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SURVEY OF MATERIALS USED IN HOUSE CONSTRUCTION

prepared for:

Forest Products Association

and

Western Australian Softwood Producers Association

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SURVEY OF MATERIALS USED IN HOUSE CONSTRUCTION

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This survey was commissioned by the Forest Products Association (WA) and the Western Australian Softwood Producers Association. The survey repeats a similar survey undertaken in 1983.

We gratefully acknowledge the contribution of the WA Department of Conservation and Land Management through provision of data from the 1983 survey, printing and distribution of survey forms, and printing of the final report.

We also acknowledge the assistance of the Local Government Authorities which participated in the collection of data. Those authorities participating are indicated in Appendix B.

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1.0 INTRODUCTION

In 1983 a survey was conducted to obtain information about the types of materials used in house construction. The need for the survey arose from a lack of detailed information concerning building material usage, most importantly timber usage. This importance stems from the long lead time associated with the timber industry. The survey was designed to provide a data base to which future surveys would be compared. A second survey has now been conducted.

The aim of the second survey analysis was to establish trends in the usage of different building materials. This report discusses the results of the second survey, conducted October-November 1987, which examined data directly comparable to the first survey of September-November 1983. The results of the second survey are shown graphically in Section 2 of this report and in tabular form in Section 4. Section 4 also contains discussion of the comparisons between the surveys.

As with the first survey, the analysis does quantify rather than qualify the use of specific building materials, that is, influencing factors of the use of specific materials have not been identified. This may be the focus of further research.

OVERVIEW

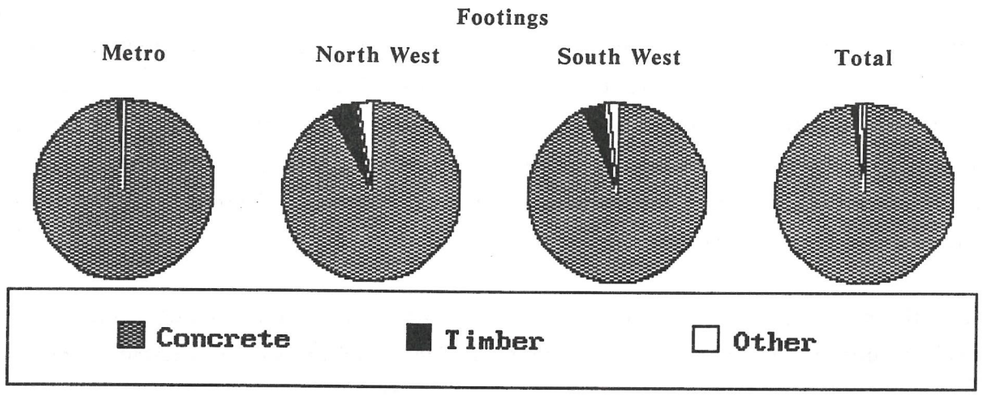
The significant trends identified from the results of the surveys are as follows:

- an increase in the use of fibre cement as an outer wall cladding;
- a shift towards plasterboard inner wall cladding in the North West;
- a decrease in pitched roofs in the North West;
- a slight decrease in the incidence of tile roofs in North West;
- an increase in the use of pine in ceiling joists;
- a slight increase in the use of plasterboard as a ceiling cladding;
- an increase in the incidence of timber outer door frames;
- a decrease in the use of metal inner door frames in the South West in favour of timber frames.

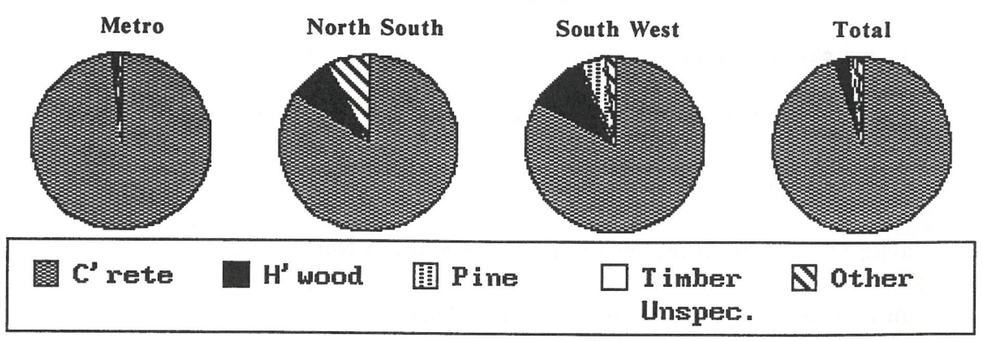
2.0 GRAPHICAL SUMMARY OF RESULTS

The average house, calculated from the 1987 survey is 201.8m^2. From a comparison with the previous survey in appears that the average house size is getting larger, the average in 1983 was 180.2m^2.

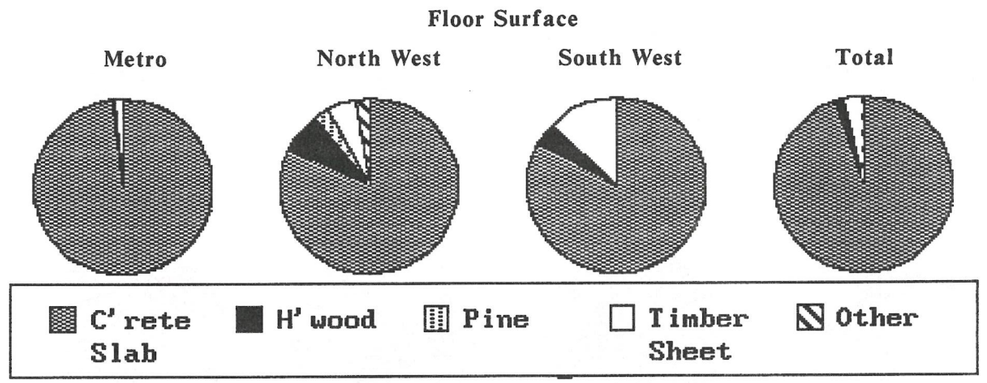
The following pie charts illustrate the results of the 1987 survey.



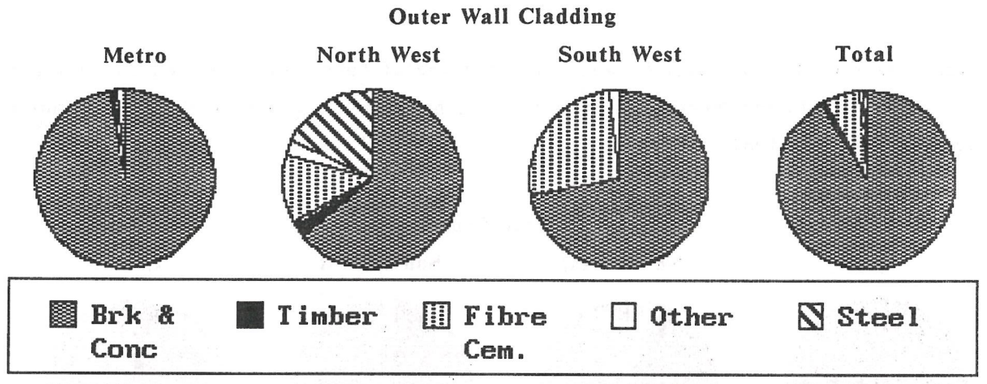
There are no significant differences in the type of buildings materials used in footings between the 1983 and 1987.



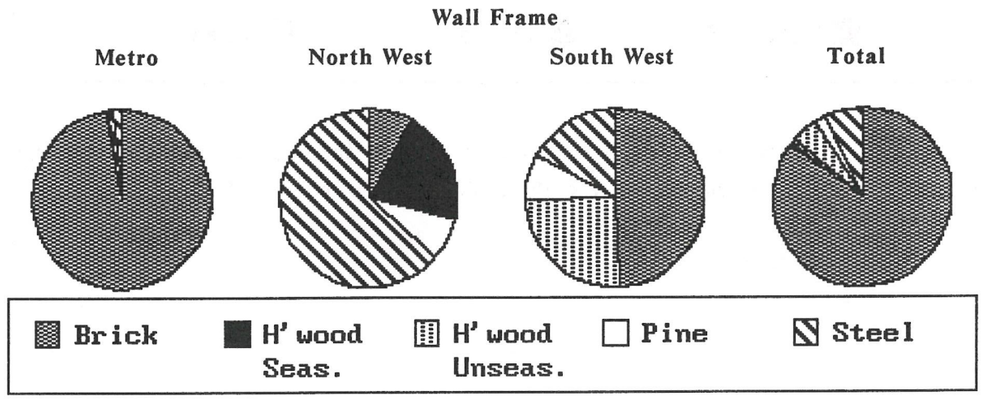
A comparison between surveys indicates a slight increase in timber floor frames.



