

A COMPARATIVE STUDY OF DEFECTS IN HOUSES CONSTRUCTED BY REGISTERED BUILDERS AND OWNER BUILDERS

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SUMMARY

The lack of attention to quality by house builders in the Victorian Housing Industry has been a contentious issue for more than two decades. In an attempt to improve the quality of housing, various mechanisms have been adopted and discarded by industry-based organisations and government legislation. While builders are encouraged to improve construction quality, little is known and published about the quality of housing produced by owner builders. This paper presents preliminary findings from a research project that compares the quality and defects of houses built by owner builders with those of registered builders. The findings suggest that there is no significant difference between the quality of housing procured by owner builders and registered builders. The functional elements within a house where defects are likely to occur are identified and discussed. The paper suggests that the use of a registered builder's management expertise does not necessarily guarantee a better quality product.

INTRODUCTION

Traditionally, in Victoria most housing has been procured from a project house builder, in advance of orders by users, by a public authority for renting or sale to users or by owners themselves. In recent times there has been a rapid decrease in the number of houses constructed by owner builders. Registered builders have dominated the housing market. This may be due to the fact that registered builders are able to respond to legislation, adopt a degree of risk, in terms of time, quality etc and offer financial packages to first time home buyers. However, the number of owner builders still represents a significant proportion of the total houses built. As the population of Victoria changes, through migration and from social factors, the demand for housing has continued to increase. Registered builders have reacted to this increase in demand by building in volume and in many instances have been criticised for producing houses of poor quality as measured in terms of the number and severity of defects encountered. This may be due to the ease with which individuals or organisations could commence operation as builders. The ease of entry allowed an influx of inexperienced operators. Due to this and increased competition, poorer quality products have become apparent. Easy entry has been exacerbated by the minimal capital outlay required to form a building company and ease of credit offered from material suppliers (Construction Skills Training (Victoria) 1993).

Using data derived from inspection reports obtained from the Archicentre (a subsidiary company of the

Royal Australian Institute of Architects) this paper suggests that there is no significant difference in quality between houses constructed by registered builders and owner builders. The data is used to identify the primary areas where defects are most likely to occur. This will assist owner and registered builders to concentrate their efforts on certain key areas so that they can improve quality and minimise their costs through rectification of defects.

THE VICTORIAN HOUSING INDUSTRY

The Victorian Government has recognised the importance of the house building industry (1992) by highlighting the following:

- the residential building industry contributes 5% (\$4.6 billion in 1989/90) to Victoria's gross domestic product,
- for every \$100 spent on housing an additional \$100 is generated through production,
- for every job created in the industry another 0.9 of a job is created elsewhere and
- that most of the material inputs in the residential sector are produced in Australia.

The importance of the housing industry to Victoria's economy can easily be underestimated. Thus, for the sake of the economy generally, it is important that the industry procures its products efficiently and effectively.

An important impediment to a more effective and efficient housing industry may be its fragmented nature. Research by Filby (1974) and the Victorian Government (1992) indicated that the majority of houses are constructed by small builders. Ninety per cent (90%) of all house builders only obtained between one and five building permits and employed less than four people as staff.

The nature of housing

The workforce employed also reflects the heterogeneous nature of the housing industry. House construction, whether by registered builders or owner builders, relies heavily on specialist subcontractors. It is an industry that has adopted principles based on industrial manufacturing and standardization as work processes and procedures have become simplified. Thus, the authors argue that the process of constructing a house remains similar irrespective of the type of builder, and the

type of house being constructed. Furthermore, as tasks have become specialised the quality of the final product, the house, has largely remained constant.

Previously, there was uncertainty as to the accepted definition of an owner builder. For the purpose of this discussion an owner builder is deemed to be someone who has applied for, been granted a building permit and has registered their house with an approved fund (Housing Guarantee Fund Ltd) as required by the Victorian House Contracts Guarantee Act 1987. The main function of the Act was to provide protection for house purchasers against default by builders. Table 1 identifies the total number of houses registered with the Housing Guarantee Fund Ltd (HGF) between 1988 and 1996 in Victoria. The table also shows the number of houses registered by owner builders compared with the largest 20 registered house builders.

