Hence, the level of training and knowledge provided to workers about the consequences and opportunity costs of wasteful practices can influence their attitudes towards waste management practices. 42% and 60% of supervisors and labourers respectively answered that waste management applications were not included in their training sessions. This indicates a lack of knowledge and reinforcement of ideas to the workforce regarding the importance on waste management practices.

Even though 98% of managers identified waste management as being as important as the other site activities (Figure 5), least priority was given for waste management in the actual practice, whereas the highest priority was towards monitoring quality, followed by progress and cost factors (Table VI).

Take in Table VI

Comparison of attitudes of construction estimators and contractors

A contrast of perception between estimators and site managers were identified relating to the performance in the organisation in the area of waste management (Figure 6). A majority of site managers (85%) believe their organisations perform well in the area of waste management, while only 55% of estimators believe it so. However, only 455 of site managers and 60% of estimators believe that their company has a waste management strategy.

Take in Figure 6

This indicates the differences in attitudes and perceptions of different groups of people within the same organisation: one group having a negative and the other having a positive perception regarding the performance of waste management applications and the existence of an associated company policy. Therefore it can be argued that these contradictory perceptions negatively influence the effective waste management practices at the organization level.

Conclusion

Minimisation of construction waste has been emphasised in terms of improving performance while achieving the sustainable goals of the industry. Since the construction industry is labour intensive, attitudes and perceptions of the workforce affect the growth of it and minimisation of waste is also not an exception. Therefore, a change in attitudes and perceptions of the construction workforce is vital to gain the maximum benefits from waste management practices. Thus, this research was focused on the Sri Lanka construction workforce to evaluate and identify the influence of their attitudes and perceptions towards waste management strategies. Research reported in this paper indicates the positive perceptions and attitudes of the construction workforce towards minimising waste and conserving the natural resources. However, the behaviour of construction workforce in the actual scenario indicates a lack of effort in practicing their positive attitudes and perceptions towards waste minimisation. The reasons behind this lack of practice of waste management applications were found as other priorities during the pre and post construction stages such as profit, time, cost etc.

It can also be concluded that negative attitudes towards the subordinates, attitudinal differences between different working groups, lack of training to reinforce the importance of waste minimisation practices have obstructed proper waste management practices in the construction industry. Further, inadequate communication of strategies from top to bottom level of the organisation, and lack of data flow from construction sites to estimators have

negatively affected the waste management applications. Thus, development of better communication channels within the organisation, use of reliable practices (work studies) to establish the waste allowances, providing proper training to construction workforce regarding waste management practices, and introducing incentives for better waste management practices would help to develop and implement waste management applications in the construction industry and thereby improve its performance.

Acknowledgements

Authors would like to acknowledge the contribution received from A.N. Hewamanage towards the data collection of this paper.

References

Alwi, S., Hampson, K. and Mohamed, S. (2002), "Waste in the Indonesian construction projects", Proceedings of the 1st international conference on creating sustainable construction industry in developing countries, November, South Africa, pp. 305-315

Bossink, B.A.G. and Brouwers, H.J.H. (1996), "Construction waste: Quantification & source evaluation", Construction Engineering and Management, Vol. 122 No. 1, pp. 55-60

Chan, H. C. Y. and Fong, W. F. K. (2002), "Management of construction and demolition materials and development of recycling facility in Hong Kong", Proceedings of International conference and innovation and sustainable development of civil engineering in the 21st century, Beijing, pp. 172-175

DCMS, (2002), Better public buildings, Department of culture media and sport, UK

Egan, J. (1998), Rethinking construction: Report from the construction task force, Department of the environment, transport and regions, UK

Ekanayake, L.L. and Ofori, G. (2000), "Construction Material Waste Source Evaluation", Proceedings of Strategies for a sustainable built environment Pretoria, 2nd August 2003 Available at:

www.sustainablesettlement.co.za/event/SSBE/Proceedings/ekanyake.pdf

Formoso, T.C., Hirota, E.H. and Isatto, E.L. (1999), "Method for waste control in the building industry", 2nd August 2003, Available at: http://construction.berkeley.edu/~tommelein/IGLC-PDF/Formoso&Isatto&Hirota.pdf

