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Journal Objectives

Surveying and Built Environment is an international peer reviewed journal that aims to develop, elucidate, and explore the knowledge of surveying and the built environment; to keep practitioners and researchers informed on current issues and best practices, as well as serve as a platform for the exchange of ideas, knowledge, and opinions among surveyors and related disciplines.

Surveying and Built Environment publishes original contributions in English on all aspects of surveying and surveying related disciplines. Original articles are considered for publication on the condition that they have not been published, accepted or submitted for publication elsewhere. The Editor reserves the right to edit manuscripts to fit articles within the space available and to ensure conciseness, clarity, and stylistic consistency. All articles submitted for publication are subject to a double-blind review procedure.

Topics

All branches of surveying, built environment, and commercial management including, but not limited to, the following areas:

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From the Editor

This issue of SBE has five reviewed papers, covering research outcomes and discussions in different construction related areas, including management of construction firms, effects of stress on estimators in construction projects, investigations on concrete characteristics under various applied stress conditions, information modeling and optimization technique for reducing waste in high-rise residential buildings, and professional ethics. The diversity of the topics covered in this Journal not only shows the active participation of different disciplines in the surveying profession in sharing experiences and good practices, but also provides readers a platform to widen their scopes and knowledge about the technological and managerial developments in the surveying and built environments.

There is an interesting observation that I would like to share with readers. The reviewed papers presented in this issue are all submitted by academics. I truly believe that, many interesting/ challenging problems and their solutions that surveying professionals have encountered in private sectors, consulting companies and government organizations are worthy of addressing and presenting in the SBE. This is my hope that more experience sharing and discussion from various organizations of the surveying profession could be seen in future issues of SBE.

Finally, I would like to thank all Reviewers, Editorial Board Members, and the Journal Secretary for their support throughout the process of preparing this issue of SBE.

Professor Esmond Mok
Editor Vol 18 Issue 1

Submission Guidelines

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Full paper submission should consist of a file in Microsoft Word format attached to an e-mail message.

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Language:

English

Content

Full Paper should include title of paper, author details, ABSTRACT, KEYWORDS, and REFERENCES.

Paper length

Full paper should not be more than 20 pages, including all text, graphs, tables, diagrams, maps, pictures, illustrations, and appendices.

Paper size

Set paper size to A4. The lines of text (except the text under ABSTRACT) should be indented left and right 3cm from the paper margin.

Text font

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Abbreviations

No full stop is needed for titles, names, acronyms, and measurement units: eg, Mr, Dr, PRC, UK, HKSAR, Jan, Feb, Mar, 4m, 5ft.

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Drop 2 line spaces and type **ABSTRACT** in bold, full caps, 12 point size, and centred. On the next line, type the content of the Abstract in 10-point size, indent 3cm on both margins, left and right justified.

Abstract should be a single paragraph outlining the aims, scope, and conclusion of the paper. It should be no more than 300 words in length.

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Drop 2 line spaces before typing each of the above topics. The text should be single spaced, single column, indented 3cm on both margins, left and right justified, and 12-point size. Paragraphs should not have any indentations. Any abbreviations used should be defined.

Section headings are in bold and full caps. There should be no blank lines between the heading and the first line of text. Separate paragraphs in each Section with one blank line. There should be two blank lines before each Section.

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The Relationship of Organizational Culture and the Implementation of Total Quality Management in Construction Firms

Canis WM Cheng and Anita MM Liu[1]

ABSTRACT

Various researchers have alleged that organizational culture affects the performance of total quality management (TQM) and further suggest that failure in the implementation of TQM is caused by a mismatch with organizational culture. In order to implement successful TQM, organization members should have a clear understanding and agreed approach in achieving the quality goals. This study seeks to examine the relationship between organizational culture and the implementation of TQM in construction firms.

KEYWORDS

construction firms
organizational culture
total quality management

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INTRODUCTION

The emphasis on quality building products has been a focus of the Hong Kong construction industry since the 1980s. From the 1990's, the Hong Kong Housing Authority has been implementing quality assessment schemes, notably, PASS (Performance Assessment Scoring System), to foster improvement of the building quality in public projects. The Government ensures public housing meets the required standard by enforcing mandatory ISO 9000 Certification System for contractors. Many contractors have, consequently, begun to incorporate TQM (Total Quality Management) for continuous improvement, e.g., MTRC (Mass Transit Railway Corporation) projects, and sought ISO 9000 certification.

Various researchers, such as Cameron and Quinn (1999), Dellana and Hauser (1999), allege that organizational culture affects the performance of total quality management. Kekale and Kekale (1995), Al-Khalifa and Aspinwall (2001) and Dellana Hauser (1999) further suggest that failure in the implementation of TQM is caused by a mismatch of organizational goals with culture. Since organizational culture can be regarded as the shared values or beliefs among the people in an organization, organizational culture will affect people's belief in the implementation of TQM. In order to implement successful TQM, organization members should have a clear understanding and agreed approach in achieving the quality goals.

This study seeks to understand the contractors' adoption of TQM and their organizational cultures. The research objective is to examine the relationship between organizational culture and the implementation of TQM in construction firms.

QUALITY CONCEPTS AND TOTAL QUALITY MANAGEMENT

Defining quality is fundamental to the understanding of TQM. There are various interpretations of *quality*. Generally, quality is the standard of a product or service which meets the customers' (reasonable) expectations. Juran (1999) defines quality as *fitness for use* which encompasses quality of design, quality of conformance, the availability and adequacy of service. Feigenbaum (1983) defines quality as the total composite product and service characteristics of marketing, engineering, manufacture, and maintenance through which the product and service in use will *meet the expectations of the customer.* The International Organization for Standardization, ISO (1994), defines quality as the totality of characteristics of an entity that bears on its ability to satisfy stated and implied needs.

The competitive global market demands companies to consistently provide high quality and reliable products at a low cost. In order to keep up with the pace, technological, political and social skills must be improved constantly. Corporations must have long term goals and TQM is an organized way to manage for total quality, effectiveness and competitiveness involving everyone, at all levels, in an organization.

Principles of quality management are put forward by various researchers such as Deming (1986), Juran (1999), Crosby (1979), Feigenbaum (1983) and Imai (1986). Such principles include the Deming triangle, the Juran Trilogy, Concept of Zero Defects, Kaizen approach etc. It can be concluded that there are significant common elements in the various quality philosophies. The most important point is not in selecting/implementing the appropriate managing principles, but to ensure all participants understand and believe in the reasons for applying such quality management philosophies and tools. The emphasis on beliefs and commitment of the individuals points to the principles of TQM.

Total Quality Management focuses on a continuous improvement process (Amrik

and O'Neill 1999) with an emphasis on people and their involvement and receptivity to continuous change. Thus, TQM is an integrated effort for gaining competitive advantage by continuously improving every facet of an organization's activities (see Lindsay and Petrick, 1997; Ho, 1999; Irwin, 1990; Logothetis, 1992). ISO officially defines TQM as a way of managing an organization which aims at continuous participation and co-operation of all its members in the improvement of quality in order to achieve customers' satisfaction, long-term profitability of the organization and benefit of its members, in accordance with the requirements of society.

Commitment, knowledge and involvement are the three fundamental characteristics of TQM that form the TQM (isosceles) triangle. These three characteristics are of equal importance and are interdependent. All three are required to achieve successful, long-term, sustainable improvement of the company.

Since the Hong Kong Housing Authority enforces ISO 9000 certification on contractors for public housing projects, the contractors have embraced the idea of TQM to various extents. However, Chu (2002) concludes that the management understanding towards total quality in Hong Kong is immature. Gryna and Watson (2001) suggest several factors to develop a positive quality culture; i.e., creation and maintaining the awareness of quality at all levels, presence of management leadership on quality, encouragement of self-development and empowerment, providing opportunities for employee participation to inspire action and providing recognition and rewards.

As TQM is a management approach which concerns the common values and beliefs of all the people in the organization, an understanding of the organizational culture of construction firms is of paramount importance.

ORGANIZATIONAL CULTURE

According to Hofstede (2001), organizational culture is the collective programming of the mind that distinguishes the members of one organization from another. Schein (2004) defines organizational culture as a pattern of shared basic assumptions that was learned by the organization as it solved its problems of external adaptation and internal integration, that has worked well enough to be considered valid and, therefore, to be taught to new members as the correct way to perceive, think and feel in relation to those problems.

Researchers often use different dimensions to describe organizational culture. For instance, Caldwell, Chatman and O'Reilly (1991) identify seven dimensions to develop their Organizational Culture Profile (OCP), i.e., innovative, stable, respecting people, outcome oriented, detail oriented, team oriented and aggressive. Some researchers allege that there are principal factors that influence the choice of culture and structure, for instance, Handy (1993) suggests these principal factors to be history, ownership, size, technology, goals, the environment and the people; and in Hofstede's (2001) culture dimensions, there are three dimensions (power distance, uncertainty avoidance and individualism—collectivism) which may particularly influence organizational culture.

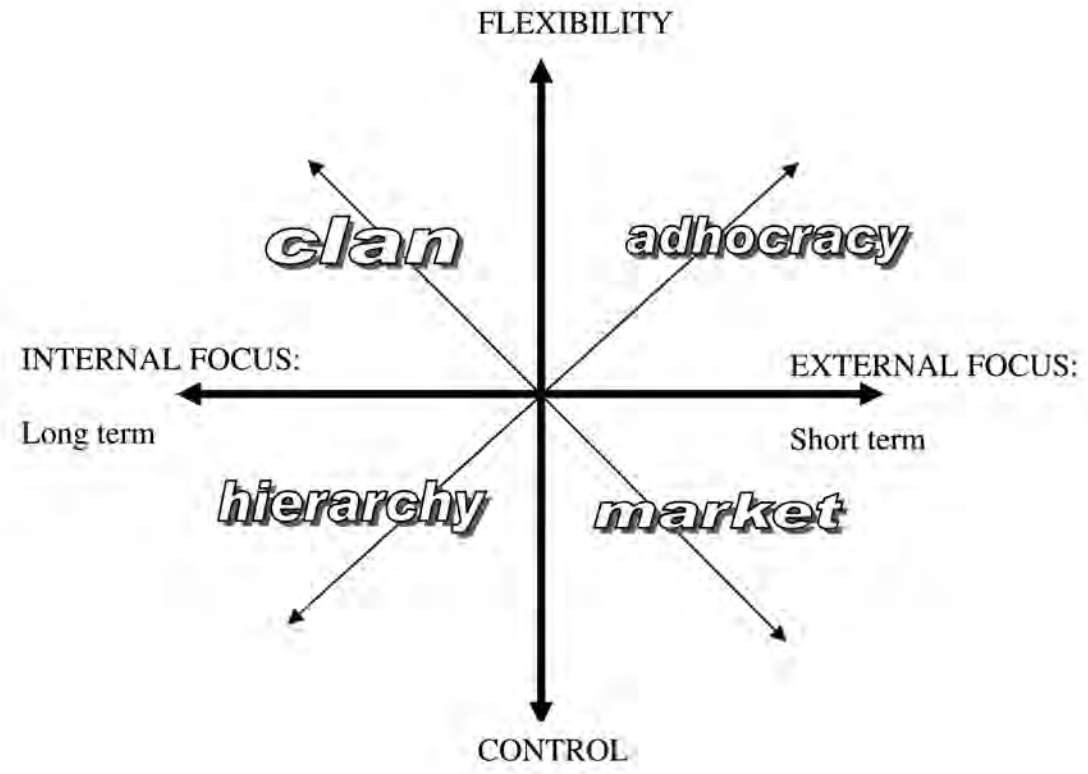
Definitions from most scholars, e.g., Hofstede (2001), Schein (2004), Cameron and Quinn (1999), Beyer and Trice (1993), suggest that organizational culture is a pattern of shared basic assumptions and values within an organization which allow the organization to operate. Values are implicit. In order to identify the individuals' perceptions of their working environment, Quinn (1988) suggests that values, motives, and problem-solving styles could reflect four notions of organizing, which emerge

to a close parallel of four information-processing orientations, to form the basis of a competing values framework. The competing values framework is also applied in the study of sustainable development (Liu 2006) and organizational culture of construction firms in China (Liu, Zhang and Leung 2006).

The competing values framework is used to determine organizational effectiveness. Campbell (1974) creates a list of indicators for organizational effectiveness, which Quinn and Rohrbaugh (1983) then analyze to form two major dimensions splitting the indicators into four main clusters. In these two dimensions, one differentiates effective organizing criteria from *flexibility* to *stability* while the other one differentiates from *internal focus and integration* to *external focus and differentiation*. The ends of these x and y axes (figure 1) represent competing values and the four quadrants each represents a distinct organizational culture type, i.e., hierarchy, market, clan and adhocracy.

Fig. 1 Competing values framework

Source: Adapted from Cameron and Quinn (1999)



Hierarchy Culture

In the 1950s-60s, organizations set rules and policies for employees to govern their work procedures; leaders would ensure smooth running of the operation. In the long term, the hierarchy culture is to facilitate a stable, predictable and efficient environment for the organization. (The seven characteristics stated by Weber (1974) are rules, specialization, meritocracy, hierarchy, separate ownership, impersonality and accountability.)

Market Culture

Popular in the late 1960s due to a very hostile and competitive market, organizations focused on their transaction costs with external constituencies aiming to create competitive advantages over their competitors. It is a results-oriented workplace driving towards profitability and productivity using aggressive strategies. In the long term, such a culture focuses on competitive actions and achieving stated goals and targets.

Clan Culture

People working in such an organization have shared values and emphasize teamwork. They develop an environment stressing human relationships where managers empower their staff and facilitate them to participate and commit. In the long term, such a culture will lead to an organization focussing on individual development with high cohesion and morale.

Adhocracy Culture

These organizations like to be adaptive, flexible and innovative so they can use new resources to gain further profit. However they bear high risks and greater uncertainties. Emphasis is on individuality, risk taking and anticipating the future.

ORGANIZATIONAL CULTURE AND TQM

Understanding the dominant culture of an organization before implementing TQM is important. Environmental changes produce different emphases within an organization, thus, new approaches in learning and adaptation are required. Schein (2005) regards cultural dynamics as a natural evolution because there is constant pressure exerted on any culture for growth and evolvement. Beyer and Trice (1993) propose that cultural change can be initiated by top management. Leaders should pay attention to what the objectives of the organization are and implement different but appropriate strategies for their followers for continuous success.

Kekale and Kekale (1995) allege that the mismatch of organizational culture with TQM implementation principles is a reason for the failure of implementing TQM, while Doyle (1992) blames lack of management leadership and inadequate training. Al-Khalifa and Aspinwall (2000) discover that the clan and adhocracy cultures provided the best working environment for successful implementation of TQM; this is also supported by Dellana and Hauser (1999). However, organizations differ in their backgrounds (history/leadership style) and, thus, there is no unique way of implementing TQM.

