



UK TIMBER ENGINEERING GROUP

Making Research Work!

UK TIMBER ENGINEERING GROUP

A MAJOR SEMINAR

on

“ENGINEERED TIMBER FLOORS - THE OPTIONS”

to be held at

THE NATIONAL MOTORCYCLE MUSEUM

on

THURSDAY 21 MARCH 2002

Chairman: Peter Ross (Ove Arup & Partners)

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INTRODUCTION

Timber floors have seen an expanded range of new products entering the market over the past decade and these are becoming increasingly popular with builders and Housing Associations.

This seminar is the first of its kind to present a broad overview of the options available nowadays and gives a unique opportunity for attendees to talk to the major suppliers of those systems.

It is intended that the papers presented represent a broad coverage of the key technical aspects affecting the engineered timber floor industry and are of relevance to both specifiers and manufacturers alike.

We hope you have an enjoyable and informative day.

UK Timber Engineering Group

WHAT MATTERS TO BUILDERS

By Luke R.J Whale, Ph.D
TimberSolve Ltd.

1.0 INTRODUCTION

In 1997 TimberSolve were awarded a research project by the then UK Government Department of the Environment (now DLTR) to study options for wood-based floors with improved performance characteristics. The backdrop to the study was a very real disenchantment being expressed by users of intermediate solid timber floors, based on their perception that they were no longer meeting expected performance levels. This was already causing some builders to change their intermediate domestic floor specifications toward alternative wood- or concrete-based floor options, in spite of these often being far more expensive at first blush.

The research project would study the reasons for this disillusionment with traditional timber floors, the drivers for change which existed, and the merits of each of the alternative options capable of meeting the new more demanding needs of the market. Should gaps be identified in the ability of existing alternative wood-based solutions to fulfil these market requirements, then the research would go on to suggest new wood-based systems which might also become viable alternative solutions. The next presentation in this Seminar will deal specifically with the performance attributes of these various existing and prospective new options for wood-based floor joists. This presentation will therefore concentrate on the relative importance of the various performance requirements which builders identify when making decisions as to which system they will employ.

Before any assessment can be made of the likely success of a new or existing floor joist system, a clear picture is required of the various performance attributes expected of them, and their relative importance. At the outset of this research, it was therefore decided to design a questionnaire aimed at house builders, to ask for their opinions on what makes the perfect floor joist. This would help provide the performance criteria by which existing joist options could later be judged, as well as providing a checklist against which prospective future new systems could be measured. At the same time as collecting information on 'What Matters to Builders', opportunity was also taken to seek current usage statistics on the existing floor options, on the associated constructions employed in domestic intermediate floors, and on the degree of satisfaction experienced by both solid timber and I-joist users. In the remainder of this paper the replies received from this questionnaire will be reviewed, together with their implications for the suppliers of both traditional timber joists and the various 'engineered' wood-based joists that now seek to replace them.

2.0 THE QUESTIONNAIRE

The domestic floor questionnaire was designed to be easily understood and quickly completed. It was exclusively designed for and dispatched to house builders, particularly those building more than 200 houses per annum. Where quantitative information was sought, this was mostly in terms of percentage usages for various systems. Where qualitative information was sought, this was mostly requested on a graduated scale (eg. 'very satisfied' to 'dissatisfied' or 'no problem' to 'big problem'). The questionnaire could be completed anonymously if preferred, to avoid any worries about commercial confidentiality, and a postage-paid reply envelope was enclosed to minimise the cost/time in replying.

The questionnaire was mailed out during the period July 1998 to October 1999 to a total of 219 house building companies abstracted from various trade association lists. After a second mailing to recipients who hadn't responded to the initial mailing, the total number of replies had risen to 54 companies – representing a reply rate of 25%. The cumulative total number of new house starts claimed to be being built by the respondents was almost 38000 starts/per annum – representing over 20% of the new build housing sector in the UK.

