



Australian suburban house building: industry organisation, practices and constraints

authored by

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ACRONYMS

ABS	Australian Bureau of Statistics
COAG	Coalition of Australian Governments
HIA	Housing Industry Association
NHSC	National Housing Supply Council
OH&S	occupational health and safety

EXECUTIVE SUMMARY

Evidence that the supply of new housing is inadequate is broadly recognised by the federal government, the National Housing Supply Council (NHSC), state governments and industry bodies such as the Housing Industry Association (HIA). The latter forecasts a housing shortage of 466 000 homes by 2020, while the Master Builders Association has also confirmed that it recognises a housing supply issue and has lent its support to the program of work on this issue initiated by the Coalition of Australian Governments (COAG).

The premise for this research is that there is a significant gap in this COAG work program. What is missing is any focus on the operations of the housing industry itself. This research responds to this gap. It takes as a starting point the Australian Bureau of Statistics (ABS) (2008) report *Average quarterly completions times for new houses*, which indicates that construction times for new homes are lengthening. The starting point for this research is that lengthening construction times is a problem that needs to be addressed within the broader context of constraints on housing supply—we start by examining the practices and constraints that may contribute to this problem.

ABS data provides no indication of why there have been changes in completion times; why there is variation in completion times across the states and territories or; why there are differences between the states and territories in completion time changes. However, the variable trends infer that across states and territories there are different building and contracting practices—and that these practices have been changing.

The undersupply of new housing and increases in the time between commencement and completion of new houses provides the context for the following principal research question being used to guide this research.

How is the work of new suburban house building organised and what practices and constraints may contribute to delays in building completion times?

Four secondary research questions have then been developed as a means for guiding the research program that respond to the principal research question.

1. What are the trends in the time taken to build new housing measured through commencements and completions?
2. How do builders typically organise work on new housing projects from commencement to completion through a system of contracts?
3. What are the main issues identified by industry participants managing new house building that may relate to and assist in explaining lengthening construction times?
4. In what ways might house building arrangements and practices be changed so as to reduce building completion times?

The research approach that responds to these questions uses mixed methods including:

- Literature review.
- The analysis of ABS statistical data.
- Semi-structured interviews with builders, supply and install contractors, sub-contractor, consulting professionals, regulators and industry association representatives.
- Observation and tracking of processes used by industry participants in selecting new house building case studies.

- Scenario-modelling for simulating industry-wide implications of existing and alternative arrangements using Simul8 software.
- Presentation of preliminary research findings to industry participants and consultation on implications.

Chapter 2 ‘Lengthening construction times’ extends the analysis of the ABS Building activity data and indicates that over the period of 2000 to 2008, there was an increase in the average time that houses were under construction, while the production rate of houses per quarter over that period has remained relatively stable in all states except New South Wales, where production has declined. Gharaie et al. (2010) and Gharaie (2011) investigate whether trends in house size, in relation to floor area, may be responsible for this growth in house completion time and conclude that this is not the case. In this chapter we also consider the argument that labour supply shortages might be a key factor behind increasing completion times. We present labour supply data for the residential building industry and conclude that although builders will experience labour shortages, it is not possible to say that increases in completion times are due to labour supply shortages.

In order to investigate in more detail the way builders organise and undertake new housing construction, Chapter 3 presents an overview of the system of three principal contracting types typically used by volume builders; supply contracting, supply and install contracting and subcontracting. Against the background of this overview of arrangements, the framework of rewards, risks and safeguards is introduced as a framework that can assist in analysing the complexity of contractual arrangements used in new house building.

The volume house builders have developed an explicit and carefully documented contract system based on an extensive breakdown of the component parts of the typical house. In recent years the three-part contract system has been built into several proprietary software packages, which also have the capacity to issue, track and acquit orders. These packages are now widely used among volume builders in a number of states and have been made a central element of their IT support systems.

At the core of the contracting arrangements lie two types of managers on the production front line—supervisors and construction managers. Supervisors arrange subcontracts directly with tradespeople, while construction managers will usually be responsible for working with and supervising five or six front-line supervisors. Through the supervisors they will be responsible for the building of approximately 75 to 90 houses at any one time. Typically, construction managers will have been supervisors and carpenter subcontractors in the past and will know the job role of supervisors and the subcontracting system intimately.

The research to date includes pilot interviews with builders, managers, supervisors, supply and install contractors and subcontractors. From these interviews key issues are identified, which perhaps begin to help explain why there has been an increase in the time taken to build new residential dwellings. Firstly, it is important to note that each building project is delivered through a ‘temporary organisation’, namely, a complex network of contractor and subcontractors of products and services. Many these temporary organisations form and ultimately disperse at the end of the project. Further, contractors and subcontractors are likely to be members of other multi-organisations through their involvement in other projects being run by other builders. For example, a plumbing company is likely to be supplying and installing plumbing materials and fixing them into new houses being built by other builders.

As a result of the interview analysis, three factors emerge that might help to explain lengthening construction times:

1. *The housing commodity itself*: Increased house size appears unlikely to be a major factor in lengthening construction times, however, increased complexity of house design is likely to have led to more complex and time-consuming programming of work and tasks, and may also relate to defects (see below); along with the increase in the number of models.
2. *Coordination and scheduling*: The contract system of subcontracts, supply contracts and supply and install contracts is complex and needs to be successfully organised and scheduled during the building of a house. Although the research is still in progress, it appears at this stage that one of the contributing factors causing the problems experienced by supply and install contractors may lie within the performance management systems of the volume builders.
3. *Quality*: The quality of work is an issue recognised by most volume builders, as indicated by the widespread adoption of quality systems which, in turn, may motivate construction managers and supervisors to push back on subcontractors and contractors to remediate defects. Some evidence was revealed that initial inspections of frames are refused 'probably 70 per cent of the time' and final completions are refused 'about 50 per cent' of the time, while around 30 per cent of the time, jobs that are inspected more than the six times allowed for in the standard agreement.

The research to date in this project raises many questions regarding the role of current practitioners, strictures and practices in contributing to lengthening construction times. The conclusion places the issues of suburban house building in a broader context of the housing industry and suggests there is scope for the development of a housing industry policy. The conclusion also outlines the next steps planned for this research that will further explore this early identification of issues in new housing construction.

1 INTRODUCTION

This paper presents initial research into the residential house building industry. The starting point for the research is the observations that there is an undersupply of new housing. This has led to research on various factors, such as urban land availability, planning and under utilised land that may be constraining supply. However, there has been little examination of the operations of the housing industry itself. Prima facie there is a case for this on the grounds that there has been an increase in the average time taken to build fully detached new housing. Fully detached housing, although a declining proportion of new housing, continues to be the main form of new housing produced by the housing industry.

This is the context for the following principal research question:

How is the work of new suburban house building organised and what practices and constraints may contribute to delays in building completion times?

This chapter introduces the research by first outlining the key issue of the undersupply of housing and the government policy research response. It then introduces the issue of the time taken to build new housing that suggests that there may be important organisational issues that need to be identified and addressed. The research approach and the structure of the paper that follows outline how the research will be undertaken.

1.1 The housing supply issue

The increasingly inadequate supply of Australian housing, especially in capital cities, is now a recognised, nationally significant housing policy issue. The undersupply of residential housing is a problem in itself. However, it also has flow on effects in other parts of the housing system including house price increases, rent increases in the private rental market and limits on the capacity of social housing providers to procure new affordable rental housing.

Evidence that the supply of new housing is inadequate is broadly recognised. The federal government acknowledged the problem through the budget process in 2008 when it stated that 'housing supply has not kept pace with demand' (Australian Government 2008). Two reports published by the National Housing Supply Council (NHSC) have confirmed the problem and sought to estimate its extent based upon demographic modelling (National Housing Supply Council 2009, 2010)¹. In the most recent NHSC (2010, p.64) report stated:

The gap between total underlying demand and total supply is estimated to have increased by approximately 78 000 dwellings in the year to June 2009 to a cumulative shortfall of 178 400 dwellings.

State governments also agree that there is an underlying supply problem. This is evident in the statements and work program of the Council of Australian Governments (COAG). COAG (2009a) has stated:

The housing market faces significant pressures, with population growth and a healthy economy continuing to add to strong housing demand. Housing supply has not responded as strongly as it could have to this demand.

¹ The National Housing Supply Council uses demand estimates calculated by the Australian National University Australian Demographic and Social Research Institute. Their model estimates the probable formation of different household types based on assumptions relating to migration and household transition.

Industry bodies are also monitoring housing supply and have also issued reports. The Housing Industry Association (2010a, p.4) predicts a rise in demand of 1 920 000 dwellings in the next decade, while noting that in the last decade only 1 500 000 dwellings were constructed. It forecasts a housing shortage of 466 000 homes by 2020. The Master Builders Association has also confirmed that it recognises a housing supply issue (Master Builders Australia 2010).

1.2 Policy research response

The undersupply of housing is the context for considerable government support for policy informed research examining features of the Australian system of land and housing supply that might be contributing to the undersupply of housing. Within government the features being examined are signalled in the work program of COAG (2009b) and include:

- Land aggregation, zoning and planning.
- Principles for housing development infrastructure charges.
- Consistency of planning approval and building regulations across jurisdictions.
- Titling and strata titling systems.
- Housing supply and land release targets.
- Strategic planning beyond metropolitan capital.
- Underutilised land holdings.

COAG is also focussing on policy settings within government. Those signalled for examination are:

- The First Home Owners Scheme.
- Commonwealth policies impacting on the housing market.
- The impact of Commonwealth and state energy efficiency regulations and environmental acts on house prices.
- The market impact of supply and demand side affordable housing initiatives, such as inclusionary zoning, dwelling mix and lot sizes.
- Relevant Commonwealth and state taxation settings.

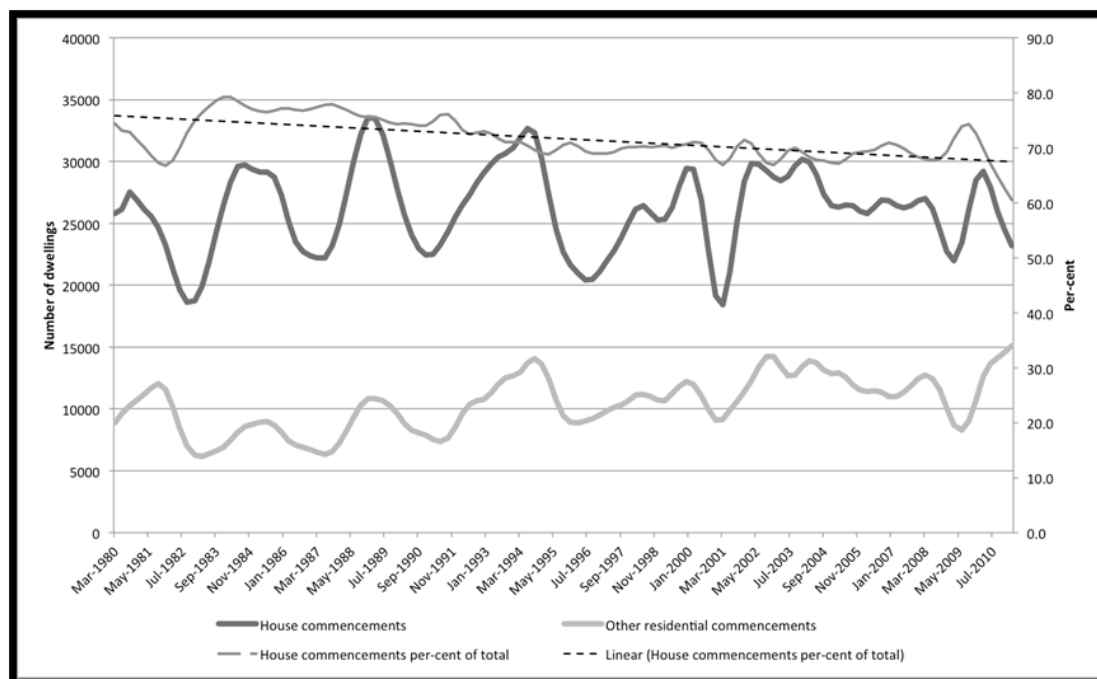
AHURI-supported research has made a considerable contribution to this research agenda, especially in relation to the interface between land use planning and housing supply (Goodman et al. 2009; Gurran et al. 2008).

