

Fig 1. Williamson's theory and the reality

Information transfer in building design  
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KEYWORDS

Architects, design, information.

ABSTRACT

Transfer of information into practice from technical and scientific research is alleged to be a weak link in the chain from research to successful innovation in the built environment. Starting with design, studies at the UK Building Research Establishment aim to make recommendations for those who produce, disseminate and use such information. Completed studies include a review and analysis of sources of information, case studies of the use of information and experience in some 40 live design projects, and the development of methods for appraising and testing textual and other documentary information. These studies indicate that designers in practice prefer to rely on experience rather than published information, use publications most in detail design, prefer graphics to text and that there is scope to improve the structure, sequence, text and graphics of much published design information. Early reports have made recommendations for the UK's British Standard Institution's publications on building and civil engineering and BRE's own publications. A recent study has interviewed designers 'over the drawing board' on their use of technical publications. The findings are being used to develop and test prototype publications. Future research will take account of other areas of information transfer within the construction industry.

Transfert de l'information dans le domaine de la conception des constructions  
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#### MOTS-CLES

Architectes, conception, information

#### RESUME

Le transfert dans la pratique de l'information fournie par les recherches techniques et scientifiques serait un élément faible dans la chaîne allant de la recherche à l'innovation couronnée de succès dans le milieu bâti. En ce qui concerne la conception, les études entreprises par l'Établissement britannique de la recherche sur la construction (Building Research Establishment, ou BRE) visent à la formulation de recommandations à l'intention de ceux qui produisent, diffusent et utilisent une telle information. Les études menées à terme comprennent un examen et une analyse des sources d'information, des études de cas sur l'utilisation de l'information et de l'expérience dans une quarantaine d'avant-projets d'actualité et l'élaboration de méthodes pour l'évaluation et le contrôle de l'information contenue dans les manuels et autres ouvrages documentaires. Ces études montrent que, dans la pratique, les dessinateurs préfèrent se baser sur l'expérience plutôt que sur l'information publiée, qu'ils utilisent surtout des publications traitant de la conception liée au détail, qu'ils préfèrent les graphiques aux textes et que le besoin se fait sentir d'éclaircir les textes et les graphiques dans une grande partie du matériel d'information qui a été publié en matière de conception. Des rapports antérieurs ont contenu des recommandations pour les publications sur le bâtiment et les travaux publics de l'Institut britannique de normalisation et pour les propres publications du BRE. Une étude récente a fait appel à des interviews menés dans les bureaux d'étude avec des dessinateurs afin de déterminer l'usage qu'ils font des publications techniques. Les conclusions sont utilisées actuellement pour mettre au point et à l'essai des publications prototypes. Les recherches futures prêteront notamment sur l'autres domaines du transfert de l'information au sein de l'industrie de la construction.

#### INTRODUCTION

Professional indemnity premiums are high and rising. An estimated 50 per cent of building defects have their origin in the design office (1) and many of these could have been avoided by using existing knowledge at the right time in the right place. Building information is not in short supply - rather it has become a deluge. How can one be sure of knowing?

The BRE approach to design information is that the users - the readers - are 'king'. We analyse the problems that designers and other members of the construction industry have in using information and identify their needs; examine existing construction industry information and the effectiveness of different methods of communication (including electronic methods); give practical guidance in selecting, structuring and presenting information and finally develop specific publications incorporating BRE research findings and test these on practitioners.

Our research so far has included studies of how designers actually design in practice, surveys of various aspects of information use within the design process and analysis of the attributes which users think are essential to good technical literature. We have also made detailed investigations of particular publications (such as British Standards) and made recommendations for their improvement.

#### MAIN FINDINGS

Basic findings from our research include:

- designers only use publications as a last resort
- they put much reliance on 'experience'
- most use of literature was at the detailed design stage; people used trade literature most and they preferred a visual approach
- designers collect little feedback on the effectiveness of their decisions
- attributes which users consider important include good summaries, date of issue, informative titles and good use of illustrations
- simple graphical treatment can do much to improve existing literature

In our present research we are aiming to produce prototype publications incorporating our findings, recommendations and testing them on real users.