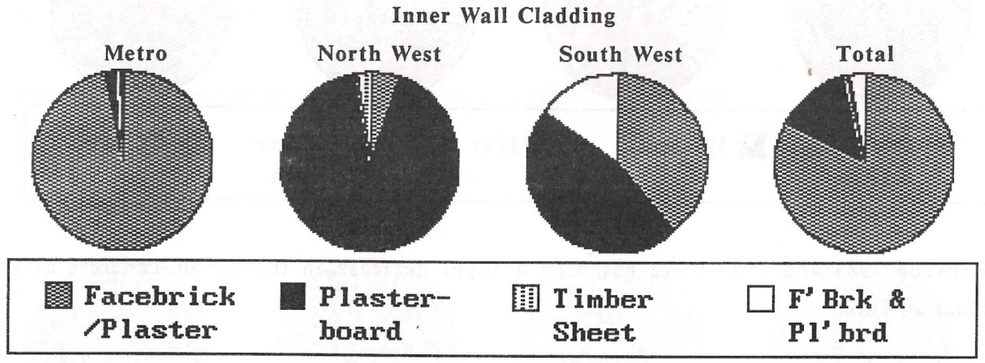
Between 1983 and 1987 there has been a slight decrease in the use of concrete as a floor surface.



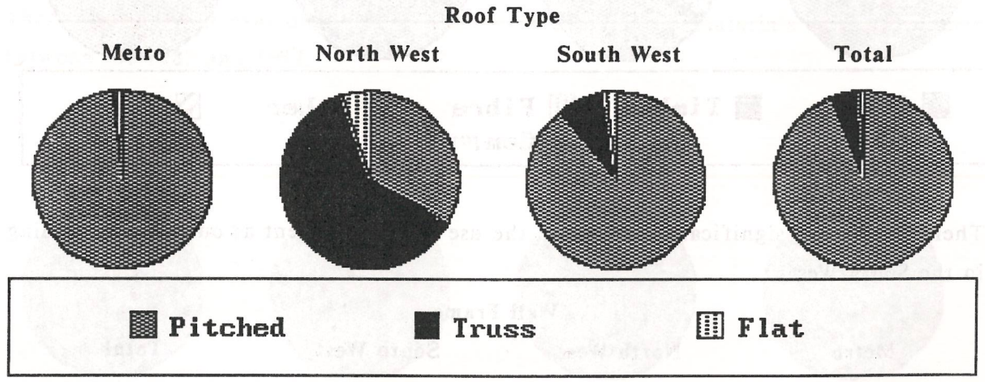
There has been a significant increase in the use of fibre cement as outer wall cladding in the South West.



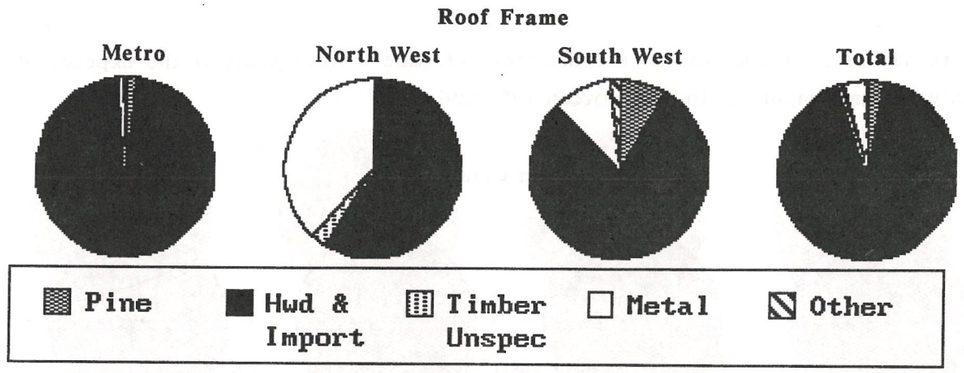
There has been a slight increase in the incidence of pine wall frames between 1983 and 1987. Brick wall framing is losing popularity in the North West and to a lesser extent in the metropolitan area.



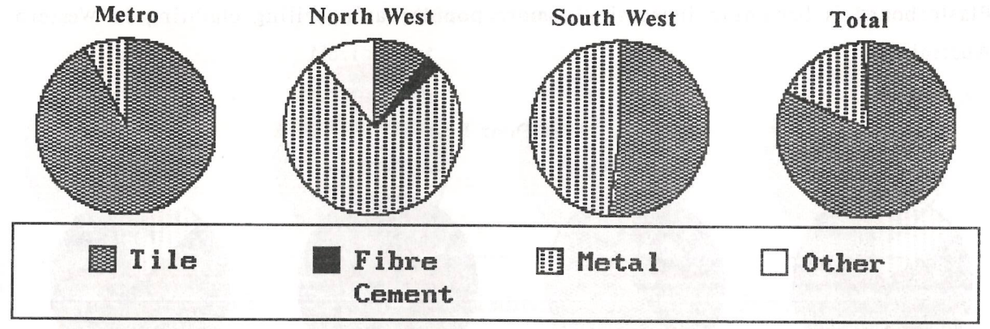
There has been a slight trend away from the use of facebrick/plastered as an inner wall cladding. In the North West plasterboard has become significantly more popular between 1983 and 1987.



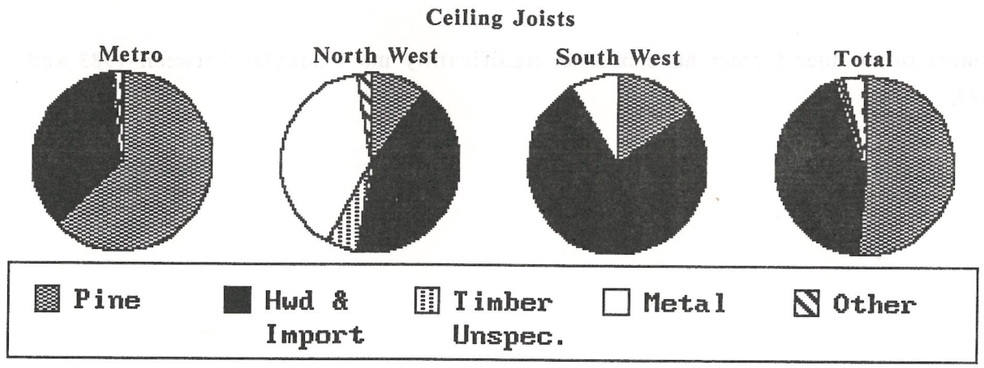
In general, there has been no significant changes in the type of roof on houses in Western Australia. In the North West the incidence of pitched roofs has increased.



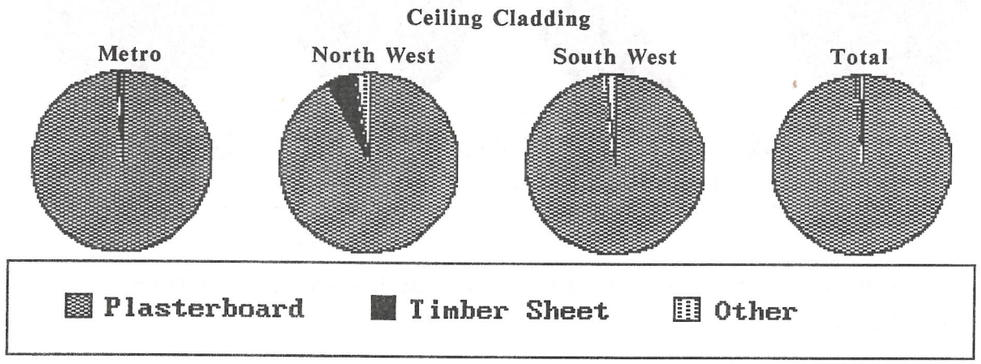
There do not appear to be any changes in the materials used in roof frames between 1983 and 1987.



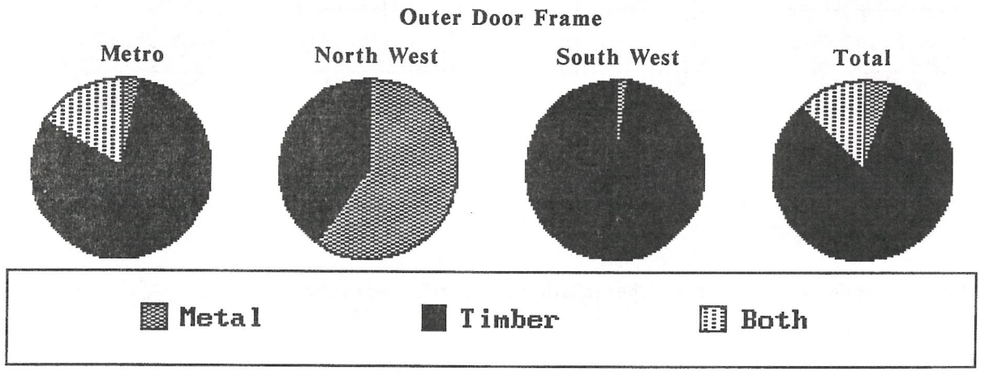
There has been a decrease in the incidence of tile roofs in the North West between 1983 and 1987.