Financial Year	Total Number of Houses Registered By the Housing Guarantee Fund Number	Houses Registered By Owner Builders		Houses By Largest 20 Builders	
		Number	%	Number	%
1988/89	44,755	10,716	23.94	8055	18.05
1989/90	31,696	8,456	26.68	5563	17.55
1990/91	25,685	6,281	24.45	4747	18.48
1991/92	28,890	6,251	21.64	5244	18.15
1992/93	30,585	5,857	19.15	5857	19.15
1993/94	32,849	5,315	16.18	6077	18.50
1994/95	29,575	4,550	15.38	6417	21.70
1995/96	33,671*	3,803*	11.29	6441	19.13

Table 1. A comparison of houses constructed by owner builders and the largest 20 house registered builders in Victoria (*derived* from the HGF Annual Reports and Housing Industry Association quarterly activity reports). All registrations with the HGF ended in April 96.

*Actual figures to that date were 3,169 owner built registrations and 24,890 registrations by recognised builders. Therefore the tabulated 12 months figures have been calculated on a *pro rata* basis

PROCUREMENT OF HOUSES

There are various ways a person can procure a house and these include:

- purchase existing house,
- commission an architect who can design, document and arrange for tenders from builders and then administer the contract,
- purchase a new house from a "speculative" house builder from one of their standard range (eg., display home designs),

- owner employs drafting service to document their own design or a "Plan Book" design, then contract with a builder, or
- become an owner Builder.

The perceived level of expected quality would vary with the different procurement approaches identified. The way in which a house is procured will significantly influence its cost, its construction time and its quality. A house purchaser may go to a house builder instead of an architect because they can physically see the product before they decide to purchase. Moreover, houses purchased through a builder are generally cheaper than those designed by an architect but unfortunately, quality

expectations are not lowered to reflect the lower price. Failure to meet display home standards or architect's specification requirements may also influence a customer's satisfaction level.

If the desired quality level of a product is not achieved, then there could be a perception that a defect has emerged. In fact, the perception of quality and what constitutes defective work may vary between the owner and the builder. What might be an acceptable quality level or standard in a speculative house may be considered defective in a project where an architect is involved. Accordingly Porteous (1992) states that the tolerance of defects and perception of quality by individual users are unique and these may not be matched by the individual builder. A contributing factor to the variability in perceptions is a differing knowledge of costs. A builder is familiar with costs and is aware of the levels of quality purchasable. Anecdotal evidence indicates that home owners may assume that the level of quality is uniform amongst all builders due to the requirement for local authority inspections during construction. Unfortunately, the reality is that the quality and associated service is generally reflected by the procurement process and the contract price. For example, architect designed homes are quite different in finish to project housing.

There are some elements and sub-elements of a building that do vary in quality, but not necessarily in operation. For example, strip footings for a house should be structurally sound regardless of the way the house has been procured. Similarly, doors should operate satisfactorily. There can be, however, a great deal of difference in quality in the manufacture of the actual door, which may affect its life span. For example, some doors may warp and bow more easily than others due to the changing atmospheric conditions and as a result there is little a builder can do with some of these products if owners do not provide continuing maintenance. Another example may be the choice of timber used for windows. The cost of a Meranti timber framed window is considerably less than that of Western Red Cedar. The fundamental difference in cost pertains to their durability and maintenance requirements. Home purchasers may not be aware of the long-term ramifications of their decisions pertaining to maintenance when price alone is the criteria. Hence, a perception of defect may be created in the mind of the consumer and the same problem be viewed as a maintenance item by the builder. Ideally, the builder should counsel a prospective purchaser and guide them in making the correct decision so as to minimise future maintenance costs by purchasing a product that matches their short and longer term objectives.

CONSUMER PROTECTION

There have been numerous statutory attempts to instil quality control in the housing industry (eg see Hansard, Government of Victoria). The Master Builders Association of Victoria has consistently promoted the registration of builders for many years (Keast, 1994). The legislation for consumer protection emerged in 1964 with the introduction of the Consumer Protection Act. However, it was not until 1973 that the House Builders Liability Act was introduced, which required house builders to be registered with an approved fund. The original funds were administered by the two representative building organisations (HIA and MBA), but unfortunately consumers perceived that there was a bias toward builders.