Cameron and Quinn (1999) reveal that many companies failed in implementing TQM because they did not acknowledge that the implementation procedures might constitute a fundamental change from the direction, values and culture of their companies. Hence, an appreciation of the need for culture (change) to match the TQM approach is fundamental to successful TQM implementation.

DATA COLLECTION

In order to examine the relationship between TQM and organizational culture in construction firms, questionnaires designed to collect data on organizational culture profiles and TQM implementation are sent to 51 building contractors from the Hong Kong Housing Authority approved contractors list. All these companies have obtained the ISO certificates and possess their own quality management policies and systems. A collection of opinions (10 respondents in each construction firm) from different organization members is assembled instead of a single respondent from each firm.

Organizational Culture Assessment Instrument (OCAI), as developed by Cameron and Quinn (1999) based on the Competing Values Framework, is used to measure organizational culture. Six dimensions (dominant characteristics, leadership style and approach, management of employees, organizational glue, strategic emphases and criteria of success) are used to identify the underlying assumptions and values of an organization. The OCAI is modified to elicit responses on a 5 point Likert scale.

ECI Measurement Matrix (European Construction Institute 1993) is adapted to determine the construction firm's progress towards the achievement of Total Quality. There are twelve considerations for attaining the goal, each with six levels of attainment, scoring from 0-5. The total score is used to determine the quality management understanding of the company. There are six levels of achievement in management understanding: none, uncertainty, awakening, enlightenment, empowerment and wisdom.

DATA ANALYSIS

Nine contractors responded to the questionnaire and their OCAI scores are summarized in Table 1. The results suggest that out of the six dimensions, dominant characteristic, organizational leadership, management of employee and criteria of success are strongest in the clan culture, while organization glue and strategic emphases are strongest in the hierarchy culture.

The average organizational culture profile tends to be biased towards a mix of clan and hierarchy, with characteristics of high commitment and morale, emphasis on human resource development, information management and communication, as well as focus on stability and control. The construction industry in Hong Kong is well established for many years, and the results show that construction firms opt for a stable and efficient working environment.

Table 1: Organizational culture scores of the nine construction firms

	Culture type			
Organizational culture dimensions	Clan	Adhocracy	Market	Hierarchy
Dominant Characteristic	3.51	3.23	3.32	3.34
Organizational Leadership	3.39	3.17	3.20	3.36
Management of Employee	3.47	3.11	3.26	3.27
Organizational Glue	3.19	3.23	3.10	3.30
Strategic Emphases	3.40	3.49	3.31	3.57
Criteria of Success	3.37	3.33	3.24	3.23
Overall organization culture profile	3.39	3.26	3.24	3.34

Out of the nine contractors, eight have reached a stage of enlightenment or empowerment, with one company at the stage of uncertainty. The company at the stage of *uncertainty* is informed about the importance of quality management but has taken no action for the implementation of TQM because it is not certain about the real benefits. The three companies at the stage of *enlightenment* realize the benefits of implementing TQM, and are trying to enhance such a program for further gain by careful monitoring. The five companies at the stage of *empowerment* have a good knowledge of TQM and learn and apply the principles in their projects practically, with good team work, communication and understanding of customer value. Leadership commitment is what is missing to reach the stage of wisdom. The result reveals the situation that construction firms in Hong Kong are well on their way towards total quality.

Table 2 shows the association between the four types of culture and the stage of management achievement towards total quality. Correlation analysis is further carried out to examine the culture dimensions that affect TQM significantly (See Table 3).

In Table 2, it is found that the stage of empowerment has the highest coefficient of correlation with the clan and hierarchy culture, while there is no relation with the stage of empowerment for the market culture and the adhocracy culture. Table 3 shows the contribution of various culture dimensions

Table 2: Spearman's rho correlation coefficients of TQM achievement and culture types

	Clan		Adhocracy		Market		Hierarchy	
empowerment	0.870	(0.002)	0.609	(0.082)	0.000	(1.000)	0.870	(0.002)
enlightenment	-0.550	(0.125)	-0.275	(0.474)	0.274	(0.476)	-0.550	(0.125)
uncertainty	-0.550	(0.125)	-0.550	(0.125)	-0.411	(0.272)	-0.550	(0.125)

Figures in parentheses denote significant levels.

Table 3: Spearman's rho correlation coefficients of TQM achievement and culture dimensions

Culture Dimension	Dominant Characteristic		Organizational Leadership		Management of Employee		Organizational Glue		Strategic Emphases		Criteria of Success	
Culture Type: **Clan**												
TQM	0.375	(0.321)	0.571	(0.108)	0.831	(0.006)	0.770	(0.015)	0.848	(0.004)	0.599	(0.088)
Adhocracy												
TQM	-0.288	(0.452)	0.126	(0.748)	0.234	(0.544)	0.454	(0.220)	0.924	(0.000)	0.481	(0.190)
Market												
TQM	-0.092	(0.813)	0.247	(0.522)	-0.276	(0.472)	0.220	(0.569)	0.000	(1.000)	0.407	(0.277)
Hierarchy												
TQM	0.593	(0.092)	0.957	(0.000)	0.698	(0.037)	0.895	(0.001)	0.826	(0.006)	0.928	(0.000)

Figures in parentheses denote significant levels.

to TQM. It is shown that strategic emphases, management of employees and organizational glue have a significant attribution to TQM in the clan culture; for adhocracy culture, strategic emphasis is significant. Most of the culture dimensions in the hierarchy culture attribute to the TQM score – with organizational leadership having the highest correlation coefficient.

The results imply that the management style (leadership and employee management) and the way to hold the organization together (organization glue and strategic emphases) are important factors in determining the success of TQM implementation. As it is a management approach seeking continuous improvement to satisfy all stakeholders, TQM is found to be more successful in companies with a long term and internal focus in managing aspects.

Furthermore, *management of employees* in the market culture is negatively associated with the TQM achievement level which suggests that TQM may be implemented more successfully in a working environment emphasizing on customer-orientation rather than one which is highly work goal-oriented.

CONCLUSION

Organizations have different working environments, work attitudes and leadership styles, which influence the implementation of the TQM approach. It is therefore important that companies understand their organizational culture profiles to integrate the TQM approach.

Generally, the ideal culture profile for TQM implementation is one which supports a friendly working environment with leaders acting as advisors to allow smooth operation of the organization under a long term concern for growth and acquisition of new resources. At the same time, the organization should be held together by high commitment and morale from the participants in order for TQM to be implemented successfully within a set period.

From the results, an ideal organizational culture for TQM in the Hong Kong construction industry is best to have the dominant characteristics, organizational leadership, organization glue and criteria of success of a hierarchy culture; the management of employees of a clan culture; and the strategic emphases of an adhocracy culture. This verifies Quinn's (1988) allegation that no organization would reflect only one value system for it to perform well, values in all the four cultures should be obtained.

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Adjusting Stressors – Job-Demand Stress in Preventing Rustout/Burnout in Estimators

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ABSTRACT

In Hong Kong, the majority of estimators experience high stress levels since the cost estimation task requires a high degree of accuracy (Peurifoy and Oberlender, 2002). In the striving for high performance, stress and stressors should be managed well in the estimation process. Stress is defined as the deviation between the expected workload and the actual ability of individual estimators in construction projects. Since stress involves both a quantitative workload (e.g., too many/few tasks) and a qualitative workload (e.g., repetitive/complicated tasks), this study investigates the stressors and stress of estimators based on two workload dimensions of Job-Demand Stress. It aims to (1) identify the stressors in the estimation process, (2) investigate the impact of stressors on the Job-Demand stress of estimators in Hong Kong, and (3) analyze the interrelationship between different stressors of the construction estimators.

Using factor analysis and correlation analysis, six main stressors have been revealed in the estimation process. The study revealed that there is a significant relationship between quantitative and qualitative stress levels. Job-Demand stressors such as Work Underload and Home-Work Conflict have a significant effect on qualitative Job-Demand stress and indirectly affect the quantitative stress of estimators. Stress is not only caused quantitatively and qualitatively by workload, but also affected by personal stressors in the estimation process.

KEYWORDS

Estimators
Job-Demand stress
Qualitative stress
Quantitative stress
RO-BO Scale
Stressors

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INTRODUCTION

According to the Occupational Handbook of the U.S. Department of Labor (Bureau of Labor Statistics, 2004), the functions of an estimator include compiling and analyzing data on all of the factors that will influence the project cost, gathering information on site, determining the quantities of materials and labor the project will need to furnish, and preparing a cost summary for the entire project. The main function of estimators is to accurately estimate the cost associated with the project and ensure that the project is profitable. Estimators, therefore, play a vital role in preparing estimates (Peurifoy and Oberlender, 2002). Their accuracy in making the cost prediction determines the success of the contracting business (Petri, 1979). In fact, the complicated project information to be handled within a stringent tendering period during the cost estimation process increases the stress level of estimators. Hence, Leung (2004) and Leung *et al*. (2005b) identified different stressors during the cost estimation process and investigated the significant relationship between stress and estimation performance in Hong Kong.

Since stress depends on individuals' workload/work difficulty and their actual ability to carry out a task, Job-Demand (JD) stress is applied in the study to measure the stress of estimators in construction projects. The paper aims to (1) identify the stressors in the estimation process, and (2) investigate the impact of stressors on the job-demand stress of estimators in the industry.

STRESSORS FOR ESTIMATORS

In construction projects, estimators often carry out a series of tasks, such as a feasibility estimate, a preliminary estimate, a pre-tender estimate, a detailed estimate, a change order estimate, a progress estimate, and so on (Schuette and Liska, 1994). They need to work with different project participants on a particular project in a specific environment. There are four main types of stressors (Leung and Lam, 2002; Leung *et al*., 2005b): personal, interpersonal, task, and physical stressors.

Personal Stressors: These refer to individuals' personal behavior (type A) and an estimator's private life involving family and friends. *Type A Behavior* is characterized by extreme interpersonal competitiveness, aggression, time-urgency, and chronically hostile behavior (Friedman and Roseman, 1974), while private life refers to the demand on time, energy, and commitment by families, friends, communities, and other spheres of one's private life (Quick and Quick, 1989).

Interpersonal Stressors: These refer to the personal relationships between estimators, their colleagues, and project team members in formal or informal capacity. *Role Conflict* mainly focuses on negative emotion. It arises when a person is required to take on more than one role and when the adequate performance of one role jeopardizes the adequate performance of the others (Burke and Greenglass, 1993). *Distrust* among project team members/colleagues may lead to poor communication, and a lack of social support causes stress from being isolated or ignored (Cooper, 2001). Therefore, *Social Support* can act as a stress buffer (Cohen and Hoberman, 1983) which involves the resources of one's interpersonal relationships.

Task Stressors: These refer to the workload (too much/little) and role ambiguity of estimators involved in a project. *Role Ambiguity* in the estimating team may induce stress due to inadequate information about

the responsibilities, scopes, and objectives of tasks. *Work Overload* causes stress and anxiety because of intensive work carried out in stringent timeframes (quantitative overload) and because of managerial inability to deal with tasks (qualitative overload) (Cooper and Marshall, 1981). *Work Underload* arises when estimators are in a state of boredom and apathy due to the insufficient tasks in the surplus period (quantitative underload) or because they are required to carry out boring and repetitive tasks (qualitative underload). Since all tasks have to be carried out by an individual, the expectation of estimators should also be considered as an attribution of estimators' stress in the form of depression, low self-esteem, dissatisfaction, futility, and intention to leave (Buller and Schuler, 2000).

Physical Stressors: These refer to poor working conditions such as extreme high/low temperature, noise, overcrowded environment, or poorly designed office. An uncomfortable *Working Environment* can disturb estimators' privacy or social interaction. Noise, temperature, ventilation, lighting, hygiene, overcrowdedness, and the like within an organization can create stress in an individual (Mind Tools Ltd., 2006).

Job-Demand stress is generally assessed by Job-Demand stressors such as work overload, work underload, role ambiguity, and role conflict. In order to examine whether Job-Demand stress is solely produced by work-related stressors, other stressors including personal behavior, social support, distrust, work environment, and private life are also considered in the study.

MEASUREMENT OF STRESS LEVEL

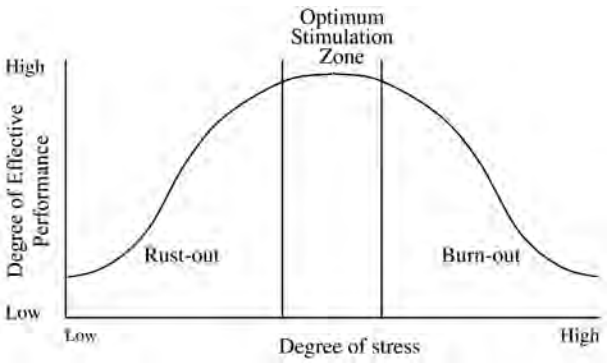
Job-Demand Stress

It is a common perception that stress comes from task stressors. Job-Demand stress involves the volume of work that has to be accomplished (quantitative) and the difficulties involved in the work (qualitative) (Fernet *et al.*, 2004). It is defined as "a perceptual phenomenon arising from a comparison between the demand on the person and his ability to cope" (Cox, 1978, p.25). Since Job-Demand stress depends on the deviation between one's perception of his/her expected ability and the actual ability to achieve the task (Gmelch, 1994). Task stressors, especially the workload, are the common factors that influence individual stress.

RO-BO

When talking about 'stress', people generally mean 'over-stress' and its effects. Though too much stress (over-stress) can result in 'burn-out', too little stress ('under-stress') can also affect the performance of civil engineers through 'rust-out' (Lingard 2003). Previous research studies (Fisher 1986; Hebb 1995) have suggested that there is an inverted U-shaped relationship between degrees of stress and levels of performance (Leung *et al.* 2005a). Performance will not reach an optimum level if estimators are under- or over-stressed (see Figure 1).

Figure 1 RustOut–BurnOut Scale (Gmelch, 1994)



The RustOut-BurnOut (RO-BO) scale (Gmelch, 1994) is an easy way to identify the positive/negative signs of respondents' stress in the estimation process, which enables the separate measurement of the stress of estimators in the quantitative and qualitative dimensions.

Rustout Syndrome is a widespread ailment in many organizations today. From the organization's point of view, rustout means less productivity and less ability to respond to emerging challenges. From a personal perspective, rustout means that employees are passive and unwilling to grow and change (Leider and Buchholz, 1995).