1.3 A housing industry focus

The premise for this research is that there is a significant gap in this COAG work program. What is missing is a focus on the operations of the housing industry itself. It implies an assumption that the way the housing industry currently builds dwellings, whether they are detached houses, town houses, apartments or flats, does not require examination. This research responds to this gap by focussing on the building of detached houses that continue to be the dominant form for new housing supply. Figure 1 shows that although there has been a decline in the proportion of detached house commencements as a proportion of the commencement of all dwellings and a

concomitant increase in the commencement of other residential dwellings, houses remain the dominant built form for new residential housing.²

Figure 1: House and other residential commencements (quarterly)

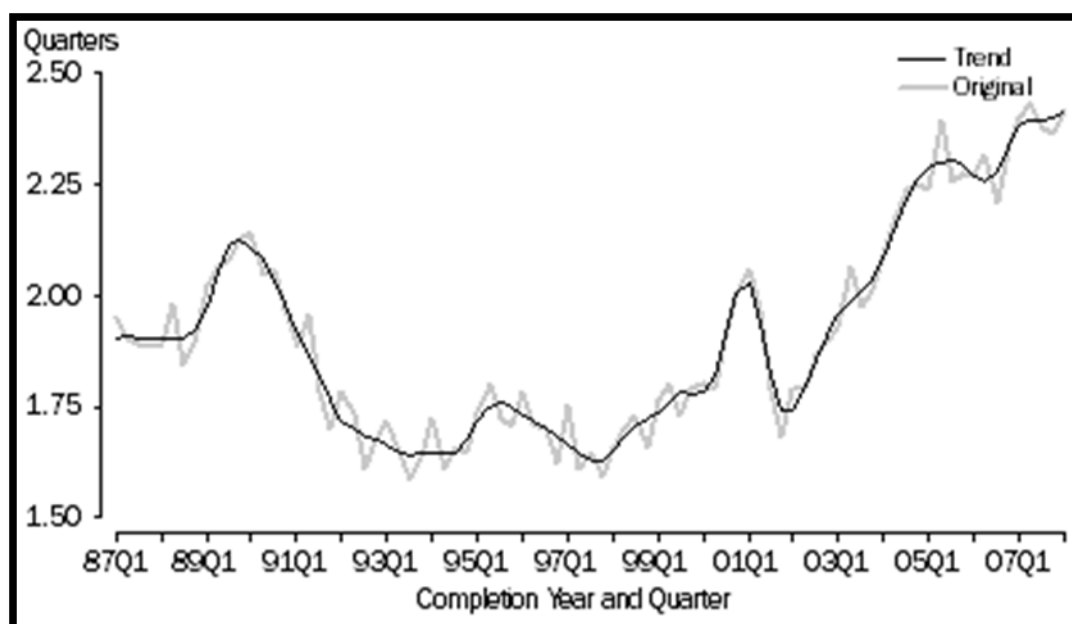


Source: Australian Bureau of Statistics (2011c)

This research into the production of detached housing takes as a starting point the ABS (2008) report *Average quarterly completions times for new houses* that presents data on completion times for the period 1998–2007 for Australia as a whole and each of the states and territories. It measures the time between the commencement and completion quarters for fully detached houses being built from scratch. This completion trend data for the time taken to build fully detached houses for Australia as a whole is presented in Figure 2. In summary, this series indicates that the average construction time for detached housing increased in the late eighties, declined in the early nineties, stayed relatively stable during the mid-nineties and began to increase in the late nineties. During the naughties it continued to increase.

² Industry arrangements used for the development and building of 'other residential dwellings' (town houses, apartments and flats) are very different. This difference makes research into the development and building of 'other dwellings' too large for a single project. This research focuses on detached housing.

Figure 2: Average number of quarters to complete new houses—Australia



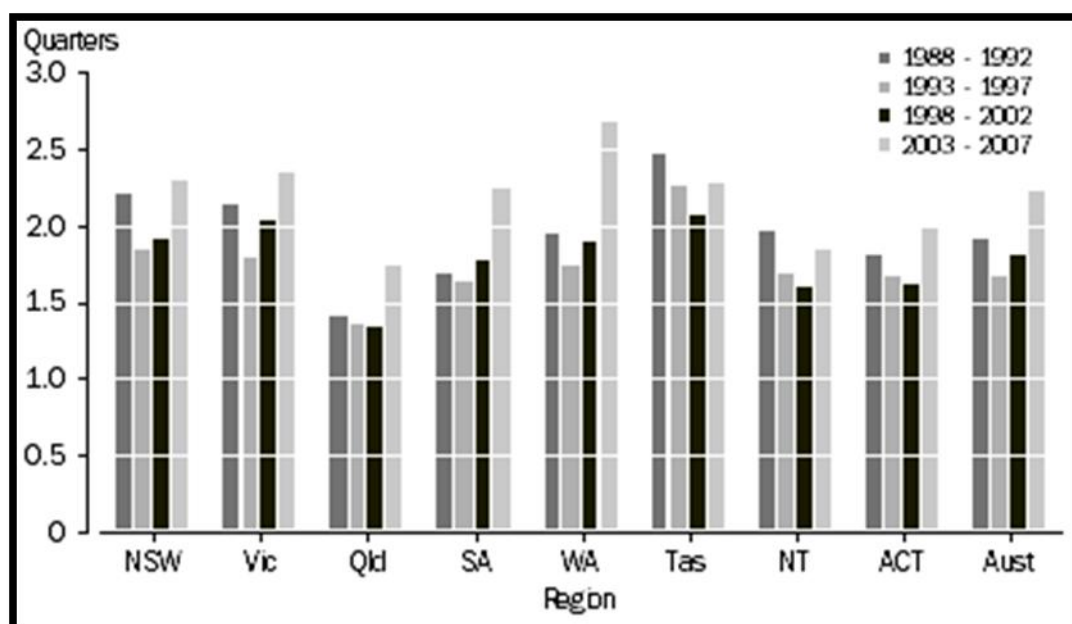
Source: Australian Bureau of Statistics (2008)

When this trend data is displayed at the state and territory level (see Figure 3), it suggests that the way the industry operates over time within the different jurisdictions varies. Further, it suggests that the way the industry changes the way it works across the jurisdictions varies. In other words, completion time trends are not synchronous.

In summary, Figure 3 shows:

- Queensland consistently had the shortest average completion times and Tasmania had the longest average completion times.
- Western Australia has seen the largest increase in average construction times in the latest five-year period.
- Most states are characterised by relatively long completion times in the period 1988–92.
- Most states experienced a fall in completion times in the 1990s and increases in the period 2003–07.
- NSW and Victoria in the latest period experienced longer completion times than prior to the fall.
- Queensland, South Australia and Western Australia show modest falls in average completion times following the period 1988–92 but pronounced rises in 2003–07.

Figure 3: Average number of quarters to complete new houses—states and territories



Source: Australian Bureau of Statistics (2008)

Of course this simple presentation of data provides no inkling as to why there have been changes in completion times; why there is variation in completion times across the states and territories or; why in the most recent period there has been a sustained increase in completion times.

This phenomenon of increasing completion times provides a starting point for this research because *prima facie* increasing completion times is a policy problem. It indicates that there may have been a decline in productivity, where productivity is a measure of how efficiently the housing sector workforce uses resources to produce new dwellings. This suggestion is based on the finding that the housing sector labour force is reasonably self contained because there is little movement into or out the broader construction industry (Australian Bureau of Statistics 1999, 2004). It is a policy problem because it appears that fewer houses are being produced than there otherwise would be if the completion times of earlier years, say in the mid-1990s had been maintained.

1.4 Research questions and research approach

The undersupply of new housing and increases in the time between commencement and completion of new houses provides the context for the following principal research question being used to guide this research.

How is the work of new suburban house building organised and what practices and constraints may contribute to delays in building completion times?

Four secondary research questions have then been developed as a means for guiding the research program that respond to the principal research question.

1. What are the trends in the time taken to build new housing measured through commencements and completions?
2. How do builders typically organise work on new housing projects from commencement to completion through a system of contracts?

3. What are the main issues identified by industry participants managing new house building that may relate to and assist in explaining lengthening construction times?
4. In what ways might house building arrangements and practices be changed so as to reduce building completion times?

The research approach that responds to these questions uses mixed methods including:

- Literature review.
- The analysis of ABS statistical data.
- Semi-structured interviews with builders, supply and install contractors, subcontractor, consulting professionals, regulators and industry association representatives.
- Observation and tracking of processes used by industry participants in selecting new house building case studies.
- Scenario-modelling for simulating industry-wide implications of existing and alternative arrangements using Simul8 software.
- Presentation of preliminary research findings to industry participants and consultation on implications.

A summary of the research approach is presented in Table 1.

Table 1: Research question and summary of research approach

Secondary research questions	Data sources	Methods
What are the trends in the time taken to build new housing measured through commencements and completions?	→ ABS Building activity, Australia (8752.0) esp. Tables 33–39	→ Statistical analysis
How do builders typically organise work on new housing projects from commencement to completion through a system of contracts?	→ Literature review → Builders, managers, supervisors, supply and install contractors, subcontractors, consulting professionals, regulators and industry association representatives	→ Semi-structured interviews of industry participants → Observe and track construction processes on case study sites
What are the main issues identified by industry participants managing new house building that may relate to lengthening construction times?	→ As above	→ Semi-structured interviews of industry participants → Data analysis and presentation of interim research findings and consultation with industry participants
In what ways might house building arrangements and practices be changed so as to reduce building completion times?	→ As above	→ Presentation of interim research findings and consultation with industry participants → Scenario modelling

The paper that follows this introduction has four further chapters.

1. Chapter 2 'Lengthening construction times' extends the analysis of the ABS Building activity data presented above and increases our understanding of the main trends in the time taken to complete the construction of new houses.
2. Chapter 3 'Analysing suburban house building' presents an overview of the way builders organise and undertake new housing construction. It does this by presenting an overview of the system of supply contracting, supply and install contracting and subcontracting typically used by volume builders. Against the background of this overview of arrangements the framework of rewards, risks and safeguards is introduced as a framework that can assist in analysing the complexity of contractual arrangements used in new house building.
3. Chapter 4 'Building houses: issues from the field' presents an initial analysis of interviews with builders, managers, supervisors, supply and install contractors and subcontractors. From these interviews key issues are identified which perhaps begin to help explain why there has been an increase in the time taken to build new residential dwellings.
4. Chapter 5 'Conclusion' briefly discusses the next steps planned for this research that will further explore this early identification of issues in new housing construction.

2 LENGTHENING CONSTRUCTION TIMES

This section examines the data on housing supply and how lengthening construction times may be affecting that supply. Recent work by Gharaie et al. (2010) and Gharaie (2011) has investigated this phenomenon and suggests that an understanding of activity-based and workflow-based planning approaches may go some way to explaining what is happening in the industry. The distinctions between these two approaches will not be discussed further in this Positioning Paper but will inform our subsequent work in modelling the production of housing by the volume builders.

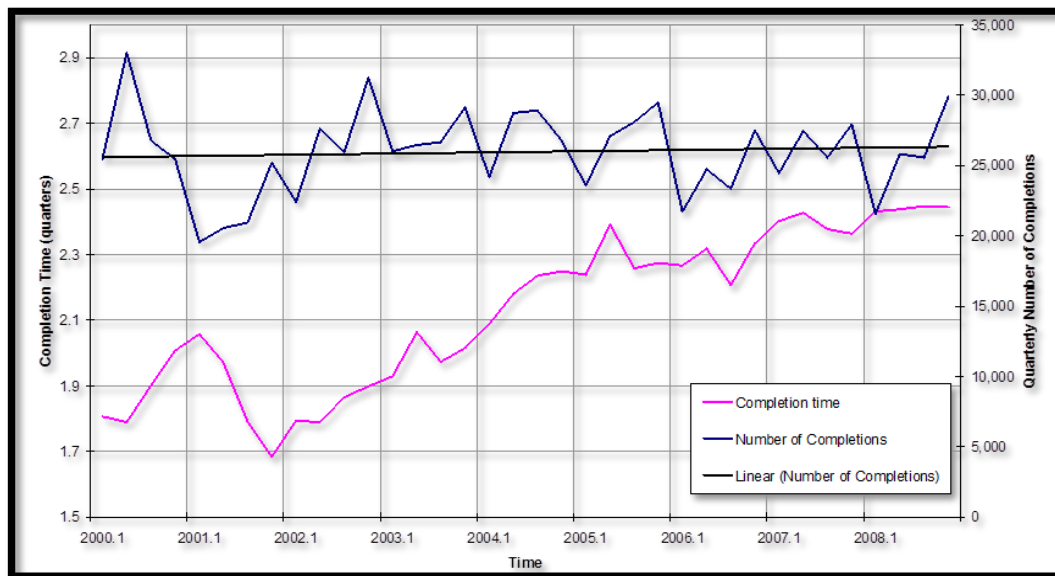
In the first section we describe the Australia-wide increase in construction times of detached dwellings. Here the detached dwelling is defined as one 'which stands alone in its own grounds separated from other dwellings by at least half a meter ... predominantly used for long-term residential purposes and consisting of only one dwelling unit' (Australian Bureau of Statistics 2011a). The average completion time is considered to be the time between the first physical building activity on site and the housing being ready for occupation.

