POTENTIAL OF PREFABRICATED PODS TO EXTEND HOUSES: INITIAL FEASIBILITY STUDY FOR SOCIAL HOUSING

Jim Kempton[1] and Stewart Fergusson

Touchstone Housing Association, Touchstone House, PO Box 160, Whitley Village, London Road, Coventry CV3 4HZ, UK

Current UK Government policies aim to provide affordable housing, expand housing provision in key geographical areas and achieve the Egan principles. This has raised the profile and potential utility of modular and prefabricated buildings and components. Social housing also faces its own particular problems; including government polices that reduce the rental income from certain properties, an ageing stock profile, low demand for properties in certain areas, and various National standards for housing including Decent Homes and Affordable Warmth. All these issues can have the effect of lowering income and increasing expenditure. The need for innovation to sustain financial viability is therefore paramount. With these factors in mind, an initial feasibility study was undertaken to establish whether prefabricated 'extension pods' could be utilised to increase the size of existing dwellings for Touchstone Housing Association based in the UK– typically Victorian terraced properties, to produce a cost saving over traditionally built extensions, and increase housing demand. This is of course different from erecting a complete dwelling, and raises particular issues. The results of the feasibility study show that their may be scope for the use of the prefabricated pods, but several problems need to be resolved. Particular problems include the transportation and handling of the pods, the interfaces between the pods and the existing dwellings, assurances over the whole life costs of the pods and customer (i.e. tenants of the dwellings) acceptance. We call on the construction industry to consider the potentially large market in social housing and work with the sector to overcome the barriers to the use of prefabricated extension pods.

Keywords: house extensions, prefabrication, social housing.

INTRODUCTION

The UK social housing sector faces difficult times. Government policies and other issues can result in reducing incomes and increasing expenditure. The main policy impacting on income is the 'Rent Restructuring Regime' (RRR) (CIH, 2002) whereby all social housing rents will be based on a formula incorporating average geographical population incomes and average geographical property prices. Touchstone Housing Association (THA), as with many other social housing providers, faces a net loss due to the RRR.

Increased expenditure arises from several sources, Table 1 below summarises these sources.

[1] jkempton@touchstone.org.uk

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Table 1: Summary of increased expenditure sources

Source	Brief Explanation
Decent Homes Standard (DTLR, 2002)	Social housing must meet four main criteria relating to physical condition standard and energy efficiency (i.e. controllable heating and insulation levels)
Affordable Warmth (DTI, 2003)	Social housing must meet standards to eliminate fuel poverty – defined as a household's ability to afford to pay for adequate fuel with less than 10% of its disposable income
Rising Contractor Costs	Rising costs of works due to competition for contractors within and outside sector – skills shortages in the trades are becoming acute
Age of Stock	High proportion of Victorian (built prior to c.1900) properties having substantial repair and maintenance requirements
Low Demand (Holmans and Simpson, 1999)	Certain geographic areas experiencing lack of demand for social housing due to social issues such as employment, crime, etc. resulting in lost income
Customer Demands and Expectations	In Touchstone Housing's experience, Customer demands and expectations have risen substantially over the last few years

The literature takes the view that there are two main ways in which organisations can compete, being competition on price and competition by innovation (or differentiation) (Johnson and Scholes, 2003). The social housing sector cannot, broadly speaking, compete on price due to the RRR i.e. they are not in a position to charge much higher rents for high demand properties to offset lower rents for low demand properties. Perhaps an example puts this issue into perspective as shown in Figures 1 and 2.

Figure 1: "Walsgrave"

Figure 2: "Hillfields"

The house on the left is in an area known as "Walsgrave" in the City of Coventry. It is a popular area, with good schools and other facilities. The picture on the right shows a

problematic area, in terms of social issues such as crime, known as "Hillfields" in Coventry (discussed further in this paper: see also Appendix 1). Whilst THA experiences high demand for houses located in Walsgrave and much lower demand for houses in Hillfields, THA are unable to charge any more/ less rent to reflect the different high/ low demand levels – as would be the case in a private company renting to the private rented market. Therefore, it would seem sensible to suggest that innovation is the only way to sustain the sector. The use of prefabricated pods to extend houses is suggested as an innovative method to increase Touchstone's housing capacity and save money.