Burnout Syndrome includes headaches, ulcers, illnesses, or disabilities. From the organization' s point of view, burnout may cause an increase in the overall absentee rate and hence reduce the productivity. From a personal perspective, burnout means that employees feel fatigue and frustration with their job. They may also exhibit signs of detachment from their organization (Maslach and Jackson, 1981).

RESEARCH METHODOLOGY

To measure the individuals' stress level, RO-BO scale was included in the survey to reflect both quantitative (number of assignments) and qualitative (difficulty of assignments) dimensions of workload on an individual. Eighteen questions (refer to Table 1) were extracted from the literature review, covering personal, interpersonal, task, and physical items (Leung and Lam 2002; Leung 2004; Leung *et al.* 2005b). The respondents were requested to rate each item on a *7*-point Likert scale ranging from 1 (extremely disagree) to *7* (extremely agree).

The questionnaire was distributed to 500 estimators in Hong Kong by post or fax. One hundred and sixty-three questionnaires were returned, representing a response rate of 32.6%. All the respondents had had relevant estimation experience in construction projects, and they covered several main sectors in the construction industry such as developers, consultant firms, main contractors, public sectors, subcontractors, and other types of companies. The majority of respondents were from contractor firms (30%).

RESULTS

Principle Estimation Stressors for Estimators

In order to identify the main categories of estimation stressors for estimators, 18 "expected" response items of stressors were factor-analyzed by SPSS with varimax rotation (eigenvalue = 1 was selected as the cut-off value). To ensure similar characteristics for each category, only those items with a factor loading greater than 0.5 were accepted as principle estimation stressors (Rahim *et al.*, 2000). The corresponding factor loadings with the coefficient alpha reliabilities are summarized in Table 1.

The results generated seven factors of stressors: Personal Behavior (S1), Social Support (S2), Role Conflict (S3), Poor Environment (S4), Work Underload (S5), Distrust (S6), and Home-Work Conflict (S7). They were basically loaded onto the appropriate factors, except for factor 1 (S1) and factor 6 (S6). A new factor, named Personal Behavior (S1), was formed, consisting of three Type A Behavior items (items 1-3) and two Work Overload items (items 4 and 5). Since item 16 (Role Ambiguity) had a factor loading smaller than 0.5 and the reliability of S6 was lower than 0.5, the Distrust factor (S6) was deleted in the following study (see Table 1). In general, these six stressors can be grouped into two main categories, Job-Demand stressors (S5 and S7) and Non Job-Demand stressors (S1, S2 and S4).

Table 1 Scale Items, Factor Loadings, and Coefficient Alpha Reliabilities for Stressors

	Factor (Stressor)		Item	Factor Loading	Alpha (α)
S1	Personal Behavior	1	I demand a lot of the quality of my work.	0.733	0.676
		2	I do not go home before I have finished what I have planned.	0.723	
		3	I am an achievement-oriented person who has the need to win.	0.608	
		4	I have a lot of responsibility in my job.	0.568	
		5	There is constant pressure to work every minute, with little opportunity to relax.	0.555	
S2	Social Support	6	I feel well supported by my friends and/or family.	0.758	0.635
		7	There are trustworthy persons that I could turn to for advice if I was having problems.	0.674	
S3	Role Conflict	8	My beliefs often conflict with those of the organization.	0.860	0.791
		9	I am often caught between conflicting demands from my supervisor and staff.	0.838	
S4	Poor Environment	10	My office is too crowded.	0.885	0.776
		11	My office is too noisy.	0.881	
S5	Work Underload	12	I frequently find my work boring and repetitive.	0.776	0.645
		13	I feel my skills and abilities are not being used well.	0.757	
S6	~~Distrust~~	~~14~~	~~There often seems to be a lack of trust between myself and my subordinates.~~	~~0.844~~	~~0.490~~
		~~15~~	~~I seldom delegate tasks because others cannot complete the tasks as well as I can.~~	~~0.666~~	
		~~16~~	~~I am not sure I have divided my time properly among task.~~	~~0.471~~	
S7	Home-Work Conflict	17	My family/friends would like me to spend more time with them.	0.843	0.629
		18	My devotion to work is usually in conflict with my devotion to family.	0.734	

Note: All items were measured on a 7-point scale rangingn from "extremely disagree" to "extremely agree."
Kaiser-Meyer-Olkin Measure of Sampling Adequacy = 0.635.
"~~xxx~~" – Items with a factor loading less than 0.50 or factors with an alpha coefficient (α) less than 0.5 were deleted from the above data analysis.

Table 2 Means, Standard Deviations, and Correlations between Stressors and Stress

Stress/Stressors	M	SD	Qtt Stress	Qlt Stress	S1	S2	S3	S4	S5	S6
Quantitative stress	0.610	3.336	-	-	-	-	-	-	-	-
Qualitative stress	0.160	3.361	.641**	-	-	-	-	-	-	-
S1 Personal Behavior	21.031	4.633	-.056	-.009	-					
S2 Social Support	14.129	2.683	-.111	-.087	.110	-				
S3 Role Conflict	6.871	2.323	.029	.079	.218**	-.106	-			
S4 Poor Environment	6.135	2.684	.089	.101	.182*	.278**	.213**	-		
S5 Work Underload	7.086	2.430	.032	.175*	.137	-.059	.311**	.073	-	
S7 Home-work Conflict	8.423	2.477	.051	.180*	.082	-.107	.220**	.360	.181*	-

Note: n = 163 construction estimators.
* Correlation is significant at the 0.05 level (2-tailed).
** Correlation is significant at the 0.01 level (2-tailed).
Qtt stress Quantitative Stress Level ; Qlt stress Qualitative Stress Level.

Relationships between Principle Estimation Stressors and Stress Level

To investigate the relationships between estimation stressors and the Job-Demand stress of estimators (quantitative stress and qualitative stress), bivariate correlation analysis was applied in the study (see Table 2). Figure 1 illustrates the results of correlation analysis found in the study.

Table 2 shows that the level of quantitative stress of estimators is higher than that of the qualitative stress. The Job-Demand stress of estimators is mainly due to the number of tasks rather than the task difficulty. Estimators often work overtime on construction projects. Therefore, they usually operate under stress, especially when they are facing deadlines (Anonymous, 1998).

However, the results reveal that quantitative stress has a significant correlation (r = 0.641; p<0.01) with qualitative stress. This shows that the number of tasks the estimators have to carry out is significantly related to the difficulty of tasks that they have to handle. Estimators/ estimating managers should not consider the quantity or quality of the tasks independently.

No relationship was found between quantitative stress and the stressors, while qualitative stress was found to be significantly

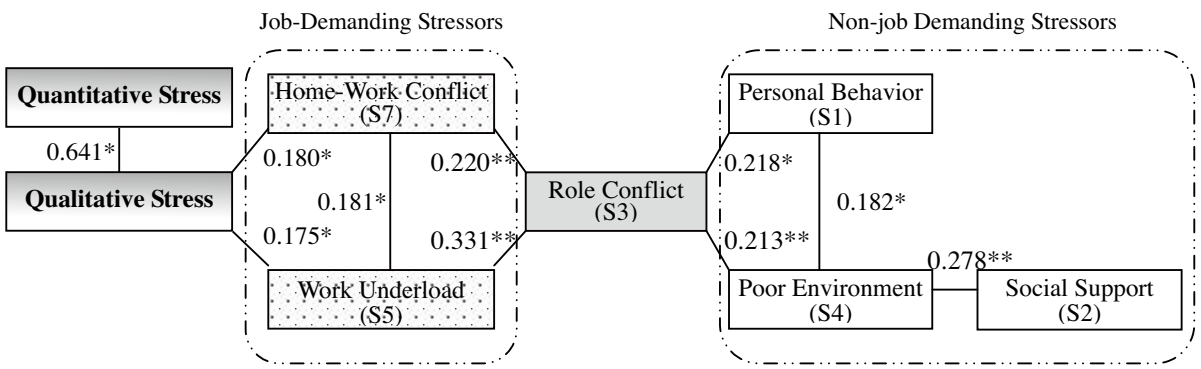


Figure 1 Hypothesised Model based on Results of Correlation Analysis
Note: ——— significant relationship (p<0.01**) ; ------ significant relationship (p<0.05*)
xxx -Critical Stressor; xxx -Job-demanding Stressors; xxx -Non-job demanding related Stressors.

related to two stressors Work Underload (S5: $r = 0.175$; $p<0.05$) and Home-Work Conflict (S7: $r = 0.180$; $p<0.05$). Hence, the principle stressors affected the qualitative stress of estimators rather than the quantitative stress. Estimators/estimating managers should not only adjust the workload assigned to them, but also consider their private life and their relationships with their family and friends (Kanter, 1977). However, the positive relationship between qualitative stress and Work Underload was an interesting result: those who are delegated tasks beneath their ability also experience qualitative stress (task difficulty). Work Underload represents boredom and repetitiveness in doing a task. It is difficult for estimators to carry out a boring task repetitively when they find that their skills and abilities are not being used well or appropriately.

Among the six stressors, Role Conflict (S3) can be considered as a critical stressor in the estimation process, as it links the Job-Demanding stressors and the Non Job-Demanding stressors. (refer to Fig. 1) Although the remaining stressors have no significant relationships with the Qualitative and the Quantitative Stress, the results still indicated that four of them are related to the stress indirectly. Role Conflict of estimators in a consultant firm or construction company is directly related to work underload, personal behavior, home-work conflict and the working environment.

Social Support (S2) acts as the root of the stressors-stress relationship for the construction estimators. It is well known that construction estimation involves complicated and demanded tasks. Estimators are required to review all drawings, contact different experts/suppliers, clarify uncertainties, call quotations, check historical data, calculate unit rate, allow accuracy mark-up percentage, etc. In practice, it is common to work overtime in the estimation process. Thus, social supports (S2) from estimator's family and friends are very important for the demanding estimation tasks. This implies that a lack of social support of an individual estimator would lead to an increase in the individual stress level of estimators indirectly by chain reaction.

In sum, estimators are more likely to have conflict with the organization and their supervisors (S3), if they work underload (S5), involve the particular personal behavior (S1) and work in a crowded and noisy environment (S4). Role Conflict can also be attributed from the conflict between their estimation tasks and their family (S7), or the support by their friends and family (S2).

RECOMMENDATIONS

In order to optimize the estimation performance, estimators' task difficulty and working ability have to be appropriately balanced. It is suggested that regular examination of estimation teams' RustOut/BurnOut degree of stress be carried out in all construction firms, as the RO-BO scale involves both quantitative and qualitative RustOut/BurnOut dimensions. Estimating managers can then adjust the workload and the nature of tasks for each estimator before the estimators experience rustout or burnout.

Since Work Underload and Home-Work Conflict are the main stressors influencing qualitative rustout and burnout respectively, estimating managers need to clarify whether the tasks given to estimators are too boring or repetitive. They should perhaps hold meetings with those estimators who have high qualitative stress and provide psychological consultation to their employees to solve/support their personal problems. By understanding their personal life and adjusting their workload, estimation performance can be improved.

Many studies have found an inverted U-shaped relationship between stress level and performance (Jex, 1998; Leung *et al.*, 2005a), while other recent studies have questioned such a relationship (Westman, 2001). Moreover, Allen *et al.* (1982) and Friend (1982) found only negative linear relationships between stress and performance. This survey investigates the impact of stressors on both quantitative and qualitative stress, but it does not reveal the relationship between quantitative stress and estimation performance or between qualitative stress and estimation performance. To understand overall stress management in the estimation process, further study on the impact of different types of stress is recommended.

CONCLUSION

This paper has identified the stressors experienced by estimators and investigated the impact of such stressors on the qualitative and quantitative stress of estimators in Hong Kong. The results indicated a significant relationship between quantitative and qualitative stress levels. Job-Demand stressors such as Work Underload and Home-Work Conflict have significant effects on qualitative and quantitative Job-Demand stress. Other estimation stressors including personal/ interpersonal stressors (personal behavior, social support and role conflict) and physical stressor (work environment) are correlated to the qualitative stress indirectly via Job-Demanding Stressors.

The study found that Work Underload and Home-Work Conflict are two main stressors affecting the estimators' qualitative Job-Demand stress directly. Private Life cannot be easily controlled by a company; and Role Conflict is found to be a critical stressor for the stress level of the construction estimators. It is recommended that the RO-BO scale, which is a simple and fast indicator of stress, be used by construction companies to examine the stress situation of estimators and as a guideline for how to adjust the workload among company estimators. Construction companies should pay attention to the qualitative and quantitative Job-Demand stress situation of estimators in order to prevent the occurrence of burnout or rustout.

In sum, stress is not only caused quantitatively and qualitatively by workload, but it is also affected by personal stressors in the estimation process. Estimating managers need to consider both the task and personal stressors in order to prevent rustout and burnout in estimators.

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The Effects of Applied Stress on the Modulus of Elasticity and Modulus of Deformability of Laterized Concrete

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ABSTRACT

This research work assessed the effects of applied stress on the modulus of elasticity and modulus of deformability of laterized concrete. Laterized cubes of size 150x150x150mm were prepared as test samples. Three mix ratios of (1:1½:3), (1:2:4) and (1:3:6) were used. The specimens were tested at curing ages of 7 to 28 days. The results have shown that increase in the level of applied stress brings about decrease in modulus of elasticity and modulus of deformability. Modulus of elasticity of laterized concrete is always less than the corresponding modulus of deformability, but both increase with an increase in strength.

KEYWORDS

Laterized Concrete
Modulus of Elasticity
Modulus of Deformability
Compressive Strength
Applied Stress

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INTRODUCTION

Laterite has been used in building construction for thousands years and approximately 30% of the world's present population still lives in laterite structures (Confirman, et. al, 1990). Lateritic soil has been one of the major building materials in Nigeria (Osunade, 2002). In addition to easy availability, laterite has the advantage of requiring no specialised skilled labour for its production.

Laterite is found extensively all over Nigeria and for that matter, all over the tropical regions of the world. Lateritic soils are essentially products of tropical or sub-tropical weathering usually found in areas where natural drainage is impeded (Lasisi and Osunade, 1984). Laterized concrete is concrete in which sand component is partially or wholly replaced by laterite. Whole replacement is often referred to as terracrete.

Today, the use of lateritic soils for building seems to be restricted to rural areas. This may not be unconnected with the fact that there have not been accepted standards design parameters for the effective structural applications of laterite in laterized concrete. Although the use of laterite as a substitute for sand as fine aggregate in concrete has been studied by many, not much is known about the elastic properties of laterized concrete.

Determination of the elastic modulus of concrete is necessary for stress analysis associated with environmental effects and for computation of the design stresses, deformation and deflections under load in concrete and reinforced concrete structures (Abadjieva, 1998).

