

Attitudes Towards Prefabricated Housing: Breaking Away From The Past

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Abstract:

The Latham Report (1995) identified a need for greater teamwork within the UK construction industry. The Egan Report (1998) took this principle further and in particular posed a series of challenging targets for the UK house building industry. These targets were focused around greater use of innovative techniques derived from manufacturing, and included the increased use of standardisation, prefabrication and “whole house thinking”. In response to these challenges a number of Housing Associations examined the way they procured their new social housing and identified large panel, factory based timber prefabrication as one possible means of addressing the challenges posed by Latham and Egan. However, in proposing this solution the Housing Associations were acutely aware of the history associated with the use of prefabricated timber housing systems in the UK and in particular the long-term maintenance and refurbishment issues.

This paper reports the initial findings from a research programme, funded by the Housing Corporation, which aimed to establish current attitudes towards prefabricated housing systems and identify gaps in knowledge that could undermine their effective maintenance. The paper concludes that attitudes have changed over the past 15 years with all the stakeholders exhibiting a more positive attitude than had been reported previously. In addition the paper identifies key areas of knowledge and skill required within the UK workforce if modern prefabricated systems are not to fall victim to the mistakes of the past.

Keywords: Prefabricated Housing; Attitudinal Survey; Maintenance and Refurbishment.

BACKGROUND TO STUDY

The need for innovation in the construction sector to improve both product and process is widely accepted. In the UK house building has often been characterised as traditional, site based and masonry dominated, partly as a function of perceived consumer conservatism but also as a consequence of conservative attitudes among mortgage institutions, a reluctance to invest in innovation, and risk aversion within the construction sector itself. Whilst there are some notable exceptions the Egan report (1998) identified the weakness of this situation and advocated new approaches to both production and procurement to secure better quality, lower cost, safer and timelier production.

The Latham Report (1995) identified a need for greater teamwork across clients, contractors and consultants and advocated a move towards more Partnering based contracting. Egan took this principle further, posing a series of challenging targets to the industry and advocating a greater use of techniques derived from manufacturing, including standardisation, prefabrication and “whole house thinking”. In addition, the

Egan report identified five key drivers that needed to be addressed if the UK construction industry was to benefit from the radical change experienced in other industries. Whilst these drivers were considered applicable to all sectors of the construction industry Egan specifically identified house building for the social rented sector as an area where significant improvements in performance could be achieved. The Rethinking Construction Task Force argued that, as new social housing was commissioned by a few major clients, this should provide the main opportunity for improvements in house building performance.

Specific responsibility for procuring new social housing in the UK resides with Registered Social Landlords (RSL's) however the majority of the funding for new development comes from the Housing Corporation via an annual bidding round. In the annual bidding round individual RSL's submit development projects which, following evaluation, are either adopted as part of the Annual Development Programme (ADP) and funding is allocated, or are rejected. Although the details of the bid process are not relevant to the present paper, the fact that from 2000 onwards a proportion of the ADP had to be deemed to be Egan compliant is.

In the 2000/2001 bidding round 10% of the construction cost element of the ADP had to be procured using the Egan principles set out in Rethinking Construction. Further, in subsequent bidding years this percentage was set to rise until by 2003/2004 the whole ADP would be 100% Egan compliant. As one aspect of this move to full Egan compliance the Housing Corporation introduced the Kick-start Programme (The Housing Corporation, 2001) which ring fenced approximately £80 million of Social Housing Grant to support prefabrication based projects over the two funding years 2001 - 3. In order to bid for this funding RSL's had to identify new development opportunities that utilised one of a pre-selected range of innovative (offsite fabricated) house building technologies.