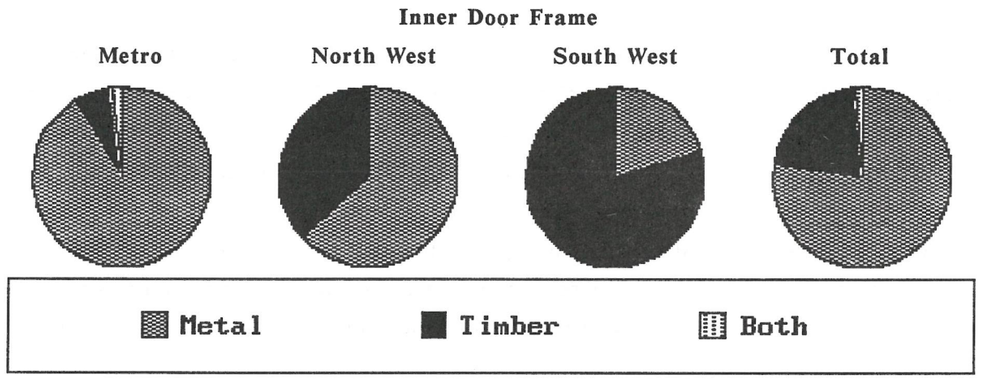
There has been an increase in the incidence of pine ceiling joists at the expense of hardwood and imported timber between 1983 and 1987.



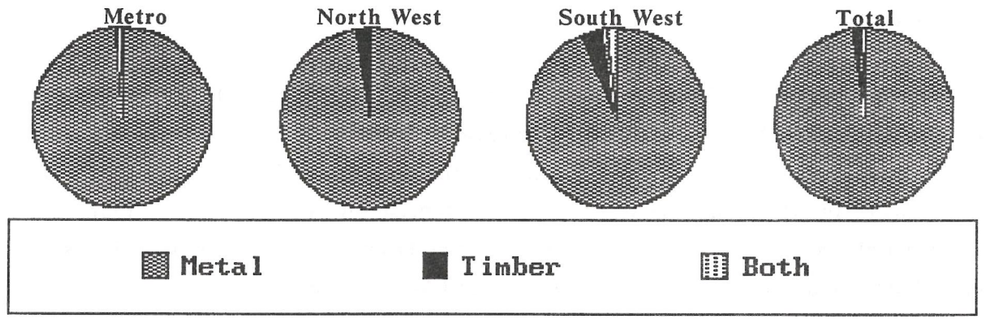
Plasterboard is becoming increasingly more popular as a ceiling cladding in Western Australia.



Timber outer door frames have become significantly more popular between 1983 and 1987.



There has been a significant drop in the incidence of metal inner door frames in favour of timber in the South West.



There have been no significant changes in the type of materials used in window frames between 1983 and 1987.

3.0 METHODOLOGY *

This survey is a replication of one conducted in 1983 by the Forests Department of Western Australia. In 1983, the entire population, that is, all Western Australian housing approvals, were included in the survey. This eliminated the possibility of bias due to sample selection. However in the 1987 survey it was decided to take a sample of housing approvals . Provided a representative sample is chosen from within the population, adequate reliability can usually be obtained from a sample. As well as being less costly, sampling will also reduce the extent of nonsampling errors such as nonresponse bias, reporting of misleading or wrong information and data coding errors.

In the current survey, data was collected over one month (19 October 1987 to 17 November 1987) from 22 local government authorities. Enough authorities were selected to ensure a sample size of a least 500.

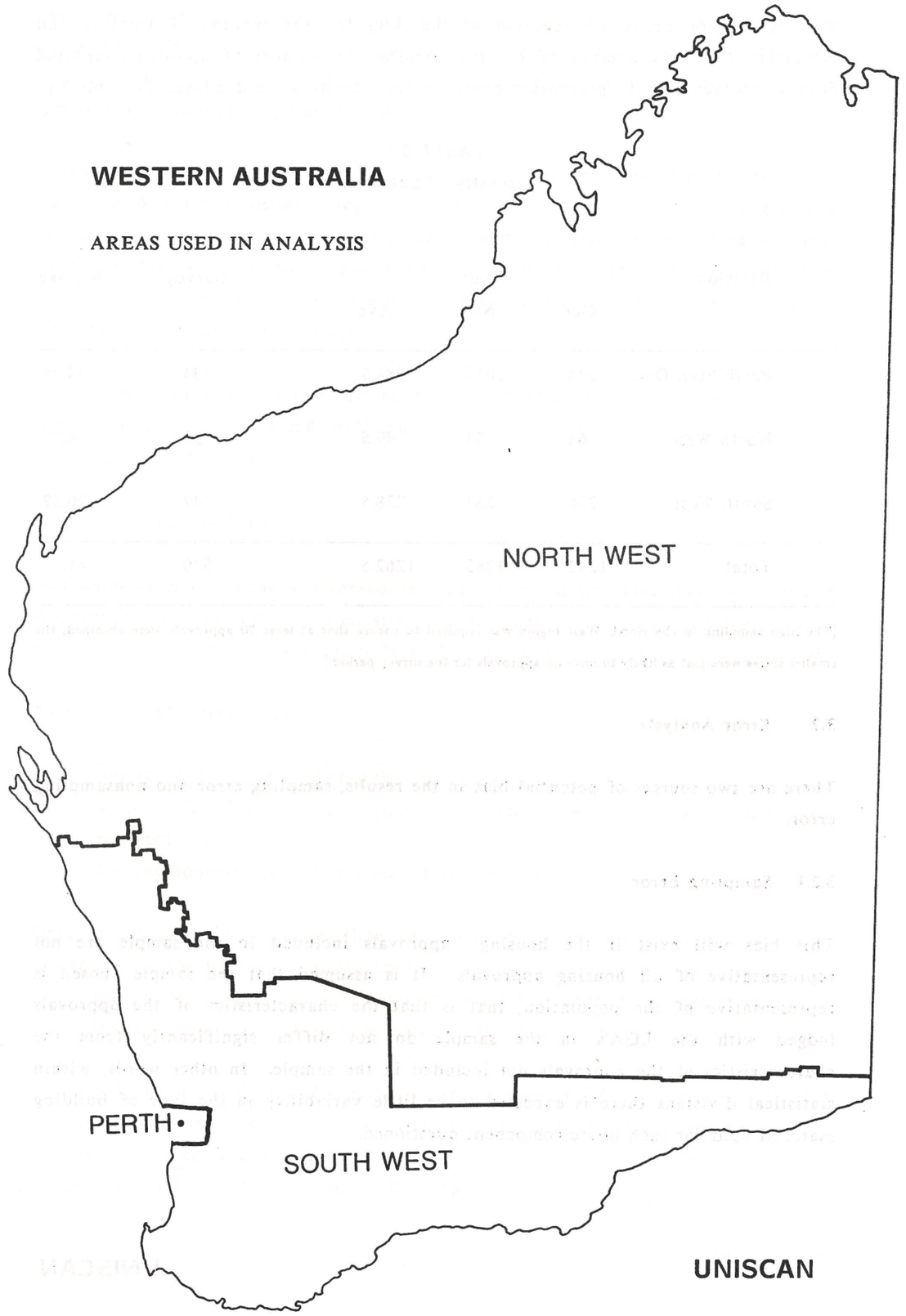
3.1 Sampling Procedure

The sampling frame consisted of all local government authorities (LGA) in Western Australia as classified by the Australian Bureau of Statistics. In addition to ensuring that the sample consisted of at least 500 approvals, no region where comparisons were to be made in the final analysis was to consist of less than 20 approvals. Approximately 90% of the total sample was to come from the Perth Statistical Division evenly distributed over the North, South, East and West corridors.

A random selection of LGA's within each Statistical Division (again as classified by the ABS) were chosen so that the above criteria were met. Once again a total census approach was used within each LGA, that is, all approvals lodged within the survey dates were included for each LGA in the sample.

For the final analysis the LGA's were divided into three divisions for which comparisons would be made. The three divisions will be referred to as the Perth Statistical Division or the 'metropolitan area', the North-West and the South-West. (These divisions are shown on the map on page 9.) A list of all Western Australian LGA's is included in Appendix C. LGA's included in the survey are marked.

