

An investigation into Information Overload in Construction Project Teams¹

The Architecture/Engineering/Construction (AEC) Industry is a major economic sector; it accounts for 8-10% of the Gross Domestic Product in the UK. In recent years, there has been a rapid expansion of IT applications available to all AEC professionals. This paper investigates the effects of information flow in project teams within the UK construction industry. Information takes a variety of forms; some is well managed, and some is not. Developments in information and communications technologies have increased the flow of information such that managers are confronted with an information flood that provides more information than they are able to process.

The resultant impact of information overload on decision quality is an important topic that is widely recognised. The development of the information society has resulted in employees being bombarded with information whether pro-actively seeking it or not. The resulting increased number of sources from which information emanates affects all employees. Previous studies have revealed that although the problem has existed for many years, this problem is rapidly increasing and impacting both individual and organisational performance. The rapid advances made in information technology have exacerbated the perceptions and the actual effects of information overload.

A survey has been conducted across two major UK contractors and 17 sites with a total project value of £953 million. The survey was conducted across 5 different contract types including PFI, Prime Contracting and Construction Management. The initial results show that 60% of respondents consider that information overload affects their colleagues. This and other results are discussed within the context of emerging IT driven business solutions within construction.

1.0 INFORMATION IN THE AEC INDUSTRY

It is recognised widely that the modern AEC (Architecture/Engineering/Construction) industry has more diverse types of participants than many other business sectors (*Duyshart, 1997*). Hence the information types used throughout the construction process are as diverse as the process itself.

Information within construction is usually given the label of a "document". In terms of modern information medium development this term is obsolete, but since this is the common standard, understood and used across the industry, it is the term of choice in defining the existing mechanism.

Construction documents can be split into four groups:

Project Documents: these documents may be organised under the four main stages of a project, namely: Pre-design, Design, Contract and Contract Administration;

Office Management Documents: these include Quality Management, General Office, and Archives. Encompasses documents which are used in day-to-day management and operation;

Communication Documents: these include Drawings Letters Memos, and Instructions;

Reference Documents: these include Standards, Codes, Regulations and trade Literature (*Duyshart, 1997*).

¹ Tony Thorpe is Head of department, Building and Civil Engineering, Loughborough University, Loughborough, Leicestershire, England; Paul Anderson is a Research Student, Building and Civil Engineering Department, Loughborough University, England

2.0 INFORMATION MANAGEMENT STRATEGY IN THE AEC INDUSTRY

It has been suggested that more efficient information management within the AEC industry is a primary mechanism for increasing its productivity (*Egan 1998*). Indeed many think of the industry as backward in deploying technology, and that the application IT has been piecemeal and only very few contractors have a comprehensive and integrated information system for its core business (*Mak, 2001, Marsh, Flanagan, 2000*).

Although there is growing interest in the role of innovation within the AEC sector and the diffusion of innovation within and across construction organisations, there has been little consideration of IT implementation in this context (*Whyte, et al. 2002*).

The key to information strategy within the AEC industry is investment justification, or rather, the lack of it. The reason for this is that both business and project activities need to be costed. Even experienced accountants are often stymied by the problems they face when it comes to recording and calculating the costs of IT (*Love, Irani, 2001*). The result is that organisations in the AEC industry that have little knowledge of how to evaluate both their future IT investments and their current IT systems (*Andresen, 2002*).

The factors often result in construction organisations with very good software systems, but whose systems are ill equipped to leverage support to the construction end-user and the project team to such an extent to contribute a good ROI. Problems such as lack of clear audit trails, on-site versioning control, interoperability between software systems, quality of information, and Information Overload result are common place.

2.1 Information Overload

There are three terms that have been used to describe Information Overload in current literature. These are, data smog (*Shenk, sited in Edmunds, Morris 2000*), analysis paralysis (*Stanley, Clipsham, sited in Edmunds, Morris 2000*), and information fatigue syndrome (*Oppenheim, sited in Edmunds, Morris 2000*). Information Overload is frequently mentioned in the literature of a range of disciplines such as medicine, business studies, and the social sciences, as well as in computing and information science. There are limited references to Information Overload within the AEC industry. Most people can recognise Information Overload. However, there is no universally agreed definition of it. It can mean several things, such as having more relevant information than one person can assimilate or it could mean being burdened with a large supply of unsolicited information, only some of which may be relevant (*Butcher, sited in Edmunds, Morris 2000*).

A large amount and high frequency of information act like noise when they reach overload. At this point the frequency is too high for the receiver to process efficiently without distraction, stress, increasing errors and other costs making information poorer (*Klapp, sited in Edmunds, Morris 2000*). Another definition describes Information Overload as the point where there is so much information that it is no longer possible effectively to use it (*Feather, sited in Edmunds, Morris 2000*).