In 1984 the two separate funds were merged to form the independent HGF. Needless to say, however, allegations of bias towards builders continued primarily because of a lack of knowledge by consumers about their responsibilities in relation to procedural matters. Another problem was the practice by some builders of encouraging owners to obtain building permits and registering themselves as owner builders under the pretext that construction costs would be cheaper. This resulted in consumers not being covered against defective work. In 1987 the House Contracts Guarantee Act was introduced in an attempt to give consumers greater protection. Procedures for reporting defects and making claims were simplified but were still perceived to be insufficient, and as a result HGF ceased the registration of houses in April 1996. It was during this period that separate registration figures were recorded for approved builders and owner builders and thus provided the time frame and the basis for the research presented in this paper.

FRAMEWORK FOR DEFECTS

There are various definitions of a defect (Porteous, 1985 & 1992). Perhaps the simplest and most comprehensive definition is that defined by the Oxford English Dictionary, which defines a defect as 'a shortcoming or falling short in the performance of a building element'. This definition has been legally validated as can be seen in the case of *Schuller AG v Wickman Machine Tools Sales Ltd* (Dorter and Sharkey, 1990). The CIB W86 (1993) also supports the above by defining a defect as 'a situation where one or more elements do not perform its/their intended function(s)'. These definitions fail to acknowledge the following aspects of a defect:

- *Technical* - when the workmanship or material of an element reduces its capacity to fulfil the functional performance of a structure and
- *Aesthetic* - when the appearance of a material or building element is adversely affected.

An important consideration associated with a defect is its severity. A serious defect in the technical category can affect the health and safety of occupants as well as have significant economic ramifications. A serious defect in the aesthetic category is likely to have economic ramifications only and possibly less serious psychological consequences rather than affect health and safety.

The terms major and minor have been used to describe the severity of a defect. However, the fundamental problem associated with using such terms is that there has been no accepted definition. Porteous (1985) confirmed this difficulty and suggested that a lack of uniformity of judgement has hindered the categorisation process. Archicentre, a subsidiary company of the Royal Australian Institute of Architects has used the following classification to establish the difference between a major and minor defect. A major defect is related to the age of the house and is categorised as:

- affecting safety or if not fixed may lead to major damage; and
- costing more than \$A800.00 (1994) to repair.

If the defect does not match any of these criteria then it is considered to be a minor defect.

ORIGIN OF DEFECTS

The origin of defects has been the subject of extensive research and publication (eg Porteous, 1992). Figure 1 illustrates the origins of defects in the building process. Essentially the building process requires inputs in the form of plant, labour, equipment and capital. The organisation of these resources is dependent on good effective management. It is suggested by Kaplan (1992) that building defects result from procedural inadequacies and as a result are caused by human error. Defects can also be caused by deliberate omissions resulting from poor estimating. It is suggested that the introduction of a quality assurance system may reduce the amount of defects that occur in housing construction. Moreover, the use of on-going management training and skills development may also reduce defects and improve the quality of the final product. This is a pro-active measure rather than the reactive situation existing with the Housing Guarantee Fund.

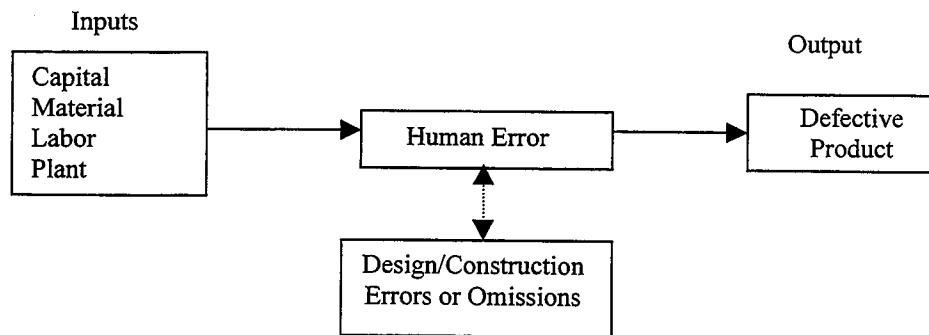


Figure 1. The causes of defects in the building process

METHODOLOGY

The objectives of the research presented in this paper are to:

- determine the incidence of major defects,
- identify the specific locations in houses where defects are most likely to occur and
- compare the number of defects in houses built by owner builders and registered builders.