* The definitions used and questionnaire are the same as that in the 1983 survey. For this reason these elements of the survey are left for Appendix A.



The number of approvals reported to the ABS for the months of October and November 1987, the average of the two months, the number of approvals reported from the survey and the percentage cover for each division are displayed in Table 3.1.

TABLE 3.1
Intensity of Sampling

Division	ABS			Survey	% Cover
	Oct	Nov	Ave		
Perth Stat. Div.	948	1021	984.5	434	44.08
North West	68	31	49.5	39	78.79
South West	226	231	228.5	47	20.57
Total	1242	1283	1262.5	520	41.

[The high sampling in the North West region was required to ensure that at least 20 approvals were obtained; the smaller shires were just as likely to have no approvals for the survey period.]

3.2 Error Analysis

There are two sources of potential bias in the results, sampling error and nonsampling error.

3.2.1 Sampling Error

This bias will exist if the housing approvals included in the sample are not representative of all housing approvals. It is assumed that the sample chosen is representative of the population, that is that the characteristics of the approvals lodged with the LGA's in the sample do not differ significantly from the characteristics of the approvals not included in the sample. In other words, within statistical divisions there is expected to be little variability in the type of building material used for each house component questioned.

When reporting the proportions of materials used for each component and when comparing differences between regions and surveys the above assumption extends to assuming that the statistical distributions of the components do not differ significantly from the population as a whole.

When comparing differences between regions Chi-Square tests have shown that in most cases the differences between regions are highly significant given the sample sizes (exceptions are total floor area, window frame and to a lesser extent ceiling cladding). It is important however that care is taken when interpreting the results of cells where frequencies are less than five. These results could have easily occurred by chance; they have been marked accordingly.

The comparisons of the two surveys have been subjected to t-tests to determine which are the statistically significant differences. Only these results have been included in the main body of the report.

3.2.2 Nonsampling Error

Nonsampling error includes nonresponse bias. This implies that there are possible differences between the characteristics of the housing approvals included in the survey and those not included due to lack of information supplied by the respondents.

Nonresponse bias may occur if:

- not all LGA's agree to supply the information requested, or;
- within each LGA not all approvals lodged between the survey dates are reported, or;
- for any approval not all information requested is supplied.

Only one LGA refused to complete the questionnaire and refused access to the information. The number of approvals expected to be lodged in any month with this LGA is such a small proportion of total approvals that there is no reason to believe the omission of this LGA will bias the representativeness of the sample.

It can only be assumed that all approvals for the sampled LGA's have been reported on the questionnaire. A direct cross check with the ABS reported approvals will not confirm the completeness of approvals as they are firstly, available for calendar months only and secondly, not necessarily accurate.

The response rates for the individual components of the questionnaire are given in Table 3.2.2.

Table 3.2.2
Response Rates for Individual Components

Section	Total Survey	Total Response	% Response
Floor Area	520	516	99.2
Footings	520	520	100.0
Floor Frame	520	520	100.0
Floor Surface	520	520	100.0
Outer Wall Cladding	520	519	99.8
Wall Frame	520	519	99.9
Inner Wall Cladding	520	517	99.4
Roof Type	520	520	100.0
Roof Frame	520	411	98.3
Roof Cladding	520	417	99.4
Ceiling Joists	520	416	99.2
Ceiling Cladding	520	520	100.0
Outer Door Frame	520	472	90.8
Inner Door Frame	520	481	92.5
Window Frame	520	508	97.7

As can be seen from the table the responses on the individual components were near 100% in almost all cases. The lowest rates were recorded for the outer and inner door frames. This may be due to a lack of understanding of what was required. This is discussed further below.

Another form of nonsampling error involves the reporting of misleading information. This may occur due to carelessness or lack of understanding on behalf of the respondent. The problem is compounded when a number of different people are collecting the information.

There were obvious instances where the respondent did not understand what was required. This is evident from the low response rates mentioned above for the outer and inner door frames. There appeared to be confusion as to whether the term 'outer door frame' referred to the external doors of the house (as was intended), just the

front door or to the visible part of a door frame where the inner door frame referred to the internal frame of that same door. For this reason the results of the current survey should be interpreted with care.

The term 'imported timber' was vague and may also have caused some confusion. It was not stated whether this meant imported from interstate or overseas.

The inclusion of the chance to record 'timber unspecified' for a number of components may have induced the low proportions in the other timber categories for those components. The respondent could quickly record unspecified rather than try to determine the specific type of timber.

Due to the high proportion of 'timber unspecified' responses in the roof frame and ceiling cladding components further data collection was required. These methods are discussed in Section 4.17.

4.0 SURVEY RESULTS

This section includes the results of the survey for the individual components of each house approval. The materials used within each component have been compared to the previous survey and the statistically significant differences are discussed.

Note in the tables that follow:

- Tables reporting results of the current survey include a "*" where the cell frequency was less than 5. These proportions should be interpreted with care.

- Where comparisons are made to the 1983 survey only statistically significant differences (at the 95% confidence level or better) have been displayed. The complete tables are included in Appendix C.

- In all tables where comparisons have been made the results of the 1987 survey are shown in **bold.**

- The proportions refer to the valid percent. That is missing values have been excluded when calculating the proportions. This is in keeping with the last survey.

- Tables may not add due to rounding.

4.1 Floor Area

The average house size, calculated from the 1987 survey, is 201.8m^2. This is larger than in 1983 when the average was 180.2m^2. The houses in the North West are the smallest, the average being 173.4m^2 compared to 195.4m^2 in the South West and 204.8m^2 in the metropolitan area.

The mode, which is the most popular house size, given by the mid point of the 50 square metre range with highest frequency is 124.5m^2. This was the same in the first survey.

The median, or the house size such that half of survey approvals are larger and half smaller, is 182.6m^2. In the 1983 survey the median house size was 169.0m^2.

4.2 Footings

Concrete is the dominant material used in footings, accounting for over 97% of house approvals in 1987. The relative importance of concrete drops only slightly in country areas as evident in Table 4.2.

Table 4.2
Footings

	Metropolitan	North-West	South-West	Total
Concrete	98.8	92.3	93.6	97.6
Steel			2.1*	0.4*
Hardwood		5.1*	2.1*	0.6*
Softwood	0.5*			0.4*
Timber-Unspecified	0.5*			0.4*
Other	0.2*	2.6*	2.1*	0.7*

There are no statistically significant differences in the type of material used in footings between 1983 and 1987 when comparing total Western Australian approvals.

4.3 Floor Frame

94.9% of houses use concrete for the floor frame. This proportion drops slightly in country areas; in the South West the use of unseasoned hardwood and pine has been reported. Steel has been included as a category of its own in this survey although it only accounts for a small proportion of the total floor frames. Table 4.3 displays these results.

Table 4.3

Floor Frames

	Metropolitan	North-West	South-West	Total
Concrete	98.2	84.6	83.0	94.9
Hardwood-Seasoned	0.7*	5.1*	2.1*	1.1
Hardwood-Unseasoned	0.2*	2.6*	8.5*	1.8
Pine			4.3*	0.8*
Timber-Unspecified	0.2*			0.2*
Other	0.7*	5.1*		0.7*
Steel		2.6*	2.1*	0.5*

A comparison between the 1983 and 1987 surveys shows a slight increase in timber use.

4.4 Floor Surface

Concrete slab is the predominant material used as the floor surface of houses in Western Australia. 98.2% of all metropolitan approvals report the use of concrete; timber sheet is virtually the only substitute used. Table 4.4/1 shows the drop in the proportion of concrete floor surfaces evident in country areas. Timber sheet is a popular substitute in the South West and to a lesser extent in the North West. Included in the 'other' category are combinations of materials such as concrete or hardwood with timber sheet.

Table 4.4/1

Floor Surface

	Metropolitan	North-West	South-West	Total
Concrete Slab	98.2	82.1	83.0	94.8
Hardwood	0.5*	7.7*	4.3*	1.4
Pine		2.6*		0.1*
Timber Sheet	1.4	5.1*	12.8	3.6
Other		2.6*		0.1*

Combinations of concrete and timber sheet and hardwood and timber sheet are included in the other category.

There has been a slight trend away from the use of concrete as a floor surface in the metropolitan area (99.2% in 1983 to 98.2 in 1987). This appears to be in favour of timber sheet.

4.5 Outer Wall Cladding

Brick is the most common outer wall cladding in Western Australia. Although there is no evidence of the use of steel as an outer wall cladding in the Metropolitan area and the South West it is popular in the North West. Table 4.5 also shows the incidence of fibre cement as an outer wall cladding in the country areas.