However the term is defined, there cannot be many individuals who have not experienced the feeling of having too much information which uses up too much of their time, causing them to feel stressed which, in turn, affects their decision-making. Concurrent with these phenomena is the anxiety generated by worrying whether an important piece of information has been missed in the volume of material that is being processed.

3.0 INFORMATION OVERLOAD SURVEY

3.1 Introduction

The purpose of the survey presented here is to investigate Information Overload within construction project teams, as well as some basic quantification of the information types received by different construction professionals. To achieve this the survey asked

eleven questions regarding how their colleagues on their current projects deal with information, their opinion on how it affects their colleagues, and then the respondents personally. The last question attempted to give an insight into the typical amounts being handled by each individual on a weekly basis. Eight of those questions are presented here. The results will provide directions for research, an ignition point for construction organisations to improve internal processes for their employees, and provide a platform for understanding problems encountered on a daily basis by construction employees. The paper commences with a description of the survey and methodology used followed by the profiles of the respondents, the findings of the survey, and some concluding remarks.

3.2 Survey's origin and methodology

The ideal method for investigating Information Overload within construction project teams would be to select multiple sites across the country and use them as case studies, following them from start-up to finish identifying specific information flows justifying that flow, and then measuring the outputs of that information flow, be it negative or positive to productivity/process.

Information Overload within the construction industry is not a subject that has been investigated to a large extent and the justification for extensive research has to be made. Therefore this survey was intended as a litmus test and to give a snapshot view across as many projects as possible. This survey does not examine the entire project as a whole but is intended to dip in at a point to measure the status and opinion of the project team members at the time of the survey. This method does not give the most clear and versatile results but it does provide an ignition point for further research if the results conclude that Information Overload is present.

The questionnaire design was conceived from "Dying for information? An investigation of Information Overload in the UK and Worldwide" (*Reuters, 1996*). Based on a survey of 1,000 people in the UK, US, Ireland, Germany, Singapore and Hong Kong, the survey shows that over half of respondents 'crave' information, while almost half claim that if information was a recognized drug, they would know people they would consider addicted. With the ever-increasing use of complicated IT systems in use in the construction process and the increased availability of construction information as a result, it is not difficult to conceive encountering problems from Information Overload

Three major UK contractors were contacted to participate in this survey. One declined, two accepted. Their designation within this study is Company A and Company B. The survey was designed to be conducted over the telephone and to take a maximum of 4 minutes to complete which meant the participants inconvenience was limited to a minimum. The telephone survey was also chosen as it provided direct access to the target sites, project managers and project teams on a one-to-one basis.

3.3 Respondants

A total of 30 projects sites were sourced from the participating organisations, 16 from Company A and 14 from Company B. The sites were chosen by the organisations without any firm statistical causation, though this was accepted as the survey is aimed at providing a theoretical resource for an extensive future examination of the area.

From the 30 sites a total of 17 at a total project value of £953 million were happy to participate in the survey. The number of project team members varies on each site, and since the number of site employees was not provided, only a percentage of respondents corresponding to the number of sites can be calculated. The site respondent rate was 57%. This is significantly higher than could have been expected through a postal survey. Though at the same time, more was expected from using this methodology. A total of 50 surveys completed from the 17 sites. The following two tables represent the spread of respondents, and contract type

Contract type	Frequency	Percent (%)
Construction Management	18	36.0
JCT	18	36.0
NEC	3	6.0
Prime Contracting	4	8.0
PFI	7	14.0
Total	50	100.0

Table 1. Contract type

Table 2. Participant spread

Title	Frequency (%)	Percent (%)
Project Manager	15	30.0
Commercial Manager	5	10.0
Design Manager	4	8.0
Project Planner	8	16.0
Document Controller	1	2.0
Site Engineer	2	4.0
Construction Manager	8	16.0
Package Manager	3	6.0
Contracts Executive	1	2.0
M&E Manager	1	2.0
Information Controller	1	2.0
Quantity Surveyor	1	2.0
Total	50	100.0