The questionnaire asked for replies to the following 7 questions :

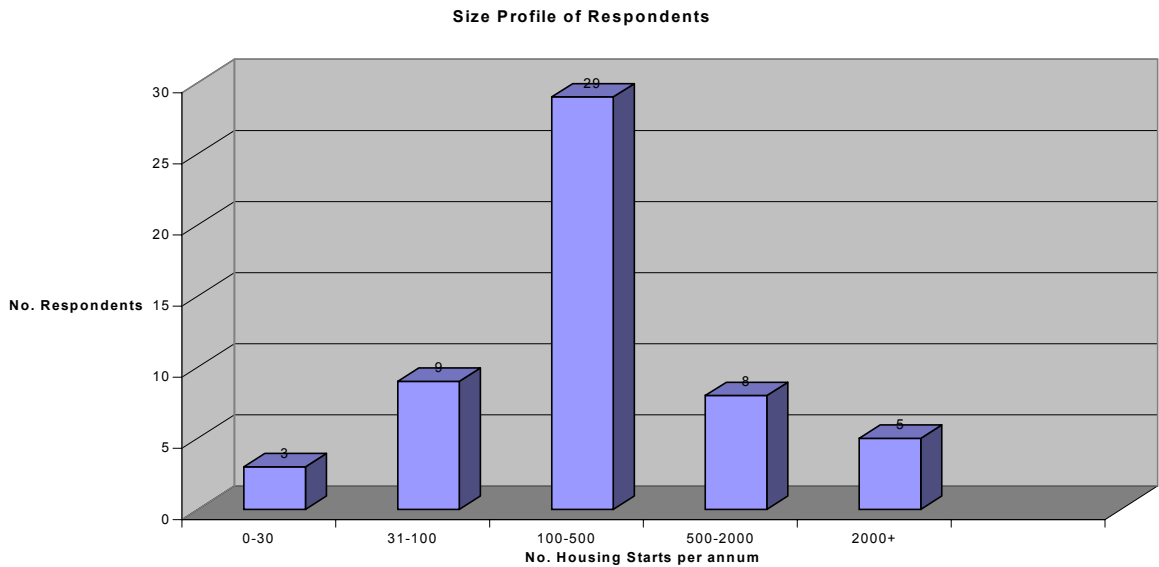
1. COMPANY DATA
- *No. of housing starts/pa*
2. JOIST TYPE USAGE STATISTICS
- *Solid timber* *First floor*
% usage of - *I-joist* by vs
- *Concrete* *Ground Floor*
- *Other*
3. DEGREE OF SATISFACTION – BY JOIST TYPE
- *Level of satisfaction of* - *Solid joist users*
- *I-joist users*
4. TYPES OF FLOOR JOIST SUPPORT
- *% usage of types of support*
5. FIRST FLOOR CONSTRUCTION DETAILS
- *Floor decking thicknesses/types*
% usage of - *Joist centres* for - *Solid joist users*
- *Joist sizes* - *I-joist users*
- *Blocking/strutting*
- *Ceiling board thickness*
6. SHORTCOMINGS (IF ANY) OF SOLID JOIST FLOORS
- *The nature and extent of problems encountered with traditional timber floors*
7. REASONS FOR NOT USING 'ENGINEERED' TIMBER JOISTS
- *The most common reasons cited for not using 'engineered' timber joists*

A copy of the questionnaire itself is given in Annex A, together with a summary of the replies received. The results are discussed in more detail in the next section.

3.0 QUESTIONNAIRE FINDINGS

3.1 Company Data

A breakdown of the size of the companies replying to the questionnaire, in terms of their stated number of housing starts per annum, is given in Figure 1 alongside the total number of building companies registered under each size category in the UK.



No. Starts/pa	0-30	30-100	100-500	500-2000	2000+
Total No. respondents	3	9	29	8	5
Total No. UK builders	15000+	245	100	21	14
% of Registered Total	≈ 0%	≈ 4%	29%	38%	36%

Figure 1 – Size Profile of Questionnaire Respondents

It can be seen that the size of companies responding to the questionnaire is weighted toward the larger builders, with two-thirds of respondents building in excess of 100 houses per annum. This is evident from the fact that whilst only the views of 54 companies are represented in this survey (compared with the 15000+ registered building companies), they together represent some 20%+ of the total number of UK housing starts. Whilst the size distribution of companies responding is therefore atypical of that which exists in the UK, their size certainly means they represent a significant proportion of UK building activity.