Results of investigation presented in this paper are parts of the authors' effort aimed at developing design parameters for the effective structural application of lateritic soils in concrete. This study specifically looks into the effect of applied stress on the modulus of elasticity and modulus of deformability of laterized concrete.

PREVIOUS WORK

Most studies reported in the literature focused on the stabilisation and utilisation of laterite and lateritic soils with the addition of lime, cement, or bentonite (Kumar, 2002). The first published work on laterized concrete, according to Osunade (2002), appears to have been by Adepegba in 1975 – a study in which the strength properties of normal concrete were compared with those of laterized concrete. The conclusion of that study was that a concrete in which laterite fines are used instead of sand, can be used as a structural material in place of normal concrete. In another study, Balogun and Adepegba (1982) discovered that the most suitable mix of laterized concrete for structural purposes is (1:1½:3) with a water/cement ratio of 0.65, provided that the laterite content is kept below 50 per cent.

While studying the effect of mix proportion and reinforcement size on the anchorage bond stress of laterized concrete, Osunade and Babalola (1991) established that both mix proportion and the size of reinforcement have a significant effect on the anchorage bond stress of laterized concrete specimens. The richer, in terms of cement content, the mix proportion, the higher the anchorage bond stress of laterized concrete.

Osunade (1994) in another study found that increase in shear and tensile strengths of laterized concrete was obtained as grain size ranges and curing ages increased. Also, greater values of shear and tensile strengths were obtained for rectangular specimens than those obtained for cylinders. Neville (1995), submitted that laterite could rarely produce concrete stronger than 10MPa. However, Osunade (2002), Ata (2003) and Olusola (2005) proved this assertion to be wrong and went further to establish that laterite could produce concrete of higher grades.

In a recent study by Ata, Olusola and Aina (2005), it was found that Poisson's ratio of laterized concrete ranges between 0.25 and 0.35 and increases with age at a decreasing rate. Methods of curing, compaction method and water/cement ratio have little influence on the Poisson's ratio. Poisson's ratio of laterized concrete increases as the mix becomes less rich.

EXPERIMENTAL METHODOLOGY

Laterite, gravel and ordinary Portland cement are the major materials used in this research work. Though all the materials were sourced from within Ile-Ife in Ife Central Local Government Area of Osun State, Nigeria, the cement was manufactured by West Africa Portland Cement at Sagamu and conformed with the requirements of BS12 (1991). The washed gravel used as coarse aggregate had an almost uniform size of 20mm while the laterite fine aggregate was of maximum size of 2.36mm.

Three mix proportions of (1:1½:3), (1:2:4) and (1:3:6) were used. The optimum water/cement ratios for workable mixes were determined using the following expression (Lasisi and Ogunjimi, 1984)

$$y = -0.9 + 3.85x$$

where y = cement/laterite ratio
x = water/cement ratio

The ratios 0.623, 0.753 and 1.013 were used for (1:1½:3), (1:2:4) and (1:3:6) mix proportions respectively.

After the collection of gravel and laterite used as coarse and fine aggregates respectively in this research work, various tests and analyses were carried out on some selected samples in order to ensure their compliance with various established standards. Some of the analyses carried out on the samples include sample grading, moisture content determination and Atterberg limit determination.

The ingredients were mixed manually on a neat platform with the predetermined amount of water. Batching was done by weight. Laterite and gravel were thoroughly mixed before the introduction of cement. The whole mixture was thoroughly mixed before water was added. Mixing was fast and assumed to be completed when a homogenous mix was obtained.

Before casting, the inner parts of 150x150x150mm cubic moulds were coated with mould oil to ensure easy demoulding and smooth surface finish. Immediately after the mixing, the wet mixture was cast into the moulds using hand trowel and compacted in accordance with BS 1881: Part 116 (1983). The specimens were demoulded 24 hours later and water cured till they were tested.

The strength characteristics of each cube were tested on an ELE 2000 compression machine. Three specimens for each curing age were brought out of the curing tank and tested in accordance with BS 1881: Parts 116 and 121:1983. Two dial gauges were attached to the machine to measure extensions. The gauges were on the vertical plane to measure the longitudinal extensions.

The laterized concrete cubes were loaded in compression at a constant loading rate. Initially the cubes were loaded with a load, which caused compressive stress equal to 5 per cent of the ultimate compressive strength. In the second minute of loading, the readings from the dial gauges were taken. The loading continued until stress of 10 per cent of the ultimate compressive strength was reached and the corresponding extensions recorded. The sample was then unloaded back to 5 per cent of the ultimate compressive strength and the value of the elastic deformation (ε_e) was determined. The successive loading and unloading cycles continued at 10 per cent intervals up to the stress level of 70 per cent of the ultimate compressive strength. At each load level, readings on dial gauges were taken.

The relative total deformations $\Delta\varepsilon_d$ and the relative elastic deformations $\Delta\varepsilon_e$ were determined using the following formulae:

$$\Delta\varepsilon_d = \frac{a_l - a_o}{L_o}$$

$$\Delta\varepsilon_e = \frac{a_l - a_u}{L_o}$$

Where:

a_l is the reading at the end of the loading
a_u is the reading at the end of the unloading
a_o is the reading at 5 per cent of the ultimate compressive strength
L_o is the gauge length

The modulus of elasticity (E_e) that corresponds to elastic deformations and modulus of deformability (E_d) corresponding to total deformations (elastic and plastic) was calculated using the following formulae:

$$E_e = \frac{\Delta\sigma}{\Delta\varepsilon_e}$$

$$E_d = \frac{\Delta\sigma}{\Delta\varepsilon_e}$$

Where $\Delta\sigma$ is the increase of the stress.

The modulus of elasticity and the modulus of deformability depend on the level of applied stress chosen (expressed as percentage of ultimate load) (BS 8110: 1985, Darakchiev, Nikolov and Abadjieva, 1990). In calculations of the modulus of elasticity and modulus of deformability the point on the curve corresponds to 33 per cent of the ultimate strength was chosen as prescribed in BS 1881: Part 121:1983.

RESULTS AND DISCUSSIONS

Sieve analysis of the lateritic soils sample used shows that the coefficient of uniformity (CU) as being approximately equal to 4.30. The value shows the laterite sample to be well graded. The Atterberg's limits tests indicated values of 36.5%, 17.5%, 19.0% and 1.13 for the liquid limit, the plastic limit, the plasticity index and the liquid index respectively. From the British Soil Classification System for Engineering purposes (Terzaghi and Peck, 1967), soils having liquid limit between 35 and 50% are said to have intermediate or medium compressibility of plasticity. Thus, with a liquid limit value of 36.5%, the lateritic soil sample used in this research work

Figure 1 Influence of the level of applied stress on the modulus of elasticity and modulus of deformability of laterized concrete at 7 days curing age

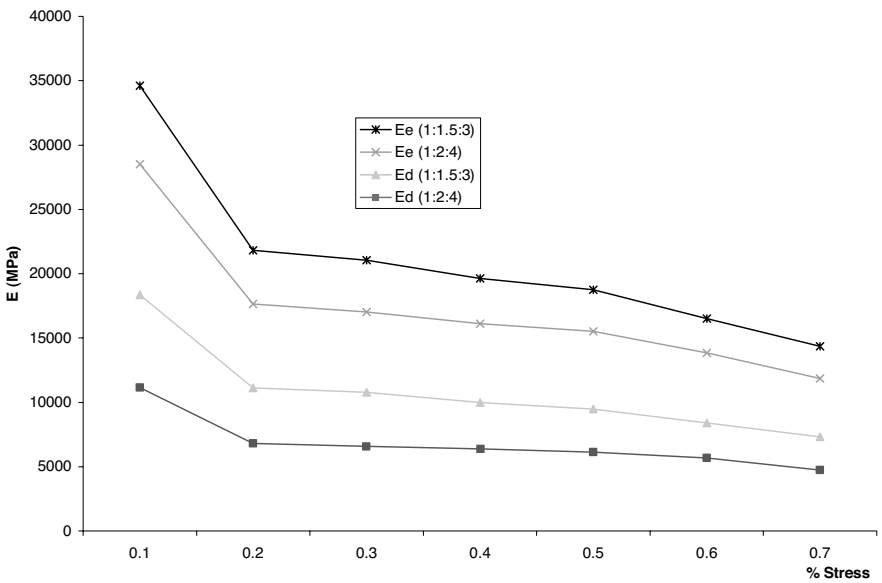


Figure 2 Influence of the level of applied stress on the modulus of elasticity and modulus of deformability of laterized concrete at 14 days curing age

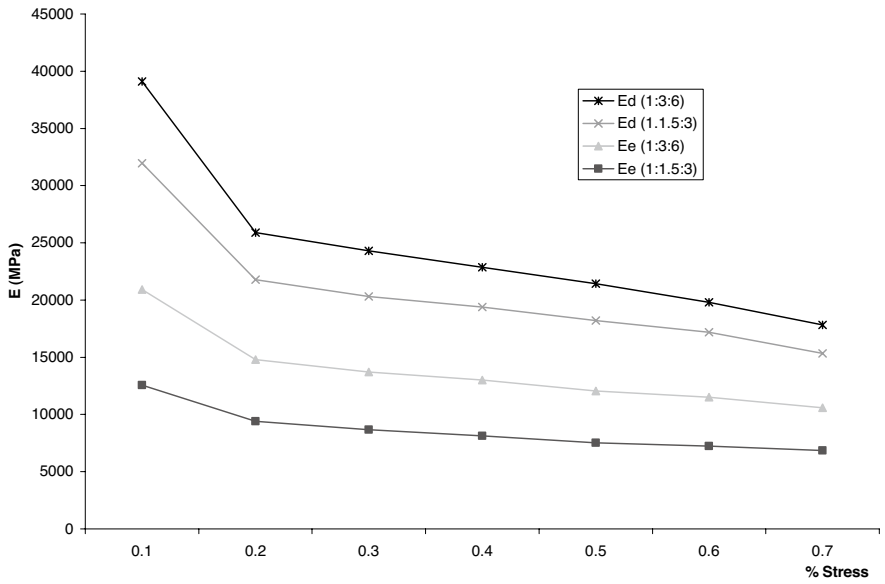


Figure 3 Influence of the level of applied stress on the modulus of elasticity and modulus of deformability of laterized concrete at 21 days curing age

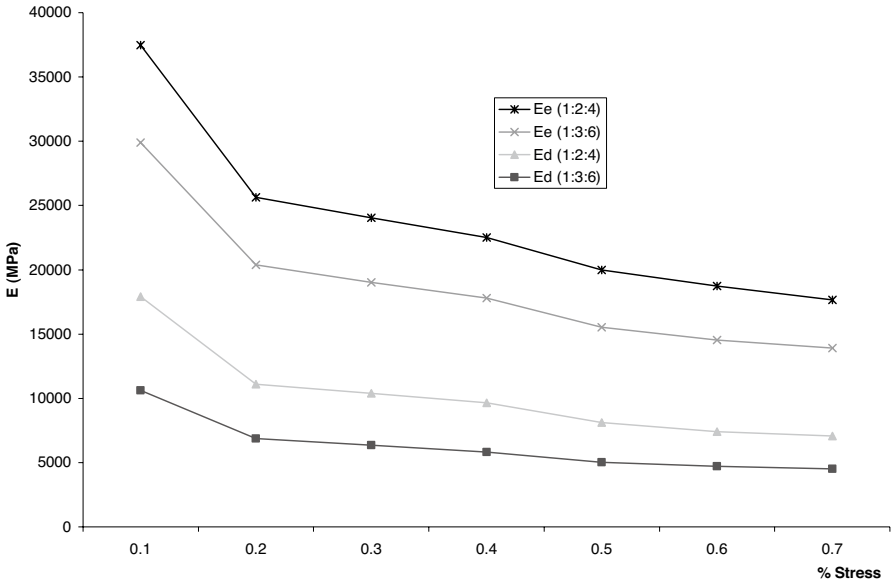


Figure 4 Influence of the level of applied stress on the modulus of elasticity and modulus of deformability of laterized concrete at 28 days curing age

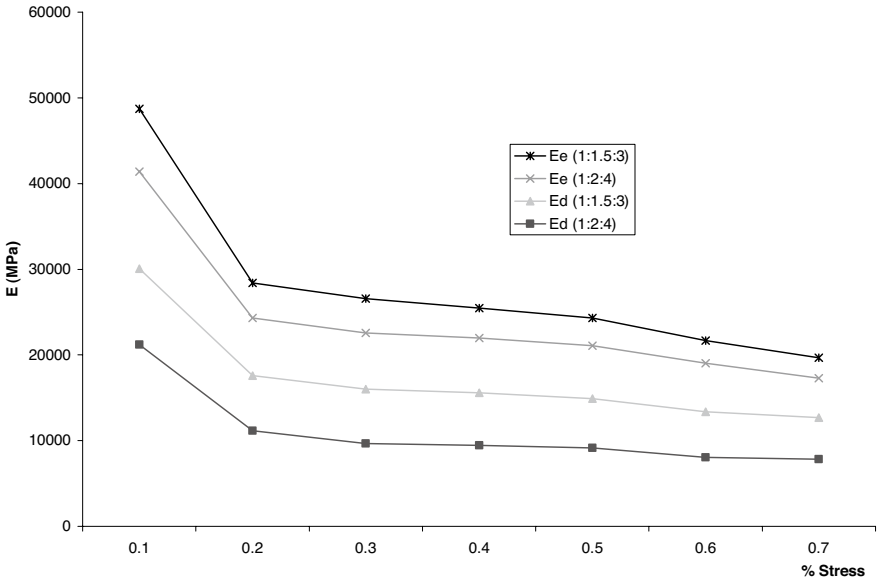
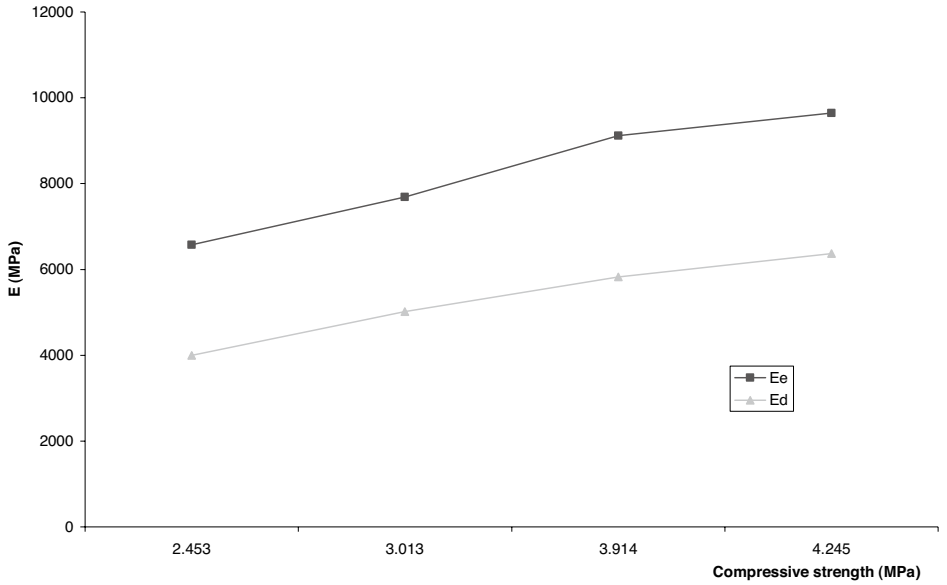


Figure 5 Modulus of elasticity and modulus of deformability of laterized concrete at different compressive strengths



can be said to have intermediate plasticity and as a result very clayey. Similarly, with a plasticity index of 19.0, the lateritic soil sample falls into the group of medium cohesive soil (PI between 20 and 30%, Jackson and Dhir, 1996).