#### CASE STUDIES OF LIVE DESIGN PRODUCTS

A study of designers in architectural offices showed that, despite the various information resources and other design aids available to them, designers relied most frequently on their own experience when making design decisions. Design practitioners did not appear to use formal design methods. The research projects examined the routes taken by designers to reach design decisions to find out how these vary from job to job and to see how the use of information and experience can influence design decision-making. The research was undertaken by the Institute of Advanced Architectural Studies, University of York, under contract to BRE. (2,3,4,5,6). It was based on a series of case studies of live design projects in various types of architectural offices involved on different types of buildings.



The designers were interviewed as the designs progressed from inception to working drawings. These interviews provided information on the sequence of decision-making and on what influenced the decisions. Although the sample size was small (some 30 case-studies) it is likely that the findings apply to architectural practice in general. They indicated how experience, recorded design data and outside constraints beyond the designers' control influenced the design of the projects studied.

#### The design process

The design process observed during the case studies followed a fairly consistent pattern. An initial concept for the building plan, form and general construction was developed rapidly, using little information other than the client's brief, the site constraints and the designer's own experience. This initial concept was then developed and refined, using more deliberately researched information, and later modified as constraints and requirements emerged more clearly. In nearly all case studies the initial concept formed the basis of the final decision. There was often too little time to explore the alternatives in any depth. The few major changes to the designs were generally due to requirements imposed by statutory authorities.

This pattern of working contrasted strongly with the simplified models of the design process. It showed that detailed aspects of a design sometimes called for the designer's special attention at an earlier stage than is generally predicted, while design analysis is nevertheless often short-circuited by the designer on the grounds of his experience. This has implications for information use in the design process.

As part of the research project, some architects were asked to keep daily diaries of their activities. Figure 1 illustrates the difference between the designer's intentions and the actual happenings on one typical day.

#### Things beyond the designer's control

Factors beyond the designer's control such as budget, project programming and site constraints were recognised as significant influences on design decisions in all the case studies. Outside agencies appeared to cause significant delay and disruption to the design process, in particular affecting general briefing and communication with clients, and negotiations for statutory approvals, particularly town planning.

Inadequate briefing by the client at an early stage of the design was found to complicate the design and to cause abortive work. Briefing guides developed by the designer or client, in the few cases in which they were used, provided a valuable basis for the development of the design and also avoided the communication problems which tended to arise in other projects.

#### Use of publications and experience

Designers tended to seek written information as a last resort when their own experience or that available in the office failed to give either an answer or to provide the understanding to enable a solution to be worked out.

Experience was widely quoted as the preferred source for information and should be better exploited. The way experience is gained, and transferred between designers within a practice, has therefore been explored in a further study with the aim of helping designers to improve both the quality and quantity of experience used.

#### Feedback from completed buildings

The offices studied collected little systematic feedback on the performance of their designs once built. Nor was there any evidence that formal continuing education played a part in design. Yet continuing education is potentially a good means for disseminating feedback from completed buildings.

Designers rarely kept systematic records of design decisions. These can be useful if design work is delayed or to consult for similar buildings later on, saving cost. Figure 2 shows a design record sheet in use.

### STUDY OF BRITISH STANDARDS

#### The problem

UK building designers have been concerned about the content and form of construction industry British Standards and Codes (BSs) produced by the British Standards Institution (BSI). Designers use BSs too little; they complain about excessive length, complexity and legalistic flavour and have called for clearer design guides. This has coincided with the recasting of the Building Regulations in functional terms and the possible use of BSs as 'Approved Documents' giving detailed design advice. BSI therefore asked BRE to carry out a study to clarify the actual and potential users of BSs and to propose how documents could be better structured and presented for these users.

#### Research approach

In examining why people used BSs so little, there were similarities with why people are reluctant to use buses and other public transport. By tentatively applying findings from travel research to the corresponding aspects of information (7), a travel analogy provided a valuable source of ideas for improving BSs.

If a traveller does not use a bus it may be because no bus goes there, or because he does not know which bus to use. More likely it is because the bus journey is too slow or inconvenient; time is the key to travel behaviour. The inference is that time is also the key to information-seeking behaviour so many proposals for improving BSs aimed to save the reader's time.

#### Principles for better writing

Some principles have been identified for deciding what goes into a document. In particular, a document should contain as much as possible of the information needed by one kind of user for one activity and in the sequence in which the user is most likely to use it. Duplication between documents may be desirable if the reader is unlikely to read the source document. Clearer language, better illustrated text, less complex numbering, more spacious layout and bolder typography, judicious use of colour - all could contribute to making BSs less bland and unappetising to the reader so that they are more likely to be bought, read and used. Other proposals concerned directory information and marketing.