Industry professionals perform house inspection reports commissioned for selling or buying

purposes. These reports are quite descriptive and generally accurate in the appraisal of the house. Inspection reports fall into two categories:

- *Pre Purchase* - Potential purchasers of a particular house commission these Home Inspection Reports. The general requirement is that they want to know the condition of the house and identify what repairs and rectifications are required.
- *Owner-Builder Reports* - These House Contract Guarantee Reports are commissioned

by owner builders who wish to sell the house and must provide an inspection report as a condition of the sale to comply with the House Contracts Guarantee Act 1987 and register with the Housing Guarantee Fund Ltd.

These inspection reports identify defects in the houses being inspected. Important considerations when selecting the data source were minimising subjectiveness of inspectors, the format used in the presentation of the reports and the professional standing of the organisation responsible for the reports. When evaluating the various inspection services as a source of data, an important criterion was whether the inspecting organisation had a structured induction course for their future inspectors thus theoretically reducing subjectiveness. The Archicentre reports were adjudged to best satisfy these criteria and thereby have the most suitable data for this study.

Data Collection

Criteria for selection of reports were based on the age of the house and date of report. Registration of owner built houses was not required before 1988 and only houses built from 1988 were considered. House Contract Guarantee Reports included a separate sheet providing details of permit issue, relevant inspections and date of issuing of Certificate of Occupancy. Home Inspection Reports stated the estimated age of the house. If an inspection report was dated 1994 then the house could not be older than 6 years. This method was also applied to houses inspected in 1995, 1996 and 1997. There were 1002 houses by owner builders and 770 houses by registered builders within the three year period. Owner built houses were coded with a HO prefix and numbered consecutively from HO 0001 to HO 1002. Houses by registered builders were given a HR prefix and numbered consecutively from HR 001 to HR 770.

A general deficiency with inspection reports regardless of who performed the inspections is that of objectivity. It would be unrealistic to expect an inspector not to show any bias in favour of the person commissioning the report. The deficiency with the data is that the inspections are commissioned by people at opposite ends of the procurement process. The pre-purchase reports are commissioned by the purchaser and the owner built report by the seller. With this in mind, one would want a comprehensive report listing all existing problems whereas the other person, that is the seller, would like these items minimised. Obviously whichever course of action is taken the price of a house may increase or decrease. Another impediment to objectivity with the owner built reports may be that if a mistake is made and an item

missed the house will be covered by the insurance mandate of the HGF. It was not possible to ascertain the extent to which this may have affected the data, if at all.

While it is considered these deficiencies may exist in the Archicentre reports they would also exist in the data of other inspection services. The decision to use Archicentre data was made on the following grounds:

- the structured procedures carried out by inspectors registered with a professional body ensure that the data presented a reasonable and professional standard of recording,
- the reports contained all data needed to conduct the research and
- data was easily accessible which ensured that a sufficient and representative sample could be collected.

CLASSIFICATION OF DATA

The important aspect of defects to be considered for this study was their nature and location. An initial list of 14 categories of defects was compiled using a categorisation process similar to Robinson (1987).

A list of elements and sub-elements was compiled based on readings from the Archicentre and Robinson together with AS4349.1-1995, N.P.W.C. publications and the experience of the authors in being responsible for the construction of in excess of 1000 houses. The initial lists of defects and elements were refined by conducting a series of pilot studies of 8, 20 and finally 100 houses from each of the two data samples. Comments were also sought from industry practitioners with extensive experience in housing, inspection services, arbitration, litigation, structural and geo-technical engineering. This was particularly necessary to confirm the appropriateness of the definitions for the incomplete and workmanship defect categories. The final category of defects numbered 11 plus an entry for *no defects*. The total number of building elements found was 35, which were grouped into 8 categories. Refer to Table 3 for this refined grouping.