PREFABRICATION – A GOVERNMENT AGENDA

Sir John Egan's 'Rethinking Construction' (Egan, 1998) report stated that the use of prefabricated building systems could contribute to 30% savings in the construction industry. Particular reference was made to the potential for the social housing sector to use prefabrication with the comment *"…prefabricated units which can be incorporated into a number of buildings including…housing association developments"* (p.10).The Housing Green Paper (DETR, 2000, p.76) also gave reference to the Deputy Prime Minister's desire to encourage the use of prefabricated methods with the statement *"We also want to promote greater use of new housing construction techniques, such as prefabrication…"* This statement has been further reinforced by comments made by the Deputy Prime Minister at press conferences. The Government's desire to expand housing provision and provide affordable housing (DETR, 2000) also advocates the use of prefabricated methods.

WHY EXTEND SOCIAL HOUSES?

As previously mentioned, a particularly problematic geographic area is known as 'Hillfields' (see Appendix 1). THA has an excess of 2 bedroom dwellings in its stock portfolio and an under supply of 3 bedroom properties. This has an impact on the overall demand for properties, 3 bed properties tend to be in higher demand than 2 bed properties. The distribution of Touchstone's housing stock Hillfields area by number of bedrooms is shown in Figure 3.

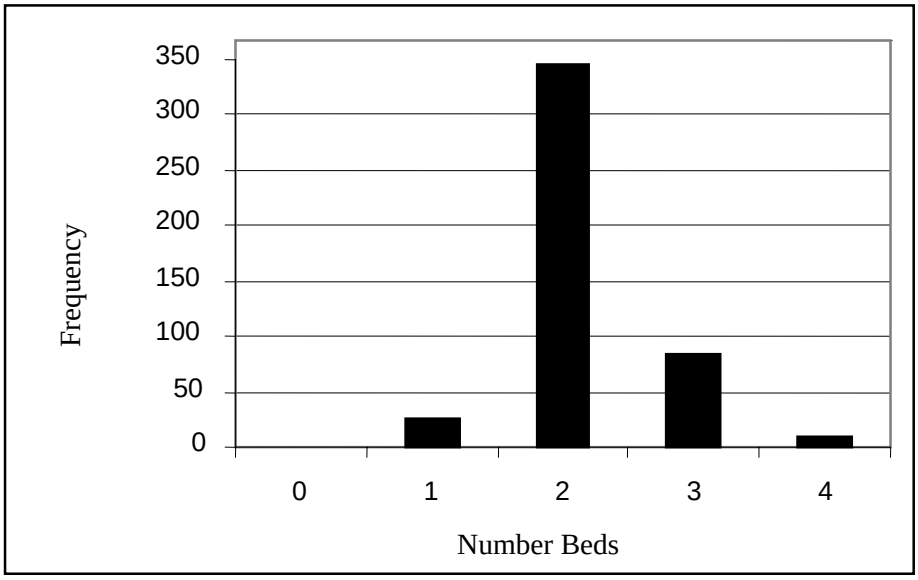

Figure 3: Distribution of housing stock by bedrooms

In terms of housing build year the stock is dominated by Victorian terraced properties, as shown in Figure 4. The vertical axis shows the number of properties in each stock type (shown on the horizontal axis). For clarity, only the Victorian terraces are highlighted. The other types are, for example, new build houses, flats etc.