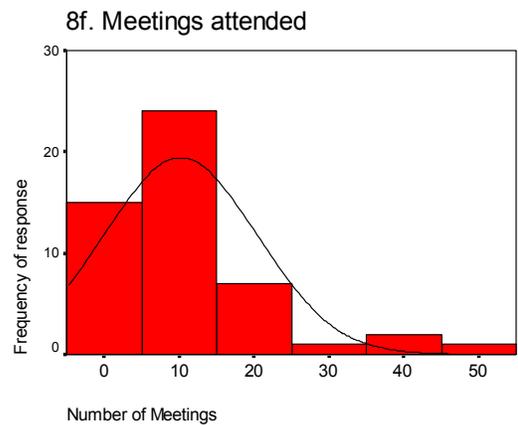
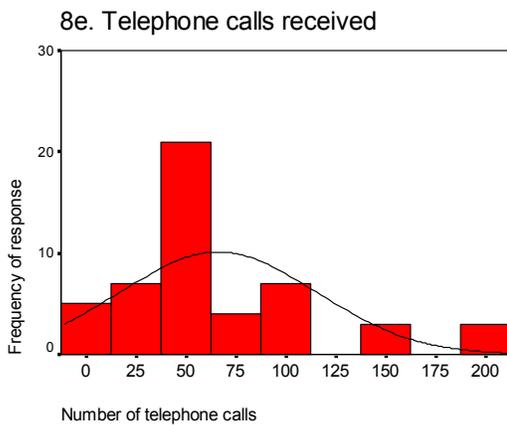
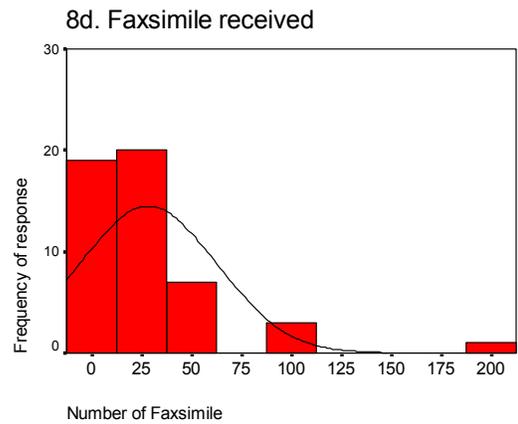
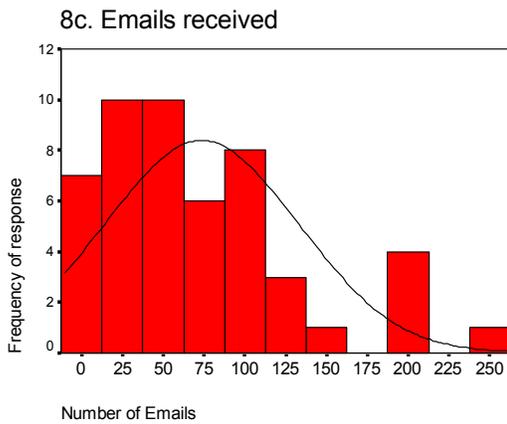
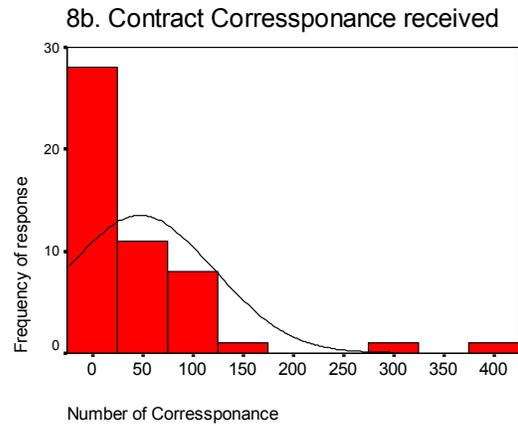
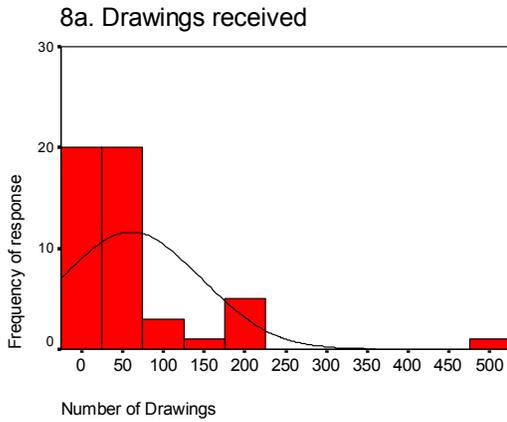
Table 1 shows the spread of contract type amongst the surveyed construction projects. Table 2 shows a large percentage of the respondents were the project managers, this was because since the survey needed the permission from project manager to proceed across the site, they were always the first person surveyed on the site. Also, on every site there was a project manager, this was not true with other members of the team.