Table 4.5

Outer Wall Cladding

	Metropolitan	North-West	South-West	Total
Solid Br & Concr	97.2	64.1	71.7	91.4
Hardwood	0.2*			0.2*
Imported Timber	0.2*			0.2*
Timber-Unspecified	0.7*	2.6*		0.6*
Fibre Cement	1.4	12.8	26.1	6.2
Other	0.2*	2.6*	2.2	0.7*
Steel & Steel Clad		17.9*		0.7*

The most significant change in the type of material used as an outer wall cladding is the increase in the amount of fibre cement used in the South West, from 0.3% in 1983 to 26.1% in 1987. As steel has been included as a category of its own in the 1987 survey and included in the 'other' in the 1983 survey it is impossible to compare these results.

4.6 Wall Frame

While brick is by far the most popular material used for wall frames in Western Australia this proportion varies significantly between metropolitan and country areas. Table 4.6 shows that while few substitutes for brick are used in the metropolitan area, steel is the most frequently used material in the North West followed by seasoned hardwood. In the South West just under half of the wall frames are brick, a quarter are unseasoned hardwood, the remainder are mostly steel frames with a small proportion of pine.

Table 4.6
Wall Frames

	Metropolitan	North-West	South-West	Total
Solid Brick	97.0	7.9*	48.9	84.9
Hardwood-Seasoned	0.5*	21.1		1.2
Hardwood-Unseasoned			25.5	4.6
Pine	0.5*	7.9*	8.5*	2.2
Timber-Unspecified	0.5*			0.4*
Steel	1.6*	63.2	17.0	6.8

The proportions reported for solid brick include two combinations of hardwood and brick.

Statistical tests show that there has been a slight increase in the proportion of pine used in wall frames from 1.1% in 1983 to 2.2% in 1987. In is also evident that there has been a slight decrease in the incidence of solid brick in the metropolitan area from 98.6% to 97%. It is suggested that this has been in favour of steel framing but this can not be ascertained from the results as the incidence of steel frames in the 1983 survey was not reported separately but included in the 'other' category. The decrease in popularity of solid brick in the North West is more pronounced, in 1983 36.7% of houses were reported to have solid brick, in 1987 only 7.9% were reported.

4.7 Inner Wall Cladding

Facebrick/plastered is the most common type of inner wall cladding in Western Australian houses. Most metropolitan houses use facebrick/plaster with only a slight incidence of plasterboard. This is not so in the country areas. In the North West plasterboard is by far the most popular material used for inner wall cladding. In the South West plasterboard is slightly more popular than facebrick/plaster but there were a number of approvals indicating the combination of the two. Table 4.7 displays these results.

Table 4.7
Inner Wall Cladding

	Metropolitan	North-West	South-West	Total
Facebrick/Plaster	96.8	5.3*	39.1	82.9
Plasterboard	2.3	92.1	45.7	13.5
Timber Sheet	0.5*	2.6*		0.5*
Facebrick/Pl Brd	0.5*		15.2	3.1

The plasterboard category includes combinations of other materials.

Statistical tests show a slight trend away from facebrick/plaster towards the use of plasterboard for inner wall cladding in Western Australia. In 1983 86.7% of houses used facebrick/plastered, 82.9% were reported in 1987. In the North West there has been a significant shift towards the use of plasterboard from 45% in 1983 to 92.1% in 1987. This has also been at the expense of facebrick/plaster (29.5% to 5.3%).

4.8 Roof Type

Pitched roofs are the most popular type of roof in Western Australia as a whole and in the South West; almost all of metropolitan roofs are pitched. In contrast truss roofs are popular in the North West, only a third of houses have pitched roofs as evident from Table 4.8.

Table 4.8
Roof Type

	Metropolitan	North-West	South-West	Total
Pitched	98.2	33.3	89.4	94.0
Truss	1.4	61.5	8.5	5.0
Flat	0.2*	5.1*	2.1*	0.8*
Other	0.2*			0.2*

There have been no statistically significant changes in the type of roof frame used in the metropolitan and South West divisions. The incidence of pitched roof frames has fallen in the North West from 51.9% in 1983 to 33.3% in 1987. This trend has favoured both truss and flat roof frames.

4.9 Roof Frame

Table 4.9 reports the survey results for roof frames. As mentioned above, due to the high proportions of 'timber-unspecified' responses further data collection was required. Section 4.17 describes these methods and section 4.17.1 tabulates the results and compares them to the previous survey.

Table 4.9
Roof Frame

	Metropolitan	North-West	South-West	Total
Hardwood-Seasoned	9.9	28.2	2.1*	9.2
Hardwood-Unseasoned	31.0	30.8	76.6	39.6
Pine	2.4		8.5	3.4
Timber-Unspecified	56.2	2.6*		43.6
Metal	0.5*	38.5	10.6	3.9
Other (Comb)			2.1*	0.4*

4.10 Roof Cladding

While tile is the most popular roof cladding in Western Australia as a whole this is a result of the high proportion of the roofs in the metropolitan area. Table 4.10 shows that in the South West there is an even spread between tile and metal roof cladding while in the North West over three quarters are metal.

Table 4.10
Roof Cladding

	Metropolitan	North-West	South-West	Total
Tile	92.4	10.5*	52.2	82.0
Fibre Cement		2.6*		0.1*
Metal	7.4	76.3	47.8	17.3
Other	0.2*	10.5*		0.6*

There were a couple of combinations of tile and other materials included in the tile category.

The only statistically significant difference between 1983 and 1987 in the type of roof cladding materials used is the decrease in the proportions of tile roofs in the North West from 31% to 10.5%.

4.11 Ceiling Joists

Table 4.11 shows the original results of the survey for ceiling joists. As with the roof frames further data collection was required. The results are presented in section 4.17.2.

Table 4.11
Ceiling Joists

	Metropolitan	North-West	South-West	Total
Hardwood-Seasoned	0.7*	23.7		1.5
Hardwood-Unseasoned	17.9	18.4	76.6	28.6
Pine	18.6	10.5*	14.9	17.6
Imported Timber	2.6			2.0
Timber-Unspecified	58.7	5.3*		45.9
Metal	0.2*	39.5*	8.5*	3.3
Other	0.5*	2.6*		0.5*
Not Applicable	0.9*			0.7*

The other category includes combinations of hardwood and pine and pine and metal.

4.12 Ceiling Cladding

Plasterboard is the most popular ceiling cladding in all areas of Western Australia as seen in Table 4.12. The North West divisions reported the lowest incidence where the proportion was still as high as 92.3%.

Table 4.12
Ceiling Cladding

	Metropolitan	North-West	South-West	Total
Plasterboard	99.1	92.3	97.9	98.6
Timber Sheet	0.2*	5.1*		0.4*
Other	0.7*	2.6*	2.1*	1.0

The other category extends to include exposed beams and plasterboard combinations.

There has been a statistically significant increase in the proportion of plasterboard used in ceiling cladding from 90.8% in 1983 to 98.6% in 1987. This increase is most prominent in the metropolitan area (90.6% to 99.1%).

4.13 Outer Door Frame

Timber is the most popular type of material used in outer door frames, it is used almost exclusively in the South West. In the North West however, metal is slightly more popular than timber as evident from Table 4.13/1.

Table 4.13/1
Outer Door Frame

	Metropolitan	North-West	South-West	Total
Metal	3.6	60.0	2.1*	5.5
Timber	80.3	40.0	97.9	82.2
Metal & Timber	16.2			12.3

Table 4.13/2 shows the statistically significant changes in the type of material used in the outer door frame. There has been a significant increase in the incidence of timber outer door frames but as mentioned in Section 3.2.2 this should be interpreted with care.

Table 4.13/2
Comparison of Survey Results - Outer Door Frame

	Metropolitan		North-West		South-West		Total	
	1983	**1987**	1983	**1987**	1983	**1987**	1983	**1987**
Metal	8.7	**3.6**	31.3	**60.0**	24.4	**2.1**	12.7	**5.5**
Timber	23.7	**80.3**	60.9	**40.0**	69.2	**97.9**	34.1	**82.2**
Metal and Timber	67.7	**16.2**	-	-	-	-	53.2	**12.3**

4.14 Inner Door Frame

Over three quarters of inner door frames are metal. This is not so in the South West where timber is more popular. The proportions are reported in Table 4.14.

Table 4.14
Inner Door Frame

	Metropolitan	North-West	South-West	Total
Metal	91.6	63.6	20.5	77.6
Timber	6.4	36.4	79.5	20.9
Metal & Timber	2.0			1.5

There has been a slight increase in the use of metal and timber combinations in the metropolitan area (0.7% to 2.0%). In the South West there has been a significant decrease in the use of metal from 47.7% in 1983 to 20.5% in 1987. This has been in favour of timber frames (from 50.7% to 79.5%).