The application of offsite fabrication methods to the UK house building industry has been the focus of considerable attention over the past few years. The Housing Forum has produced a number of reports in an attempt to promote the technology amongst those responsible for developing new housing. The Housing Forum Demonstration Projects Report (Housing Forum, 2002) provided detailed case study information on the performance of a large number of RSL focused development projects whilst the Homing in on Excellence report (Housing Forum, 2002) clearly identified the arguments for offsite fabrication and the barriers to implementation that need to be overcome within the UK mass housing market. With respect to the latter, the past UK experience of non-standard house construction and the inadequacy of current levels of training / skills amongst the workforce were identified as major obstacles that needed to be addressed if offsite fabrication was to have a major impact on the UK house building industry. These findings were similar to those reported previously by Chandler (CIB, 1988) who examined a range of maintenance issues (including defect recognition and repair evaluation, knowledge and skill of professional and site staff and whole life performance of building components) as part of the Construction Industry Training Board Tern Project. Chandler concluded that research was required not only into the technology of repair for non traditional housing but also into the whole decision making process.

The current project aimed to address these issues by examining whether past (adverse) UK experiences of prefabricated housing and / or inadequacy of current levels of training / skills amongst the workforce were actual rather than perceived barriers to the current implementation of prefabricated housing amongst RSL's, their professional advisors and their house building contractors. The project was funded by the Housing Corporation through their Innovation and Good Practice Grant scheme.

Details of the Research Project

Initial interviews undertaken by the research team with senior RSL development staff had identified that, whilst the majority of RSL's had responded enthusiastically to the broad challenges posed by the Egan agenda (e.g. partnering) there were a number of specific issues that had to be addressed if off-site prefabrication was to become their preferred method of house construction. Amongst these issues was the need to examine the extent to which attitudes towards prefabrication amongst the stakeholders to the social house building process could undermine development opportunities. Within this context, the current project sought to examine the extent to which;

- a lack of skills to effectively project manage prefabricated development projects (both during design and during construction) could prejudice good design and construction; and
- a lack of understanding about key aspects of effective maintenance of prefabricated buildings (e.g. the importance of intact vapour barriers in timber or steel framed buildings) could prejudice good maintenance and potentially undermine warranties.

Whilst either of these issues alone would prove problematic to RSL's as they sought to promote the greater use of off-site prefabrication, the combination of the two together would cause concerns to valuers and funders, and ultimately prejudice mortgageability. This paper reports the results from the maintenance and refurbishment part of the project.

Details of the Questionnaire

Following the review of previous studies (outlined above) and a telephone interview with Professor Ian Chandler, a semi structured, telephone based interview questionnaire was developed to address the attitudes and experiences of the five key professional (Built Environment) stakeholders sets who, through the inputs they provide to the housing development decision making process, have a significant impact on whether prefabricated housing solutions would be adopted ahead of more traditional ones. In developing the survey instrument consideration was given to the need to distinguish between the pre-fabricated housing systems identified in the Kick-Start programme. The survey matrix for

	RSL Developer	Architect	Contractor / Producer	Maintenance	Implementers
Timber Frame					
Advanced Timber Panel					
Steel Frame					
Concrete Frame					
Composite Construction					
Structural Integrated panel					

Figure 1. Survey Matrix

the project is shown in Figure 1. Results for this paper have been drawn from the responses provided by the RSL development team and their professional advisors, (i.e. Architects, Surveyors, and Implementers / Employers Agents).

The survey questionnaire was developed in five sections, contextual, procurement, project management, skills audit and maintenance issues. Results for this paper have been drawn from the contextual, procurement and maintenance sections.

Summary of main findings

Details of Respondents

Initial contact was made with selected representatives (who, through a review of recent housing development projects it was believed had been involved in Egan compliant schemes) of the various stakeholders to the social house building process.

Of the 37 organisations approached 19 participated in a formal telephone interview (Figure 2). Those interviewed ranged from Chartered Surveyors through Development Managers to Managing Directors of RSL's. The Chartered Surveyors answered questions on maintenance issues only.

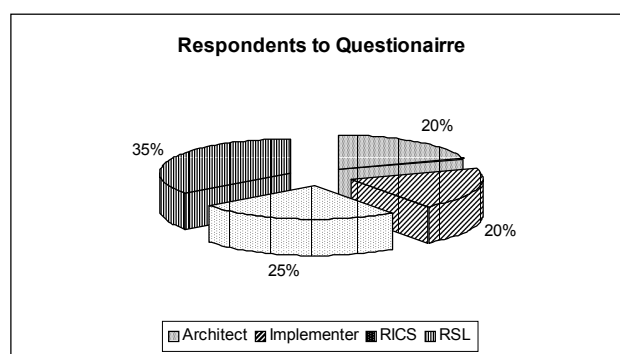


Figure 2. Details of Respondents

Each interview was conducted using a standard telephone protocol in which the interviewer administered a semi-structured questionnaire. All interviews were recorded on audio tape. All interviews took place during April and May 2002.