3.4 Presentation of Results

3.4.1 Results.

Questions asked	Strongly agree %	Agree %	Neither agree/dis %	Disagree %	Strongly disagree %
Q1. Level of agreement with "My colleagues receive large amount of unsolicited information"	4	32	24	34	6
Q2. Level of agreement with "My colleagues receive large amounts of solicited information"	24	54	14	8	0
Q3. Level of agreement with "My colleagues need as much information as possible in order to keep abreast of site matters and planning decisions"	24	42	20	14	0
Q4. Level of agreement with "I frequently work with colleagues who feel unable to handle the quantity of material accumulated"	2	42	26	26	4
Q5. Level of agreement with "I frequently work with colleagues who experience Information Overload"	12	48	14	24	2
Q6. Level of agreement with " My colleagues suffer socially as a result of Information Overload"	8	28	26	38	8
Q7. Level of agreement with "I am personally finding it difficult to keep pace with the level of information accumulated at work"	4	34	18	36	8

Question 8. In a typical week on your current project how many of the following do you receive?



3.4.2 Analysis of results – Whole group. Question 3, question 1, and question 4 provide some insight when examined together. In Q3, 24% strongly agree and 42% agree that their colleagues need as much information as possible to keep up to date with on-site matters. In Q1, 36% either strongly agree or agree that their colleagues receive large amounts of un-asked for information. In Q4, 42% agree and 2% strongly agree that they

frequently work with colleagues who feel unable to handle the quantity of information gathered.

The result is a process were construction professionals want as much information as possible, but at the same time receive information that was not requested in the first place, and then struggle with the amount of information pressed upon them

The Composite - Communication by Computer Between Main Participating Organisations on Site – report which was jointly funded by An Industry Consortium and Loughborough Universities Department of Environment found that 60% of sites do not have anyone on site responsible for IT. The study also looked at site information flow, and in its results stated general correspondence as a daily problem.

This has been confirmed by this study. Q5 and Q7 investigate the proliferation of Information Overload. Q5 identified that 12% strongly agree and 48% agree that they frequently work with colleagues that experience Information Overload. In total 60% of the construction professionals surveyed on the 17 construction sites involved stated that they work with colleagues who suffer Information Overload.

Q7 seeks a direct answer to the extent of Information Overload. Overall, 4% strongly agree and 34% agree to personally finding it difficult to keep pace with the level of information accumulated at work and 18% neither agreed nor disagreed. Therefore 36% of the construction professionals surveyed involved within the 17 projects with a pound value of 953 million directly admitted to being overload by the amount of information they have to handle.

The average amount of information received on a weekly basis on the 17 construction sites:

Communication Medium	Overall results	Project Managers	Those not directly admitting to Information Overload	Those directly admitting to Information Overload
Email	74	90	65	86
Contract Correspondence	50	72	38	63
Telephone calls	66	76	62	71
Meetings attended	10	13	8	13
Facsimile	28	28	31	31
Drawings	60	55	73	64
Total	288	334	277	328

It is interesting to note that Facsimile is still being used in day to day operation on some sites. In total, the average construction professional surveyed has 315 separate sources of information to deal with in one week, as well as the information to be processed from the 10 meetings attended.

As expected, some of the 17 sites had more information problems than others. The COMPOSITE report identified 90% of sites stating that IT resources were purchased as and when required as a site decision, not a company decision. The most prone Information Overload sites had poorly integrated IT infrastructure, which resulted in a confusion of the information resources/specifics needed for a smooth administration of the project.

3.4.3 Analysis of results – Project Managers. This section deals specifically with the results gathered from the project managers. The results for the Project Managers were analysed in the same manner as with the overall results

In Q3, over 53.3% of the Project Managers within this survey agree that their colleagues need as much information as possible to keep up to date with on-site matters. In Q1, 46.7% either strongly agree or agree that their colleagues receive large amounts of un-asked for information. In Q4, 54% strongly agree that they frequently work colleagues who

feel unable to handle the quantity of information gathered. Compared to the overall results the project managers are more extreme in their views towards Information Overload

Q5 and Q7 investigate the proliferation of Information Overload for Project Managers. Q5 identified that 20% strongly agree and 66.7% agree that they frequently work with colleagues that experience Information Overload. In total that is 86.7% of the Project Managers surveyed on the 17 construction sites involved stated that they work Information Overloaded colleagues on a frequent basis

Q7 seeks a direct answer to the extent of Information Overload. Overall, 13.3% strongly agree and 46.7% agree to personally finding it difficult to keep pace with the level of information accumulated at work. Therefore 60% of the Project Managers surveyed involved within the 17 projects with a pound value of 953 million directly admitted to being overload by the amount of information they have to handle.