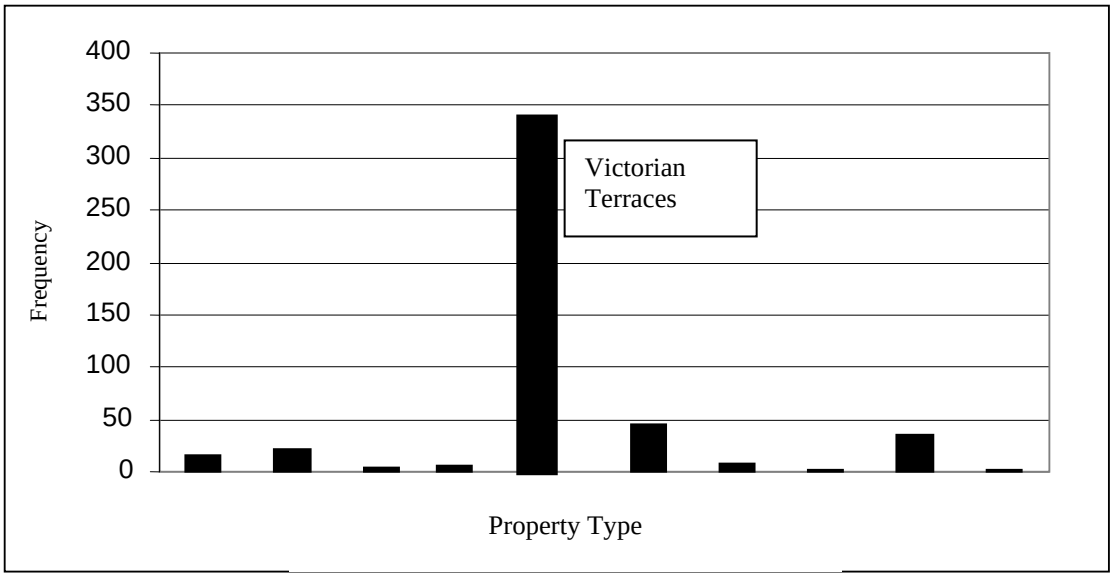

Figure 4: Distribution of housing stock by build year

So, in summary, the Hillfields area is characterised by two bedroom Victorian terraced dwellings, that may be suitable for extension by using prefabricated pods.

THE CASE FOR PREFABRICATED PODS

Estimates of cost for pods are around £8,000 per unit (excluding transport/ lifting and groundwork costs). An average cost for a traditionally (i.e. brick and block) built extension is estimated at £28,000. Other social housing providers have already employed the use of modular building units to achieve cost and time savings in the construction of whole (as opposed to extensions) dwellings. Further savings could be realised if the pods can be pre-fitted with e.g. a bathroom or kitchen.

Regulations governing the rental of properties (and common sense) mean that a 2 bedroomed property could only be let to a single (married) adult (s) with 1 child or 2 children of the same sex (i.e. to share one bedroom). The use of two-storey extensions would give the opportunity of having a bathroom and kitchen on the ground floor and three bedrooms upstairs. A third bedroom will increase the potential to let a property. A recent report (Lee *et al*., 2003) suggests that demographic modelling of the Coventry area showed a need for an increase in the supply of housing for 'middle-age' tenants, with the implication that children would also need to be housed. A 3 bed property will also improve Touchstone's rental income. The actual increase per 3 bed property over a 2 bed is relatively small equating to around £4 per week. However, from Figure 3 above, it can be seen that THA own around 340 two bed properties. If 200 of these were converted to 3 beds the extra income generated per year would be £41,600 (i.e. 200 x 4 x 52). Assuming an inclusive cost of, say, £9,500 per pod, the payback period would be around 45 years (i.e. (200 x 9,500)/ 41,600). This may seem an unrealistic proposition. However, two other important cost issues arise. The first is the issue of 'low demand' described earlier in Table 1. THA experience problems with renting 2 bed homes. To quantify the cost of the low demand problem in the Hillfields

area, the average void period (the length of time between a tenant leaving a property and a new tenant taking up residence) for 2 bed properties is 12 weeks. The average number of voids in Hillfields is 85 properties per year. Given an average rent of £60 per week, the average rent loss on 2 bed properties is £61,200 per year. The second issue is that there are significant costs associated with remedial repairs to houses that become void, and, in addition, management costs associated with administering the void property. Taking a figure of £1000 per void property, this equates to £85,000 per year. The 3 bed properties are in higher demand, and should therefore reduce the number of voids – and hence reduce the amount of rent and repair/management losses. The Total Potential Gain (TPG) per year is then:

TPG $_{\textbf{per year}}$ = Σ (Extra Rent Income + Savings in Rent Loss + Savings in Repair and Management Cost) *Therefore*:

TPG $_{\textbf{per year}}$= Σ (41,600 + 61,200 + 85,000) *Therefore*:

TPG $_{\textbf{per year}}$ = £187,800

The payback time for 200 pods using the TPG is 10 years (i.e. (200 x 9,500)/ 187,800) – a more realistic proposition. Of course, this figure is obviously the very best outcome, and assumes that converting 2 beds into 3 beds will stop voids occurring. In reality voids will still occur, even with 3 bed properties. A simple model of the payback period in relation to the number of voids was undertaken and is shown in Table 2 below.