Many of the recommendations of this study have now been included in a BSI publication on the preparation of BSs for building and civil engineering (8).



#### A graphical format for regulations

A further application of the proposals from the BSI study was a prototype document on sound insulation. A largely graphical format was developed and a typical page from the prototype is shown in figure 3.

A small pilot exercise carried out to compare the effectiveness of this prototype with an earlier, wordier version indicated that the graphical version led to more accurate assimilation of the information without the loss of speed.

#### SURVEYS OF USERS OF TECHNICAL LITERATURE

Much basic information about the users of technical and product literature in the UK construction industry has been gathered from surveys carried out by BRE and other organisations.

Two BRE surveys of designers' general use of information have been made and another has specifically centred on their use of BRE's own publications.

#### General UK surveys

A total of 1500 architects, surveyors and builders (representative of a total universe of 58,000) were asked questions on their reader-ship of trade and other technical publications in 1983 and again in 1985 (9). BRE was able to contribute specific questions to the 1985 survey to gain an insight into what the reader feels is required in the information he receives. The surveys also sought to determine any changes in attitudes, use of word processing equipment or electronic means of information gathering that had taken place in the two years.

One interesting feature of these two surveys was that it was possible to compare directly the behaviour and attitudes of architect designers with those of surveyors and builders. For instance, when questioned on essential attributes of good technical publications, all occupational groups were in general agreement on the most important factors but there were some differences (see figure 4). Architects put more importance on A4 size paper than other groups, quantity surveyors put 'cost information' top of their list while builders and building surveyors stressed the value of 'date of issue'.

Attributes deemed unnecessary included 'prepunched holes' and 'not more than four pages'. CI/SfB coding did not receive much support either but these factors do not necessarily interfere with the designer's understanding of what he is reading. Their omission does however make it less likely that he will find the document in the first place. A similar survey of attributes carried out with qualified librarians and information scientists would probably come up with different preferences in this area.

During 1985, a further survey was carried out for BRE by Mandix of Cardiff (10). This involved 'across the drawing board' interviews with a hundred designers (split equally between architects and architectural technicians). To select those willing to be interviewed and to ensure that the sample was properly structured, a postal survey had first been completed on 2000 randomly chosen designers. This postal survey also collected information on the amount of use

of various types of technical publications by the designers indicating that the designers fell into two distinct groups - those who believe in using technical information and those who don't bother.

This point was reinforced during the series of interviews with designers - people were either conscientious readers of say, BRE publications, or they rarely used such material in their work.

Other indications from the interviews were:

- amount of use of technical publications did not depend on length of time in practice.
- date of issue and provision of a summary were considered highly essential attributes of technical publications.
- a major problem for designers was discovering the right publication and then finding the relevant information in the publication itself.
- designers are not aware of how long they spend each day searching for information and do not appear to value information seeking time.
- most designers file their technical publications as a 'pile' close at hand. The majority knowingly kept out-of-date editions.
- pricing of technical publications was seen as a deterrent to their use by most designers.
- publications issued by BRE were considered particularly independent and authoritative.

#### Surveys of users of BRE publications

Throughout the last twenty-five years, many survey results and reports have been issued which discuss BRE's ability to transfer the results of its own research to the UK construction industry. Nearly all make comments on the importance of the image of BRE. It is seen as able to give impartial advice and therefore what it says in its technical publications is believed by the readers. The other main point that regularly arises is the importance of conveying building research results to teachers who will then pass them on to student practitioners.

In 1983, some 90 people were retrospectively asked for their views on BRE publications that had been sent to them (free of charge) in response to their written enquiries. They said that they appreciated the unbiased advice and kept the publications in case or until they were needed again. Diagrams and photographs were quoted as being particularly helpful to the readers.

A similar survey was made in 1984 of readers of two particular BRE Information Papers that had been requested on impulse through one of the construction industry journals. All those contacted were architects or architectural technicians and they again confirmed that diagrams and photographs were useful in explaining the information. The majority kept the papers personally. There was however a very wide range of opinions on how useful the documents were: what was helpful to one designer was 'regurgitated rubbish' to another.