3.2 % Floor Usage Breakdown

Figure 2 represents the breakdown of respondents utilising solid timber, I-joists or concrete floors for their ground- and first-floor construction. This demonstrates the domination of concrete systems in ground floor construction, and timber systems in the first floor. In the first floor sector, 27% of the starts represented were already using I-joists. This statistic is undoubtedly distorted because of the preponderance of larger companies replying, but it is interesting to note that even if all of the housing starts not represented in this survey were ascribed as solid timber joist users, then 3 years ago I-joists would still have possessed a 6% market share.

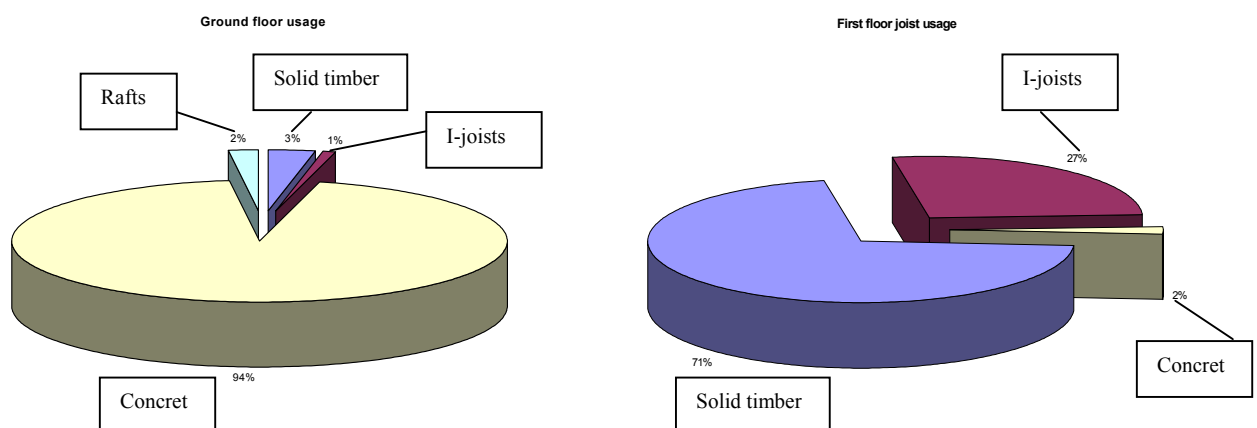


Figure 2 – Floor Usage Statistics

3.3 Satisfaction Levels

One of the most stark statistics gathered from the questionnaire relates to the level of satisfaction expressed by users of solid timber floors, in comparison with engineered timber floors. Figure 3 illustrates the difference in the degree of satisfaction expressed by users of the alternative systems. Whilst 100% of I-joist users were either 'generally satisfied' or 'very satisfied', only 39% of solid timber joists users expressed the same degree of satisfaction. This is a telling statistic for those involved in the supply of solid timber joists, and indicates that engineered joists could ultimately achieve market shares of nearer 60% if this dissatisfaction is translated into changes of joist specification.

Satisfaction Level	Solid Joist Users	I-Joist Users
Very satisfied	2%	70%
Generally satisfied	37%	30%
Not entirely satisfied	43%	0%
Dissatisfied	18%	0%

Figure 3 – Satisfaction Levels for Solid joist/I-joist Users

3.4 Joist Support Types

Replies received to this question indicate that of the 90% of masonry houses constructed in the UK at that time, approximately two-thirds of these had joists that were built-in to the masonry, with one-third supported on hangers. Recent changes to the 'Thermal' Part of the Building Regulations, together with intended future changes to the 'Sound transmission' Part, mean that these statistics may well be reversed over the next few years.

3.5 First Floor Construction Details

To some degree the statistics listed in Annex A for question 5 are self-explanatory. For solid timber floors, they illustrate the preponderance of 8" joists, spaced at 400mm centres, with solid timber blocking, and using 18mm or 22mm chipboard flooring with 12.5mm plasterboard ceilings. In contrast, I-joists are seen to predominately be spaced at 600mm, with 22mm chipboard flooring and either 12.5mm or 15mm plasterboard ceilings. The 80% statistic on the use of solid timber blocking on I-joist floors is confusing to say the least, and is thought to be erroneous, probably due to misunderstandings in the question.