Figures 1 to 4 are typical graphs showing the influence of the level of the applied stress on the modulus of elasticity and modulus of deformability of laterized concrete at ages of 7 and 28 days. The stress level is expressed as the ratio of the existing stress in the laterized concrete to ultimate compressive strength of the cube. Figure 5 shows the effect of different

compressive strength on modulus of elasticity and modulus of deformability of laterized concrete.

The Figures show that both modulus of elasticity and modulus of deformability decrease with an increase in the level of the applied stress of laterized concrete. For instance, sample (1:1.5:3) at 0.75w/c and curing age of 7 days, with the increase of level of loading from 10 per cent to 70 per cent of the ultimate load; the modulus of elasticity decreases 2.35 times and the modulus of deformability decreases 2.91 times. While at the age of 21 days with a similar increase in the loading level, the modulus of elasticity decreases 2.07 times and the modulus of deformability decreases 2.47 times. When the applied stress increases beyond approximately 70 per cent of the ultimate strength; mortar cracking (connecting the bond cracks) develops. The development of a continuous crack system reduces the load-carrying capacity of the specimen as its ultimate strength is reached faster. The increase in strain while the loading is acting is due to creep effect in laterized concrete, which is more at higher stress.

The Figures also reveal that the modulus of elasticity of laterized concrete is always higher than its corresponding modulus of deformability. This is as a result of elastic deformations being always less than plastic deformations. The difference between modulus of elasticity and modulus of deformability is greater at lower levels of loading.

Mix proportion affects both modulus of elasticity and modulus of deformability. For example, at 28 day curing age and 30% applied stress; mix (1:1½:3) produces modulus of elasticity and modulus of deformability of 9647.73MPa and 6367.18MPa respectively. Whereas, mix (1:2:4) at the same ages and applied stress could only produce modulus of elasticity and modulus of deformability of 6550.00MPa and 4014.52MPa respectively. This is not unconnected with the fact that mix proportion affects strength. The richer the mix then is the higher the moduli.

It can also be deduced from the Figures that both moduli increase with increase in the curing age. Since laterized concrete strength increases with increase in curing age, it can be said that its exhibition of low strain at high strength is responsible for this. This falls in line with Neville's (1995) submission that high-strength concrete has higher modulus of elasticity. This increase in modulus of elasticity and modulus of deformability with time (curing age) is only proportional to the strength but it (the increase in the moduli) is less than the corresponding increase of strength with time. That is, the modulus per unit strength decreases with age. The decrease is greater at the early ages of laterized concrete. But at later ages; strength increases more rapidly than the moduli of laterized concrete.

CONCLUSIONS

From the foregoing discussion of results, the following conclusions can be made:

1. The modulus of elasticity and modulus of deformability of laterized concrete decrease with an increase in level of the applied stress.

2. Both moduli increase with an increase in the strength of laterized concrete with time but the increase in the moduli is less than the corresponding increase in strength with time.

3. Modulus of elasticity of laterized concrete is always higher than the corresponding modulus of deformability. The difference between the moduli is greater at lower levels of applied stress.

4. The modulus of elasticity of laterized concrete lies between the range of 7000 and 9500MPa, while that of deformability lies between the range of 5000 and 6000MPa.

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Conflict of Interest within Construction Practitioners: Quantity Surveying, Case Study

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ABSTRACT

The instinct of decision making is the pride of professionalism in the construction industry and professionalism is a function of demonstrable skill, competence and professional ethics, it is predicted by professionals' academic background, length of time in practice and professional status. The research is aimed at identifying ethical perceptions of practicing Quantity Surveyors across the levels of professional status. It was discovered that young or new entrants into Quantity Surveying practice own up to self-interest while senior members always consider public interest. The implication is that this proportionality affects the image of professionalism in Quantity Surveying practice unpleasantly as well as the future of the profession. It concludes by recommending feasible panacea for implementation by professional bodies and education authority.

KEYWORDS

Professional Ethics
Professional Interest
Professional Status
Quantity Surveying Practice

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INTRODUCTION

Professional services are largely created and sustained by the continued interest, expectations and demand of the public. Moreover, professionalism is imperative of certain core values; competencies, responsibility and willingness to serve public interest (Chalkley 1990; Carey and Doherty, 1968). The view of the public determines the continuous recourse to, demand for and continued existence of any profession; through trust, confidence as well as the pride and respect for the quality performance of services rendered. The systemic complexity of the construction industry with respect to project performance is not only targeted at meeting clients demands through the dynamism of technical competencies and innovative skills but the behavioral pattern of professionals to protect client's interest and sustain public-industry harmony (Chalkley, 1990; Poon, 2004a; Nkado, 2000).

The construction industry can not afford to ignore the imperatives of professional ethics among the practitioners, which in recent years has been under very serious criticism. This makes the redemption of her image inevitable, if she chooses exists. Egan (1998) reports that over thirty-three percent of clients are dissatisfied with contractors and consultants' performances. Reporting a recent survey conducted by Construction Clients Forum in the United Kingdom, Poon (2003) reports that fifty-eight percent of the respondent clients experience program over-run with an average of forty-eight days delay in anticipated delivery, while thirty-two percent experience cost over-runs. Ridout (1999) adds that fifty-seven percent of clients experienced defects on their projects. Therefore, this study affirms the need for the industry to equip the practitioners technically and address the pertinent need to further institutionize the new paradigm of reliable, flexible and mixed public-industry transaction strategy through professionalism as operational ethos. Unfortunately, the cultural misalignment between the construction industry and public interest through professional ethics has been proved to be the single largest factor leading to poor quality of work and client dissatisfaction in the industry (Pollington, 1999). Nonetheless, balanced professionalism has been seen as the most important antidote (Poon, 2004 a and b).

Professional misconduct in the construction industry has not just affected public confidence and respect for the pride of professional competencies, professional bodies are aware that there had been unwarranted concern on the state of professionalism in the construction industry in government's special discourses (Latham, 1994; Egan, 1998; Fan et al., 2003; Ho et al., 2003; CIRC, 2001). Also, apart from other erroneous violations involving surveyors in the UK with which most clients passionately resolved to be silent because of ignorance or socio-political reasons, a fraction of over two thousand and seven hundred misconduct cases were reported to professional conduct panel (Poon, 2003). Ho et al., (2004) also report that Hong Kong recorded a whooping loss of over HK$600,000,000 on two barely completed 34-storey buildings later demolished for severe irredeemable structural problems. There were other reported cases of 'short piling' and salt water construction scams, poor service quality of work and so on in the Hong Kong and UK construction industries which were pivoted by unscrupulous professional misbehaviours. Ultimately, the industry has failed over the years to satisfy client's desire to create maximum value for money (HKEDC, 1996; Ho et al., 2003).

Like many anecdotal evidences in the literatures, Poon (2003), referring to the Steven Gould - RICS Regulations' Director, says there are some Quantity Surveying firms who unintentionally don't seem to understand how to handle clients money and are culpable

of certain actions that could be severely damaging to clients' interests. Nonetheless, Nkado (2000) gives an overview of the ubiquitous need of certain professional skills in quantity surveying that are pertinent to meeting clients' demands, which in stochastic analysis of Olatunji and Ogunsemi (2006a) and Vee and Skitmore (2003) reflect conflict of interest. Pearl et al (2005) and Poon (2003) attribute this ugly phenomenon that has robbed quantity surveying profession the much expected pride of place of professionalism in the industry to the conflict of views of the various cadres of practicing quantity surveyors as regards certain ethical principles and the systemic complexities that make it difficult to justify certain culpable conceptions and practices. Therefore, the significance of addressing conflict of interest in professionalism in the construction industry (especially in quantity surveying practices) is to encourage high quality industry performance and proliferate positive awareness of the improving image of the profession by the doubting public.

PROFESSIONAL ETHICS AND QUANTITY SURVEYING PRACTICE

Quantity surveying practice enjoys uniqueness and ubiquitous expertise in construction cost management to generate value for client's money all through the construction process and other duties wherever adaptable. Despite Quantity Surveyors' traditional expertise in feasibility and viability appraisal of construction investments; drafting, compilation and documentation of construction contracts; preparation and subsequent analysis of construction contract bids, quotes or tenders; contractor selection advice and financial management of all construction works and allied reporting, including auditing, cost planning, cost indexing etc, they are also very relevant in construction project management, value management, facilities management, management contracting, construction dispute resolution, research consultancy (Seeley, 1996; Abdullah and MBQIC, 2005; Nkado, 2000). Interestingly, quantity surveying practice is gaining more relevance in asset management, project management, taxation, law, insurance, banking and manufacturing – especially oil and gas (Yakub, 2005), yet the profession still needs a lot of publicity (Poon, 2004b; RICS, 2002) through enterprising packaging and marketing of an attractive image of professionalism, not only in technicalities but in ethical discipline.

Traditional ideals of quantity surveying practice and professional conduct have been challenged by recent social, political and technological changes (Fan et al., 2001). It is inevitable that as the profession expands rapidly in relevance and demand within and outside construction, there is the need to sustain the growth as it changes with time and demand proliferation with enterprising service attitude and the right mind of professional indemnity through the duty of care to sustain productivity exclusively in the industry.

Professional ethics therefore, justifies the acceptability of abstract standards of behaviour against practical tasks, not exclusively limited to technologies, transactions, activities, pursuits and assessment of institutions, but includes more of practical conceptualization and public expectations in the interest of responsibilities, willingness to service the public and astute competencies (Fan et al., 2001; Carey, 1968; HKEDC, 1996; Chalkley, 1990; Poon, 2003; 2004a). However, as requisite responsibilities increase and the professionals produced by academic and professional establishments proliferate, there is the need to sustain the maintenance of public trust and confidence in quantity surveying professional practices of both the new entrants and old generation practitioners, the duo of whose professional perceptions are always

dichotomous. Conducts of practitioners have to be correlated with intentions, means and ends (Ray et al., 1998) of constituent members in relation to perception instinct and variables like self, employer/company, clients, superiors, colleagues, family and general public (Poon 2004b).

For instance, new entrants; junior, technician, graduate and associate members with minimal professional exposure differ in technical and ethical perceptions compared to more experienced, senior members with higher academic and professional qualifications and experience especially during systemic dilemma and economic recessionary period. This may be as a result of different academic exposures and backgrounds, length of time in professional practice, age and cumulative exposure of Quantity Surveyors to systemic challenges, position in organization hierarchy as it affects corporate decision making instinct and so on (Fan et al., 2001). Further, Caroll (1978) adds economic influence through continent rewards and organizational policies, while Nyan and Ng (1994) opine that the nature and role of professionals in establishment's business may affect their professional disposition to ethical discipline and conscientiousness.

Therefore, as challenges and ubiquitous demands expand with new entrants of quantity surveying practice professing with different goals, it may be difficult to hold them under serious legal obligation to uphold ethical practices. This is because they may not be recognized as members of professional bodies until they are duly examined and registered, which may not be a mandatory requisition to operate within their delimited scope. Also, except in exceptional cases, academic establishments are not so keen in monitoring the ethical conducts of their products out of school. Moreover, there are no serious legislation co-relating employment conditions and fundamental or statutory professional obligations with the legal powers of professional bodies, who are specifically monitoring practitioners' conducts in conformity with ethical standards, other than individual's personal decisiveness whether or not to uphold ethical standards. In other words, practicing quantity surveyors are better made to be more responsive to better ethical decisions through personal convictions established through timely, consistent, interactive and best practice trainings that are well packaged to arouse proactive involvement at personal and corporate levels (for both practicing quantity surveyors and other practitioners, construction and non-construction related) and not mere extenuative compulsive calls commonly paraded by professional bodies. Moreover, available educational facilities are set up to produce more of technical skills in graduates than the ethical aspect (Fan et al., 2003). At large, it has also been difficult for professional bodies to track down incidences of professional misconducts because there are no incentives or reward by either government or professional bodies to recognize or applaud practitioners' desire or attempts to challenge serious ethical confrontations.

There had been various brilliant scholarly attempts to define ethical conceptualizations and the routenization of its application to demystify what constitute professional misconducts and the corresponding effects on the image of professionalism in the sensitive roles of Quantity Surveyors in the construction industry. Vee and Skitmore (2003) and Tranfield and Gleadle (2003) study ethical dilemmas of construction managers. Fan et al (2001; 2003) study factors affecting ethical perceptions and decision instincts of construction administrators. Poon (2003; 2004 a & b) also examines the relationship between behavioural or professional ethics in quantity surveying, construction management and project performance. Although, Badger and Gay (1996) believes in personal ethics wherein everybody is treated with the same level of sincerity, Borkowski and Ugras

(1992) opine that the ethical perception of Quantity Surveyors can be affected by some demographic variables which are likely to cause intrinsic conflict of interest between practitioners operating in the identified variables. Such include age, position in organization, education level, nature of business and nature of assignment in business in relation to strictly guided employment conditions and gender. Mehta and Keng (1984) add annual personal income, while McDonald and Pak (1996) opine that size or organization is also a prime potential worthy of recognition in this regard. McDonald (1995) also considers experience as a very important variable that marks practitioners out in ethical judgment.

PROFESSIONAL MISCONDUCTS IN QUANTITY SURVEYING PRACTICE

Based on the foregoing, it is possible to considerably identify professional misconduct and where to attribute them in the ethically polarized cadres of Quantity Surveyor. Ferrell and Weaver (1978) identify negative tendencies like Quantity Surveyors' frequent temptation to provide trade secret in exchange for unscrupulous inducements, compromise to dispense professional service with very despicable low level of honesty, especially when faced with competency challenges traceable to negligence and stern denial of fault. Also common is the tendency to exaggerate services provided to deceive client into paying more than necessary. There are reported cases where Quantity Surveyors, employed to protect client's interest connive with greedy contractors to defraud the unsuspecting clients (McDonald and Zepp, 1998).