In the second section we consider the view that completion time increases can be attributed to labour shortages in the residential construction. The approach we take is to suggest that although labour availability changes and labour shortages are reported by industry participants, it is important to recognise that the overall trend shows a consistent long-term increase in residential sector labour supply. Although labour supply may be a factor, other factors are also important. This observation leads to the discussion in Chapter 3 about features of residential house building that appear to be linked to the growth in completion times.

2.1 Construction time increases

Data from the ABS are illustrated in Figure 4, which indicates that average Australian house completion time has risen from 1.8 quarters in quarter one 2000 to 2.4 quarters by the beginning of 2008. The number of house completions per quarter has stayed relatively stable during this period at around 27 000 houses per quarter (Gharaie et al. 2010). It is of particular note that during this period of greatly increasing demand the industry has not been able to deliver more houses to market, in fact, completion times have grown.

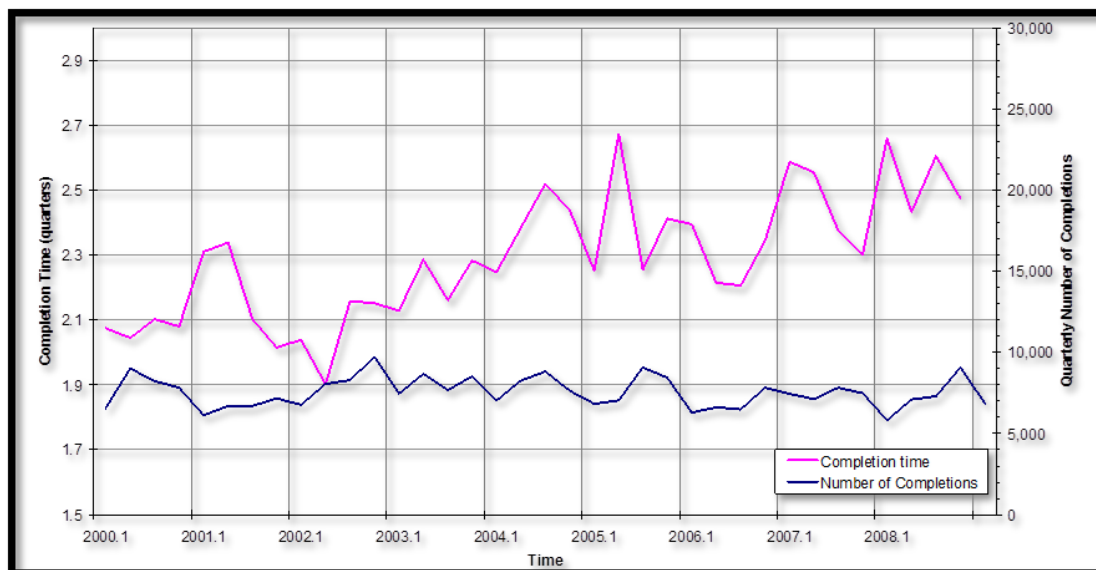
Figure 4: Average house completion times and number, quarterly—Australia



Source: Gharai et al. (2010)

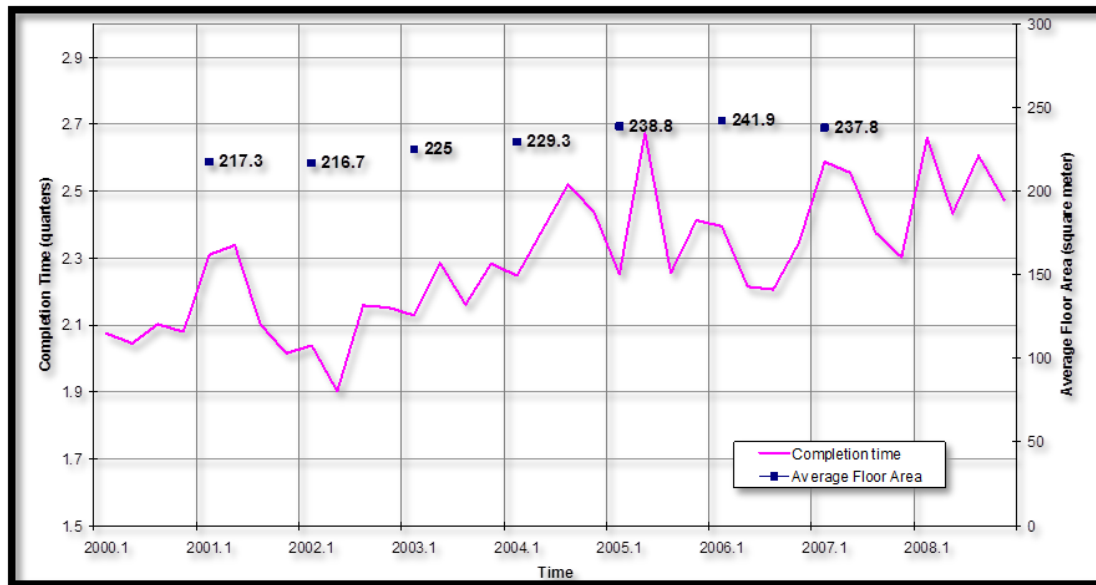
In the case of Victoria, the statistics show a broadly similar trend to the national situation. Figure 5 shows that the average number of house completions per quarter in Victoria has remained relatively stable from 2000 to 2008 at approximately 8000 houses per quarter. The average house completion time in this period has grown from approximately 2 quarters in 2002 to 2.5 quarters in 2008 (Gharai et al. 2010). Figure 6 shows average house completion times and the corresponding average floor area indicating that the completion time increases are probably not due to increasing floor area (Gharai 2011). This phenomenon will be investigated further in this work as issues such as increasing density of residential subdivisions may be a contributing factor to increasing completion times.

Figure 5: Average house completion times and number, quarterly—Victoria



Source: Gharai et al. (2010)

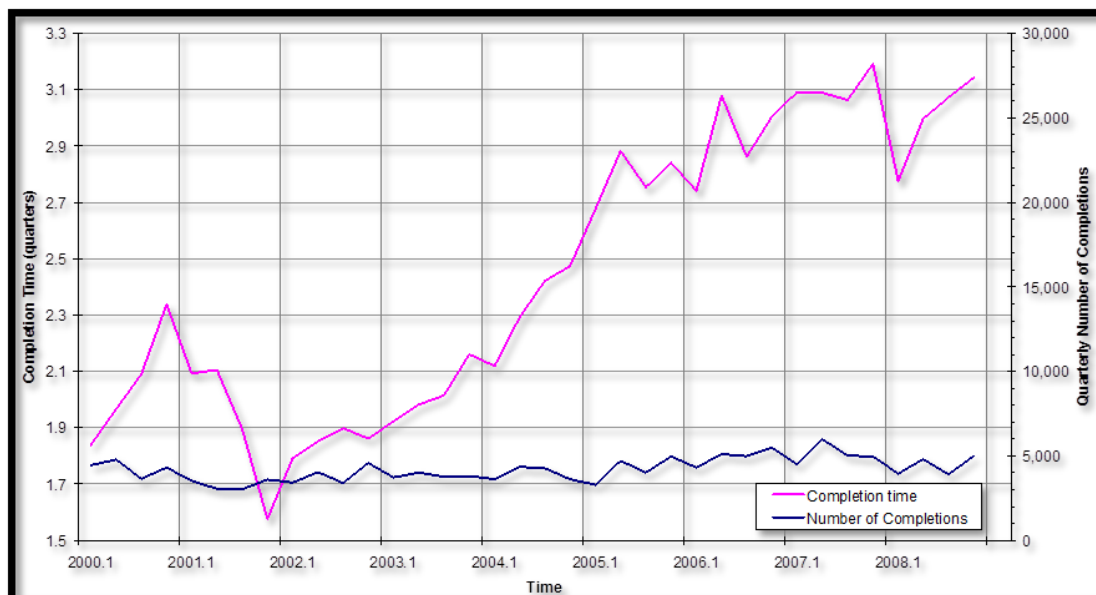
Figure 6: Average house completion times and average floor area—Victoria



Source: Gharai (2011)

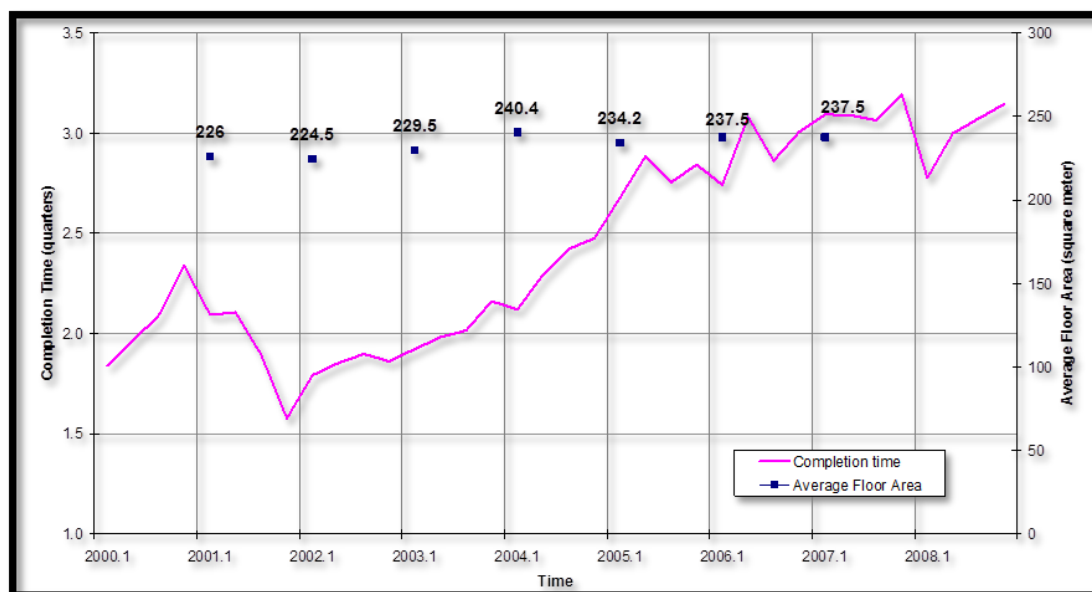
Gharai et al. (2010) also show similar data for other Australian states with Western Australia showing the most dramatic increase in average house completion times from a minimum of 1.6 quarters in 2002 to 3.1 quarters in 2008 while the number of house completions per quarter has remained relatively stable at around 5000 (see Figure 6). New South Wales presents a different picture. In this state, completion times increased similar to other states while the number of houses produced per quarter over the period of 2002–08 has declined markedly. Even though less houses were being produced, the average length of time increased (Gharai et al. 2010).

Figure 7: Average house completion times and number, quarterly—Western Australia



Source: Gharai et al. (2010)

Figure 8: Average house floor area and average house completion time—Western Australia



Source: Gharaie (2011)

The discussion above indicates that over the period of 2000–08 there was an increase in the average time that houses were under construction, while the production rate of houses per quarter over that period has remained relatively stable in all states except New South Wales, where production has declined. Gharaie et al. (2010) investigate whether trends in house size, in relation to floor area, may be responsible for this growth in house completion time and conclude that this is not the case.