3.6 Shortcomings with Solid Timber Floors

Together with the replies to questions 7, the answers to this question are particularly relevant to the question 'What matters to builders'. Figure 4 illustrates the results graphically. This shows that problems associated with joist shrinkage (ie squeaks, cracks, gaps and nail popping), together with their associated call-back costs, are primarily the reason for the dissatisfaction levels expressed in question 3. Of these, 'squeaky' floors were cited as the biggest problem, followed by 'popping' of plasterboard nails and gaps appearing under skirting boards. The associated call-back costs were variously regarded as either a small or a big problem that occurred some of the time. Cost estimates for these (averaged over the total number of units built) ranged from £10 - £400 per unit, with the mean value being £140 and the median value being £50.

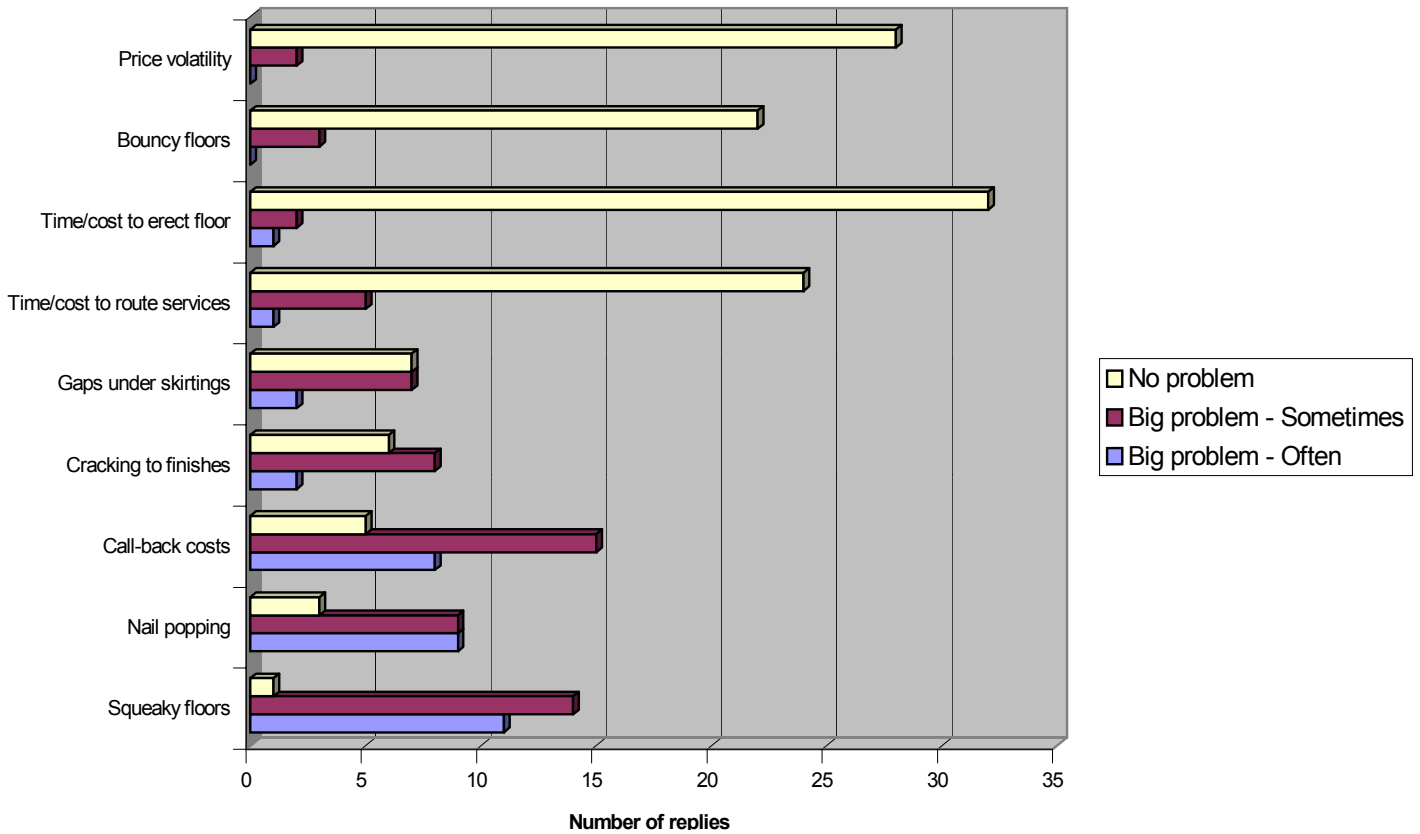


Figure 4 – Problems Related to Traditional Timber Joists

3.7 Reasons for Not Using ‘Engineered’ Timber Floors

Finally, respondents not using ‘engineered’ timber floors were asked what the primary reasons were. Figure 5 demonstrates that cost by far represented the largest obstacle to greater take-up, followed by a perceived lack of track-record, limited choice of suppliers, or a lack of product data. This can only be regarded as positive news for those involved in the supply of ‘engineered’ joist systems, as these more commercial/marketing oriented factors are largely within the control of the system suppliers themselves. Indeed in the 3 years since this survey was conducted, increased competition together with the greater experience/confidence gained in their use in the meantime, has meant that great strides have been taken