## FUTURE RESEARCH PLANS



The findings of the research into designers' use of information are first being reported, with recommendations. These will be exemplified in prototype publications and design aids which will be tried out on designers in practice. BRE is also contributing from its research to the current revision of British Standard BS 4940 (which gives recommendations for the content and presentation of technical publications) providing a way for results from the research to be used by the construction industry itself to improve the effectiveness of technical communication to designers.

Further research into information transfer is planned to take account of contractors' interests.

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## Day 2 Intentions

Duration	Job	Activity
3 hours	1	 Continue lobby drawings.
4½ hours	2	 Presentation of scheme to in-house design study group.

## Actual events

Time started	Job	Activity
8.35	2	 Prepare and pin up presentation drawings for project appraisal. Find out procedure for appraisal.
9.35	1	 Request drawings from CAD plotter.
9.42	2	 Phone calls to client - not available.
9.50	1	 Resume drawing lobbies.
10.10	2	 Rep calls as arranged regarding glazing for project.
10.30	1	 Resume drawing.
10.45	2	 Presentation of project to in-house study group, favourable response.
11.22	1	 Return to drawing board.
12.45	2	 Attend discussion of in-house study group, including lunch.
2.10	-	 Discussion with IAAS on self-interviewing.
2.28	2	 Contractor for project rings up for progress report on planning appeal.
2.30	2	 Discuss design revisions with an architect not in project team. Re-draw elevation.
2.55	1	 Resume drawing.
3.00	2	 Mess about with elevation.
3.10	1	 Resume drawing.
3.30	2	 Ring client - no reply.
3.33	1	 Receive call from project team member.
3.40	1	 Borrow drawings for use in C & S work.
3.47	-	 Receive call from ex-colleague - lunch appointment on Friday.
3.55	1	 Continue finalising stair drawings for steelwork tender.
4.00	1	 Engineer borrows negs to get prints.
4.03	1	 Continue drawing.
4.15	1	 Find that I cannot do without negs, retrieve them from print room.
4.17	2	 Speak to client - resolve question.
4.18	1	 Continue drawing.
4.30	1	 Update drawing numbers; engineer borrows negs again for photocopying.
4.57	1	 Ring health physics section of office regarding technical enquiry.
5.00	1	 Continue drawing. Receive and modify drawing from CAD machine.
5.30	1	 Discuss progress with team job architect.
5.40	1	 Obtain standard stickers from team members; cut out and stick on.
6.00	-	Tidy up and go home.



Key		
	Discussions with architectural colleagues	
	Discussions with other professionals	
	Formal meeting	
	Drawing	
	Reading written information	
	In-house training	
	Telephone call	
	Administrative tasks	
	Lunch	
Job	Nature of work	Plan of work stage
1	Industrial complex for industrial company; working drawings of staircases	F
2	DIY superstore for private commercial company; planning appeal	E

Figure 1 A typical day in the life of a designer



Design record sheet				Sheet number 2
Project: DIY Superstore Completed by: B. Bright		Keywords: Elevations Hi-tech Starwall		
Date	Progress (eg new instructions, meetings, approvals)	Design activity (include options being considered)	Sources of information (include people and experience)	Design decisions - with reasons (include reasons for rejecting alternatives)
13 & 15 Jan	Following up first project meeting	Following up tentative decision to use metal cladding for rapid construction, with research & discussion	Talk to colleagues who have used it (P. Smith, R. Day). Architectural Review 12.8.92 Manufacturer's literature on cladding systems (in library files) esp. Starwall	
16 Jan	Visit to Liverpool & Widnes to see other buildings of same type owned by client	Beginning to appreciate image required of the building; saw pitfalls to be avoided Considered other cladding options	Visits to built examples with client, engineer and QS/ job manager. Took photos of jobs visited and obtained plans - both in job file Reviews in AJ 6.1.91, 7.4.92 Asked architect & engineer of P. Smith & S. Jones	Need hi-tech image but human scale and take care with finish Reject asbestos cladding (poor appearance, durability less than client wanted)