Table 2: Model of Payback Period

No. of Voids	Average Void Period (12 weeks)	Rent Loss @£64	Increased Management Cost @£1000	Pod Cost (200 x 9,500)	Total Potential Gain (TPG)	TPG -(Rent Loss + Management Cost)	Payback Period (Years)
0	12	0	0	1900000	187800	187800	10
10	12	7680	10000	1900000	187800	170120	11
20	12	15360	20000	1900000	187800	152440	12
30	12	23040	30000	1900000	187800	134760	14
50	12	38400	50000	1900000	187800	99400	19
60	12	46080	60000	1900000	187800	81720	23
63	12	48384	63000	1900000	187800	76416	25
70	12	53760	70000	1900000	187800	64040	30
100	12	76800	100000	1900000	187800	11000	173
105	12	80640	105000	1900000	187800	2160	880
106	12	81408	106000	1900000	187800	392	4847
107	12	82176	107000	1900000	187800	-1376	-1381
108	12	82944	108000	1900000	187800	-3144	-604
109	12	83712	109000	1900000	187800	-4912	-387
110	12	84480	110000	1900000	187800	-6680	-284

The data on prefabricated pods has suggested a life of 25 years (see later in paper). From Table 2 it can be seen that the maximum number of voids allowed to ensure a payback from investment in the pods over their life is 63 voids per year. THA needs to be confident that the extended houses will increase demand sufficiently to keep the numbers of voids to 63 or less per year.

It is also important to remember, however, that THA is in the 'business' of supplying social housing – that is housing for people in *need*. It is not just a case of economics; it is a case of providing what is *needed*.

Prefabricated extensions are not only limited to dwellings where no extension already exists. Many dwellings in the Hillfields area have already had extensions added. In many cases, however, these extensions and associated fit-outs (i.e. Kitchens and/ or Bathrooms) were carried out in the 1970's and early 1980's. The work carried out was often not of a satisfactory standard, in terms of both the structure of the extension and the internal components. Prefabricated pods could also be used to replace these. A simplistic sketch of how a two storey pod might be added to an existing dwelling is shown in Figure 5 below.

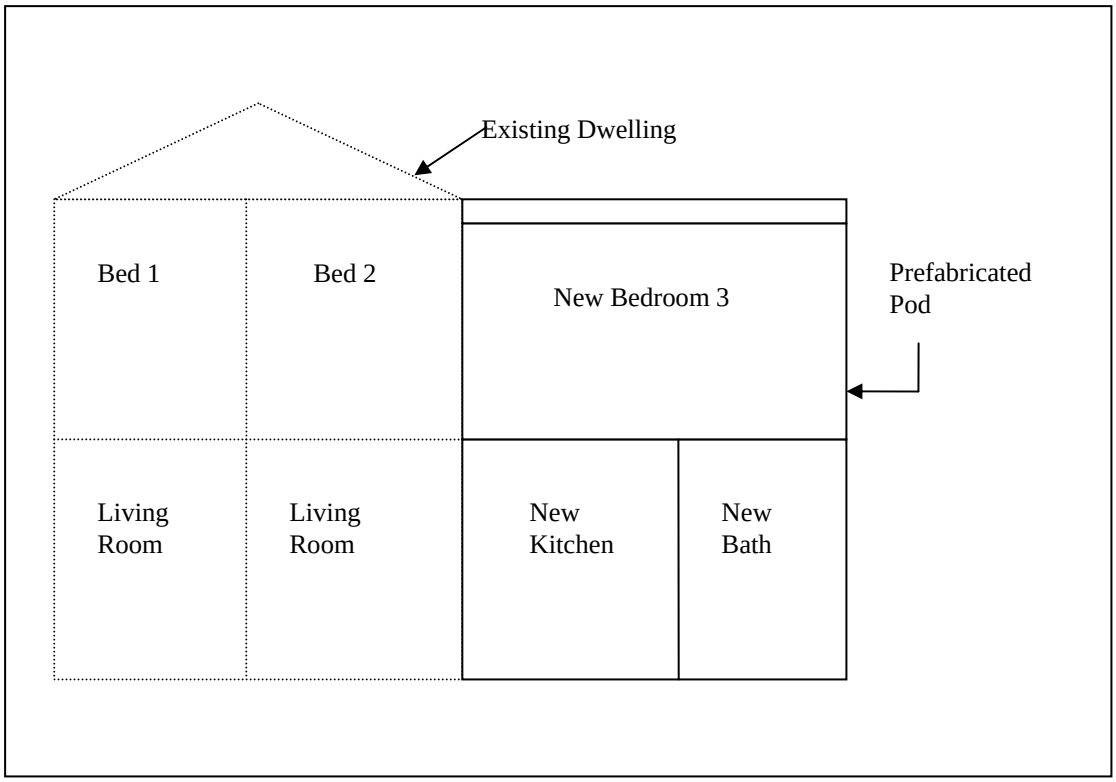

Figure 5: Side Elevation Sketch of Existing Dwelling and Pod (Not to Scale)

Figures 6 and 7 below show examples of pods in the process of being fitted out, while Figure 8 shows the structural frame of a one storey pod.