in addressing all of these factors in the meantime. Interestingly, each of the more technically oriented factors, which are often the more difficult for the joist suppliers to address, figured much less significantly as obstacles to change, with even the biggest of these (lack of flexibility in joist depth) having now also largely been addressed.

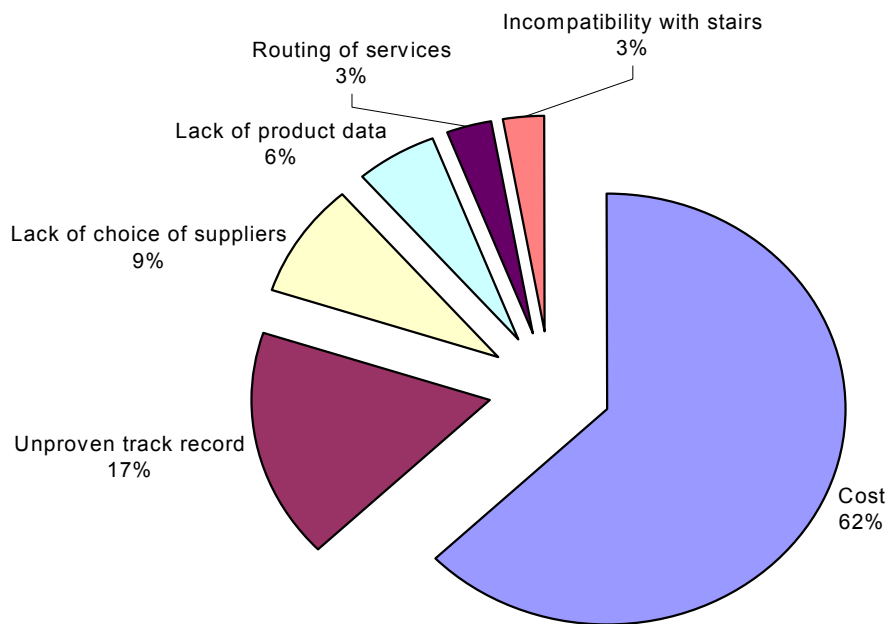


Figure 5 – Primary Reasons Given for Not Using Engineered Wood-Based Floor Systems

4.0 CONCLUSIONS

Responses to the domestic floor questionnaire do much to explain the reasons why engineered wood-based joists are increasing in popularity at the expense of traditional timber floor joists. Significant levels of dissatisfaction were being expressed by users of solid timber joists, in comparison with users of wood based I-joists where no such dissatisfaction was evident.

The problems underlying this dissatisfaction with traditional timber joists revolve largely around their propensity to shrink in service, manifesting itself in a variety of ways with various degrees of severity and frequency. The associated call-back costs on traditional joisted floors were variously estimated at between £10 - £400 per plot, with the likely average figure being in the range £50-£150.

The primary obstacles cited as reasons for not changing to ‘engineered’ wood-based joists were largely within the orbit of the joist suppliers to control, and indeed many of these have already been addressed since the survey was carried out.

The conclusion must be that unless the supply chain involved with traditional timber joists addresses the issue of joist shrinkage, with all its attendant problems, their market share will continue to be eroded by various alternative ‘engineered’ joist options.