4.15 Window Frames

As evident from Table 4.15 almost all window frames are metal. This is similar to the results of the previous survey.

Table 4.15
Window Frames

	Metropolitan	North-West	South-West	Total
Metal	98.8	97.3	93.6	97.8
Timber	0.7*	2.7*	4.3*	1.4
Metal & Timber	0.5*		2.1*	0.8*

4.16 Upper Storey Details

Very few responses were recorded relating to upper storey details. It may have been that the respondents did not report the results properly due to a lack of understanding.

Table 4.17 reports the proportions of materials used for the internal stairs component. It should be noted that there were 456 valid responses but 398 of these were 'not applicable'. This leaves only 58 valid responses on which to base the proportions so a breakdown for divisions has not been displayed.

Table 4.16
Internal Stairs

	Total
Concrete	43
Metal	9
Hardwood	29
Imported Timber	2
Timber - Unspecified	9
Other	9

From the number of responses other than 'not applicable' on the internal stairs component it is estimated that the number of approvals for multiple storey houses during the survey period would be less than 58. (The number of multiple storey houses would be less than this number as the question was investigating both internal stairs and railings, some single storey houses may be included.)

Assuming that the number of multiple storey houses in the survey is approximately 50, the response rates for the individual components range from 18% to 48%. Considering these low response rates no discernible conclusions can be drawn about the materials used in the upper storey of multiple storey houses. The following details are based on the responses received.

- Concrete is used in most cases for the floor frame.
- Approximately two thirds of floor surfaces are concrete slab.
- Brick is the most popular outer and inner wall cladding and wall frame.
- Half of the respondents indicated timber unspecified for the material used as ceiling joists.
- The most frequently used ceiling cladding is plasterboard.
- Most outer door frames are timber or a combination of timber and metal.
- Two thirds of inner door frames are timber.

4.17 Roof Frame and Ceiling Joists - Further Results

As the responses to the survey resulted in high proportions of 'timber-unspecified' for roof frames and ceiling joists further data collection was undertaken to distinguish between hardwood and pine.

The building permits available from the LGA's did not contain the necessary information as details were recorded concerning the builder registered for each permit.

Telephone contact was made with as many of the builders as possible. Although the builders could not state which timber was used for individual permits they suggested that they used a consistent type of timber for all roof frames and ceiling cladding. This information has been cross referenced against permit numbers to obtain the required results. These results are tabulated and discussed below.

4.17.1 Roof Frame

The additional data collection resulted in a 91.2% response rate of which only 0.5% were still 'timber-unspecified'. Table 4.17.1/1 shows hardwood and imported timber was the most popular material used in roof frames, with only a small incidence of metal and pine.

Table 4.17.1/2
Roof Frame - Adjusted Results

	Metropolitan	Total
Pine	1.8	3.0
Hardwood and Imported Timber	97.2	91.9
Timber - Unspecified	0.5	0.5
Metal	0.5	4.1
Other	-	0.4

The method of data collection did not allow the application of statistical tests to compare the differences between surveys. Table 4.17.1/2 shows that considering the proportion of 'timber-unspecified' responses in the first survey it is impossible to clearly identify any trends in the type of timber used in roof frames.

Table 4.17.1/2
Comparison of Roof Frame Results - Adjusted

	Total	
	1983	1987
Pine	1.3	3.0
Hardwood and Imported Timber	87.2	91.9
Timber - Unspecified	5.7	0.5
Metal	2.2	4.1
Other	3.7	0.4

4.17.2 Ceiling Joists

A 91.5% response rate was obtained when additional data was collected concerning ceiling cladding materials. The proportion of 'timber-unspecified' responses was reduced to 1%. The additional results suggest half of all ceiling cladding joists are pine. The results are displayed in Table 4.17.2/1.

Table 4.17.2/1
Ceiling Joists - Adjusted Results

	Metropolitan	Total
Pine	62.7	51.1
Hardwood and Imported Timber	34.8	43.3
Timber - Unspecified	1.0	1.0
Metal	0.3	3.5
Other	0.5	0.5
N/A	0.8	0.6

Once again it was not possible to apply statistical tests to the results but Table 4.17.2/2 shows an increase in the incidence of pine ceiling joists resulting in a trend away from hardwood and imported timber.

Table 4.17.2/2
Comparison of Ceiling Joists' Results - Adjusted

	Total	
	1983	1987
Pine	26.3	51.1
Hardwood and Imported Timber	63.6	43.3
Timber - Unspecified	5.3	1.0
Metal	2.5	3.5
Other	0.4	0.5
N/A	1.9	0.6

APPENDIX A
COMPLETE TABLES OF RESULTS - 1983 & 1987

The following tables contain all the results of the 1983 and 1987 surveys. Significant differences at the 95% confidence level are marked with a "*", a "**" indicates significance at the 99% confidence level.

Table A1
Total Floor Area

	Metropolitan		North-West		South-West		Total	
	1983	1987	1983	1987	1983	1987	1983	1987
Less than 100	3.6	6.5**	9.4	7.7	8.1	6.4	4.7	6.5
100 to 149	32.9	29.1	47.2	30.8	32.7	38.3	33.4	30.8
150 to 199	31.3	18.6**	20.5	38.5*	30.6	17.0	30.7	19.1**
200 to 249	18.6	18.8	9.4	12.8	15.1	12.8	17.6	17.5
250 to 299	7.9	11.6*	9.4	2.6	7.8	12.8	7.9	11.5**
300 to 349	2.8	7.2**	3.1	5.1	3.8	4.3	3.0	6.6**
350 to 399	1.7	4.0**	0.8	2.6	0.8	4.3	1.5	4.0**
More than 400	1.1	4.2**	-	-	1.1	4.3	1.1	4.0**

Table A2
Footings

	Metropolitan		North-West		South-West		Total	
	1983	1987	1983	1987	1983	1987	1983	1987
Concrete	99.8	98.8**	96.0	92.3	91.8	93.6	98.1	97.6
Brick	-	-	-	-	0.5	-	0.1	-
Steel	-	-	0.8	-	2.9	2.1	0.6	0.4
Hardwood	-	-	0.8	5.1	2.9	2.1	0.6	0.6
Softwood	-	0.5*	-	-	0.5	-	0.1	0.4
Timber - unspecified	-	0.5*	0.8	-	0.5	-	0.1	0.4

Table A3
Floor Frame

	Metropolitan		North-West		South-West		Total	
	1983	1987	1983	1987	1983	1987	1983	1987
Concrete	99.3	98.2*	88.7	84.6	89.2	83.0	96.9	94.9*
Hardwood								
- seasoned	0.1	0.7**	2.4	5.1	1.0	2.1	0.4	1.1*
- unseasoned	-	0.2*	4.0	2.6	4.3	5.8	1.0	1.8
Pine	-	-	-	-	-	4.3**	-	0.8*
Imported Timber	-	-	-	-	0.2	-	-	-
Timber - unspecified	-	0.2*	2.4	-	0.8	-	0.3	0.2

Table A4
Floor Surface

	Metropolitan		North-West		South-West		Total	
	1983	1987	1983	1987	1983	1987	1983	1987
Concrete Slab	99.2	98.2*	87.1	82.1	89.3	83.0	96.8	94.8*
Hardwood	0.2	0.5	5.6	7.7	1.9	4.3	0.7	1.4
Pine	-	-	-	2.6	-	-	-	0.1
Timber sheet	0.3	1.4**	6.5	5.1	7.0	12.8	1.8	3.6**

Table A5
Outer Wall Cladding

	Metropolitan		North-West		South-West		Total	
	1983	1987	1983	1987	1983	1987	1983	1987
Solid Brick and Concrete	98.8	97.2**	62.7	64.1	75.6	71.7	92.8	91.4
Hardwood	-	0.2*	0.8	-	1.6	-	0.4	0.2
Softwood	-	-	-	-	1.4	-	0.3	-
Imported Timber	-	0.2*	-	-	-	-	-	0.2*
Timber - unspecified	-	0.7**	-	2.6	0.2	-	0.1	0.6*
Fibre Cement	0.6	1.4	28.6	12.8	0.3	26.1**	4.9	6.2

Table A6
Wall Frame

	Metropolitan		North-West		South-West		Total	
	1983	1987	1983	1987	1983	1987	1983	1987
Solid Brick	98.6	97.0*	36.7	7.9*	53.9	48.9	87.3	84.9
Hardwood								
- Seasoned	0.2	0.5	10.9	21.1	7.2	-	2.0	1.2
- Unseasoned	0.2	-	2.3	-	19.8	25.5	4.2	4.6
Pine	0.1	0.5	1.6	7.9	4.8	8.5	1.1	2.2*
Imported Timber	-	-	-	-	1.6	-	0.3	-
Timber - unspecified	0.1	0.5	13.3	-*	3.7	-	1.3	0.4