Notorious Quantity Surveyors also falsify reports frequently to favour selfish interest without considering professional implications and employer's ambition. They also conceal systemic errors to justify negligence, 'adapt' trade/contract figures for unprofessional reasons or compromise to pressure by inducement or expressed threat to doctor professional opinions and standards. They also help to 'save' other consultants' neck whose roles are vivid and tantamount to causing project failure (Newstom and Ruch, 1975, Albratt et al., 1992, Izraeli, 1988; Olatunji et al 2006a).

Because of Quantity Surveyors' ubiquitous relevance in construction cost management, they are more prone to 'conscience auction' through undeserving bribes, inducements and gifts, most especially during site visitation and valuation at the inception of construction such that the erudity of the professional responsibility is fouled and pocketed at the "payer's" will. There have also been reports of abuse of office especially in cases like misappropriating organization or official time and resources for personal use (Dubinsky et at., 1980), waste longer time on job than envisaged (Ferrell and Weaver, 1978) and exhibit indolence at work (Albratt et al., 1992). Dolecheck and Dolecheck (1984) also add the tendencies to compromise personal standards or professional principle to fulfill employer's demand at the expense of the client or the public at large. Dubinsky at al. (1980) also confirms illegal collusion between Quantity Surveyors to arrange cover prices for cartels and hamper the free flow of virtuous competition.

Apart from vices identified from literatures, experience shows that some consultant Quantity Surveyors can stoop so low to change tender figures for contractors in order to win client's interest, especially under lowest bid atmosphere where contractor selection is subjectively driven by price-data-only paradigm. There are also cases whereby there are allegations of releasing very delicate and confidential contract secrets, while a good number of client's Quantity Surveyors engage in bid pricing for candidate contractors at

the expense of consultant Quantity Surveyors, while others refuse to whistle-blow the defaults of corrupt senior executives perpetrating illegal deals with contractors.

There are possible cases where disciplinary panel members have a backlog of unreported unethical/criminal cases hunting their shadows but poised to the unsuspecting professional bodies clean. In most developing countries where the profession in just growing, professional sins are covered to sustain huge quantum of membership, while grievous ones are settled by diplomacy, leaving behind despondent history. From latent records, it is predictable that professional bodies in some countries may be politicized in the future to nail or indict members unjustly, in which case the professional body is hired or pressurized to dent the image of members aspiring in bigger politics. Judicial procedures have been helpless in many circumstances of like manner in some developing countries.

RESEARCH MATERIAL AND METHOD

A total of eighty (80) questionnaires were received from the sum of one hundred and forty-seven (147) administered, both as hard copies and e-mails, to randomly selected quantity surveying firms in Hong Kong, UK, Singapore, Malaysia and Nigeria. The contact details of 40 target respondents from Hong Kong and UK were retrieved from the websites of surveying professional bodies (RICS and HKIS) in the two countries, while 47 questionnaires were administered to target respondents retrieved from renown authors and surveying practitioners from Singapore and Malaysia being participants at the biennial international convention of Malaysian Quantity Surveyors held in the Kuala Lumpur, Malaysia in 2005. 60 hard copies were administered to Nigerian Quantity Surveyors in practices ranging from the academics to other facets of professional practice. The questionnaire administration, spanning seven months (November 2005 – May 2006), allowed snowball approach in which respondents were advised to pass questionnaires to their colleagues whose opinions they think might be of good interest.

After repeated reminders through e-mails and telephone calls, about fifty-four percent of the targeted respondents were received from practicing Quantity Surveyors in all categories in private and public sectors irrespective of service specialty. There was no significant disparity in the responses, though from different locations and specialties. This is largely due to the fact that the aim of the study is not to establish the ethical conflict of interest in the different locations where the questionnaires were administered but in the various cadres of quantity surveying practice in those places which, in the opinion of the researcher, are some of the places that portray the best practices in quantity surveying in the developed and the developing countries in Europe, Asia and Africa. Another research is ongoing to address the concept of ethical perceptions of Quantity Surveyors in the three continents earlier identified as well as the correlation of same between different construction practitioners. Table 1 shows the analysis of questionnaire distribution and responses received from the identified places, while Table 2 shows the analysis of the responses from the identified cadres of quantity surveying practice.

From Table 1, 41% of the respondents are resident in Africa (Nigeria), 26% are from Asia, out of which 7 respondents (representing 27% of the responses from Asia) are from Malaysia; 10 respondents (representing 39% of the responses from Asia) are from Singapore, while 9 (representing 34% of the responses from Asia) are from Hong Kong. Moreover, 28% of the respondents are resident in the UK.

Table 1 The country/continental bases of the respondents

Practice Group	Africa	Asia	Europe	Total
Industrial Trainees	9	5	2	16
Technician Members	8	5	2	15
Graduate Members	5	4	5	14
Registered Junior Members	4	4	4	12
Registered Intermediate Members	3	4	2	9
Registered Senior Members	2	2	4	8
Fellows	2	2	2	6
Percentage Total	**33 (41%)**	**26 (33%)**	**21 (26%)**	**80 (100%)**

Table 2 Analysis of Questionnaire Distribution and Responses

Practice Group	Distributed	Responses	Percentage
Industrial Trainees	20	11	7.5%
Technician Members	25	10	6.8%
Graduate Members	22	18	12.2%
Registered Junior Members	20	13	6.8%
Registered Intermediate Members	20	12	8.2%
Registered Senior Members	20	10	6.8%
Fellows	20	06	4.2%
Total	**147**	**80**	**54.4%**

From the received questionnaires, 7.5% are Industrial Trainees who are under compulsory practical training in fulfillment of the requirement for the award of degrees and diplomas. Their contributions were not voided because the program takes a great influence on their ethical training and subsequent practice beliefs. While striving to reconcile classroom trainings with the intricacies of practice odds – mostly very strange to most of them, they also contend with their career objectives which may not be at par with the practice or life styles of their senior colleagues.

Moreover, 6.8% of the respondents are Technician Members who are experienced members but with less academic qualifications. Their passion and seasoned techniques to sustain keen professional practice necessitate their pride of place in the wealth of the research materials. The 12.2% of the respondents are Graduate Members,

who are graduates with higher academic qualifications but aspiring for full professional recognition through a number of competency assessments. The 8.8% of the respondents are Junior Registered Members. They are recognized practitioners with limited years of experience, which in most cases can be referred to as Associates, who have passed professional examination and registered as practitioners. Intermediate members have more years of experience than the Junior Members. They have 8.2% of the responses for this research. Senior Members are more of experience than the Intermediate Quantity Surveyors, while Fellows are the highest cadres achievable, both having 6.8% and 4.2% of the responses in the study. Their tendency for very tight schedules as senior executives in practice and scarcity account for the low response received from Fellow members.

Although, many members are of the opinion that the ethical standard of their practice have not changed in the past 10 years, many still believe that there is room for improvement. A larger population of newer or younger practitioners believe that even when the perception have not changed, professional opinions of Senior Quantity Surveyors are often affected by external pressures, and the unchanged standards may not be changing with client's demand in the interest of the larger public, especially when confronted with dilemmas. 76% of the respondents opine that there are numerous unethical practices in the profession, which may mar the image of her professionalism in no distant future if proper attention is not paid to the contemporaneousity of public's ethical demand in the interest of sustained trust and confidence in professional competence, willingness to serve and the sense of responsibility (Chalkley, 1990).

Regrettably, traditional pedagogy encapsulated in professional training through academic institution is more into core skill development than ethical enhancement. The industry needs behavioral repositioning in order to improve the image of professionalism. Professional bodies recognized this and support the aggressive mobilization for Change (RICS 2003b) through campaign and training. However, most trainings are only fancied by candidates seeking professional recognition, only a fraction of which are considered, leaving a bulk demoralized in the pain of frustration and failure.

Further analysis reveals that 68% of the respondent have not attended any professional training that discusses updates of ethical issues in the past 18 months that is packaged well enough to convince them that certain contemporary practices are unethical. 78% strongly agree that the nature of higher education they receive is not well packaged enough to prepare them for ethical challenges faced in the practice, and would prefer that schools' curricula be modified to accommodate more of ethical training as much as technological or technical trainings in quantity surveying professional occupation. 54% of the respondents also blame the public as the single largest factor that is responsible for the misalignment in ethical perceptions and understanding of quantity surveyors because the client reserve the god-like position including the right to undermine professional standards and opinions as well as exhibit debilitating behavioral instincts like vices associated with lowest bid syndrome and undervalue the input of professional services of quantity surveyors in the consideration of professional fees.

The upkeep of ethical standard should bother more of younger Quantity Surveyors than the Senior Members, because they reserve the role to sustain the profession better than it was met. However, attending ethical training is at will and in most cases, there are no enough facilities and time to accommodate all persons and problems. It is also dependant on employment condition, in which case, the traditional positioning might be anti-ethical. Even when Senior Members refuse to loose their ethical grounds, they loose their firm tastes

to time, while their fractional population may reduce their passion for the stand, especially when professional corruption has eaten deep into the fabrics of practice polity. Therefore, the situation has polarized the entire professional state as intrinsic interests are in conflict. Table 3 analysis respondent's ratings of the decision factors affecting ethical milestones in Quantity Surveying practice against the identified groups in the system.

From the analysis presented in Table 3, average rating shows that respondents believe more on company's goal or interest than the client interest. This is justified by the fact that the respondents mostly operate in profit oriented set-ups and will only agree with client's interest as long as it does not contravene with corporate goal or opinion as firm are under increased pressure to declare more profit in the phase of competition than ever (Ho et al., 2003; 2004). Employees and corporate organizations would only sustain their desire to exist in business, only in this regard - delimiting clients interest to company growth.

Moreover, respondent considered more paramount, Superior's interest rather

Table 3 The respondents' ratings of decision factors affecting ethical milestones on Quantity Surveying practice.

Demographic Variables	Industrial Trainees	Technician Members	Graduate Members	Registered Junior Member	Registered Intermediate Members	Senior Registered Members	Fellows	Average Rating
Self Interest	1.82	4.55	4.36	4.72	2.20	2.20	2.50	**2.94**
Company's Interest	3.25	3.46	3.81	4.18	4.82	1.80	1.10	**4.13**
Client's Interest	2.65	3.61	3.82	3.96	4.51	4.61	4.81	**4.00**
Superior's Interest	4.22	3.85	4.71	2.05	4.68	4.72	0.0	**3.46**
Colleagues' Interest	2.83	3.71	3.96	1.25	1.20	1.20	0.51	**2.09**
Family Interest	4.05	2.60	1.65	2.82	2.75	1.80	1.00	**2.38**
Public Interest	1.95	2.40	2.60	2.65	3.86	4.55	4.85	**3.27**

The respondent ranked importance factors on 5 – 0 rating Scale. 5 being very important, 0 being not important at all.

than public interest. This is because most administrative decision are top-to-bottom and learning practitioners believe or are made to depend mostly on superior's opinions, since contravening this may be insubordination. Superior's motives drive company's goals and so company's interest must be respected by all in the interest of firm harmony. Some respondents believe in public interest, however quite a large number has little understanding and respect for what it stands to be. Most people believe respecting public interest may not give immediate economic gain and so serving the interest of the public may be too complex to observe and un-enterprising.

They expect the public to understand their corporate goals in order to sustain their existence. Some respondents believe that foul practices have little or no effects on public interest, however, its gains are needed to remain relevant in a society where social status are delineated by economic possession. Ranked least in order of significance are; family interest, colleagues' interest and self-interest. Respondents assert this to the fact that culturally, personal interest is easily influenced in young people by their closer families than colleagues. For instance, one may respect one's wife's view than a colleague's view, when faced with certain dilemmas. Only a few experienced professionals can absolutely separate official matters totally from family influence, even when they are under pressure.

However, each group of the respondents have different ethical perception. Fellows believe more of public interest, then client interest than company interest (confirming Fan et al., 2003). Very negligible in order of importance are family interest, self-interest or colleagues' interest. This is because they are mostly top management executive and so may not be influenced by any superior rather they affect corporate opinions and perceptions tremendously. On the other hand, Senior Registered Members are prime movers of company's interest and so must remain loyal to Superior's opinions to satisfy client desire within delimited scope of corporate perception. Public interest is equally more important, but should not outrage clients interest, who they are paid to support. Also, being family prime-directors, they are least affected by family and self interest and more unlikely affected by colleagues' interest, since they are obliged to corporate statutory standards rather than self opinion.

Moreover, Registered Intermediate Members also believe in company's interest, then Superior's interest than client interest. Like their senior counterparts, their respect for the public is delimited to corporate statutory milestones and operational standards. In most cases, family interest is more potent on them than self interest and are least affected by colleagues' opinions. Registered Junior Members however, have personal goals (self interest) that are considered more important than the goodwill of their organizations (Fan et al 2003). Next in importance to Junior Members is to stay within limits to sustain corporate goals, which is delimited by client's interest. Empirical survey in this study shows that they are more prone to family influence, than public interest and least affected by superior's influence. Even when this may not be interpreted as insubordination, it is evident that private and personal goal is what dictates their choice of career.

Graduate Members are perpetual learners of professional conducts, getting ready to achieve professional recognition. Automatically, superior's influence principally affects their goal in this regard and so must hold superior's interest in higher esteem than self-interest. Most graduates learn through collaborative network of peers and in most cases when faced with difficult situations not exposed to superiors, they tend to respect colleagues' advice, who deem to understand better. Apart from those milestones affecting Graduate Members' innate competencies, they respect client interest. Rarely, they are more prone to flout corporate statutory standards because of lack

of experience and vision misalignment. They are mostly exposed to most serious difficult situations against ethical standard and so may seldom public interest except possessing very good passion for the profession and may not be affected by family pressures.

However, Technical Members cherish self-interest because of their inclination to core technical competencies. They also consider closely, superior's interest in relation to client interest within the scope of corporate interest. They are less susceptible to family pressure and public interest. Industrial Trainees, however have no personal instincts other than what they were exposed to learn in the organization. They fear more of superior's interest, then culturally, family interest than company interest and colleagues' interest. Public interest has no meaning to them because they depend on immediate exposure to dictate their ethical perceptions.

From all indications, the professional motives of the different cadres of Quantity Surveyors identified in this study are greatly influenced by their dispositions to the variable interest identified in the study. For instance, the ultimate goal of professionalism in the construction industry is the amount and the gross value of respect professionals have for public interest. The more deviated professionals are to these ideals, the more deviant they are to professional ethics. This explains why new entrant professionals are more susceptible to abhorrent misconducts than the older generations. It is more pathetic in quantity surveying because of the ubiquitous relevance of the profession in cost management.