The questionnaire replies reviewed in this paper do much to explain ‘What matters to builders’ in respect of domestic intermediate floors, and they therefore act as a yard-stick upon which both existing and prospective new joist options might be compared. The next paper in this seminar will undertake such a comparison, based on the performance requirements for floor joists established during this research.

The questionnaire results reported upon in this paper formed part of a research and development project supported by DLTR under the ‘Partners in Innovation’ programme (project ref. Cc1522:CI 39/3/459). Copies of all reports produced during this project can be obtained from TimberSolve’s web site address at: www.timbersolve.co.uk

ANNEX A

The following document summarises replies received from questionnaires sent out to all major UK housebuilders between July 1998 and October 1999

Text in black in the following document is from the original questionnaire, whereas text in red or blue is providing a summary of the results received.

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DOMESTIC FLOOR QUESTIONNAIRE

- We have recently been awarded a government (DETR)/industry funded research project to develop improved wood-based domestic flooring systems.
- The first step is to establish the types of domestic floor currently being built, along with their shortcomings.
- We hope you can help us gain this information by answering the following 7 questions. Your response can be completed anonymously if you wish. A postage-paid reply envelope is enclosed for your convenience.
- Any information you provide will be treated in confidence and remain wholly unattributed in any compilation of questionnaire responses.

Thank you in anticipation of your assistance

1. COMPANY DATA

Number of house starts per year ..*Total replies = 54 (representing a reply rate of 25%)*

Replies were received from building companies accounting for a cumulative total of 37700 new house starts/annum (approx 24% of the total UK market)....

2. INDICATIVE USAGE OF TYPES OF FLOOR IN YOUR VARIOUS HOUSE TYPES ?

Replies expressed as % starts (no. of users)

First floor

71% (41)	Solid timber joists
27% (12)	Engineered wood-based I-joists
2% (0)	Concrete....Precast / beam & block
0% (0)	Other, please specify.....

Ground floor

3% (1)	Solid timber joists
1% (0)	Engineered wood-based I-joists
55% (32)	Concrete....Precast / beam & block
39% (17)	In situ concrete slab on solid
2% (0)	Other, please specify.....(Rafts).....

3. DEGREE OF SATISFACTION WITH YOUR MOST-USED FIRST FLOOR SPECIFICATION

Solid timber joist users [% of starts (no. of users)]:

2% (1) Very satisfied
 37% (22) Generally satisfied
 43% (14) Not entirely satisfied
 18% (4) Dissatisfied, reviewing options

I- joist users [% of starts (no. of users)]:

70% (5) Very satisfied
 30% (7) Generally satisfied
 0% (0) Not entirely satisfied
 0% (0) Dissatisfied, reviewing options

4. INDICATIVE USAGE OF SUPPORT ARRANGEMENTS TO YOUR FIRST FLOORS

(Replies expressed as % starts)

- 62% Joists built into masonry
- 28% Joists laid in hangers fixed to masonry
- 10% Timber-frame
- 0% Other, please specify.....

5. DETAILS OF YOUR FIRST FLOOR CONSTRUCTION

(a) Indicative percentages of types of floor decking used ?

Solid timber users [% of starts (no. of users)]:

54% (16) Chipboard of ..22mm thickness. .
31% (17) Chipboard of ..18mm thickness.
0% (0) Plywood of ..18mm thickness.
6% (1) OSB of ..18mm thickness.
9% (7) T&G Softwood 22-28mm thickness

I-joist users [% of starts (no. of users)]:

92% (10) Chipboard of ..22mm thickness.
0% (0) Chipboard of ..18mm thickness
6% (1) Plywood of ..22mm thickness.
0% (0) OSB of ..22mm thickness.
2% (1) T&G Softwood 22mm thickness

(b) Joist details

Solid timber users [% of starts (no. of users)] :

22% (3) ...600mm centres between joists

28% (8) ...450mm centres between joists

50% (30) ...400mm centres between joists

I-joist users [% of starts (no. of users)] :

95% (12) ...600mm centres between joists

3% (0) ...450mm centres between joists

2% (0) ...400mm centres between joists

Indicative percentages of joist sizes used - Solid timber users only :

(Replies expressed as % starts)