Figure 2 A designer's record of decisions made and information sources consulted

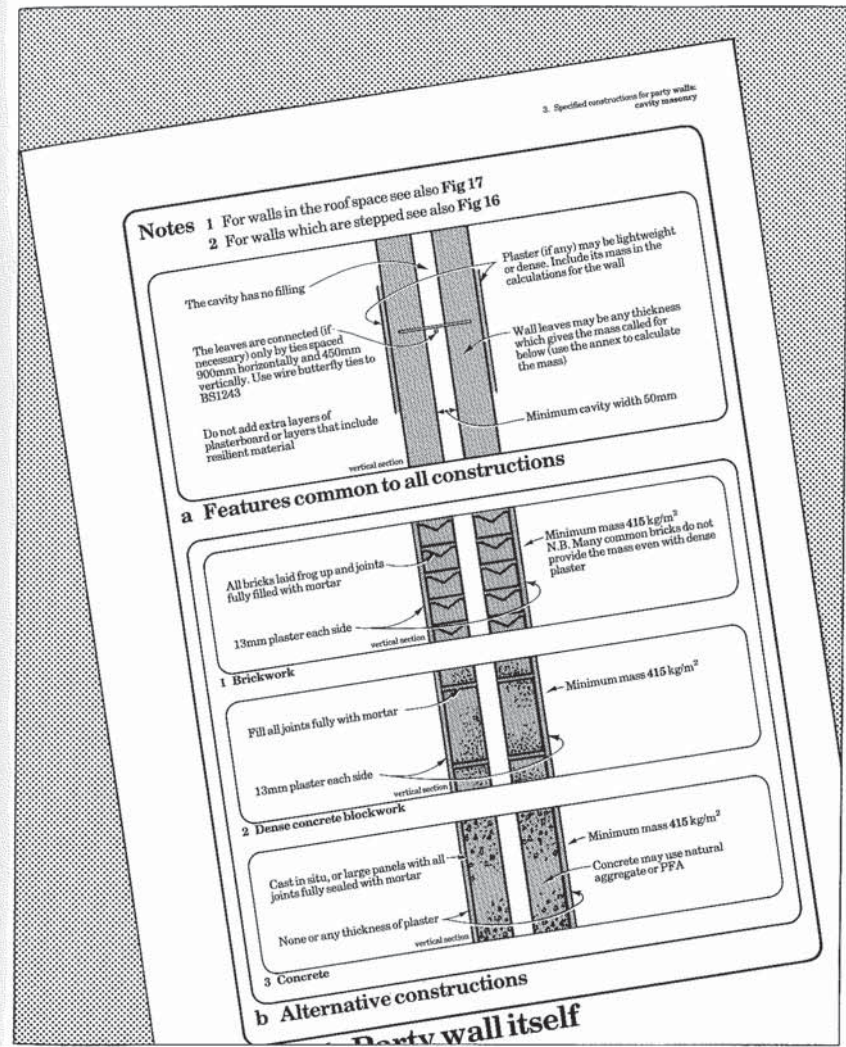


Figure 3 Sample page from prototype publication on sound insulation

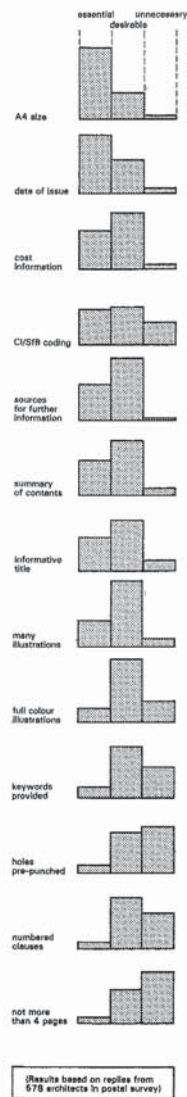


Figure 4 Architects' rating of the importance of various attributes of technical information

NETWORK  
A new resource on housing and design research

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KEYWORDS

Architecture, Planning and User Participation, Case study, Design and Construction Processes and Tools, Information Exchange.

ABSTRACT

NETWORK is a new international non-profit organization, having as its two primary objectives:

- to support local research initiatives in the related fields of housing and design,
- to improve communication among researchers and research organizations at work in these fields. These activities build on 20 years of research and development by SAR (= Foundation for Architects Research, Eindhoven, The Netherlands) and on the experience of those who have expanded and adopted its basic theories.

The type of research and development that is carried out is illustrated by the Keyenburg project in Rotterdam. This project is characterized by tenant control of the individual dwelling lay-out plans. The processes, products and methods that were used to achieve this goal are described. The Keyenburg experience is relevant to all professionals who consider housing as a highly dynamic and complex process, and who are prepared to adjust their professional roles, activities and methods accordingly. NETWORK hopes to realize a world-wide interchange of such experiences, thus adding to the specific body of knowledge that is at issue.