The Reuters report: Dying for Information? An investigation into the effects of Information Overload in the UK and worldwide, conducted 511 telephone interviews in the UK. The participants were identified as key recipients and users of information. The industry sectors covered included manufacturing, telecoms, retail/distribution, finance and business services, but not the construction industry.

One of the key questions within that report was: "I am finding it difficult to keep pace with the level of information accumulated at work" which was used in this research. A comparison between the results can be seen below

Level of agreement to question 10.	Reuters	Construction survey (Project Managers)
Strongly agree	12%	13%
Agree	18%	47%
Neither agree/disagree	26%	7%
Disagree	20%	27%
Strongly disagree	24%	7%

The difference between the results is significant. 30% of surveyed personal in the Reuters report admitted to being Information Overloaded, compared to 60% in this study.

4.0 CONCLUSIONS AND RECOMMENDED STUDY

The intention of this research was to provide a raft for further in-depth research in the area of Information Overload on Construction projects. The survey has succeeded in doing this. The main distinctions are:

- 60% of Project Managers surveyed directly admitted to being Information Overloaded.
- 87% of Project Managers believe that they work regularly work with colleagues who are Information Overloaded.
- Overall 38% of personal surveyed admitted to experiencing Information Overload
- In comparisons to other research of the same topic in other industries, the results indicate the Construction Industry has a substantially greater problem with Information Overload.

The results suggest that the Project Managers on the sites are acting as a filter to most incoming information on-site. They collect the non-specific information and then distribute it accordingly. Those who admitted to experiencing Information Overload received a greater amount of information than those who disagreed. This correlated with the Project Managers receiving a relatively large amount of information, compared with the overall values. These

amounts are not of substantial value to display an individual reason for Information Overload, but provide a demonstration that the volume of information is only part of the problem.

In the same way that many organisations seem to ignore the Information in Information Technology when buying solutions, the Information in Information Overload does not simply mean volume, but many dynamics, some of which are extremely difficult to measure and change on a rapid basis. The key issue that must be described is a detailed examination of the information process within construction projects, and the reaction to that information flow affected by the users. Information Overload is not the problem; it is only the result of many problems.

The Architecture, Engineering, and Construction Industry is an information intensive industry. So much so that Information Overload is common and increasing in many key areas. The result of Information Overload is stress, poor decision making, bad moral, and an overall negative impact on an individual's performance. There are many other reactions and results of Information Overload, many of whom have yet to be measured.

Technology is constantly changing, but human nature is not. Therefore IT and EDM systems (including collaborative systems) need to be better designed and facilitated around the construction professional and not just the processes are needed to minimise impact of Information Overload. Additionally, more focused training and support on this issue needs to be implemented so that the individual/Project Director can identify the symptoms and effect change. Above all, the impact of Information Overload on AEC operations and its effects has to be identified as a problem by AEC organisations.

Any further research within construction looking at Information Overload must endeavour to focus not on Information Overload as a problem but on the processes that lead to it. Therefore future research must investigate not only information flow, technology and usefulness of the information transferred but the social reactions to the exposure of various different communications mediums that construction professionals experience. This research is currently underway

REFERENCES

- Andresen, J., 2002, How to select an IT evaluation method – in the context of construction, International Council for Research and Innovation in Building and Construction CIB w78 conference 2002, Aarhus, Denmark
- Duyshart, B., 1997, The digital Document, Architectural Press, Reed Educational and Professional Publishing Ltd.
- Edmunds, A., Morris, M., 2000. The Problem of Information Overload in business organisations: a review of the literature. International Journal of Information Management 20 (2000) 17-28
- Egan, J., 1998. Rethinking Construction, Report of the Construction Task force on the Scope for improving the Quality and Efficiency of the UK Construction Industry, Department of the Environment, London
- Love., P, Irani. Z., 2001, Evaluation of IT costs in construction, Automation in Construction, 10 (2001) 649-658
- Mak, S., 2001, A model of information management for construction using information technology. Automation in Construction 10 (2001) 257-263
- Marsh, L., Flanagan, R., 2000, Measuring the costs and benefits of information technology in construction, Engineering, Construction and Architectural Management 2000, 7/4, 423-435

Reuters, 1996, Dying for information? An investigation of Information Overload in the UK and Worldwide. Reuters Business Information, London.

Thorpe, A., and Murray, J. 1996. COMPOSITE: Site communications survey, Final Rep. Prepared for DETR, Loughborough University, U.K.

Whyte, J., Bouchlaghem D., Thorpe, A., 2002, IT implementation in the construction organisation. Engineering, Construction and Architectural Management 2002 9 5/6 371-377