Table A7
Inner Wall Cladding

	Metropolitan		North-West		South-West		Total	
	1983	1987	1983	1987	1983	1987	1983	1987
Facebrick/Plastered	98.5	96.8*	29.5	5.3**	52.4	39.1	86.7	82.9*
Fibre Cement	-	-	7.0	-	2.3	-	0.8	-
Plasterboard	0.8	2.3**	45.0	92.1**	39.9	45.7	10.2	13.5*
Solid Hardwood	-	-	-	-	-	-	-	-
Solid Pine	-	-	-	-	0.2	-	-	-
Timber Sheet	-	0.5**	1.6	2.6	0.3	-	0.2	0.5

Table A8
Roof Type

	Metropolitan		North-West		South-West		Total	
	1983	1987	1983	1987	1983	1987	1983	1987
Pitched	98.7	98.2	51.9	33.3*	90.3	89.4	95.1	94.0
Truss	0.7	1.4	48.1	61.5	8.3	8.5	4.2	5.0
Flat	0.3	0.2	-	5.1*	1.0	2.1	0.4	0.8

Table A9
Roof Frame

	Metropolitan		North-West		South-West		Total	
	1983	1987	1983	1987	1983	1987	1983	1987
Hardwood								
- Seasoned	0.6	9.9**	19.4	28.2	12.8	2.1*	3.9	9.2**
- Unseasoned	89.2	31.0**	33.3	30.8	71.7	76.6	83.3	39.4**
Pine	0.8	2.4**	-	-	3.3	8.5	1.3	3.4**
Timber - unspecified	4.5	56.2**	22.5	2.6**	6.4	-	5.7	43.7**
Metal	0.3	0.5	23.3	38.5	4.7	10.6	2.2	3.9*
Other (comb.)	4.5	-**	1.6	-	1.1	2.1	3.7	0.4**

Table A10
Roof Cladding

	Metropolitan		North-West		South-West		Total	
	1983	1987	1983	1987	1983	1987	1983	1987
Tile	93.6	92.4	31.0	10.5*	61.7	52.2	84.9	82.0
Asbestos Cement	-	-	0.8	2.6	1.3	-	0.3	0.1
Metal	6.3	7.4	68.2	76.3	37.0	47.8	14.8	17.3

Table A11
Ceiling Joists

	Metropolitan		North-West		South-West		Total	
	1983	1987	1983	1987	1983	1987	1983	1987
Hardwood								
- Seasoned	0.8	0.7	7.1	23.7**	11.5	-*	3.3	1.5*
- Unseasoned	59.5	17.9**	33.1	18.4	67.4	76.6	60.0	28.6**
Pine	33.1	18.6**	-	10.5**	6.4	14.9*	26.3	17.6**
Imported Timber	0.1	2.6**	-	-	0.8	-	0.3	2.0**
Timber - unspecified	4.1	58.7**	22.0	5.3*	6.4	-	5.3	45.9**
Metal	0.2	0.2	32.2	39.5	4.7	8.5	2.5	3.3

Table A12
Ceiling Cladding

	Metropolitan		North-West		South-West		Total	
	1983	**1987**	1983	**1987**	1983	**1987**	1983	**1987**
Plasterboard	90.6	**99.1****	90.7	**92.5**	91.6	**97.9**	90.8	**98.6****
Solid Hardwood	0.9	-	-	-	-	-	0.7	-
Solid Pine	0.2	-	-	-	1.2	-	0.4	-
Timber Sheet	-	**0.2***	0.8	**5.1**	0.8	-	0.2	**0.4**
Imported Timber	-	-	-	-	-	-	-	-
Fibre Cement	-	-	3.1	-	0.8	-	0.3	-

Table A13
Outer Door Frame

	Metropolitan		North-West		South-West		Total	
	1983	**1987**	1983	**1987**	1983	**1987**	1983	**1987**
Metal	18.7	**3.6****	31.3	**60.0****	24.4	**2.1****	12.7	**5.5****
Timber	23.7	**80.3****	60.9	**40.0***	69.2	**97.9****	34.1	**82.2****
Metal and Timber	67.7	**16.2****	7.8	-	6.4	-	53.2	**12.3****

Table A14
Inner Door Frame

	Metropolitan		North-West		South-West		Total	
	1983	**1987**	1983	**1987**	1983	**1987**	1983	**1987**
Metal	90.3	**91.6**	76.3	**63.6**	47.7	**20.5***	81.3	**77.6**
Timber	9.0	**6.4**	23.7	**36.4**	50.7	**79.5***	17.9	**20.9**
Metal and Timber	0.7	**2.0***	-	-	1.6	-	0.8	**1.5**

Table A16
Window Frame

	Metropolitan		North-West		South-West		Total	
	1983	**1987**	1983	**1987**	1983	**1987**	1983	**1987**
Metal	98.1	**98.8**	93.9	**97.3**	93.9	**93.6**	97.1	**97.8**
Timber	1.3	**0.7**	6.1	**2.7**	5.6	**4.3**	2.3	**1.4**
Metal and Timber	0.7	**0.5**	-	-	0.5	**2.1**	0.6	**0.8**

APPENDIX B

LIST OF LOCAL GOVERNMENT AUTHORITES

Below is a list of Local Government Authorities, as classified by the ABS, compiled by divisions used in the analysis. Those LGA's sent a questionnaire are marked with a "*".

Perth Stat. Div.

Claremont (T) *
Cottesloe (T) *
Mosman Park (T)
Nedlands (C) *
Pepermint Grove
Perth (C)
Subiaco (c)
Bassendean (T)
Bayswater (C)
Kalamunda *
Mundaring
Swan *
Stirling (C) *
Wanneroo
Cockburn (C)
East Fremantle (T)
Fremantle (C)
Kwinana (T)
Melville (C) *
Rockingham *
Armadale (T) *
Belmont (C)
Canning (C)
Gosnells (C) *
Serpentine-Jarrahdale
South Perth (C)

South West

Mandurah
Murray
Waroona
Bunbury (C)
Capel
Dardanup
Donnybrook-Balingup
Harvey
Augusta-Margaret River
Busselton *
Boyup Brook
Bridgetown-Greenbushes
Manjimup *
Nannup
Broomehill
Gnowangerup
Jerramungup
Kattanning
Kent
Kojonup
Tambellup
Woodanilling
Albany (T)
Albany *
Cranbrook
Denmark
Plantagenet
Boddington
Brookton
Cuballing
Dumbleyung
Narrogin (T)
Narrogin
Pingelly
Wagin
Wandering
West Arthur
Wickepin
Williams
Corrigin
Kondinin
Kulin
Lake Grace
Chittering
Dandaragan
Gingin
Moora
Victoria Plains
Beverley
Cunderdin
Dalwallinuq
Dowerin
Goomalling
Koorda
Northam (T)
Northam
Quairading
Tammin
Toodyay *
Wongan-Ballidu
Wyalkatchem
York
Bruce Rock
Kellerberrin
Merredin
Mount Marshall
Mukinbudin
Narembeen
Nungarin
Trayning
Westonia
Yilgarn
Dundas
Esperance
Ravensthorpe
Carnamah
Chapman Valley
Coorow
Geraldton (T) *
Greenough
Irwin
Mingenew
Morawa
Mullewa
Northampton
Perenjori
Three Springs

North West

Boulder *
Coolgardie
Kalgoorlie (T)
Laverton
Leonora
Menzies
Carnarvon *
Exmouth *
Shark Bay
Upper Gascoyne
Cue
Meekatharra
Mount Magnet
Murchison
Sandstone
Wiluna
Yalgoo
East Pilbara *
Port Hedland *
Roebourne *
West Pilbara *
Halls Creek *
Wyndham-East
Kimberley *
Broome *
Derby-West
Kimberley *

APPENDIX C

QUESTIONNAIRE

DEPARTMENT OF CONSERVATION AND LAND MANAGEMENT

HEAD OFFICE
HACKETT DRIVE CRAWLEY
WESTERN AUSTRALIA
Phone (09) 386 8811
Telex AA 94585
Facsimile (09) 386 1578

STATE OPERATIONS HEADQUARTERS
50 HAYMAN ROAD COMO
WESTERN AUSTRALIA
Phone (09) 367 6333
Telex AA 94616
Facsimile (09) 367 1430

Please address all correspondence to Executive Director, P.O. Box 104, COMO W.A. 6152

Your Ref:
Our Ref: SRS:DJ
Enquiries:

Dear Sir

SURVEY OF MATERIALS USED IN HOUSE CONSTRUCTION

In 1983 local authorities in Western Australia assisted with a survey of materials used in house construction which provided base information for planning for efficient use of W.A's forest resources.