Egan Compliancy

Eighteen of the 19 respondents interviewed had been involved in the development of at least one Egan compliant housing scheme (one Chartered Surveyor had no experience of Egan compliant housing). The Egan compliance criteria for each scheme are shown in Figure 3. The schemes ranged in size from 8 to 400 house units. In all data was provided on 19 Egan compliant schemes.

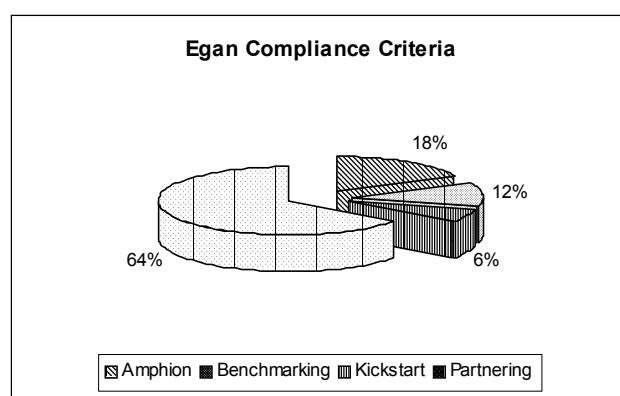


Figure 3. Egan Compliance Criteria

Whilst the majority of the Egan compliant schemes had utilised pre-fabricated construction techniques 6 had not. In subsequent analyses the responses from the implementer that had not used a pre-fabricated form of construction were included in

the project management and skills audit sections but not in the procurement and maintenance sections. The responses from the Chartered Surveys and the RSL that had not used a pre-fabricated form of construction were only included in the maintenance section.

Of those that had used a prefabricated form of construction the overwhelming majority had used timber (Figure 4). No respondents had used either Composite Construction or Structural Insulated Panels. The overall consensus from the respondents was that the schemes that they had developed had either met or exceeded their original expectations (Figure 5). The respondents were particularly pleased with the speed of construction (which in many cases was much faster than had been expected) and the quality of the finished product (which was generally as good as the manufacturers had claimed in their literature. By way of contrast, those respondents who generally dissatisfied with the performance of the prefabricated construction cited unrealistically estimates of speed of construction and the subsequent problems with programming as the project ran late as the primary reasons for their level of dissatisfaction. Finally, one RSL noted that, whilst in general they were more than pleased with the finished product they had not envisaged such high amounts of waste from the packaging.