2.2 Housing sector labour supply

A possible explanation of the increase in completion times could be labour shortages. In other words, work is delayed because subcontractors are not available to undertake work at the time that supervisors want the work done. This is the nature of the arguments made by the housing industry associations, the HIA (Housing Industry Association 2010b) and the MBA (Master Builders Association 2010). The HIA bases its arguments on data collected from industry participants who report on changes in the availability of labour and presented in the quarterly publication HIA—Austral Bricks Trades Report (HIA Economics Group 2011). It presents online survey data drawn from a sample of HIA trade subcontractor members who are asked to assess the availability of their trade in their region on a scale of 'critical short supply' through to 'massive oversupply'. The results are presented as an index and the most recent report stated:

Trade availability improved in the June 2011 quarter, from -0.07 to +0.10, marking only the second positive quarterly 'read' in the nine-year history of the Trades Report data. (HIA Economics Group 2011)

Often this type of analysis is accompanied by encouragement for government action that will increase the supply of labour. This same edition of the report stated:

That there is a structural shortage of skilled labour for the housing industry is palpably obvious to all but the most blinded of observers. A kick-start to new home building is required in 2011 and a larger pool of potential skilled labour

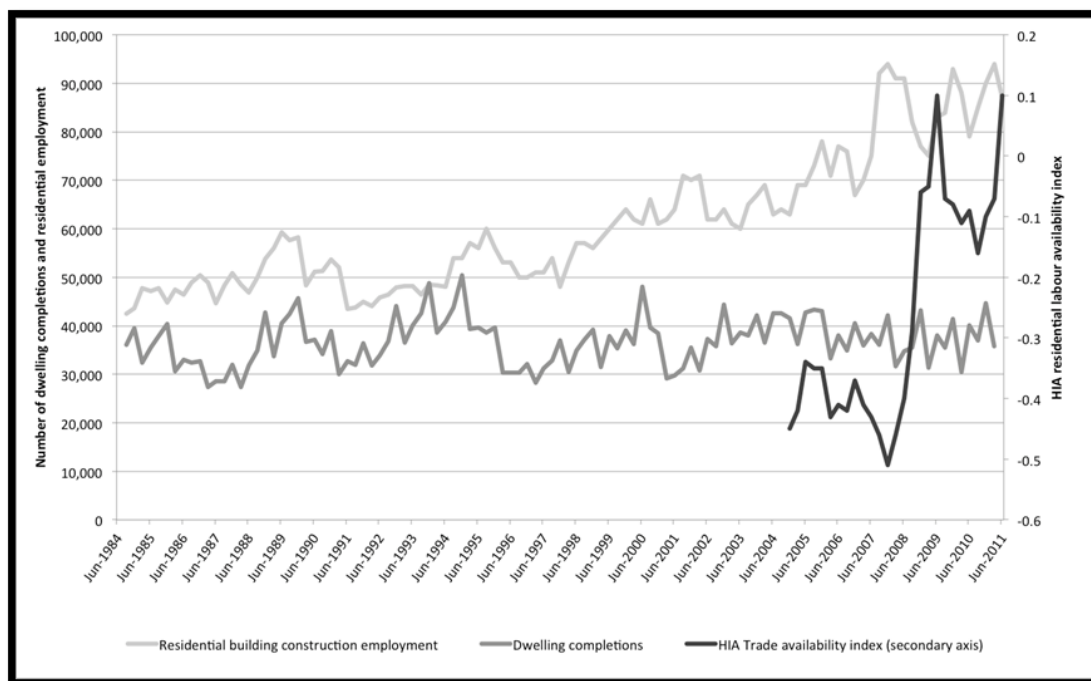
than can currently be tapped into forms a big part of solving the recovery equation. (ibid)

Certainly, regular surveys of industry participants and their experience in finding trades to undertake work are important. However, there is other evidence suggesting that assessing the demand and supply of labour can benefit from analysis of other data series. Such data is presented in Figure 9 showing consistent long-term growth in residential building construction employment of approximately 2.8 per cent per annum from the mid-1980s.

In sum, we therefore have a situation where:

- The residential building labour force is growing.
- The number of completions has remained more or less constant.
- The HIA industry survey consistently reports labour shortages and does not indicate a long-term trend that aligns either with the level of completions or the supply of labour.

Figure 9: Number of dwelling completions, residential building construction employed persons and trade availability index



Sources: a. Residential building construction employment—Australian Bureau of Statistics (2011b)
b. Dwelling completions Australian Bureau of Statistics (2010a)
c. Trade availability HIA Economics Group (2011)

There is a need to further examine the issue of residential building labour supply. However, such examination requires that important structural features of the industry are recognised and inform estimations of shortages. These structural features include:

- Industry output measures, such as completions, starts and value of work all show fluctuations around longer term trends, suggesting that businesses experience fluctuations in workflow resulting in constantly changing labour requirements.
- Residential building construction employment data although indicating long-term growth also indicates considerable fluctuations suggesting that businesses operating in particular areas will experience sharp changes in labour supply.

- The residential building labour force is distributed across both new build and renovation and there is no reliable data on the distribution and movement of labour across the two areas.
- Residential building construction activity and the supply of labour is distributed across space and there are undoubtedly state and regional differences in labour supply and demand.

In conclusion, the trend data presented and the identification of four structural features suggest that increasing completion times cannot be simply ascribed to labour shortages. The residential building industry is a dynamic and complex industry where care has to be taken in explaining phenomena including increasing completion times.

2.3 Conclusion

The ABS data shows very clearly that completion times for new fully detached dwellings have been increasing. Further, in the most recent period this increase in completion times has not been accompanied by increases in floor space. In other words, the increase in completion times cannot be explained by increases in dwelling size. This phenomenon of increased completion times has not been widely recognised and discussed within the industry or in policy discussion.

The second section examined the argument that increasing completion times could be explained by labour shortages. However, labour force data shows that there has been long-term increase in residential building labour supply at the same time as the completion rate of new dwellings has remained reasonably steady. This data is not presented in order to suggest that residential building businesses do not experience labour shortages. Rather it is argued that the housing industry is a dynamic and complex industry and where care has to be taken in explaining the phenomena of increasing completion times.

The next chapter begins the process of examining this phenomenon by examining more closely the nature of contemporary dwellings produced by volume builders. Although increases in the floor area of volume built houses may have ceased, it is important to know what the key features of the modern house are. The physical structure and properties of dwellings is likely to be related to the time taken by the workforce to supply the materials to the site and build the house. It is also important to know what the key features of the organisational arrangements used to build houses.

3 ANALYSING SUBURBAN HOUSE BUILDING

This chapter commences by discussing two key features of the Australian suburban house building system. The first is the form and the nature of the dwelling commodity, sold as a new house in the housing market, produced through the combination of materials and labour. The second is the broader organisational system through which the materials and the labour are brought together to produce new houses. There are many different ways in which commodities can be produced, however, in the case of suburban residential housing the production is undertaken through an extensive sequence of contracts.

The second part of this chapter describes the front-line management system used by volume builders to produce new housing. The base of this front-line system is a supervisor who directly oversees and is responsible for the building of approximately 15 houses each at any one time. Construction managers, who have five or six supervisors in their group within a designated region, in turn supervise the supervisors. Construction managers largely focus on ensuring an adequate supply of subcontractors and on the quality of the output in a highly competitive market.

3.1 The new housing commodity

The nature of construction work associated with the production of new dwellings and other types of buildings has some inherent key features that make it different to work required for the production of other types of commodities. Bresnen et al. (1985, p.109) describes these key features in the following terms.

The product is immobile and produced at the point of consumption; work is highly prone to seasonal fluctuations; demand can be erratic; and the production process continues to rely on the use of traditional skills and crafts. Mechanisation and system building have of course occurred, but the industry remains essentially labour-intensive and the production systems inherently less amenable to routinisation than is the case in other industries.

In the Australian context, these key features manifest themselves in the following ways.

- The site of production of new housing is distributed across Australia's metropolitan cities. The largest share of this new housing is built on vacant land on new housing estates on the fringe of large metropolitan capital and provincial cities (Goodman et al. 2009).
- The level of demand for new housing and the resulting level of commencements and completions fluctuates considerably (Australian Bureau of Statistics 2010b). The level of fluctuation in the Australian housing system of production is comparable to the level of fluctuation in other western countries with similar housing systems (Dalton et al. 2011).
- Housing continues to be produced by skilled tradespersons, such as carpenters, plumbers, electricians, plasterers and painters. A system of on-the-job and formal vocational training supports the supply of qualified tradespersons. Supervisors and construction managers in turn manage this skilled labour.
- Building workers use power tools and mechanical devices in residential building. They also work with components on-site, such as trusses and upper-floor floor joists, which are manufactured in factories. Nevertheless new house building in Australia remains labour intensive (Dalton et al. 2011).

- Government regulation of skilled tradespersons, supervisors and construction managers varies across the jurisdictions. Queensland and NSW have the most developed system of regulation. The COAG agreed in 2008 to develop a national approach to the licensing of economically important trades that will remove inconsistencies across state and territory borders. Work on the project is continuing (Council of Australian Governments 2008).

The type of housing produced in Australian cities takes many forms. However, it is possible to identify four key features of housing commodity production, which help set the scene for this discussion of the contracting arrangements used to build new detached dwellings.

- The average floor area of Australian residential dwellings has been consistently increasing for more than two decades (see Figure 7). In the period of 1984–2009, the average floor area of all new residential dwellings increased from 149.7 square metres to 218.9 square metres, an increase of 46.2 per cent. The category of residential dwellings can be broken down into the detached house and other residential dwellings and both categories exhibit a similar steady increase. New houses increased from 162.4 square metres to 248.0 square metres (52.7%), while new other residential dwellings increased from 99.2 square metres to 140.8 square metres (42.0%). However, during the naughties the rate of increase in the average floor areas has decreased significantly, evident in Figure 7, while there has been steady increase in the average completion time.³
- New residential housing is produced by businesses that range from the very small, producing just a few dwellings each year, to the large ‘volume’ builders (Dalton et al. 2011). In 2008–09, the largest volume builder commenced nearly 3800 dwellings and in this same year the largest 100 builders commenced approximately 37 per cent of all residential dwellings (Housing Industry Association 2009). This 2009 volume builder share is a continuation of a similar share reached by volume builders in the late 1990s after a period of growth in the previous decade (Dowling 2005). However, in the naughties the share produced by the largest 100 builders has levelled off to between 37 and 40 per cent (Dalton et al. 2011).
- Volume builders all have catalogues of house designs. This continues a practice in Australian house building that dates back to the late nineteenth century (Davison 1981). However, the number of models presented in these catalogues is now extensive as indicated in Table 2. In addition, these catalogues offer floor plan options for most models and façade options. Beyond this purchasers can add extra features for their kitchen, ensuites and bathrooms, external living areas and laundries, as well as up-grade standard items such as doors and windows. Illustrate the type of single and two-storey houses offered through volume builder catalogues in Victoria. In sum, there has been increasing differentiation of the house product produced by volume builders.
- Volume builders have two categories of house building, which they use when developing their business strategies. First, there is what is called ‘specs’ or ‘speckies’, which are houses built ‘speculatively’ by the builder from the catalogue and then offered for sale to a purchaser. Some of these ‘specs’ are built in display villages on estates and are used for marketing before being sold when vacant land in the surrounding estate is becoming scarce. A volume builder will typically

³ The average floor area of new houses (m²), for Australia as a whole, constructed in the period 2001–07 is the following.

2001 = 228	2002 = 221	2003 = 229	2004 = 235	2005 = 238	2006 = 243	2007 = 239
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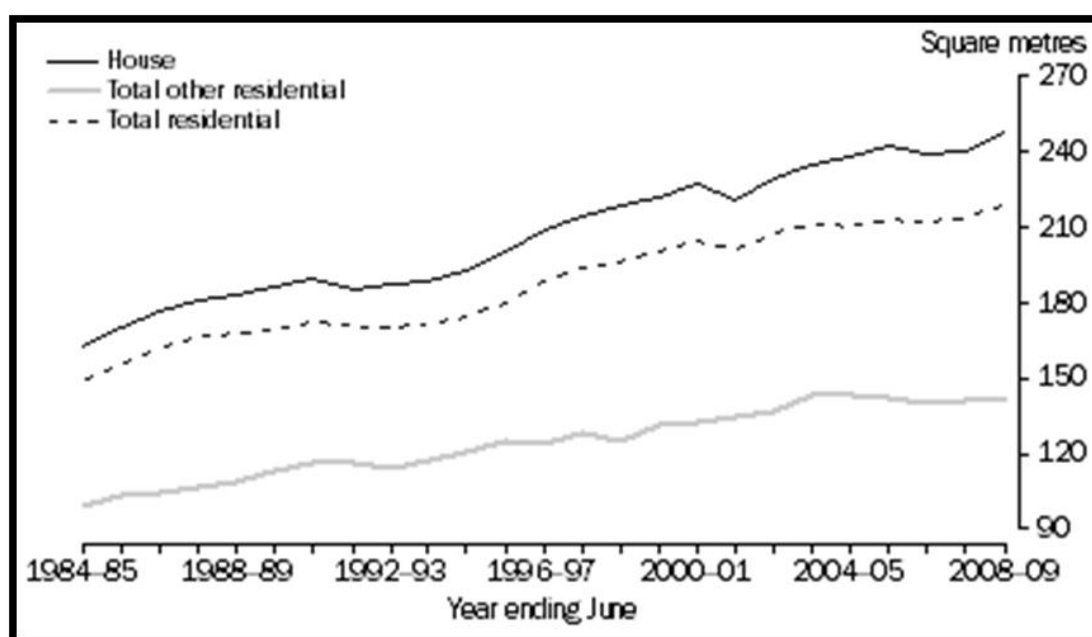
arrange with the land developer to build between two and four houses in a display village. Second, there are ‘customer’ houses built to order from the catalogue for a known purchaser. There is constant adjustment of the mix of ‘specs’ and ‘customer’ houses. Customer houses tend to be the main focus and depending on assessments of the market volume builders will raise and lower the volume of speculatively built housing.