Ganesan, S. (2000), Employment, Technology and Construction Development, Ashgate Publishing Limited, England

Gavilan, R. M. and Bernold, L. E. (1994), "Source evaluation of solid waste in building construction", Journal of Construction Engineering and Management, Vol.120 No.3, pp. 536-552

Graham, P.M. and Smithers, G. (1996), "Construction waste minimization for Australian residential development", Asia Pacific Building and Construction Management Journal, Vol. 2 No. 1, pp. 14–19

Harvard Green Campus (2005), "Construction waste management", 12th January 2005, Available at: http://216.239.59.104/search?q=cache:KDlWMburqfUJ:www.greencampus.harvard.edu/hpbs/documents/CDWaste.pdf+%22construction+waste%22+and+definitions&hl=en

Holm, F.H. (1998), Ad Hoc committee on sustainable building, Norwegian Building research institute, Blinderm

Hong Kong Polytechnic, (1993), Reduction of construction waste: final report, The Hong Kong Construction Association Ltd., Hong Kong

Hussey, H.J., and Skoyles, E.R. (1974), "Wastage of Materials", Building, Vol. 22, February, pp. 91-94

Jayawardane, A.K.W. (1992), "Wastage on building construction sites- What the Sri Lankan contractors say", Proceedings of the annual sessions of Institute of Engineers, Sri Lanka.

Jayawardane, A.K.W. (1994), "Are we aware of the extent of wastage on our building construction sites?", Engineer, Vol. 20 No. 2, pp. 41-45

Johnston, H. and Mincks, W.R. (1995), "Cost effective waste minimization for construction managers", Cost Engineering, Vol. 37 No.1, pp. 31-39

Leeders, M. R., Feron, H.E. and England, W.B. (1990), Purchasing and management, Irwin, Homewood

Loosemore, M., Lingard, H. and Teo, M. M. M. (2002), "In conflict with nature – waste management in the construction industry", in Best, R. and Valance, G. (Ed), Post design issues – innovation in construction, Arnold, London, pp. 256 – 276

Lingard, H., Gilbert, G. and Graham, P. (2001), "Improving solid waste reduction and recycling performance using goal setting and feedback", Construction Management and Economics, Vol. 19 No. 8, pp. 809-817

Macozoma, D.S. (2002), "Construction site waste management and minimisation: International report", International Council for research and innovation in buildings (CIB), 24th September 2003, Available at:

http://www.cibworld.nl/pages /begin/Pub278 /06Construction.pdf

McDonald, B. and Smithers, M. (1998), "Implementing a waste management plan during the construction phase of a project: a case study", Construction management and Economics, Vol. 16 No.1, pp. 71-78

Ryerson University, (2004), "Ordinal scale", 15th September 2004, Available at:

http://www.ryerson.ca/~mjoppe/ResearchProcess/741process10a2.htm

Rameezdeen, R. and Kulatunga, U. (2004), "Material wastage in construction sites: identification of major causes", Journal of Built-Environment Sri Lanka, Vol. 4 No. 02, pp. 35-41

Skoyles, E.R. and Skoyles, J.R. (1987), Waste prevention on site, Mitchell Publishing Ltd., London.

Spooncer, F. (1992), Behavioural Studies for Marketing and Business Leckhampton, Stanley Thornes Ltd., UK

Teo, M.M.M. and Loosemore, M. (2001), "A theory of waste behavior in the construction industry", Construction Management and Economics, Vol. 19 No.7, pp. 741-749

Teo, M. M.M. and Loosemore, M. (2003), "Changing the environmental culture of the construction industry", ASCE Construction Research Congress Conference, University of Hawaii, USA, pp. 345 - 376

Wayne state university, (2004), "Attitude", 12th June 2004, Available at: http://sun.science.wayne.edu/~wpoff/cor/grp/change.html