Figures 6 and 7: Pods being Fitted-out

Figure 8: Structural Frame (single storey pod)

POTENTIAL PROBLEMS WITH PODS

Whilst there are many potentially positive outcomes, several potential problems were also identified and are discussed below.

The type of stock

As described earlier, the housing stock in the Hillfields area is characterised by Victorian terraces. This raises several issues, particularly the interface between the existing building and a prefabricated pod. Achieving an acceptable level of finish both aesthetically and practically may be difficult.

Delivery access

The streetscape in the Hillfields area is characterised by narrow roads. In addition, given the social problems in the area described earlier, measures have been taken to implement traffic calming measures to stop ‘joyriding’ (i.e. racing cars around the streets). One such measure is the use of ‘pinchpoints’ - barriers that reduce the width of the road to only allow one car to get through. These pinchpoints typically also employ speed humps to reduce the speed of cars. A pinchpoint may be seen in Figure 9.

Figure 9: Photo of Pinch Point

This has implications for the delivery of prefabricated pods – particularly if only one or two are to be used in the street. Temporary removal of the traffic calming measures is possible, but the expense of such an exercise would need to be offset against a number of pods – i.e. to achieve economies of scale.

Another problem is craning pods into position. Apart from the access issues described above, the crane would also need a reasonable working area. This would be required in terms of practicality and for health and safety reasons.

Acceptance by customers

It has been noted that prefabrication has something of a 'bad' reputation. Writing in the Guardian Newspaper, Hodgkinson (2001) notes that "*In Britain, prefabricated housing still conjures images of draughty rooms and leaky loos* [Toilets]" In the UK, prefabrication in housing has been associated with poorly built dwellings offering little in terms of comfort or aesthetic appeal. Whilst the pods can be made to appear more traditional – by cladding with brick slips or rendering, the potentially negative preconceptions of customers may be an issue to overcome.

Sustainability

The idea of extending traditional Victorian dwellings by using prefabricated pods is a new idea. There are no real tests of time to gauge the sustainability of such a method. However data is available regarding the pods themselves and that data does point to the pods having a life of 25+ years. Of course that life is based on regular and thorough maintenance regimes being applied. If extra maintenance is required over and above the maintenance cost of traditionally built extensions, this will obviously have a negative impact on the viability of using the pods.

Economies of scale

Due to the nature of social housing providers and funding regimes, it has often been the case that housing improvements have been made on something of a piecemeal basis. For the pods to be economically viable a programme of pod delivery needs to be established, so that delivery lorries and cranes may be fully utilised. Appendix 1 shows a map of the Hillfields area with the location of the 2 bed properties.

CONCLUSIONS

The use of prefabricated pods does show potential for use in extending existing dwellings. However, at this stage it seems that those dwellings suitable for such extensions need to be carefully selected. The main identified barriers to the use of prefabricated pods are shown in Table 3 below.

Table 3: Barriers to prefabrication

Barrier	Explanation
Interfaces with Existing Buildings	Difficult to achieve watertight and robust union.
Access/ Delivery Issues	Narrow streets and traffic calming measures impacting on lorry and crane access
Customer Acceptance	Possible negative view of prefabrication by customers. Difficulty achieving a robust and pleasing finish
Sustainability	No 'real' tests of time for prefabricated house extensions
Economies of Scale	Housing Associations have a tendency to upgrade dwellings on a piecemeal basis

The social housing sector could represent a large market for manufacturers of prefabricated housing extension pods. We conclude by inviting any interested parties who have ideas for overcoming the barriers described in Table 3 to contact us and offer their advice.

FUTURE RESEARCH DIRECTIONS

Touchstone Housing have commissioned an Architect/ Structural Engineer to produce drawings and materials schedules for constructing an extension using traditional methods, these drawings will then be given to potential suppliers of prefabricated units as a guide for designing and pricing pod extensions. THA are also in the process of applying for various grants to fund an actual implementation of prefabricated pods.

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USEFUL WESITES

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http://www.tek.kingspan.com/uk/index.html (Last Visited: 23/07/2004)

APPENDIX 1: Hillfields area of Coventry (Two bed houses denoted by black triangles)