Table 2: Volume builders house models and options

	<i>Metricon Victoria</i>	<i>Henley Victoria</i>	<i>Porter Davis Homes</i>	<i>Dennis Family Homes</i>
HIA top 100 2009–10	3 rd	5 th	7 th	8 th
Number of models	69	41	52	27
Floor plan options	Between 1–4	Between 1–4	Between 1–5	Between 1–4
Façade options	Between 2–9	Between 2–7	Between 1–13	Between 1–6

Source: Volume builder catalogues on the <http://www.henley.com.au/>; <http://www.metricon.com.au/>; <http://www.porterdavis.com.au/>; <http://www.dennisfamily.com.au/>.

Figure 10: Average floor area of residential housing—Australia



Source: Australian Bureau of Statistics (2010c)

Figure 11: Henley Lexington



Figure 12: Stocklands Monterey



Figure 13: Henley Majestic



Figure 14: Stocklands Highland



Figure 15: Burbank Durham



Figure 16: Metricon Belize



Figure 17: Burbank Freeman



Figure 18: Metricon Alto



3.2 The contract system

The volume house builders have developed an explicit and carefully documented contract system based on an extensive breakdown of the component parts of the typical house. These components have then been further analysed and disaggregated so as to distinguish between the materials themselves and the labour required to work with these materials. Based on this analysis, three forms of contracts form the basis for the contract system, as follows:

- 'Supplier contracts' are contracts between the building company and a building material supply company for the supply of building components or materials only. Subsequently, the building company will form another contract with 'subcontractor' who will use these materials or 'fix' the components in the construction of the dwelling.
- 'Supply and install contracts' are contracts between the building company and another company for the supply of materials and components and their use, installation or fixing on the house building site.
- 'Subcontracts' are contracts between the building company and a 'subcontractor', who is usually a tradesperson, who is engaged directly to carry out specified work

using materials supplied by the building company. These materials are typically materials that have been delivered to the site through a 'supplier contract'.

In recent years, this three-part contract system has been built into proprietary software packages. For example, there is 'ClickHome', which also has a capacity to issue, tack and acquit orders. This is the basis for the software company claiming that it supports 'a faster, more accurate and streamlined flow of information between clients, builders, suppliers and trades' (Imagemation Pty Ltd 2011). This company now has as clients a spread of volume builders in a number of states who have made ClickHome a central element of their IT support system. These companies include Clarendon Homes, BGC, Scott Park Homes, Burbank, Signature Homes, Glennmill Homes, Don Russell Homes and Hickinbotham. Another similar system is 'Framework' used by builders such as Porter Davis, Henley Homes, AV Jennings, Simmonds and Adenbrook Homes (Insula Software 2011).

A full listing of the three different types of contracts used by one volume builder is presented in Tables 3–8. They have been prepared by aligning the contracts to key steps, or main construction elements, of the typical suburban house. These elements are the preparation of the site; the main building envelope; dwelling service systems; fixtures and fittings; external living and landscaping; and finishes and furnishings. In addition there is a set of construction support services that are supplied to each building site which are presented in Table 9.

Table 3: Building site preparation

<i>Item</i>	<i>Supply for fixing by subcontractor</i>	<i>Subcontractor engaged by builder</i>	<i>Supply and install</i>
Surveyor			✓
Earth works			✓
Silt fencing			✓
Retaining walls			✓
Drainage			✓
Termite and pest control			✓
Mud control			✓

Table 4: Building envelope

<i>Item</i>	<i>Supply for fixing by subcontractor</i>	<i>Subcontractor engaged by builder</i>	<i>Supply and install</i>
Slab heating	✓		
Slab concrete	✓		
Slab reinforcement	✓		
Slab setting out and laying		✓	
Prefabricated walls	✓		
Frame timber	✓		
Frame hardware	✓		
Structural steel			✓
Prefabricated upper floor joists	✓		
Floor sheets for upper floor	✓		
Prefabricated roof trusses	✓		
Windows	✓		
Frame carpenter		✓	
Fascia, gutter and downpipes			✓
Roof tiles			✓
Skylights and roof lights			✓
Wall wrap sisalation			✓
Brickwork sand	✓		
Brickwork hardware	✓		
Bricks	✓		
Lintel steel	✓		
Bricklayer		✓	
Brick cleaner		✓	
External cladding	✓		
External cladding fixer		✓	
Glass blocks			✓
Lock up materials—doors and locks	✓		
Lock up carpenter		✓	
Eaves materials	✓		
Eaves carpenter		✓	
Mouldings	✓		
Wall renderer		✓	
External caulking			✓
Internal caulking			✓
Insulation—wall batts			✓

Insulation ceiling			✓
Plaster supply	✓		
Plaster fixing		✓	

Table 5: Dwelling service systems

<i>Item</i>	<i>Supply for fixing by subcontractor</i>	<i>Subcontractor engaged by builder</i>	<i>Supply and install</i>
Plumbing – water and gas			✓
Underground power			✓
Telephone run-in			✓
Solar energy			✓
Electrical			✓
Smart wiring for IT services			✓
Ducted heating and air conditioning			✓
Electric heat panels	✓		
Intercom			✓
Security system			✓
Vacuum cleaning system			✓

Table 6: Dwelling fixtures and fittings

<i>Item</i>	<i>Supply for fixing by subcontractor</i>	<i>Subcontractor engaged by builder</i>	<i>Supply and install</i>
Bath tub, spa bath, shower bases	✓		
Staircase			✓
Kitchen cabinets			✓
Vanity cabinets	✓		
Granite bench tops			✓
Vanity basins and kitchen sink			✓
Attic ladder			✓
Fixing materials	✓		
Fixing carpenter		✓	
Laundry trough	✓		
Balustrade			✓
Balcony and bathroom waterproofing			✓
Tiles—wall and floor	✓		
Feature stone	✓		
Tiler		✓	
Sanitary ware and tap ware	✓		
Light fittings	✓		
Shower screens, mirrors, robe doors			✓
Splashbacks to wet areas			✓
Fly screens and security doors			✓
Home entertainment			✓
Electrical appliances	✓		
Gas appliances	✓		
Hot water	✓		
Water tanks	✓		
Antenna			✓
Fit-off—Door furniture, seals, bathroom accessories	✓		
Fixing carpenter		✓	

Table 7: Finishing and furnishings

<i>Item</i>	<i>Supply for fixing by subcontractor</i>	<i>Subcontractor engaged by builder</i>	<i>Supply and install</i>
Painter		✓	
Carpets			✓
Other floor coverings			✓
Floor sanding		✓	
Curtains and interior finishes			✓

Table 8: External living and landscaping

<i>Item</i>	<i>Supply for fixing by subcontractor</i>	<i>Subcontractor engaged by builder</i>	<i>Supply and install</i>
Carport, pergola and deck materials	✓		
Carport, pergola and deck – carpenter		✓	
Garage door			✓
Landscaping			✓
Paving		✓	
Letterbox			✓
Clothes hoist			✓
Shade sails			✓

Table 9: Building site services

<i>Item</i>	<i>Supply for fixing by subcontractor</i>	<i>Subcontractor engaged by builder</i>	<i>Supply and install</i>
Equipment hire			✓
Temporary fencing			✓
Crane hire			✓
Site cage and toilet hire			✓
Building waste bin hire			✓
Scaffold			✓
Guard rail for roof work			✓
Void protection			✓
Site cleaning			✓
Safety eye			✓
Site cleaner			✓
Site labourer		✓	

A number of key observations can be made about the resulting contract matrix that is used to build the typical suburban house.

- In the tables above 108 contracts are listed, most of which will be used in all dwellings. There are a few that depend on site conditions such as retaining walls, silt fencing and mud controls. Others may not be used, such upper floor joists and floor sheeting in single storey houses, and glass blocks if they have not been included in the design. Overall, the average house is built through a large number of contracts that have to be managed.
- Three types of subcontractors are responsible for the construction of the building envelope. The first is the concreter who sets out the slab and installs the heating, reinforcement and pours and lays the slab. However, even at this stage there is an interaction with the plumber who installs water and waste pipes alongside the reinforcement and heating system before the concreted is poured. The second is the frame carpenter who erects the wall frame, the roof frame, the upper floor, if a two-storey house, and fits the windows. Again there will be a key interaction with a structural steel supplier if it is being incorporated in the frame. The bricklayer is the third subcontractor in this sequence who has limited interaction with others, except where heavy steel lintels have to be lifted into place with crane hire support. All three of these subcontractors are of course dependant on the timely fulfilling of related supply contracts and supply and install contracts.
- The next stage is the supply and installation of service systems, including electrical power, gas and water reticulation, IT and telecom, security, vacuum cleaning, cooling and heating and intercom. They are then followed by a set of subcontractors who install external wall cladding on walls not being bricked, line eaves, install doors and locks, render external walls and fix plaster.
- Carpenters are a trade group in housing construction, where there has been considerable change in their work in recent decades. As it can be seen from the tables above, there are frame carpenters, lock up carpenters, eaves carpenters and fixing carpenters. Typically, the subcontractors that work across these four different types of carpentry work will be different people. This is the outcome of greater task specialisation or increasing division of labour. In the past one carpenter would have undertaken all four types of work.
- It is apparent from the list of contracts that many components used in the construction of the contemporary house are fabricated off-site and are brought on to the site and installed. These include roof trusses, upper floor joists, windows, doors, staircases, cupboards and cabinets. In the past these components were fabricated by carpenters and joiners but over many years this work has been moved off-site into factories, new materials introduced and the work reorganised.
- Behind the design on this system of contracts house building companies have developed systems for very careful product and materials specification. There are three factors that have driven this process of product and materials specification. First, building companies monitor the performance of materials. As consumer guarantees have been extended through government consumer protection builders have become more aware of the need for materials and products to perform over time. Second, the volume of work coupled to a subcontract system has led to a conservative approach to the up-take of innovative products and materials. Because of guarantee requirements and the difficulty implementing the use of new products and materials through the subcontract system companies slow to change. Third, the volume system has led to the formation of medium term contracts with the suppliers of products and materials with single suppliers. This is evident in the way that builders negotiate annual rebates with suppliers that are related to volumes used. Products included in this rebate system are plaster, and plumbing materials and fixtures.

- In the building site services set of contracts, there is a subset of services that are linked to the occupational and health and safety requirements of residential building sites. They are temporary fencing, use of cranes for heavy lifting, scaffolding, guardrails, void protection and safety eye. The increased and systematic use of these services is relatively recent and relates to greater recognition of occupational health and safety (OH&S) issues on residential building sites and accompanying legislation and regulation. OH&S requirements for some trades also have implications for other trades whose members might be expected to work in close proximity to each other. OH&S provisions might require the sequencing of different trade work rather than it being done at the same time. This may have possible implications for completion times.

3.3 The management system

A counterpart to the extensive system of contracting described in the previous section is a system of management and administration. As the house building companies have grown, these organisations have reviewed and reorganised the division of labour. In Australia, AV Jennings was the first company to systematically do this as it became the first volume builder in the post-WWII period. As its level of house production grew, based on a catalogue of standard houses, it paid close attention to developing a management system with clear roles and accountabilities. In the early 1960s, this quest led to a middle level manager spending time at the General Motors Holden plant in Melbourne observing production and quality control techniques in the automotive industry and subsequently working out ways to apply what he had learnt to the production of new suburban housing (Garden 1992, p.161). This process over time has led to volume builders more generally establishing a corporate structure through which planning and general and financial administration has been drawn away from the front line and become the responsibility of senior and middle level managers supported by corporate service groups of sales, marketing, ordering, design, occupational health and safety and research and development.

Two types of managers work at the production front line with responsibility for the timely and high quality production of dwellings—supervisors and construction managers.