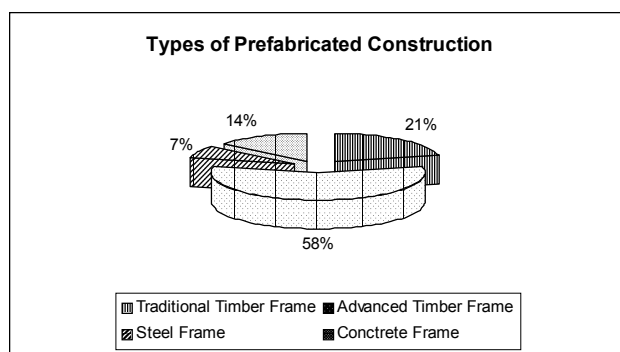


Figure 4. Types of prefabricated construction

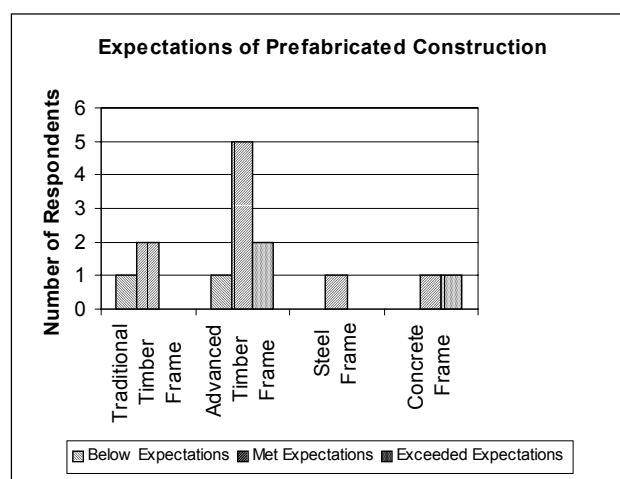


Figure 5. Expectations of Prefabricated Construction

Attitudes towards Prefabricated Housing

In assessing the attitudes towards Egan compliant prefabricated housing the sample were divided into two groupings, those who had been involved in the initial procurement decision making process (the RSL's, their architectural advisors and their project implementers) and those who would be responsible for future maintenance / refurbishment of the housing stock (the RSL's their architectural advisors and their maintenance professionals). The following sections outline very briefly the views of those responsible for procurement (as far as they expressed an opinion on maintenance / refurbishment issues) and in more detail the views of those responsible for future maintenance / refurbishment of the housing stock.

Procurement

Three implementers, 3 Architects and 5 RSL's provided information about the procurement processes they had used for their Egan compliant schemes. The results are summarised in Table 1. Whilst there was some variation amongst the respondent groupings as to the absolute importance of the various issues listed in the questionnaire, all the parties generally agreed on their relative importance to the decision making process. Overall, establishing value for money, convincing funders, the durability of components, the management of risk and ease of future adaptability were all rated as either very or extremely significant to their decision making process (Note: the exceptions to the general rankings were Architects who considered acceptability of the housing to tenants to be very significant and RSL's who considered convincing their board to be very significant.) Amongst those issues considered to be generally least significant were resistance of staff and issues relating to future maintenance. It would appear from these results that those responsible for procurement were focussing primarily of the up-front issues relating to cost and design rather than the whole life issues relating to maintenance and refurbishment. If this is indeed the case then the authors are concerned that this may result in a repeat of the problems associated with UK prefabricated housing of the 60's and 70's.

Issue	Ranking			
	Overall	Implementer	Architect	RSL
Convincing the board	9	10	10	4=
Establishing value for money	1	1=	1=	3
Management of risk	4=	4	3=	4 =
Resistance of staff	11	11	11	11
Acceptability to tenants	8	9	3=	9
Convincing funders	2	1=	8=	1
Durability of components	3	3	5=	2
Ease of future maintenance	7	8	8=	7=
Cost of future maintenance	6	5=	5=	7=
Ease of future adaptability	4=	5=	1=	4=
Cost of future adaptability	10	5=	5=	10

*Table 1 Relative Importance of Issues to the Procurement of Prefabricated Housing
(1=most important)*

Maintenance

The evaluation of the risks associated with innovative forms of construction was one of the major issues to emerge from the experiences that UK maintenance managers gained dealing with the prefabricated housing of the 60's and 70's. These risks manifested themselves in a number of forms including:

- the ability to solve design errors after construction;
- the quality of the design team and of design details;
- the quality / durability of the materials used;
- the consequences of poor site practices;
- whole life performance including
 - the evaluation of maintenance and repair strategies;

- the ability to resolve maintenance problems; and
- the ease of future adaptability of the building.

The current questionnaire sought to establish whether these issues were still of concern today and, if they were, to identify specific gaps in the knowledge / skills which would need to be addressed if they were to be overcome. Seven RSL's and 6 of their professional advisors addressed this section of the questionnaire.