FINDINGS

The 1002 owner built houses had a total 2740 defects of which 50 (4.99%) were classified major defects. The 770 houses by registered builders had 1766 defects of which 38 (4.94%) were major 9 (see Table 3). Houses without any defects numbered 227 (22.65%) for owner builders and 223 (28.96%) for registered builders. Of the owner built sample, 306 (30.5%) of houses were villa units

whereas of the sample by registered builders 161 (20.9%) were villa units. This indicates a high proportion of the owner built houses were constructed for investment purposes (rather than owner occupation) because villa units/flats are the classic investment for small property investors. Defects per house ranged from 0 to 21 (average 2.73 per house) for owner builders and 0 to 16 (average 2.29 per house) for houses by registered builders (Table 2 and Figure 2).

In Figure 3 it can be seen that the distribution of defects in the various categories are similar, with carpentry and plumbing representing 48.1% of defects for owner builders and 48.8% for houses by registered builders. Defects in the other categories displayed a similar even distribution. Although, the workmanship and incomplete categories are clearly the major sources of defects (see Figure 4). Owner built houses had many incomplete items despite the fact that a Certificate of Occupancy had been issued.

Number of Defects	Number of HO, houses	HO % Houses	Number of HR houses	HR % Houses
0-2	587	58.58%	487	63.25%
3-5	270	26.95%	199	25.84%
6-8	100	9.98%	66	8.57%
9-11	32	3.19%	16	2.08%
12-14	9	0.90%	1	0.13%
>15	4	0.40%	1	0.13%
Total	1002	100	770	100

Table 2. Incidence of defects in houses

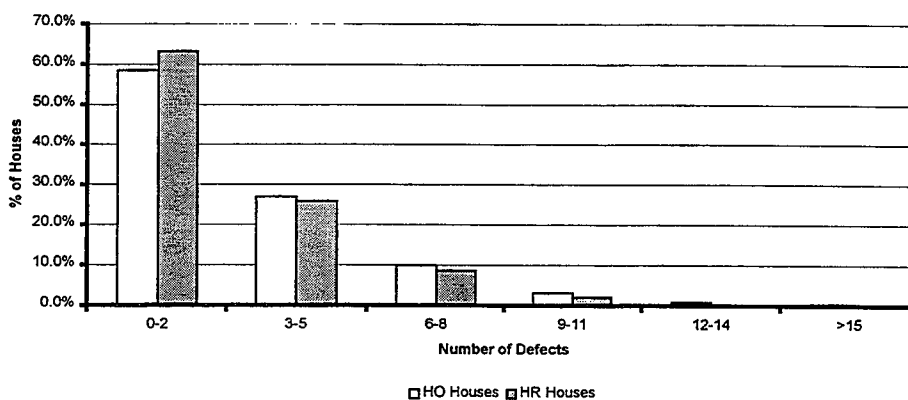


Figure 2. Percentage of defects in owner builders (HO) and registered builders (HR)

Categories	HO Defects	HO %	HR Defects	HR %
External Works	82	3.0	107	6.1
Carpentry	655	23.9	402	22.9
Brickwork	378	13.8	258	14.7
Plumbing	664	24.2	455	25.9
Electrical	92	3.3	42	2.4
Plasterer	396	11.0	178	10.3
Finishes	303	11.0	174	10.0
Miscellaneous	170	6.2	150	8.5
Total	2740	100	1766	100

Table 3. A comparison of defects in houses constructed by owner builders and registered builders