3.3.1 Supervisors

Supervisors of detached housing construction will usually be responsible for the construction of up to 15 houses at any one time. These houses will generally be in limited geographical area so that they can move around and inspect work at a number of houses each day and initiate contracts or otherwise deal with contingencies. Their work starts when they are given a set of plans for the construction of a new house. The first step, if it is a 'customer house' is to contact the client who is buying the house and talk about how they will be kept informed about building progress and the way they can monitor progress. Typically, clients are given access to digital photos uploaded by the supervisor onto a web site.

The supervisor is then responsible for organising the building process leading to a completed house. A list of responsibilities typically used by volume builders is the following:

- Deliver building construction projects within the agreed budget, client specification, quality and timeline.
- Complete call forward documents for each job prior to site start.
- Raise building variations in conjunction with the construction manager and client.

- Manage and effectively assign construction projects to completion.
- Coordinate the order and delivery of construction materials to the building.
- Coordinate the attendance of required trades persons, subcontractors etc. to the building site.
- Liaise with internal and external stakeholders to resolve issues or conflict should it arise.
- Ensure that all workers on site comply with legislative requirements and follow company specifications.
- Contribute to a safe working environment by ensuring the OH&S policy is adhered to at all times.

The process used by the supervisor to complete 'call forward' documents is different for each of the three different types of contracts, supply contracts, supply and install contracts and subcontracts.

Supervisors arrange subcontracts directly with tradespeople. Typically, supervisors will have a well-established network of tradespeople that they use as subcontractors. They are constantly in touch with these tradespeople allocating them new jobs by issuing 'call forward' orders and keeping them informed about upcoming work. Supervisors constantly seek to maintain a network of subcontractors who they draw on to work on sites. Based on past experience, they try to ensure that this network only includes tradespeople who they can rely on to complete work on time and meet quality standards. Most supervisors will have previously been tradesperson, most likely a carpenter.

Supply and supply and install contracts are 'called forward' by the supervisor but are routed through head office. In other words, there is no direct contact between supervisors and supply and supply and install contractors. For example, a supply order for concrete that will go into a floor slab will be 'called forward' by the supervisor using the Framework or ClickHome software. However, the supply order will become a part of a stream of concrete call forwards going through the head office to a concrete supply company. However, the supervisor will have directly engaged the concreter as a subcontractor who will lay out the slab and be ready at the appointed time with a gang to pour the concrete and complete the slab.

Following the issuing of call forwards the supervisor follows up to ensure that the work is done and that it meets quality standards. These standards are of two types. First, construction work has to meet the requirements of the building regulations and associated Australian standards (Victorian Building Commission 2007). At key stages in the building process a registered building surveyor will check off adherence to building regulations and standards. If the building survey finds faults, then improvement notices will be issued. Second, the supervisors are responsible for ensuring that work meets the quality standards that the volume builders set themselves. These standards relate primarily to the ultimate presentation of the house to the purchaser and market reputation for high quality work.

3.3.2 *Construction managers*

Construction managers will usually be responsible for working with and supervising five or six front-line supervisors. Through the supervisors, they will be responsible for the building of approximately 75 to 90 houses at any one time. Typically, construction managers will have been supervisors and carpenter subcontractors in the past and will know the job role of supervisors and the subcontracting system intimately.

The work of construction managers is largely focused in the following three areas.

1. Construction managers recruit, monitor and regulate the work flowing through to supervisors. They do this by allocating houses to supervisors within defined areas against the background of an assessment of the total amount of construction work to be done within the region they are responsible for.
2. Construction managers work with supervisors to ensure that they have sufficient supply of subcontractors available to them. They do this by working across their supervisor group to move available subcontractors from one supervisor to another. It also requires them working with supervisors to recruit new subcontractors while ensuring that they have the necessary insurances, registrations and qualifications. Construction managers in effect become managers of a 'pool' of subcontractors.
3. Construction managers are closely involved with quality control. At various stages in the construction of a house the construction manager and the supervisor jointly inspect the completed work. This can lead to a subcontractor being required to make good before they are given their final payment. When the house is finished the supervisor and the construction manager are involved in a final inspection prior to the hand-over of the house to the client. The company quality manager who inspects and scores all features of the house using a calibrated quality scale leads this final inspection.

3.4 Conclusion

This chapter has presented an account of the way modern volume built houses are built; key built form characteristics; the contract system used to undertake the construction of houses; and construction management.

- The standout characteristics of the way modern houses are built is that they are built on vacant land on the fringe of metropolitan cities; the production of houses fluctuates considerably; they are produced by skilled trade labour; there has been some change in the way houses are built associated with prefabrication and greater use of power tools and machinery; and there is a move towards increased regulation of the workforce that will remove inconsistencies across jurisdictions and specify skill levels.
- The key built form characteristics of contemporary volume built houses are that the average floor area of housing increased during the 1980s and 1990s, but has remained steady during the naughties; the share of new housing produced by the larger volume builders has remained constant during the naughties after an earlier increase in their share; house designs and optional extras are presented to purchasers in catalogues; and builders build to orders from purchasers and also build other houses 'speculatively', which they offer for sale.
- The contract system is organised around three main forms of contracts: supplier contracts, supply and install contracts and subcontracts. These three forms of contracts are used to supply materials and incorporate these materials into dwellings using an extensive documented breakdown of the component parts of the typical house and the services required to build them. The headings that are developed for categorising and describing the key steps are building site preparation; the building envelope; dwelling service systems; fixtures and fittings; finishing and furnishings; external living and landscape; and building site services.
- Behind the contract system volume builders have developed a set of management processes. The management front line is comprised of supervisors who organise establish the many contracts resulting in finished houses. They are in turn led by construction managers who monitor work flows, coordinate subcontract labour across groups of supervisors and monitor for quality.

This is the system that typically used by volume builders. In the next chapter, the focus is on why the time taken to build houses using this system has increased.

4 BUILDING HOUSES: ISSUES FROM THE FIELD

Chapter 3 provided a broad overview of the nature of housing industry outputs, the types of contracts used to build houses and the way in which the companies manage the house building process. In this chapter we examine this system further in the light of the central problem facing the new residential housing industry—lengthening construction times. This lengthening construction time, suggests *prima facie*, that there are problems within this system that cause delays resulting in extended construction times evident in the ABS data and discussed in Chapter 2.

In this chapter we seek to identify a set of issues that come from a preliminary interviews with industry participants. These participants are drawn from different areas of work in the housing industry, including senior management, construction management, construction supervision, supply and install contracting, building surveying and trade subcontracting. This identification and discussion of issues is undertaken against the background of a brief exposition of the idea of ‘contracting as a mode of organisation’ referred to in the principal research question.

4.1 The temporary organisations of house building

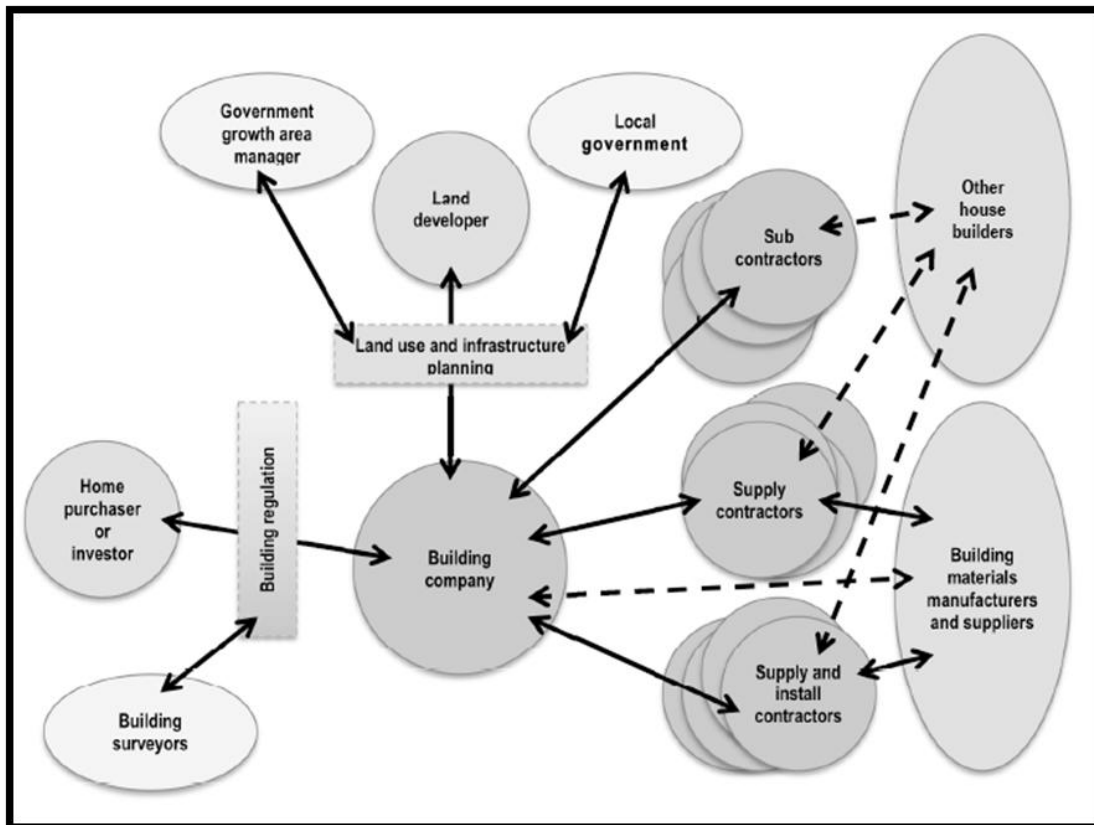
A starting point for analysing the nature of contracts in the residential building industry is that each project, in this case each detached suburban house, is delivered through a temporary organisation. Cherns and Bryan (1984) describe the temporary organisation in the following way:

... as an engagement of parts of several separate and diverse organisations—client, consultants, contractors etc.—for the limited and finite purpose of bringing a building into being from inception to completion. The business of managing the whole process is the function of a special kind of organization that is set up for this purpose. It may be called a ‘project team’: it is, in fact, a multi-organisation since its membership is drawn from representatives of many different organisations; these representatives will eventually disperse, going back to their own organizations or on to some new project, when the building is complete, so it is only a *temporary* multi-organisation.

Of course in the Australian residential housing industry, many of the ‘organisations’ that become members of a multi-organisation consist of sole traders or partners. In the construction industry as a whole, the Australian Industry Group and Australian Constructors Association (2008) reported that approximately 60 per cent of enterprises were sole traders and 30 per-cent employed between one and four people. In this context, these ‘organisations’ might include: a frame carpenter who employs three apprentices; a bricklayer who employs one labourer and an apprentice; a plasterer who subcontracts to the builder with a gang of three, two of whom are ‘on wages’ with another engaged as a subcontractor; and a supply and install plumbing company that employs 30 plumbers and apprentices supported by three clerical and accounts administrators.

Further, each of these ‘organisations’ may be participants in other multi-organisations. In other words, they can be involved in other building projects being run by other builders. For example, the plumbing company is likely to be supplying and installing plumbing materials and fixing them into new houses being built by other volume building companies. Figure 17 illustrates the key relationships that builders enter into as they form multiple ‘multi-organisations’ that build suburban houses.

Figure 19: House builders' organisational context



What is the nature of the contractual relations that are developed in this context, in particular the relations between the builder and supply contractors, supply and install contractors and subcontractors?

It is possible, following Turner (2004) to envisage two distinct types of contractual relations developing around building projects: 'lowest price contract' and 'co-operative relations contract'. Similarly, Sacchetti and Sugden (2003) argue, subcontracting relations can be understood as networks and that analysis can be assisted by recognising two forms of relations within these networks. One form is 'networks of direction' where the core firm decides and coordinates work through command and control arrangements. The other is 'networks of mutual dependence' where there is some mutual framing of decisions, sharing of responsibilities and development of trust relations. Grabher (1993) uses terms such as reciprocity, interdependence and loose coupling to describe mutual dependence type relationships.

When this dichotomy is used to envisage possible contractual arrangements in the housing industry, the following description of polar positions is possible.

On one hand, it is possible to form contracts where the builder seeks to achieve the lowest price so as to remain competitive in the market place and make a profit. Contractual arrangements are characterised by a practice and culture of winning and losing. On the other hand, it is possible to form contracts where the builders seek to establish cooperative relationships based on a mutual recognition of objectives. Competitiveness and profit remain important objectives, but they are intertwined with a sense of mutual endeavour and/or mutual interests that the builder and contractors bring to their work in the house building multi-organisation.