The survey results have proved to be of value to the housing industry, timber producers, the Department of Conservation and Land Management and other agencies and organisations.

In order to establish trends in the usage of materials in house construction the Department, in co-operation with forest industries organisations, is conducting a new survey similar to that conducted in 1983.

This survey is to cover all house approvals in a representative sample of local authorities for the period 19 October to 17 November inclusive.

Your authority has been selected within the sample. It would be appreciated if you would complete the enclosed questionnaire and return it in the reply paid envelope by 11 December 1987.

I trust information contained within the report will be of interest to you and, when compiled, a copy will be forwarded.

Data compilation and analysis for the survey is being conducted through the Centre for Applied and Business Research (CABR). Shoud you have any queries please contact Carmel McGinley, CABR, telephone 389 1455.

Yours sincerely

S K Shea

Syd Shea
EXECUTIVE DIRECTOR

DEPARTMENT OF CONSERVATION AND LAND MANAGEMENT

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Please address all correspondence to Executive Director, P.O. Box 104, COMO W.A. 6152

SURVEY OF MATERIALS USED IN HOUSE CONSTRUCTION, W.A.

From .....19 ... to .....19 ...

The following definitions and instructions are to assist with the completion of the questionnaire.

DEFINITIONS

A house is defined as a building which has been designed so that its prime purpose is to be a single self-contained dwelling unit, which is completely detached from other buildings and which occupies a separate titled block of land.

Dwellings such as flats, home units, duplexes, town houses, villa units, etc., are **excluded** from the survey.

INSTRUCTIONS

For this survey include information for all new house approvals in the period .....

..... to .....inclusive.

The questionnaire lists the various parts of house construction. For each part there are a number of categories of building material.

SINGLE STOREY HOUSES

Use one row of the questionnaire for each single storey house.

As each house is approved, enter the permit number in the first column.

As further details become known for each part of the house construction, mark the appropriate square with a cross (x).

If for any part of the house more than one category applies mark each appropriate square.

Where there is insufficient space to describe the house adequately, use the comments section on the following line.

For some sections details of particular timbers are listed. If these are unknown mark "Timber Unspecified".

When the category "Other" is used give details in the comments section.

MULTI STOREY HOUSES

For multi storey houses use one row for each storey.

Include total floor area with the lower storey only.

Give roofing details with upper storey only.

RETURNING QUESTIONNAIRE

Return the questionnaire by ..... Some house descriptions may be incomplete. For these houses, supply the name of the builder so that the remaining information can be obtained.

If you have any problems filling in the questionnaire or queries on the survey, please contact

.....Phone No. .....

SHIRE ____________________

☐☐☐☐

PERMIT NUMBER	TOTAL FLOOR AREA, m²								FOOTINGS							FLOOR FRAME							FLO SURF									
	LESS THAN 100	100 TO 149	150 TO 199	200 TO 249	250 TO 299	300 TO 349	350 TO 399	MORE THAN 400	CONCRETE	BRICK	STEEL	HARDWOOD	SOFTWOOD	TIMBER–UNSPECIFIED	OTHER	CONCRETE SLAB	HARDWOOD–SEASONED	HARDWOOD–UNSEASONED	PINE	IMPORTED TIMBER	TIMBER–UNSPECIFIED	OTHER	CONCRETE SLAB	HARDWOOD	PINE	TIMBER SHEET (PLY, ETC.)	OTHER	SOLID BRICK	CONCRETE	HARDWOOD	SOFTW	IM

F.D. 787

Period .... To ....

G			CEILING JOISTS					CEILING CLADDING								WINDOW AND DOOR FRAME						INTERNAL STAIRS AND RAILINGS							
PECIFIED	HER	NOT APPLICABLE	PLASTERBOARD	SOLID HARDWOOD	SOLID PINE	TIMBER SHEET (PLY, ETC.)	IMPORTED TIMBER	ASBESTOS CEMENT	OTHER	EXPOSED BEAMS	OUTER DOOR FRAME–METAL	OUTER DOOR FRAME–TIMBER	INNER DOOR FRAME–METAL	INNER DOOR FRAME–TIMBER	WINDOW FRAME–METAL	WINDOW FRAME–TIMBER	CONCRETE	METAL	HARDWOOD	PINE	IMPORTED TIMBER	TIMBER–UNSPECIFIED	OTHER	NOT APPLICABLE	COMMENTS				

F.D. 787

SHIRE _____

MATERIALS USED IN HOUSE CONSTRUCTION, W.A.

PERMIT NUMBER

TOTAL FLOOR AREA, m^2	FOOTINGS	FLOOR FRAME	FLOOR SURFACE	OUTER WALL CLADDING	WALL FRAME	INNER WALL CLADDING	ROOF TYPE	ROOF FRAME	ROOF CLADDING	CEILING JOISTS	CEILING CLADDING	WINDOW AND DOOR FRAME	INTERNAL STAIRS AND RAILINGS	COMMENTS
LESS THAN 100	CONCRETE	CONCRETE SLAB	HARDWOOD	HARDWOOD – SEASONED	HARDWOOD – SEASONED	FACE BRICK/PLASTERED	FLAT	HARDWOOD – SEASONED	METAL	HARDWOOD – SEASONED	METAL	METAL	HARDWOOD	
100 TO 149	BRICK	HARDWOOD	SOFTWOOD	HARDWOOD – UNSEASONED	HARDWOOD – UNSEASONED	ASBESTOS CEMENT	PITCHED	HARDWOOD – UNSEASONED	TILE	HARDWOOD – UNSEASONED	TIMBER	TIMBER	PINE	
150 TO 199	STEEL	PINE	PARTICLEBOARD	PINE	PINE	PLASTERBOARD	TRUSS	PINE	ASBESTOS CEMENT	PINE	ASBESTOS CEMENT	ALUMINIUM	IMPORTED TIMBER	
200 TO 249	HARDWOOD	IMPORTED TIMBER	SOLID PINE	IMPORTED TIMBER	IMPORTED TIMBER	SOLID HARDWOOD	OTHER	IMPORTED TIMBER	METAL	IMPORTED TIMBER	METAL	OTHER	TIMBER – UNSPECIFIED	
250 TO 299	SOFTWOOD	TIMBER – UNSPECIFIED	TIMBER SHEET (PLY, ETC.)	TIMBER – UNSPECIFIED	TIMBER – UNSPECIFIED	SOLID PINE		TIMBER – UNSPECIFIED	OTHER	TIMBER – UNSPECIFIED	OTHER		METAL	
300 TO 349	TIMBER – UNSPECIFIED	IMPORTED TIMBER	OTHER	OTHER	OTHER	TIMBER SHEET (PLY, ETC.)		OTHER		METAL			OTHER	
350 TO 399	OTHER	TIMBER – UNSPECIFIED		SOLID BRICK	FACE BRICK/PLASTERED	IMPORTED TIMBER				OTHER				
MORE THAN 400		OTHER		CONCRETE	ASBESTOS CEMENT	OTHER				TILE				
				TIMBER	PLASTERBOARD					ASBESTOS CEMENT				
				OTHER	SOLID HARDWOOD					METAL				
					SOLID PINE					OTHER				
					TIMBER SHEET (PLY, ETC.)									
					IMPORTED TIMBER									
					OTHER									

EXAMPLE 1

This example describes a single storey house of 160m^2 area. It has a concrete slab footing with cavity brick walls. Internal walls are either face brick or plastered. The pitched tiled roof is framed from unseasoned hardwood. The ceilings are gyprock fixed to pine ceiling joists. The front door frame is timber, all other outer and inner door frames are steel. All window frames are aluminium.

EXAMPLE 2

STEEL FLOOR FRAME
OREGON EXPOSED BEAMS

This is a description of a two storey house of total floor area 340m^2. Both footings and ground floor frame are steel, the lower floor surface being particleboard sheeting. Both lower and upper storeys have a combination of pine board and hardiplank outer wall cladding on unseasoned hardwood wall frames. Inner wall cladding on the lower storey is pine boards and ply sheeting. The lower storey ceiling joists which also form the upper storey floor frame are unseasoned hardwood.. Lower storey ceiling is plaster board. The upper floor surface is pine boards, the upper storey inner wall cladding is plaster board. The roof is flat and made from exposed beams of oregon and unseasoned hardwood rafters. The roof is clad in corrugated iron. The upper storey ceiling joists are the roof rafters with a ply sheet ceiling. All door frames are timber, all window frames aluminium. The stairs are hardwood.

EXAMPLE ONLY