The majority of respondents believed that maintenance issues would either be easier, or at least no more difficult to solve, for prefabricated housing compared to traditional housing (Figure 6). This view was particularly pronounced amongst the RSL respondents who in general exhibited a more positive attitude towards prefabricated housing than their professional advisors. Where opinions differed was in relation to poor quality of design and materials (where RSL's very strongly believed that there would be no difference between prefabricated housing compared to traditionally built housing whilst their professional advisors were divided on the issue) and the ability to resolve and plan future maintenance activities (where, whilst the professional advisors believed that the planning of future maintenance actions would be easier to solve for prefabricated housing compared to traditionally built housing the RSL's were less convinced. Note: Also within this category, there was a general opinion that any problems associated with timber frame construction would be easier to solve than for the other methods of prefabricated construction.).

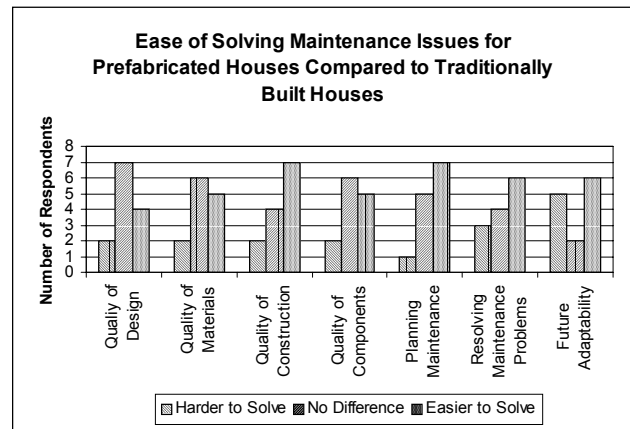


Figure 6. Ease of Solving Maintenance Problems

Finally, the data from this section of the questionnaire would appear to suggest that the traditional concerns associated with the maintenance of prefabricated housing in the UK are diminishing, particularly where they relate to the overall quality of the finished product and the ability to plan a maintenance programme. The one area where there is concern is the future adaptability of the prefabricated houses. This issue will be examined in greater detail later in the project as it would appear to be at odds with the views of those responsible for the procurement of prefabricated housing.

Knowledge and Skills Map

The final areas addressed by the questionnaire were the knowledge and skills that the RSL's and their professional advisors believed were necessary for the effective maintenance of prefabricated housing. Two knowledge/skills maps are presented in this paper, one relating to maintenance managers and the other to maintenance operatives. Again, 7 RSL's and 6 of their professional advisors addressed this section of the questionnaire.

Maintenance Managers

There was clearly a difference of opinion between the RSL's and their professional advisors about the level, although not the composition, of the knowledge and skills required by those responsible for managing the maintenance of prefabricated housing (Figure 7). Without exception the professional advisors rated all the areas of knowledge and skills as more important than did their RSL clients. Further, on examination of the open text questions contained within this section of the questionnaire it was apparent that the professional advisors were clearly of the opinion that currently maintenance managers were neither qualified, nor had sufficient experience of prefabrication, to effectively maintain these units (Note: it was unclear from the responses as to whether the professional advisors believed that their staff lacked the necessary knowledge / skills to effectively manage the maintenance of prefabricated housing or whether they were referring to the RSL maintenance staff. This will be investigated in more detail later in the project). The knowledge and skills that were considered essential by both the RSL's and their professional advisors were:

- a detailed knowledge of the maintenance actions required for each of the building components;
- a detailed knowledge of the known maintenance issues associated with the prefabricated system being used;

In addition, the following were considered desirable:

- a detailed knowledge of the expected whole life performance of the building components;
- specialist training skills (above those normally associated with traditional housing schemes) in order to identify and evaluate potential repair options.

Maintenance Operatives

Neither the RSL's, nor their professional advisors, rated any of the knowledge / skills identified in the questionnaire as essential for maintenance operatives (Figure 8). With regard to the composition of knowledge / skills required by maintenance operatives, the RSL's generally rated specialist training (survey skills, identifying repair options and evaluating repair alternatives) of more importance than knowledge of the product, whilst their professional advisors rated knowledge of the