Each of these two forms of contract have quite different assumptions underpinning the formation of contracts (Turner 2004, Sacchetti & Sugden 2003). They can be

translated into the context of suburban house building in the following way. The first type, the 'lowest price contract', would assume:

- The contract price rewards the contractor to share the builder's objectives and perform according to the contract performance specifications.
- It is possible to identify and foresee risks based on what is already known about house building based on years of experience and recognise these risks in contracts.
- The safeguards in the contract, provided by the builder, shield the contractor from the identified or foreseen risks.

The second type of contract, the 'cooperative relations' contract, takes a less mechanistic approach. It is based upon the premise that social and economic relations, in this case the social and economic relations of house building, are complex and there will always be uncertainty, despite the experience and historical knowledge of the managers, supervisors, suppliers and subcontractors. In this context, contracts should be formed in a way that supports some flexibility in their fulfilment. These contracts would assume:

- The level of incentive provided by the builder can be increased in order to elicit better and more sustained performance from the contractor.
- During the course of the building project, it will be necessary to make adjustments to the contract and these adjustments are best made collaboratively.
- Contracts do require monitoring and administration, however, the extent of monitoring and administration can vary depending on the circumstances.
- Irreconcilable differences between builders and contractors are possible, however, resorting to arbitration will result in both parties losing.

To date there exists no detailed analysis of the many contracts used. However, it is clear based on the preliminary interviews already undertaken that contracts between builders and contractors vary and can be located at different points along this continuum. However, it is also evident from these interviews that the contracts tend to be 'co-operative relations contracts' established and administered in ways that create and sustain 'networks of mutual dependence'. In the later stages of this project, the form and nature of contracts will be further examined both through examination of contract documents, many of which are simple countersigned orders, and further interviews.

4.2 Why are construction times increasing?

In addressing the 'why' questions raised above, which have not been addressed in previous research, it is clear that in the industry, with which we are concerned there exists complex relations typified by a myriad of interconnecting and necessarily temporary multi-organisational relationships around particular house building events. In particular, in this section we are responding to the following secondary research question:

- What are the main issues identified by industry participants managing new house building that may relate to and assist in explaining lengthening construction times?

It is important to note that this analysis is tentative at this stage. It is drawn from an initial nine interviews with industry participants, builders, managers, supervisors, supply and install contractors and subcontractors, who were interviewed using a semi-structured interview method. The semi-structured interview questions that formed the basis for each interview are included as Appendix 1 in this report.

At this stage in the research, we have compiled a listing of the possible factors. There is no attempt to rank or attribute the level of influence of these factors to the increase in construction time that has become evident in ABS data. Instead it is proposed to follow the research method set out in the original proposal and to present our initial research findings to the industry participants in a discussion paper and seek responses. The following is a discussion of three factors that might help to explain lengthening construction times.

4.2.1 The housing commodity itself

In recent decades, three changes in the design of new detached housing can be observed that may be related to the increase in average construction times. These changes are:

1. Increased average size of houses.
2. Increased complexity of house design.
3. Increased number of house models in volume builder catalogues available for ordering by customers.

Each change is described and the possible contribution the change might make to increased completion times considered. It is stressed that no estimates can be made about the relative contribution of these factors to increased completion times.

One possible reason for increase in construction times could be the increase in house size. Data on the increase in house size was presented in Section 3.1, which showed long-term increase in house size measured by floor area, from the mid-1980s to the end of the naughties. Prima facie it could be expected that increases in floor area will contribute to construction times. However, it should be noted that in the follow up more detailed discussion on construction times in Chapter 2, it was observed that the increase in floor area during the second half of the naughties decade had levelled off. It was also shown that despite this levelling off in floor area that construction times had continued to increase.

During the course of the interviews for this project, two aspects of new housing were identified as having resulted in a more complex building form: an increase in the proportion of two-storey houses and more complex street-facing facades. The impact of both these developments was to increase the number of contracts required to build a house and increase the number of interactions with subcontractors and supply and install contractors associated with setting up and supervising these contracts. However, it was also suggested that the change in floor design and construction associated with the shift from frame floor construction to concrete floors from the 1980s had resulted in a decrease in construction time.

In relation to two-storey construction, it is evident from an examination of volume builder catalogues that the proportion of two-storey new houses has increased. In part this appears to be a consequence of reducing land lot sizes. As average lot sizes have decreased and the size of houses has increased, the trend has been to build more two-storey houses. These two-storey houses include staircases, first storey floors, external cladding that is different to ground floor cladding, increased use of machinery to lift and construct the upper floor and increased occupational health and safety requirements such as void protection.

Volume builder catalogues also show that the street-facing facades of houses have become more complex. This increase in complexity is illustrated in Figure 17, where a photograph of a 1960s double-fronted cream brick veneer house sits alongside a current house being offered in a volume builder's catalogue.

Figure 20: 1960s cream brick veneer and current house design



A bricklayer who has been working in the housing industry for more than three decades made the following observation about the complexity of current house design based on his long experience:

You have that many ins and outs on a house, all the different facades, there's half-rendered half brickwork. There's so many different facades that jobs are just a lot more complicated than they were. They're almost got towards an architect design house in a first home-buyers home as far as detail goes. So that's one thing I reckon that's slowed it down a lot.

A supervisor pointed out how some of the design features had flow on effects in the way in which subcontractors had to be scheduled:

You've got a lot of, like the front façade with the box gutters before you can keep plastering, or else you'll flood the house out. Whereas before you could more or less plaster the house before the bricklayer even started, because it was water tight, because we didn't have these box gutters, but it was just normal roofs, and you could plaster, and the bricklayer could work around when the plasterers are plastering.

On the other hand, there was a suggestion that the shift in floor construction from a framed timber floor to concreted slab floors had reduced the time taken to build this part of the average house. As one long-term participant in the industry noted:

Everything's on, on slabs now. We used to build most of the houses on stumps. So it's footings ... base brickwork, stumps, floor joists, and then flooring, and away we went ... So it was a lot harder to get out of the ground than what it is now ... it's the slab thing, they can do it in three or four days.

Therefore, it seems as if house design is a factor in lengthening the construction time of new housing. However, the change in floor construction may have resulted in a reduction of time. In the absence of a thorough comparison, it is simply not possible to be conclusive about the contribution that changes in house design and construction have made to the time taken to build.

The third factor in the design of new houses that could be increasing completion times is the increased number of house models and options in volume builder catalogues available for ordering by customers. The extent of the proliferation of models and options made available by volume builders to purchasers was illustrated in Table 2 through a count of models and options offered by five volume builders. Recent work by Gharaie (2011) suggests that introducing extra house designs and options into a building program over time increases the completion time for houses. This phenomenon is well understood in production line manufacturing where workflow based scheduling is widely used. Gharaie (2011) demonstrates using simulation modelling of house production, which introducing two different models with a 20 per

cent variation in build time into a production schedule can introduce instability into the work flow and substantially increase the time taken to build each individual house. The effect of multiple models on the workflows of volume builders will be further investigated in the next stage of the research.

4.2.2 Coordination and scheduling

The description of the contract system in Section 3.2 showed that a very large number of subcontracts, supply contracts and supply and install contracts had to be successfully organised and scheduled during the building of a house. The question arises as to how successful and timely is this scheduling process during construction of the average house?

The indications are that timely scheduling is a major issue in the industry. The evidence for this comes from two supply and install companies: one is a plastering company, and another is a plumber. We think it is reasonable to take their experience as indicative of a broader issue. They are both companies that fulfil supply and install contracts for a number of volume builders. Both companies make it clear that it is important that they spread their work across a number of builders so that they do not become overly reliant on one builder. In this context, both companies have broad experience of the industry and say that rescheduling is common across the industry. They do not single out one volume builder for criticism.

A representative of the plastering company described the situation in the following terms:

On average, 50 per cent of the jobs we get called to start on a particular day, are not ready for us to start ... The biggest issue we have is labour allocation. We're changing that constantly, to the point now, we always assume it's going to be late, and move people around. The major issues tend to be unsafe sites, followed by insufficient noggings on changing directions ... on changing directions of trusses ... and edge parameters of garages and alfrescos and things like that ... followed by roofing ... the roof's not on or parts of the roof aren't on. The flashings aren't in.

Similarly, a plumber describes the situation in the following terms:

They [the supervisor] will say, 'I want it done next Thursday on the 5th,' or whatever it might be. 'Yeah, no worries'. We would ask a series of questions and make sure that everything's ready, but then as that job went on, as they book it in, we would then look into job notes and hopefully say, 'Well last visit we were there, that wasn't ready. Is that ready to go now?' And you know, that's where it all buggers up ... for example they book for a hot and cold rough in and yeah the frames all finished but we get there and the trusses aren't ... you get everything ready ... the day before, the guys come in, load the truck up, drive to ... we can't do it ... it might be that the roof is meant to be on ... [but] we get there and the tiler is there [and] because of OH&S, we can't work underneath the tiler ... we organise to get a gas metre there ... we ask, 'Is the service line in?' 'Yeah, the service line is in'. So we book a gas metre. We get there and there is no service line in.

It appears that one of the contributing factors causing the problems experienced by supply and install contractors may lie within the performance management systems of the volume builders. This results from the following dynamic:

- Supervisors and construction manager performance is assessed each week by noting the stage they have reached in the sequencing of issuing orders.

- The assessment is easily undertaken through the performance management data generated by the ClickHome system.
- The weekly assessment is undertaken on the day, usually Wednesday or Thursday, when supervisors are at head office meeting with their construction manager and processing completed orders for payment.
- This meeting schedule and performance assessment creates an incentive for supervisors to lodge orders before their head office day.

The dynamic this creates for supply and install contractors is noticeable. One of them described it in the following terms:

We have a five-day call out for the delivery, right? And you'd say, why would I get most of the orders on Tuesday or Wednesday? It's because most of the builders [supervisors] have their meetings with their supervisors [construction managers] on Tuesday and Wednesday ... So all the call outs come in on Tuesday and Wednesday. So on Tuesday, I'll get 20 call outs. On Wednesday, I get 40 call outs. And Thursday, I get 10. On Friday, I get one.

This ordering process helps the building supervisors meet their weekly performance key performance targets. However, through later on-site inspections they then find that some of the jobs are not ready for deliveries or undertaking work on-site. The supervisor then initiates rescheduling.

4.2.3 Quality

The quality of work is an issue recognised by most volume builders, as indicated by the widespread adoption of quality systems. As noted above, construction managers have quality assurance as a focus of their work. This is apparently undertaken in conjunction with in-house quality managers. The practice of site inspections, monitoring and admonishment of construction managers and supervisors with an apparently poor quality record is a feature of the organisational life of many volume building companies. This appears to have had the effect of motivating construction managers and supervisors to push back on subcontractors and contractors to remediate defects so that they score well in the final quality audits.

Evidence of the extent of the issue during the building process is difficult to come by because of the nature of the contracting process. However, there is one vantage point in the system provided by the work of the building surveyor, which provides for some overall assessment about the level and nature of defects. As noted above, all dwellings must be inspected and passed by a building surveyor at set points in the construction process (Victorian Building Commission and Building Practitioners Board, 2011). Typically, the building surveyor establishes an arrangement for inspecting the house six times for a set agreed fee. If further inspections are required, then the surveyor will charge extra. The schedule of planned inspections is for pre-slab, reinforcement steel, the frame, reinspection of the frame, final completed house and a reinspection of the final house. In other words, this schedule assumes there will be faults at two stages and that reinspections will be required.

A building surveyor reported in interview that quality and observance of regulation in timber framing was the main issue. This interviewee reported that 'pre-slabs and steels are probably refused 10 to 15 per cent of the time' and frames 'probably 70 per cent of the time' and 'finals are probably, yeah, about 50 per cent'. Another indication of the extent of defects in new house construction is the proportion of jobs that are inspected more than the six times allowed for in the initial agreement. The building surveyor reports:

I would suggest it would probably be, probably 30 per cent of the jobs in, in round figures.

The issue with framing was described in the following terms:

Issues that we constantly have is frame overhangs on slabs. Variation from the original engineering document, particularly on two storeys, particularly as they get more complex with what they're doing with their steel work and the like. There'll always, generally speaking, be some issues related to the trusses and the installation of the trusses.

An assessment of a frame provided by a tradesperson who followed a problematic framer on to a job graphically describes just how poor the result can be:

... windows out of plum; windows the wrong height; windows in the wrong spots; walls out of plum; we've got a pitching beam on the garage there that's wrong, they haven't got a clue ... The gaps on windows were too big, like you should allow 10 mm each side of a window for a bit of leeway, he's got up to 40 mm so he's just not doing his job properly.

The company had picked up these defects and a program of remediation was underway.