In furtherance to a recent survey reported by Olatunji and Ogunsemi (2006 a) where the ethical perceptions of the various cadres of quantity surveying practitioners were analyzed and their operational interests juxtaposed with public interest, the researcher considers it imperative to measure the relationship between practitioners' interests and public interest with the empiricism of professional misconducts. Therefore, to define the conflicts of interest in the practice, respondents were persuaded to rate, through the scale of 0 – 5, how rampant the 14 commonest or sample misconducts are as identified from literatures. 0 being not rampart at all and 5 being very rampart.

Table 4 shows how the respondents ratings of the illicit practices.

From Table 4, it is evident that respondents have different levels of ethical perceptions and disciplines based on different levels of exposure; while the Younger House has not fully developed a full sense of professional identity (Knight and Morledge, 2005), the Older House has very strong will to operate in the highest level of professionalism with very good understanding of the industry (Fan et al., 2003). The correlation of the Mean Rating of the Younger House and the Older House is not significant. This implies that even when the wrong practices are in the day-to-day transactions of the groups of surveyors used, it is evident that the Younger House is not fully convinced that those acts are absolutely immoral, while the Older House unwittingly conceive them as part of amorality needed to season professionalism, without considering the long-term gravity of the consequences or possess no real recognition that in a worst case scenario; certain actions could be very damaging to clients' interests (RICS, 2002b; Ray et al., 1999; Vee and Skitmore, 2003; Pearl et al., 2005).

Ordinarily, all unethical practices are not intended for money rewards. Some are committed (like stern denial of fault and trying to cover others' faults and so like, by quantity surveyors) in the mind of protecting the image and respect of professionalism in their occupation. Regrettably, because of the contemporary ways those abhorrent practices are packaged, there are systemic evidences that most professionals are often confused or always find it very difficult to correlate their stands with Professional Codes of Ethics. Moreover, results

Table 4 Respondents' ratings of unethical practices in quantity surveying practice

Unethical Practices	Industrial Trainees	Technician Members	Graduate Members	Registered Junior Members	Registered Intermediate Members	Registered Senior Members
Divulgence of trade/official secrets	3.05	3.45	3.85	4.05	2.75	0.75
Promiscuity at work and abuse of office	2.85	3.55	3.65	3.88	2.15	1.25
Poor instincts of demonstrating good understanding of ethics	4.25	3.85	4.20	1.95	1.00	0.25
Illegal collaboration with other firms to detest statutory and procedural standards	4.05	4.25	4.40	4.55	3.80	1.25
High level of professional dishonesty	3.85	4.10	4.25	4.30	2.95	1.95
Falsification of transaction figures	3.86	4.15	4.04	4.24	1.98	1.35
Income defraud	4.26	4.38	4.40	4.44	1.35	0.55
Bribery susceptibility	4.35	4.55	4.50	4.54	2.44	0.15
Compromising personal principles to favour organization's expectation	3.96	3.98	4.04	4.24	3.95	4.85
Perpetrating anti-organization vices	2.83	3.91	3.97	4.01	2.51	0.35
Conspiring/collaborating to cover indecent practices of self, colleagues and superiors	4.28	3.76	3.56	2.15	1.86	0
Outright denial of fault	1.35	3.82	4.18	4.65	3.26	0.34
Professional negligence	4.56	3.24	4.21	3.51	1.98	0.22
Conniving with external forces to defraud the client	3.88	4.36	4.05	2.11	1.25	0.65

from empirical analyses in this study shows that most of these illicit practices are partly related to systemic motivation and more importantly, social inclination to ethical uprightness, public's understanding of the industry, client' s consideration of surveyors' interests in relation to other practitioners in the industry and the enforcement of rules and guidelines of professional conducts. For instance, most modern bribes and unscrupulous inducements or acts liable to simple financial improprieties are given to most quantity surveyors as 'gifts' on unofficial considerations, which any young professional might be tempted to surreptitiously consider as contingent reward for extensive hard-work or goodwill for diligence, especially when professional fees are not good enough to commensurate with professionals involvements.

Therefore, even if the ethical perceptions of older surveyors have not changed over the years, the systemic change has repackaged the practice into a different scenario such that the focus of the new entrants (about 15% annually) (Olatunji and Ogunsemi, 2006) needs to be re-orientated by both the government, educational institutions and professional bodies. In like manner, the public need reposition itself not to be fertile for professional corruption through abhorable vices like price-data-only and lowest bid syndrome that fuel collusion and imperfect competition in the industry and inadequate trust, understanding and support for good professional opinions (Olatunji et al, 2006 a).

CONCLUSION

Client's satisfaction is a function of professional ethics in relation to respecting public interest with respect to the willingness to serve the public, good sense of responsibility and practice technical competencies. Professional ethics has not only been strongly linked to projects performance, it establishes the existence and subsequent sustenance of such profession. Quantity Surveying is one of the professions that has attracted unprecedented ubiquitous demand in the construction industry in the recent past with increasing opportunity for service diversification and adaptive applicability. To this, the profession faces more challenges to satisfy clients and public interest than ever.

This study analyses the demographic variables influencing ethical perception of Quantity Surveyors with a view to establishing the conflict of interest intrinsic in the cadres of quantity surveying professional membership. It confirms previous researches that the higher a Quantity Surveyor is in professional experience and recognition the more public interest is respected. As new entrants increase the practitioner population over an average of 15% annually, ethical perception and standard get more polarized and detestable due to the influx of professionals not well grounded in the requisite ethical standards, thereby endangering the much needed desire to sustainably brighten the image of professionalism in quantity surveying practice. It is thereby recommended that:

1. Professional examinations should deemphasize promoting core technicalities above candidates of ethical discipline to achieve an equitable balance in the corollary of behavioral and technical conceptualism of practitioners.

2. Frequent training and retraining is inevitable to season members with current trends in ethical development and uncertainties, not only to equip members' competencies but to give the much needed rebirth to nurture and protect the goal of the professionals serving the public interest to exist.

3. Professional bodies should keep a record of professional dilemmas for future reference to appraise members and commend or encourage faithful crusaders in order to convince new entrants and members at large that honesty counts as much as hardwork.

4. Educational institutions should consider it imperative to monitor the ethical performance of their product in and out of school.

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Reducing Waste in High-Rise Residential Buildings by Information Modelling at the Design Stage

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ABSTRACT

High-rise building is characterized by its repetitive design in floor plan which is compartmentalized into individual units. The design of high-rise buildings is different from other forms of residential and commercial buildings because of the repetition of construction and the cycle-time for the completion of each floor. This paper describes research that has been carried out to investigate how information modelling and an optimization technique known as Design Structure Matrix, DSM, application can increase the design efficiency of a repetitive high-rise building for both private and publically funded buildings. These benefits are accrued for both 'first generation' and subsequent 'repeat' buildings. In addition to helping to eliminate 'waste' within the design process the techniques contribute to the elimination of waste within the construction process.

KEYWORDS

Information Modelling
Design Management
Waste Reduction
Analytical Design Planning Technique

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INTRODUCTION

The majority of people in Hong Kong live in high-rise residential buildings, these buildings may be publicly or privately owned. In Hong Kong the Hong Kong Housing Authority provides 682,300 public rental housing flats which provide living accommodation for one third of the population. (HKHA 2007) These types of buildings are characterised by their standardized layouts and standard design details. Design for each floor of the residential building is repetitive, similar housing blocks are typically co-located to form large estates, e.g. at Tsuen Mun and Yuen Long. The same design of building is commonly used on different estates. Modifications to standard designs are required to reflect the individual site conditions and to meet the needs of residents in the form of the provision of facilities at ground floor level where social welfare associations and/or administrative offices may be provided. Private residential developments may comprise several housing blocks or be single buildings whose 'footprint' and floor layout needs to meet the specific shape of the site. They are usually of a higher specification and provide additional facilities such as 'residents clubs' often at mid-height. The architectural, structural and building services design are usually more complicated.

The design of both public and private residential buildings follows established stages from inception to construction. Documentation typically comprises project manuals, instructions and guidelines in the form of standard layouts and details amended to produce a set of project documentation. Simple flowcharts are used to monitor the design process. No specific software for design planning other than normal desktop software is normally used by the design team.

The research reported in this paper shows how the use of information modelling and design management techniques, may be applied to model the information requirements of designers of high-rise residential buildings. The use of these techniques enables the designers to optimize the design process by ensuring that the information required in the design process is produced at the appropriate time to meet the needs of both the design team and the construction team. This ensures that 'waste' is eliminated in both the design and the construction process. Design waste is eliminated by ensuring that there are no delays in the design process due to designers waiting for information and by eliminating repetitive work. Waste at the construction stage is eliminated by ensuring the timely delivery of design information to site. The models produced form a basis for further research and modelling of the impact of design decisions.

OBJECTIVES AND METHODOLOGY

The objectives of the research were: to develop models of the detailed design process for high rise residential buildings; to develop tools and techniques for analyzing these information requirements; to investigate the differences in the models and the use of the models when the building design was 'new' and when subsequent 'standard' or repetitive designs were being considered; to investigate the differences in the models required for private residential buildings and to show how the techniques may be used to eliminate waste within both the design and the construction process.

To achieve these objectives the following methodology was adopted. The information needs of designers were identified from previous research and by interviews with practitioners who were involved in the design of high-rise residential buildings. Design process models were produced using the generic design process model already produced by members of the research

team. These models were validated by expert review and comparison with existing projects.

The Analytical Design Planning Technique was used to analyse information requirements and to sort design tasks into an optimized sequence. A number of different design scenarios were used to illustrate how the approach may be used on a typical building design for private and public funded projects. (The New Harmony Design, a common building design adopted by the Housing Authority, was chosen as the type of building for modelling of the public funded building.) Feedback on the models produced during the research and their potential for the management of the design process and saving waste was obtained from industry practitioners. This feedback was used to validate both the models and the findings.

THE ANALYTICAL DESIGN PLANNING TECHNIQUE

The Analytical Design Planning Technique enables the planning of building design to be approached in a more systematic manner through the use of process modelling to produce a model of the information required, analysis of the models by a technique known as the Design Structure Matrix, and the production of design programmes. It provides a way to understand the entire design process by taking a systems view to design. The techique improves the efficiency of the design process by reducing the level of iteration in design tasks, providing an understanding of the effects of change and reducing abortive work. It enables the constraints of earlier design and subsequent construction processes to be managed.

The technique may be viewed as a four stage technique. The first stage involves the production of a model of the design process which identifies the design tasks involved and the information requirements for each of these tasks. (To assist with this task a generic model of the information required at the detailed design stage of a building design comprising some 106 tasks and 104 information flows is available.) The second stage transfers the data into a matrix form, (the Dependency Structure Matrix, DSM), which is used to identify loops within the iteration process. The third stage is the re-arrangement of the task order to break down the iteration block producing an optimised DSM. (This enables the programme for the design of the building to be revised based on the optimized design process. The fourth stage enables the output from the DSM

Figure 1 An example of the design tasks and information requirements within the Generic Model (Austin et al, 1999)

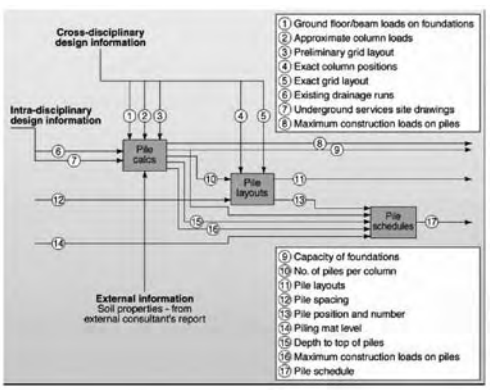
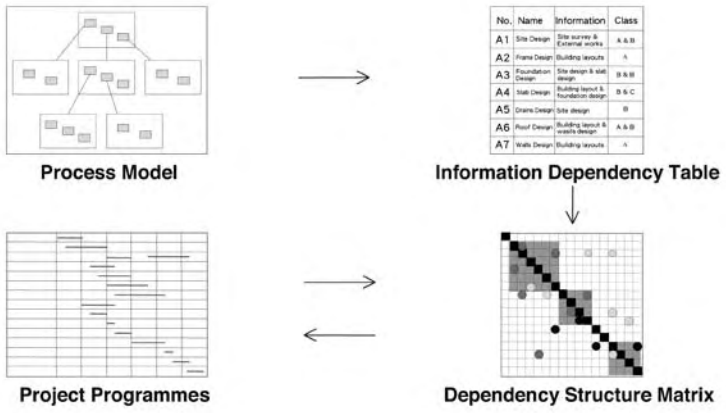


Figure 2 The four stages of the Analytical Design Planning Technique in diagramatic form (Austin et al, 2000)



matrix to be input into a conventional project planning software package. Figure 1 shows elements from the model. Figure 2 shows the four stages of the Analytical Design Planning Technique in diagramatic form. Full details of the technique may be found in Austin et al, 1999, 2000, 2002 & 2004; Baldwin et al, 2005; Browning, T., 2002.

MODELLING THE DESIGN OF THE 'NEW HARMONY' BUILDING

The generic detailed design model was used to produce a model for the New Harmony type of building. The model was reviewed and revised by deleting design activities from the generic model that were not required for the New Harmony Building type and adding any new design tasks or information requirements for this type of building. Examples of these amendments are as follows: The New Harmony Block is normally constructed on piled foundations, therefore all other types of foundations within the generic model were deleted: there was no basement within the design; there was no chilled water system design; no hot water system was included (each unit was provided with a gas heater connection point); there was no provision of compressed air system; no steam system; no emergency power is provided; the ground floor slab was designed as a suspended floor slab; and design for the commercial complex on the ground floor of the building had to be included; etc. For a full list of the amendments see Baldwin et al, (2005).

The generic ADePT detailed design model was changed to include all the above features. The new model was designated NHB (0). This model was validated against the detailed design and specification of the Master Design Manual of the Housing Department and by review from experienced professional designers within the Housing Authority. The model was divided into separate sections including architectural, civil engineering, structural and building services design and checked by representatives of each of these different disciplines. Each discipline was requested to indicate the importance of the information to each design task by rating the information as either A, B or C. (Rating A indicating the greatest influence on the design activities; B a moderate influence whilst C indicated minimum importance. This rating is important within the design structure matrix analysis as it assists in determining the prioritization of tasks.) The returns were compiled in the new summary model HB (1). This model represents 'initial' design or 'first generation' design of the building.