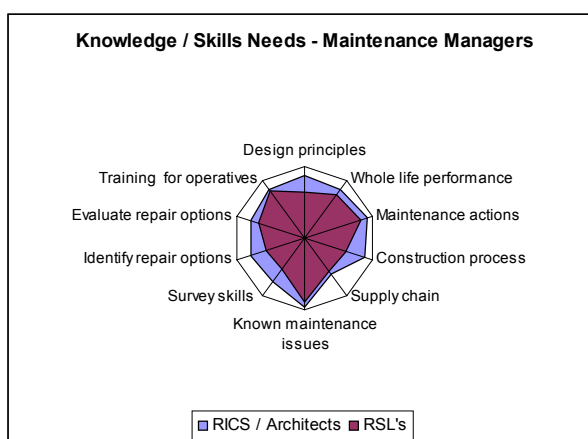


Figure 7. Knowledge / Skills Needs for Maintenance Managers

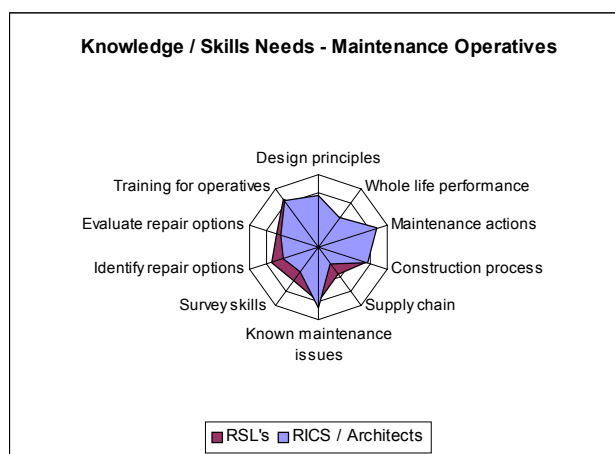


Figure 8. Knowledge and Skills Required by Maintenance Operatives

product more important than specialist training. There was general agreement amongst the respondents that it was desirable that maintenance operatives had a detailed knowledge of the maintenance actions required for each of the building components and a detailed knowledge of known maintenance issues associated with the prefabricated system. The main reasons cited by the respondents for these views was the difficulty of obtaining good quality operatives to work on any aspect of maintenance let alone to try to obtain operatives with specialist skills to work on prefabrication.

Conclusions

It would appear from the results of this study that attitudes towards prefabricated housing in the UK are changing with the perceived levels of risk diminishing.

The following tentative conclusions have been drawn from the study.

- Those respondents who had been involved with the development of Egan compliant schemes using modern prefabricated house systems generally found that they met or exceeded their expectations, particularly with respect to the overall quality of the product and with the speed of construction. Where the prefabricated housing systems did not meet expectations it was generally as a result of unrealistic claims being made by the product developers (particularly concerning construction time) which were subsequently not achieved.
- When procuring prefabricated housing, issues relating to finance, cost and design (including the ease of future adaptability) were generally considered more significant than those relating to whole life performance.
- Both the RSL's and their professional advisors believed that potential maintenance problems which may arise with prefabricated housing would be easier or at least no more difficult to solve than those associated with traditional brick construction. Where there was a difference of opinion was in the strength of this belief with RSL's generally exhibiting a more positive attitude towards prefabricated construction than their professional advisors. The one area of concern was the ease of future adaptability of the prefabricated house systems.
- Whilst there was a difference of opinion between the RSL's and their professional advisors over the level of knowledge and skills required to effectively management the maintenance of prefabricated housing there was general agreement over the composition. A detailed knowledge of the known maintenance issues associated with each prefabricated system and the maintenance actions required to address the issues were considered essential for effective maintenance management. Further, the professional advisors were of the opinion that currently maintenance managers were unqualified to, or had insufficient experience of prefabrication systems to, effectively maintain them.
- The RSL's and there professional advisors had different views regarding the knowledge and skills required by maintenance operatives with the RSL's rating specialist training of more importance than their

professional advisors who in turn rated knowledge of the product of more importance than the RSL's.

Future Work

This project is still ongoing with further interviews of development / maintenance staff and with the various industry wide stakeholder groups being planned. These interviews will attempt to consolidate the initial conclusions outlined in this paper and will address the specific knowledge / skills gap in much more detail in order to develop the educational and training materials that are required by those developing and maintaining Egan compliant prefabricated housing in the UK.

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