60 % ...2" x 8" (47mm x 194mm)

31 % ...2" x 9" (47mm x 219mm)

2% ...38mm x 235mm CLS

7% Less than 8"

Details of blocking / strutting used :

Solid timber users [% of starts (no. of users)] :

0% (0) ... None

74% (32) ... Solid timber blocking

26% (9) ...Herring bone strutting

I-joist users [% of starts (no. of users)] :

13% (4)? . None

80% (7)? .. Solid timber blocking

7% (1)? ..Herring bone strutting

(c) Indicative percentages of types of ceiling construction used :

Solid timber users [% of starts] :

24% ...9.5mm plasterboard

60% ...12.5mm plasterboard

16% ...15mm plasterboard

I-joist users [% of starts] :

0% ...9.5mm plasterboard

41% ..12.5mm plasterboard

59% ..15mm plasterboard

6. WHAT DO YOU CONSIDER TO BE THE PRIMARY SHORTCOMINGS (IF ANY) OF SOLID TIMBER JOISTED FIRST FLOORS ?

- The items listed below are shortcomings which are sometimes attributed to solid timber floors.
- The list may not be exhaustive so please add to the list as you feel appropriate.
- Please indicate the severity and frequency which each of these problems cause you.

(Replies expressed by no. of users ticking each box)

No problem	Small problem (sometimes)	Small problem (often)	Big problem (sometimes)	Big problem (often)	
1	11	14	14	11	Joist shrinkage resulting in a 'squeaky' floor
6	20	15	8	2	Joist shrinkage causing cracking of finishes
7	14	21	7	2	Joist shrinkage resulting in gaps under skirting boards
3	16	14	9	9	Joist shrinkage resulting in 'popping' of ceiling plasterboard nails
1	5	3	2	-	Joist shrinkage manifesting itself as <i>cracking, unlevel floors (x5) warping (x3) , hogging (x2)</i>
22	23	3	3	-	An excessively 'bouncy' floor
32	11	5	2	1	Cost/time to erect floor
24	12	9	5	1	Cost/time to route services
28	18	3	2	-	Price volatility
5	16	7	15	8	Call-back costs to rectify faults

What would you estimate these average call-back costs to be ?

19 replies received
 Estimates ranged from £10 - £400 per unit
Average = £140 per unit
 (Median = £50)

Any further shortcomings ?

Replies included –

Timber quality, Availability in long lengths, High moisture content, Misuse on-site, Problems cutting service holes, Acoustic transmission, Showers/baths dropping, Draughts thro' gaps, Water damage.

**7. IF YOUR FIRM IS NOT USING ENGINEERED TIMBER FLOOR SYSTEMS –
WHAT ARE THE PRIMARY REASONS ?**

Please number your reasons in order of priority (ie. the most important reason to be numbered ‘1’, etc)

(Replies expressed by no. of users ticking each box)

No. users rating as Most important	No. users rating as 2 nd most important	
<input type="checkbox"/> 22	<input type="checkbox"/> 5 Cost
<input type="checkbox"/> 6	<input type="checkbox"/> 4 Unproven track-record
<input type="checkbox"/> 3	<input type="checkbox"/> 4 Lack of choice of suppliers
<input type="checkbox"/> 2	<input type="checkbox"/> 4 Lack of product data
<input type="checkbox"/> 1	<input type="checkbox"/> 2 Routing of services
<input type="checkbox"/> 1	<input type="checkbox"/> 0 Incompatibility with standard stair flights
<input type="checkbox"/> 0	<input type="checkbox"/> 7 Lack of flexibility in joist depths
<input type="checkbox"/> 0	<input type="checkbox"/> 3 Performance in fire

Other reasons, please specify :

Replies included –

Lack of experience, Contractors inexperience in charging higher installation costs for engineered floors, Fears over glues, Small spans don't justify engineered joists, Fixing is difficult to the flanges.

Note :

In addition to the above replies 3 builders also intimated that they were just about to change their joist specifications to I-joists – these builders represented over 10 000 starts per annum between them.

- Thank you for taking the time to complete this questionnaire.
- This will help us enormously to develop an improved wood-based floor system.
- Please return the questionnaire to TimberSolve Ltd using the stamped addressed envelope provided.