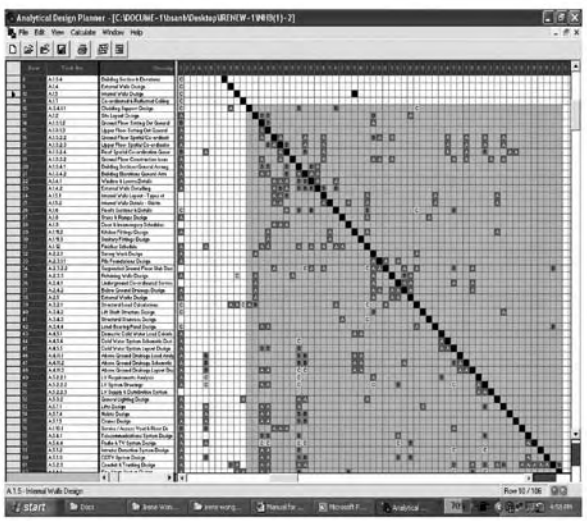
ANALYSIS OF THE MODELS

The data within the model were analysed to identify the optimised design process of the first generation model, NHB (1), and then examine the differences, compared with the model for subsequent designs, NHB (2). The NHB (1) model data were processed using the Dependency Structure Matrix of the analytical design planning technique and the order of the design tasks optimised. Analysis of this model showed the optimised design process similar to any general residential building development project. The five design tasks with the greatest number of outputs identified were: Ground floor setting out GAs; Upper floor setting out GAs; Upper floor spatial co-ordination Gas; Building section Gas; Finishes schedule.

These five tasks are all architectural design tasks indicating that architectural design is the dominating design task on which other design disciplines depend and any subsequent changes in the architectural design will create rework or even abortive works. The matrix analysis shows that the civil engineering design is the least dependant on the architectural design. Building services design is highly dependant upon architectural design. Four main 'iterative' design activities are identified. These are: Ground floor spatial co-ordination arrangements; Upper floor spatial co-ordination arrangements; Internal walls layout types, etc. and the Finishes schedule.

The optimized model NHB (1) _OPT included a main iterative loop of 46 design tasks. Building design is a multi-disciplinary process involving exchange of information. The optimized model showed how the optimal relationship of the information produced for the different disciplines to work together in the design process. In our example the Architect needs to work along with Civil Engineer, Structural Engineer and Building Services Engineer in the detail design as indicated in row nos. 32 to 62 of the matrix. If different disciplines can work together efficiently and effectively in the early architectural design stage providing clear and accurate information, the time wasted in re-work or even abortive work will be greatly minimized. The optimized model is shown in Figure 3.

Figure 3 NHB (1)_OPT: Generic Building Design Model (Summary) for New Harmony Block Optimized



The analysis above of the NHB (1) model shows the design requirements for the design of a 'new' building i.e. a building type that is being designed for the first time. As stated earlier in the paper the New Harmony design has now become a standard design for residential buildings in Hong Kong. Therefore the research considered the differences for repeat building design for different locations.

ANALYSIS OF THE NHB (2) MODEL

To assist the design of 'standard' buildings and to improve efficiency, the Housing Authority adopted the use of standard building design details. Because standard designs are adopted for the design the importance of the information requirements is reduced within the design process as all parties are aware of the design details. To model this effect the NHB (1) model was revised by downgrading the importance of the standardized design tasks to "C" as this standard information becomes readily available design information filed in the standard design detail drawing and specification. This revised model was called the NHB (2). A review of the matrix of NHB (2) model, shows 5 design tasks with the highest number of information requirements: Site layout plan; Ground floor setting out GA; Survey works design; Structural load calculations; and above ground drainage schematics.

Out of these 5 tasks, 2 are architectural design, 1 from civil engineering design, 1 from structural engineering and 1 from mechanical engineering design. The difference in this list from the NHB (1) model is explained as follows. After standardization architectural design becomes less dominant in the design process as a large portion of architectural design is standardized. Class A tasks above the diagonal are greatly reduced. Standard details form a large portion of the design, therefore change in design becomes less apparent and rework or abortive work is greatly reduced. The inter-dependency between different task activities and different disciplines becomes much smaller.

Optimization of NHB (2) forms NHB (2) _OPT and reduces the size of the iterative loop. (see Figure 4) The reduced loop includes architectural, civil engineering and mechanical engineering design tasks. Civil engineering design is important by its occupied portion. In standard design, standard details are provided in architectural, structural and building services design for the domestic blocks. However as each site location and site condition is unique, the site planning and hence civil engineering design cannot be standardized, therefore external work design and civil engineering design dominates the design process.

PRIVATE RESIDENTIAL BUILDING

To investigate the differences in requirements for private residential buildings the generic model was amended to meet the requirements of an actual private residential development. A new model PHR (0) was produced and validated. The model was optimized using the analytical design planning technique and compared with the New Harmony models.

The standard of apartments in private residential developments can vary considerably depending on the location and the prestige of the development. A commercial complex may be annexed to the residential blocks. Our study concentrated on the residential design. The Generic Building Design Model was modified to incorporate the following design characteristics: a club house and a car park for resident use, (at podium level); a club house occupying several floors with changing

Figure 4 NHB (2)_OPT: Generic Building Design Model (Summary) for New Harmony Block adjusted for standard design (optimized)

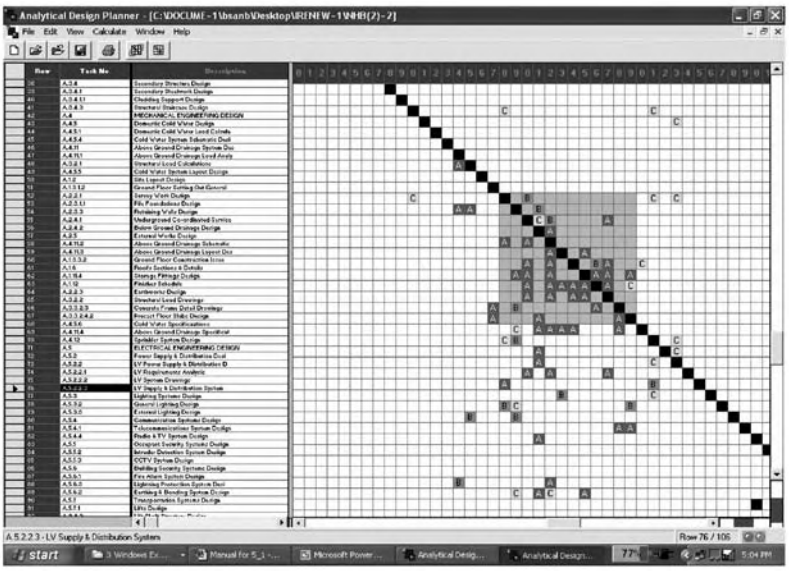
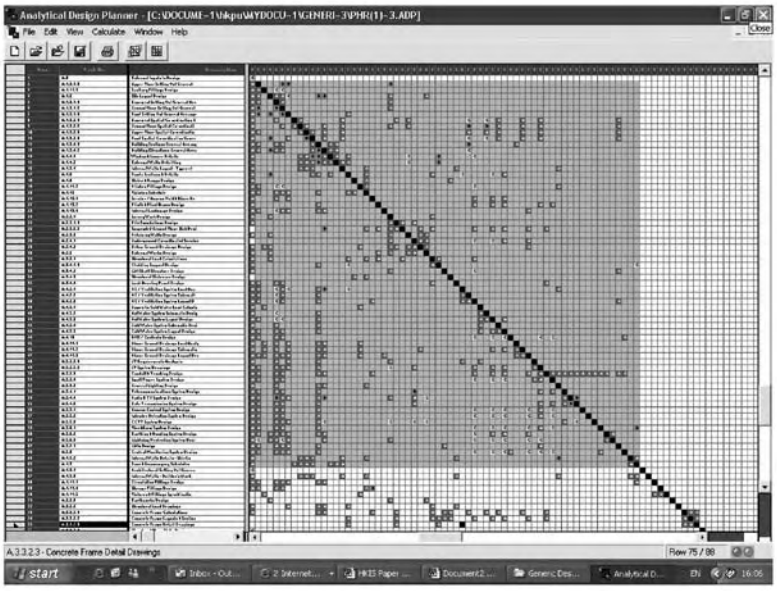


Figure 5 PHR (1)_OPT: Generic Building Design Model (Summary) for High Rise Residential Building (optimized)



& bathing facilities; separate entrances for club house, car park and residential floors are provided; kitchens and bathrooms are fully furnished; cooking and water heating by main gas supply; window airconditioning units; car park vented by mechanical ventilation system; landscaped gardens; false ceilings in entrances and club house etc.

The Generic Building Design model was amended to reflect all the above features of a private high-rise residential building. This provided a new summary model PHR (0). PHR (0) were passed to designers, who requested to complete the "class" column by putting A, B or C to indicate the importance of the information to the completion of the design tasks. (Rating A indicating the greatest influence on the design activities; B a moderate influence whilst C indicated minimum importance.) The returns were compiled in the new summary model PHR (1).

This model was optimised in a similar way as before to form PHR (1)_OPT and analyzed to understand the design process and the subsequent changes in the sequences of information input from different disciplines to reduce iterative work and increase the efficiency of the design process. There were a total of 122 design tasks in the model. The pivotal tasks, (tasks with 16 outputs or above) were: Basement setting out GAs (32 outputs); Ground floor setting out GAs (31outputs); Upper floor setting out GAs (34 outputs); Roof setting out GAs (18 outputs); Building sections GAs (35 outputs); Building elevations GAs (16 outputs); Survey work design (16 outputs); Cold water system layout (16 outputs). 7 out of the above 9 tasks are architectural design tasks indicating that architectural design is the dominant discipline. The matrix analysis shows that civil engineering design has the least dependency on architectural design since they involve mainly external work and are less affected by the changes in the design of the building. Both structural and building services design depend considerably on architectural design.

After optimization, the main iteration loop is reduced to 65 design tasks (from No. 13 to 74), which is less than half in PHR (1). There are 22 architectural design tasks, 7 civil, 5 structural, 12 mechanical and 16 electrical engineering design tasks within the iteration loop. The impact of changes in architectural design is reduced. Building services design becomes more important. The Architect has to work along with Civil Engineer, Structural Engineer and Building Services Engineer in the detailed design as indicated in row nos. 13 to 74 of the matrix. Figure 5 shows part of the optimised building design model for Private High Rise Residential Building.

DISCUSSION

From the generic design model a number of different models were produced. These models form the basis for both this and future research.

The NHB (1) model, (New Harmony Building – first generation building), highlighted that the main cyclical activities are architectural design tasks (A.1) signifying that architectural design is the dominating discipline, activities related to architectural layout form the basis of the design, Architectural Spatial Co-ordination GA are important in designing internal layout. The Roof Spatial Co-ordination arrangements are not important because in this type of building the roof layout is usually simple, accommodating only water tanks and lift machine room. The A.1.12 Finishes Schedule and A.1.5.1 Internal Walls Layout are interdependent. Internal Wall Design is a requisite input to finishes selection.

The design process for a 'standard' building was examined by the production of a new model NHB (2), the NHB (0) model with the same design tasks but with importance of the information flows for 'standard' information set to a reduced level of importance. The optimized order of the design tasks is therefore different. The tasks relating to the structural and building services design assume a greater importance earlier in the design process.

For the private residential building there are more facilities, more services and more variation within the overall design sequence. Architectural design is still the dominant discipline; however optimization has re-arranged the design sequences to allow more coordination and working together for all design disciplines. The need for design co-ordination is more evident and the model and matrix highlight when co-ordination should take place.

Overall the modelling technique provides additional information to both the design and the construction team. This is of value in all three different cases. Feedback from the industry professionals who contributed to the modelling confirmed that the approach was of value in all three cases as additional information and the priority of information was provided to the designer. They recognized that the technique would also enable them to identify the impact of changes in design information or late delivery of design information.

ELIMINATING WASTE

There is now a recognition that the elimination of waste within the construction process must be addressed at all stages of the construction process. This includes initiatives to both eliminate physical waste produced as part of the construction process and waste in the form of the additional cost to the client of inefficient design and management processes. Practices developed in other industries, (Womack et al, 1990), have been extended to the Architectural, Engineering and Construction, (AEC), industries to good effect, (Alarcon et al, 1997, Cullen et al, 2005, Tommelain, 1999). The adoption of the information modelling techniques described in this paper has been a clear contributor to the reduction of waste within both the design process for different types of construction projects, (Austin et al, 1999, Austin et al, 2000, Waskett, P., 1999). By demonstrating that the modelling tools and techniques produced for these types of buildings may be extended to high-rise repetitive buildings, it confirms the opportunity for the use of the technique to be implemented and used to bring about the similar benefits within the design process. These benefits: the production; co-ordination; dissemination; monitoring and effective control of information, (Newton, 1995) are considered even more important in high rise residential buildings because problems and delays in the delivery of the correct information may affect many floors of the building.

The techniques may also be utilized to reduce the physical waste produced within the construction process. The construction industry is a major solid waste generator in Hong Kong. In the year 2000 it generated as much as 37,690 tones per day of construction and demolition waste, (Poon C.S. et al 2002). There is a general recognition by government, professionals, industry representatives that improvements must be made to this situation. The problem is not unique to Hong Kong. In the UK, ICE and CIRIA has undertaken extended studies (Ferguson et al, 1995, Coventry et al, 2001) which have looked at waste minimization through preventing and/or reducing the generation of waste at source. The Construction for Excellence study, (2001) identified the importance of dealing with waste at the design stage. This is now

generally recognised (see HK Housing Authority, Meeting Environmental Challenges for a Sustainable Future, 4th Edition, 2002/2003). Research by Poon et al, (see Management of Construction Waste in Public Housing Projects in Hong Kong, 2004) has reviewed the levels of construction waste in high rise residential building and the causes of these wastes. Minimising waste from the construction process at the design stage may be achieved by correct design details, avoiding late design modifications and incorporation of new design techniques. Information modelling and the use of the techniques described above can contribute fully to reducing construction waste. This includes waste relating to both permanent and temporary works.

CONCLUSIONS

There is a clear need to develop new tools and techniques that can help designers to analyse the information requirements in the design process and to make improvements in design management. Improvements in design management help to eliminate waste at both the design stage and the construction stage of a building. In this research, the adoption of information modelling and the analytical design planning technique has been extended to produce high rise models for both public and private residential buildings. The management of the design of such buildings benefits from this form of analysis irrespective of whether the building is being designed for the first time or is the repeat design of a 'standard' building. Different scenarios can be investigated between the extremes of 'new' i.e. first time design and 'standard' designs. These benefits extend to both private funded and government funded residential developments. Feedback and discussion of the results has been supportive and there is consensus that such approaches will provide design staff to make better informed decisions.

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