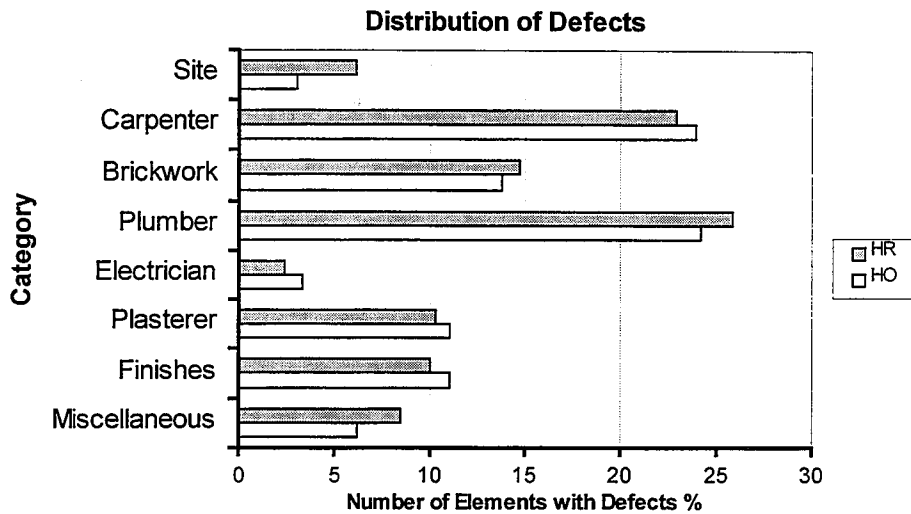


Figure 3. Number of defects found in each element for owner builders (HO) and registered builders (HR)

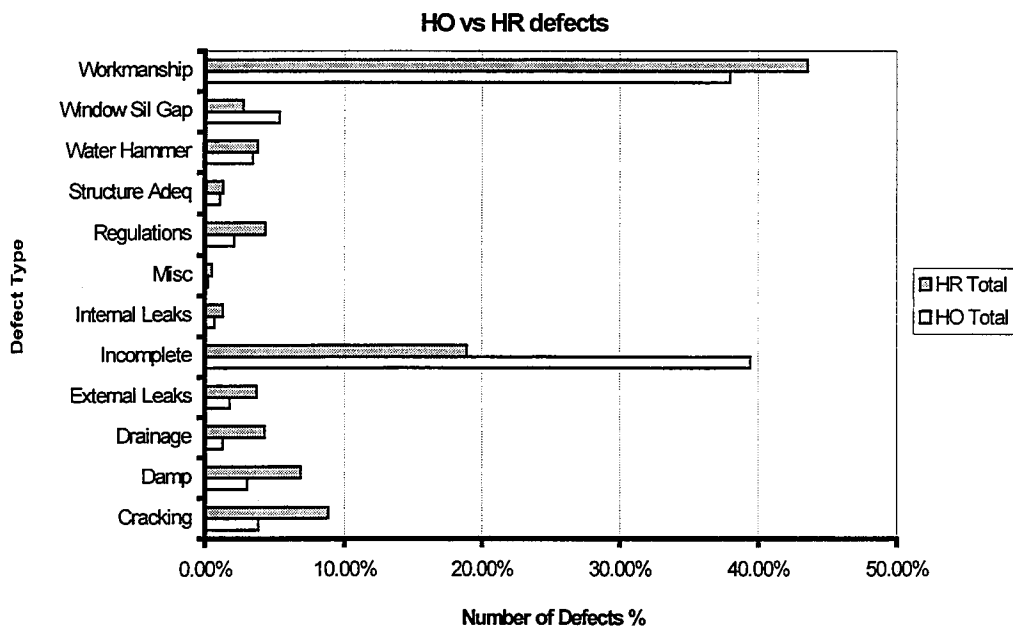


Figure 4. The number and type of defects for owner builders (HO) and registered builders (HR).

DISCUSSION AND CONCLUSIONS

House construction relies heavily on specialist subcontractors. It is an industry that has adopted principles based on industrial manufacturing and standardisation and successfully applied them to a craft-based industry. Work procedures have been simplified over the years and a high degree of specialisation has evolved but the house building process remains one of organising a series of sequential, interrelated and standardised activities.

The results show a comparable number of defects between owner built houses and those built by registered builders, which suggests there is a high degree of self-management by sub contractors regardless of who is the builder. The fact that workmanship and incomplete categories are so high confirms the need to improve the quality of management in the critical final stages in the completion of sub contract work (ie. before the sub contractor leaves site). It is notable that electrical defects were significantly lower than the other categories.

This may be attributed to the strict licensing requirements. Plumbers are also required to be licensed but not for all areas of work they perform. This may explain why that category is comparable to the other non-licensed categories.

Another very interesting finding resulting from this research is the extent to which roof/ceiling insulation was omitted or incorrectly installed. In owner built houses the incidence of this defect was 21.8% and in houses by registered builders 28.2%. This proportion is high for the omission of an item, which has been required by building regulations since 1990. Unless we check and enforce regulations, what price future energy efficiency and sustainability?

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