Of course remediation extends the planned construction time of houses, especially in the context of a more rigorous approach to quality. A supervisor explains:

... they [quality managers] are really thorough, so that generates a lot more time ... we wait for each stage until they do it ... we shouldn't, but a lot of it we wait. And then you may ask them to fix up, fix something up before you can keep going. So that might slow down ... it could be, you might go around and do check-outs on plaster work, and so if there's a few kinks in that cornice there, and a few kinks in there, you want to fix that first to get the plasterers back to fix it, before your painter continues.

Besides the formal quality evaluation systems that volume builders have put in place, supervisors also try to establish arrangements for quality work. The principal means that they have to hand is the network of subcontractors they establish and maintain. A consistent theme running through the interviews were accounts of the way in which supervisors seek to make quality and reliability the key criteria for including subcontractors in their networks.

... my success in supervising, and I tell all the young guys, the key to supervising is getting the right people. It's like any business, I suppose. If you get the right people and manage the right people, half of your battle's there. But if you don't, you're always on the back foot. If you're employing someone that's not capable, capable of doing the job, you waste your time. You waste your time fixing it, and therefore you can't get to the next jobs.

This approach can also extend to nurturing the next generation of tradespeople through the way in which apprentices are supported. However, the recruiting and training of apprentices is very much reliant upon the initiative of individual subcontractors. Volume builders are not involved in encouraging or resourcing apprenticeship schemes.

4.3 Conclusion

This chapter has sought to examine why the average completion times for new volume built houses have been increasing.

The starting point for this examination was a focus on the nature of the contracts used by volume builders to engage contractors to undertake building work. The initial evidence is that these builders are embedded in 'networks of mutual dependence' where there is some mutual framing of decisions, sharing of responsibilities and development of trust relations. Building companies do not sit at the centre of 'networks of direction' where they can organise the building of houses through command and control processes. Subcontractors are able to exercise some autonomy within the house building industry by moving between builders both organisationally and geographically. This autonomy leads to relationships characterised by reciprocity, interdependence and loose coupling.

It is in this context that three key factors were identified as features of the industry that are contributing to increased completion times.

- There have been three marked changes in the houses that are built through the contract system run by the volume builders. First, the houses over time have become larger although growth has plateaued in the naughties. Second, the designs have made the houses more complex. Third, the increased number of house models designed by the volume builders and made available through their catalogues has increased the variability of the product and reduced opportunities for standardising production processes.
- Houses built by volume builders are built using many supply contracts, supply and install contracts and labour only subcontracts. The deliveries to the site and the work on site all have to be scheduled so that materials are delivered and work is done in the right sequence. The evidence gathered through an initial set of interviews with industry participants indicated that the scheduling of deliveries and work on site is a major issue resulting in considerable rescheduling and therefore increases in the amount of time on site where no work is being done.
- The amount of poor quality of work done on site appears to be an issue. Volume builders have developed quality inspection and improvement systems in response. It seems that these systems have gone a long way towards ensuring the quality of the final product and meeting the expectations of purchasers. However, poor quality work or defects identified by supervisors, specialist quality managers employed by volume builders or building surveyors undertaking statutory inspections all lead to the recall of supply and install contractors or subcontractors and remediation work. This remediation work requires additional time to schedule and undertake.

5 CONCLUSIONS

This research aims to make a contribution to the examination of the supply of new housing in Australia in the context of continuing undersupply. An important aspect of this undersupply has been the long-term increase in the average length of time taken to build new houses. This is the context for posing the principal research question guiding this research. It asks:

How is the work of new suburban house building organised and what practices and constraints may contribute to delays in building completion times?

In response to this question, the preliminary research for this paper has reviewed literature, analysed ABS data and undertaken preliminary interviews with building industry participants. Particular attention was given to documenting the way in which house building is typically organised by volume builders through an extensive set of contracts.

Based on this analysis of contracting as a system and the way in which the work is carried out, we have identified three issues that help to explain lengthening construction times.

- House design changes, including size increases, more complex designs and increases in the number of house models have led to less standardisation and more built form complexity.
- There is some evidence that there is room for improvement of practices associated with scheduling and organisation of contracts within the management systems of volume builders.
- A significant proportion of work has defects, especially frames, that require subsequent remediation through follow up on-site work and additional inspections that extends construction times.

Of course each factor is not separate. House building is a dynamic process and the issues of house design, management and quality issues are connected.

5.1 Implications for policy

In Section 1.2 'Policy research response', it was noted that the undersupply of housing has become a focus for policy development led by COAG. This policy development is being informed by commissioned policy research. The focus for this policy development work has been signalled by COAG (2009b) and includes strategic planning, infrastructure, titling systems, planning and building regulation. It is also focussed on policy settings, found in regulations and in direct expenditure programs and tax expenditures, of federal and state governments that influence the level of housing supply.

The key point made in our summary of the COAG 'Housing reform agenda' was that there was no focus on the operations of the housing industry itself and the houses that this industry produces. This is a gap that this research seeks to fill, at least in part, by focussing on the way the housing industry produces detached suburban housing that continues to form the overwhelming share of new residential production. In other words, this research is based upon the simple proposition that what is produced by the housing industry and how it is produced needs to be considered within the broader consideration of the current and projected under supply of housing.

This finding, if it is correct, at least in part, leads to a question about whether and how detached suburban housing production might become an element in the housing supply policy debate and how the industry and government might respond.

On one hand there is the industry itself. The two main industry associations, the Housing Industry Association and the Master Builders Association, typically represent this industry. However, they are unlikely to lead policy discussion for the following three reasons.

1. Industry representatives, especially through the HIA, view their industry as an efficient industry. This is evident in public statements such as a key note address by the Executive Director of the HIA, *The Subcontractor and Australia's Housing Industry: An Example of World Class Competitiveness* (Silberberg 1991) and a recent submission to a federal government inquiry on sham contracting (Housing Industry Association 2011).
2. Volume builder firms are able, at least in part, to pass on the cost of inefficiencies associated with increased completion times to consumers. These costs are in effect capitalised within the sale price and are financed through household mortgage finance. Of course, the opportunity to pass on costs is limited by the broader housing market, where there are competing forms of housing supply and long-term affordability issues, especially for first homebuyers.
3. It is unlikely that the industry itself through its associations would sponsor an introspective review of the industry on an issue, such as increasing completion times, because it would require competing firms to share information about management processes and internal cost structures. Association policy contributions in the housing industry tend to focus on broader public policy issues such as training and education, tax, housing policy, occupational health and safety and building regulation.

On the other hand there is government. As has already been noted there is the COAG agenda that is examining aspects of the housing system. However, as this report argues there is a case for examining the structure and operations of the housing industry itself, in the context of steadily increasing completion times for houses.

Perhaps there is a case for promoting the idea of 'housing industry policy' that would endorse industry and government agreement about goals for the industry, realignment of policies that support these goals and industry association leadership. This institutional arrangement would recognise new contexts and broader public policy imperatives. The Productivity Commission argues that there are three stand out imperatives for the development of industry policy in all industry sectors in the current economic context. They are promoting innovation through the uptake of new ideas and technologies; recognising the need for greenhouse gas emission reductions and aligning industry to this goal; and increasing industry productivity (Banks 2008). This idea of 'housing industry policy' would encompass the whole housing industry by including 'other residential' housing, such as flats, apartments and town houses. The reasons for taking a whole of housing industry approach are the following.

- Other residential housing forms a significant proportion of total new housing supply than detached housing as shown in Figure 1. However, it is also clear from the data presented in this figure that the proportion of other residential housing, as a proportion of all housing, has been increasing. The trend line shows that detached housing has decreased from approximately 75 per cent in the 1980s to 68 per cent in March 2011 with a concomitant increase for other residential from 25 per cent to 32 per cent in the same period.

- Some 'other residential' housing, in particular dwellings under three storeys, is built using the same contract system used to build detached houses. Indeed, a number of volume builders are entering this market and production of this type of housing using the contract system used suburban housing production is increasing.
- If the category of 'other residential' is disaggregated, it shows that the proportion of dwellings in buildings of four or more stories has increased as a proportion of 'other residential'⁴. This housing is produced through quite different arrangements. Typically, this involves the owner of the site undertaking the building design, tendering and contracting a builder. The builder uses more direct employment, uses less subcontracting and establishes contracts that are different to those used in detached house volume building.
- Public policy support for an increase in other residential is an element in contemporary urban policy. In recent years, state governments have embedded the idea of urban consolidation in metropolitan plans as a way of producing an urban form that will support the reduction of unsustainable levels of greenhouse emissions. Therefore, it is likely that urban policy will continue to express a preference for shifting the balance between 'other residential' and detached housing towards 'other residential'. This policy setting encouraging the growth of other residential would have to be reflected in the development of a housing industry policy.

5.2 Next steps for this research

Based on the initial research findings, further questions about contracting as the dominant mode of organisation in the house building industry are evident and require further investigation. Based on these initial findings, this research will continue by focussing on the following three steps:

1. It is proposed to test the preliminary research findings with industry participants by preparing and distributing a discussion paper. The paper based on this Positioning Paper will be presented to a workshop and circulated more broadly so that we can test the accuracy of our description of the way, in which the volume building housing industry is currently organised. The discussion paper will also allow us to test our preliminary findings about possible reasons for increasing completion times being linked to changes in the housing product, the scheduling practices, and quality of work issues.
2. It is proposed to track in detail the building of a number of case study houses. Based on the initial interviews, it is clear that this case study work will be difficult to do. It is therefore proposed to consult with key industry practitioners on the design of these case studies with a view to maximising value in gathering data. One method that is currently being pursued is to more thoroughly investigate the causes of rescheduling experience by supply and install contractors. These contractors have systems which enable summary data to be extracted and for case study reschedulings to be investigated.
3. It is proposed to test the effect of the growth in the number of house models and optional extras on the production process of volume builders. This will be done using the scenario-modelling research method using Simul8 software and extend the preliminary work done by Gharaie (2011). Through this we will simulate the

⁴ The trendline for ABS building approvals data shows that the proportion of dwellings in buildings of four or more storeys increased from approximately 21 per cent in October 1993 to 46 per cent in April 2011. This demonstrates that multi-storey buildings are becoming more and more significant proportion of the 'other dwellings' category.

industry-wide implications of the trend in the growth of house models and options and potential alternative arrangements.

APPENDICES

Appendix 1: Questions for preliminary semi-structured interviews

1. Can you describe the typical arrangements for the engagement of subcontractors in the residential building industry? In particular:
 - What are the typical formal contractual arrangements between contractors and subcontractors?
 - In what ways do subcontractors obtain the building materials they use in the construction process (e.g. plasterboard, roof tiles, electrical cable, bricks, timber for framing)? Do these arrangements vary for different trades?
 - What are the arrangements for the provision and use of equipment (e.g. scaffolding, lifting equipment) on the building site? Do these arrangements vary for different trades?
2. What is the extent of the subcontracting process? Do subcontractors, in turn, extend subcontracting arrangements on residential building sites by entering into further subcontracting arrangements?
3. What are the typical processes used by builders or principal contractors to recruit subcontractors for new residential building projects? How do new subcontractors come into the system of subcontracting?
4. From the point of view of the contractor and the subcontractor can you say what the strengths and weaknesses of the typical residential builder contractor/subcontractor arrangements are under the three headings of reward, risk and safeguards?
5. What issues can arise between subcontractors who rely on each other for a sensible and timely sequencing of work? What happens when a subcontractor cannot, or should not, proceed because the work has not been done, or done properly, by an earlier subcontractor? What is the role of the principal contractor in this context?
6. How are subcontractors supervised? In particular:
 - How do contractors typically control the quality of subcontractor work? Who decides what is good or good enough and what happens when the contractor finds that the quality is not good enough?
 - What can be said about the way in which subcontractor performance is appraised in our system of residential building? Is performance appraisal only done informally or are there examples of formal subcontractor appraisal processes?
7. What issues are there about subcontractors agreeing to schedules and meeting agreed time lines? In particular:
 - What happens when a subcontractor cannot, or chooses not to, meet an agreed time-line for the completion of work on a site? Are penalties imposed or just a new time-line agreed?
 - Why has the average time taken to complete dwellings increased over the past decade? What developments have there been in the industry that help to explain this increase in completion times?

8. When new products and techniques become available from manufacturers what processes are typically associated with the take up of these new products and processes by subcontractors?
9. What is the extent and nature of the externalities, such as injury and illness, early retirement and use of the income security system, materials waste and tax minimization, associated with the present system of subcontracting?
10. Are there any other questions about issues facing the subcontracting system that you think are important and that we should have asked a question about?

March, 2011

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